ISSN 1828-5961

Wilson Florio
Architect, Ph.D. in Architecture and Technology (University of São Paulo, 2005). Since 2007, is an associate professor at the State University of Campinas. He conduct courses related to design process and digital technologies. The main focus of his research is the use of parametric modeling and digital fabrication for design process and design analysis.

Ana Tagliari
Associate Professor at FECFAU Unicamp. Architect (Mackenzie, 2002), Master's in Arts (Unicamp, 2008), Ph.D. in Architecture (FAUUSP, 2012). The main focus of her researches involves design analysis and design process, mainly in Modern Architecture, working on the following topics: architectural design, representation, unbuilt architecture, and architectural theory.

Preserving the modern architectural heritage in São Paulo. The case of the Decio Tozzi collection

Abstract

The article discusses the preservation and digitalization process of the Decio Tozzi architectural collection at the State University of Campinas. The collection, donated in 2018, includes drawings, photos, models, and other documents from Tozzi's 50-year career. The preservation process involves cleaning, cataloging, digitalizing, and creating 2D and 3D models of the projects. The digital preservation efforts aim to safeguard the collection and make it accessible for researches and public dissemination. Challenges include handling fragile materials, ensuring ethical use, and maintaining digital files. We digitalized 32 projects and produced 10 complete redrawings, both 2D and 3D. These results demonstrated that identifying details in each drawing, while redrawing, contributed to clarifying implicit intentions in documents. Redrawing contributes to preserving archives by producing new artifacts, including physical and digital three-dimensional models. We highlight the importance of preserving architectural heritage and the role of digital tools in enhancing spatial understanding.

Keywords:
Modern heritage; Digitalization; Digital Repository; 3D modeling; Conservation

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

INTRODUCTION

In 2018, the Architecture and Engineering Library of the State University of Campinas (BAE) received the "*Architect Decio Tozzi Collection*", the first collection of primary architectural documents. Since then, we have been working to preserve and disseminate this collection. The architect produced large-scale, prominent proposals and a significant number of residential projects. During 50 years as an architect, he developed a singular oeuvre, expressed through a plastic ideology in which light, space, and matter constituted elements of a new and transformative architecture.

Architectural repositories, including drawings, photos, and models, require special preservation. Curators and archivists must establish principles for appraisal and selection, as well as propose strategies for digital documentation. The increasing use of architectural repositories necessitates special care regarding access, copyright, and ethical issues, as well as significant efforts, including human and financial resources, to efficiently collect and preserve architect-produced material and ensure its durability.

In recent decades, there has been a growing awareness and productive recognition of the importance of preserving project documentation in the academic field (Piva & Galliani, 2005).

Archives hold significant value as they document the design process in architecture, but there are risks associated with digital preservation (Mitchell, 1996). To establish principles, institutional efforts should guide collection policies and identify duplicate, marginal, and ephemeral records (Olsberg, 1996). Archives are sites of memory, cultural transitions, representations of both constructed and unbuilt entities, and catalysts for knowledge creation (Farroni & Faienza, 2024; Castriota, 2011). However, they suffer from a static dimension, which can prevent them from being accessible online (Palestini, 2022). They serve as evidence, safeguard societal rights, facilitate knowledge generation, provide a research environment, and preserve significant cultural heritage (Roe, 2016).

Architecture archives repositories require substantial investment (Vernizzi, 2022) for the constant digitization and maintenance of documents, whether they are drawings, maps, photographs, models, or documents such as texts and newspaper clippings. In order to keep analog and digital documents safe in universities, professors and students must be involved in keeping an eye on all the work that is being done to protect cultural heritage and encourage more research.

Digitization is a challenge because it requires very careful manipulation of paper sheets. Since its donation, our team has implemented a set of methodological procedures to clean, identify, organize, catalog, store, digitize, redraw, and create digital and physical three-dimensional models of the Décio Tozzi Collection, in a similar way to Kent Larson's research (2000). These efforts address challenges such as drawing dimensions and delicate physical structures; cataloging an increasing volume of data; selecting criteria for architectural records; identifying duplicates; and storing and accessing the files.

We digitized 32 projects, predominantly residential, and generated 10 extensive redrawings, comprising both 2D and 3D models. The slow execution of each redrawing, caused by unbuilt projects, led us to pay close attention to every stroke. These results demonstrated that identifying details in each drawing, while redrawing, contributed to clarifying implicit intentions in documents. We also concluded that research through redrawing contributes to preserving archives by producing new artifacts, including physical and digital three-dimensional models.

The original contribution is to discuss the challenges to preserve modern heritage as well as how three-dimensional digital models of unbuilt projects are essential for clarifying intentions in documents and enhancing spatial understanding.

ARCHITECT DECIO TOZZI AND HIS COLLECTION

Graduate architect at Mackenzie University (São Paulo, 1960), Decio Tozzi became involved with large-scale and prominent proposals, such as the headquarters of the Institute of Criminalistics and Criminology (1960). In 1961, the architect opened his studio in the city of São Paulo, which developed a work with a singular style expressed through "*a plastic ideology in which light, space, and matter*" (Tozzi, 2005, p. 315).

The most recognized projects are the *Technical School of Commerce of Santos* (1969), *The Ruy Barbosa Labor Forum* (2004) in São Paulo, *The Veneza Farm Chapel* (2002), and *Residence* (1974) in Valinhos. These drawings are part of the permanent collection of the Paris National Museum

Fig. 1 - Left: In 2015, the self-box housed Decio Tozzi and his collection. Right: Precarious storage conditions of the donated materials. Source: Left: Decio Tozzi, 2015. Right: Authors, 2019.

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

of Modern Art, Centre Georges Pompidou (Centre Pompidou, 2009). In addition, some important residences and award-winning works, such as *Romeu Del Negro* (1969), *Teófilo Orth* (1973), and *Élio Tozzi* (1973), remain a reference in modern architecture in São Paulo.
From 1960 to 2015, Decio Tozzi's engagement with the architectural practice encompassed various activities, including working with class regulatory institutions, publishing his work and thoughts, and his involvement in teaching. Since the 1980s, he has been involved in a social initiative to conceptualize and materialize *Villa-Lobos Park*. Tozzi makes a significant new contribution by donating his collection of architectural works to UNICAMP, aiming to ensure that this unique content is both accessible and preserved.
In July 2018, BAE accepted the collection of the architect Decio Tozzi by his initiative, composed of: a. two project map libraries, one with 15 drawers containing architectural presentation boards of the Villa-Lobos Park proposal and the other with 5 drawers containing architectural boards of the Ruy Barbosa Forum proposal; b. 3 cardboard boxes containing 86 tubes with project drawings; c. 2 PVC panels used in the International Architecture Biennial; d. 1 physical maquette of the Ruth Cardoso Orchidarium; e. 17 cardboard boxes with CDs, floppy disks, and other documents; and f. 1400 copies of the book "*Arquiteto Decio Tozzi,*" .
With this material in hand, we, in collaboration with BAE, organized an event on September 4, 2018, to commemorate its donation and formalize the collection's granting. The program featured a lecture by the architect, an autograph session, and an exhibition of banners and pieces from the donated collection.
With the expertise accumulated by the Edgard Leuenroth Archive (AEL) at UNICAMP, founded in 1974, which is the largest collection of social history in the country, as well as the consultations and assistance provided by the FAUUSP collection team, in 2019, we established important guidelines for the description of materials and the organization of the schedule of activities with the Architect Decio Tozzi collection at BAE-UNICAMP.

WORKING METHOD AND TEAM

The work plan was centered around the following objectives: i. Ensure the physical integrity of the materials; ii. Establish methods that are efficient for future physical conservation and formal cataloging activities. iii. Start as soon as possible the treatment of the collection, aiming at its preventive conservation and its dissemination. iv. The formation of the work team, physical conservation, and a preliminary inventory.
The management of an architectural collection necessitates the formation of a transdisciplinary team. However, during this initial phase, the collection lacked the necessary funds to hire an external professional. Given these circumstances, the board of directors of BAE, in collaboration with the FECFAU professor responsible for the work, explored alternative procedures to address the shortage of personnel for daily collection and treatment activities. A group of selected students received a Care Grant provided by the Student Support Service Program (BAS-SAE) and worked between 2019 and 2021 in the initial stages.
Since the undergraduates involved were not from the area of conservation, documentation, or even architecture, it was essential to train this initial group on the requisite curatorial processes prior to starting activities with the material. In April 2019, two introductory workshops took place to achieve this goal. The first workshop addressed the inventory of the material, presenting the control instruments prepared for the preliminary inventory of the iconographic material of the collection, as well as specific terms in the area of architecture and drawing materials.
The second workshop had the partnership of AEL and was taught by a conservation specialist, who instructed the scholarship holders on techniques of brush cleaning, scalpel handling to remove small crusts of dirt and adhesive tapes, and new forms of storage (Figure 2). After this training, the team initiated physical conservation activities in May of the same year.

PHYSICAL CONSERVATION

The primary issue was the accumulation of dust in the documents due to their time in the self-box and improper storage methods in cardboard boxes and tubes. Hence, the first stage of physical conservation involved re-storing documents and materials in smaller cardboard boxes. These packages had no description of contents. Therefore, we discarded them and re-stored the material in new 'archive type' boxes, labeling them on the external side with a general identification of their contents, before storing them in a collection module on the library's sliding shelf (Figure 4).
Then, there was the beginning of the cleaning and maintenance of physical iconographic materials in the collection, the architectural boards of projects. From 2019 to 2021, the cleaning process occurred (Figure 2). This physical conservation stage took into account the degree of damage and exposure of the materials to establish a work order. As a result, the cleaning process started with the drawings stored on cardboard tubes and then

Fig. 2 - Left: Rolls of drawings that were taken out of the cardboard tubes. Right: The work team carried out hygienic activities and stored the project rolls in TNT packaging. Source: Authors, 2019.

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

moved on to sheets of map libraries. In summary:
• Removal of surface dirt from the tubes and drawers of the map libraries and the use of soft brushes for the drawings.
• Removal of crusts and adhesive tapes from design boards using a scalpel.
• Clean tubes to place the cleaned collection on the library's sliding shelf.
• TNT over the glue residue points on the design boards.
• The project rolls were stored in TNT packaging.
• The TNT "cover" was placed to cover the projects stored in the drawers of the map libraries.

PRELIMINARY INVENTORY OF PHYSICAL ICONOGRAPHIC MATERIAL

One of BAE-UNICAMP's functions as curators of the Decio Tozzi collection is its inventory and description, which ensure control over documents and enable the dissemination of the archive. The institution adopted the description sheet as an alternative method because the then-current work prospects did not allow for systematized cataloging.
Another pre-established basis for the preliminary inventory was the adoption of a guideline to order the description process. We adopted the same criterion as the benchmark institution, FAUUSP, which prioritizes research demand, starting with the physical iconographic material of Decio Tozzi's single-family residence projects.
Consequently, based on this document type, the aforementioned description sheets were prepared. The initial stage of these control instruments involved establishing an auxiliary coding system to facilitate the organization and identification of the material. The adopted standard (Figure 3, center) has the following structure:
1. Collection code + project code (C+P CODE): The collection's individual record consists of the architect's initials (DT), while each project's individual record has a sequential number.
2. Subcode: A sequential number identifies each individual record of each version or stage of development within the projects.

C+P CODE	SUBCODE	BOARD NO.
DT /	1 .	1

Fig. 3 - Left: The project rolls in TNT. Center: Adopted coding. On the right, blueprint copies stored in boxes on shelves. Source: Authors, 2019.

3. Board No.: This refers to the unique record of each design board within a specific project version, as indicated by a sequential number that corresponds to the stamp information.
4. Documents and packaging, as well as the collection description and control sheets (Tables 1 and 2), use this coding for physical identification. The numerical sequence of the project codes does not follow a chronological order. We established the organizational logic by grouping the same programs and based on the research demand criteria. In these cases, an order is made based on the design stages, from the preliminary study to the execution and details.
The control instruments proposed for the physical iconographic material are divided into two fronts of description: the architectural and the current state of conservation of the material. The first survey collects data regarding projects and drawings that are relevant for future cataloging and of

Table 1 – The architectural survey sheet. Source: Authors, 2019.

Code	Name of the Project	Architect (Author)	Co-Author	Collaborators	Client	Location	Program	Year	Year of Constr.

Subcode	Board	Type of Representation	Tools of Representation	Paper	Size (cm)	Copy or Original

Notes	Person in charge of the survey
	(Name/year/activity)

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

interest for scientific research. The second document details the material's physical condition upon receipt. This study is being done to make sure that it is complete and to see if more extensive restoration work is needed.
The *"Architectural Survey of Iconographic Material"* sheet comprises three blocks: i) a general identification of the architectural project; ii) a description of the available material; iii) observations and the identification of those responsible for the survey (Table 1). The "Survey of the current state of conservation of the iconographic material" sheet names the project by its subcode and splits the rest of the table into two sections: i) the main damages seen in the drawings; ii) a field for additional notes and the names of the people who are in charge of cleaning and the survey (Table 2).

Code		Current State of Conservation							
Subcode	Board	Holes	Stains	Wrinkles	Cracks	Extension	Rip	Extension	Hygienization procedures
Notes							Person in charge of the Hygienization		
							(Name/Year/Activity)		
							Person in charge of the survey		
							(Name/Year/Activity)		

Table 2 – Current state of conservation. Source: Authors, 2019.

TECHNIQUES FOR PRODUCING AND REPRODUCING DRAWINGS ON ANALOG MEDIA

The digitization of architectural collections makes it possible to reproduce original drawings. Unlike drawings of works of art, architectural drawings are mostly technical drawings with the purpose of construction. However, one can consider the drawings as artistic expressions when there are clear indications of authorship by a renowned architect. Decio Tozzi is a skilled designer (Figure 5). His small sketches, frequently between 4 and 10 centimeters, are concise and expressive. With just a few quick traces, the architect was able to express his ideas on paper.
Before the use of digital resources, the documents produced by modern architects were mainly conceived on a set of types of analog media: 1. Tracing Paper (Trash Paper / Bumwad) – A thin, translucent paper used for preliminary sketches and overlays. It allowed architects to layer designs and make revisions easily; 2. Vellum – A high-quality, semi-transparent paper made from cotton or wood pulp. It was commonly used for final drawings due to its smooth surface and durability; 3. Blueprint Paper – A special paper coated with light-sensitive chemicals used in the blueprinting process (diazotype or cyanotype). Architects utilized translucent paper, such as vellum or tracing paper, for drawing and creating blueprints. 4. Drafting Linen – A durable, transparent fabric coated with starch or resin, often used before vellum became widespread. It was resistant to tearing and could handle repeated erasures; 5. Mylar (introduced in the 1950s-60s) – A polyester film that became more common in the late 1960s and 1970s for its dimensional stability and durability.
In the Decio Tozzi collection, we identified six ways to present his projects. The preliminary drawings were traced mainly by graphite on fragile tracing paper, resulting in bad conservation (Figure 6a). The conception and execution drawings were produced on transparent paper vellum (Figure 6b) and, sometimes, on polyester film (very expensive). The copies were produced on blueprint paper (Figure 6c), normally folded in paper boxes, resulting in severe discoloration of the support and folds.
To present a memorial of the projects for competitions or to municipal authorities, the drawings were copied (xerographic process) and reduced to A4 format to compose a small bound book with collage text and drawings (Figure 6d). The draw-

Fig. 4 - Sliding shelf and module reserved for the Tozzi Collection at BAE. Source: Authors, 2020-2022.

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

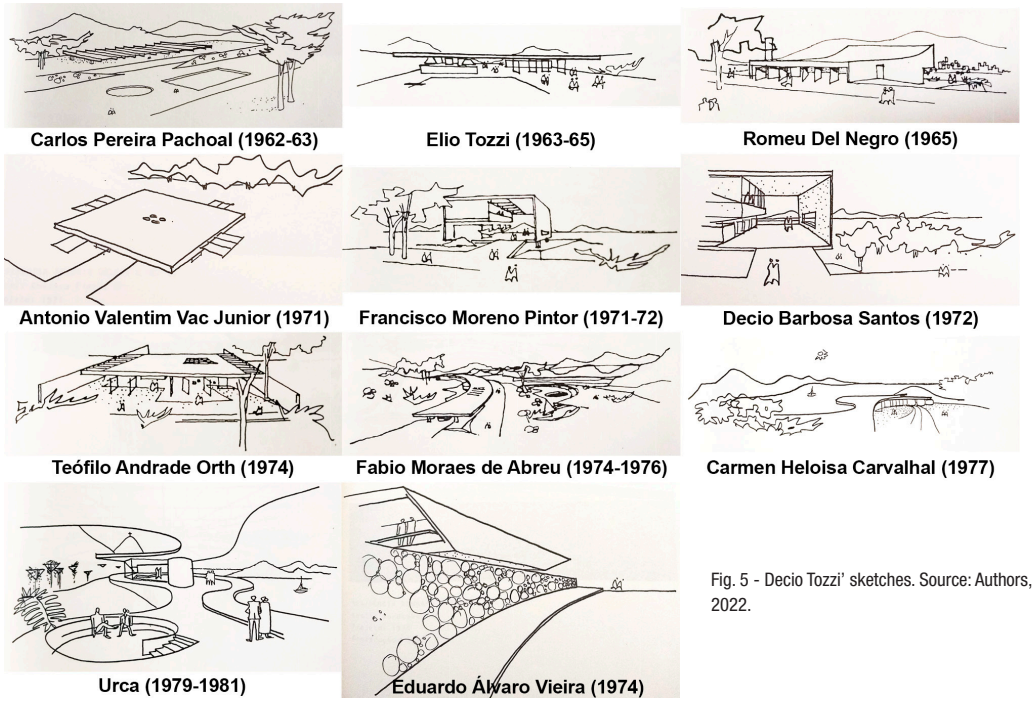

Fig. 5 - Decio Tozzi' sketches. Source: Authors, 2022.

drawings on vellum paper using an ink pen and then painted them with colored pencil. The black and white copies are very impressive too.

TECHNIQUES AND SPECIAL CARE FOR THE PRESERVATION OF DRAWINGS AND ANALOG DOCUMENTS

It is important to highlight that, up to the present moment, we have found in the Decio Tozzi Collection most of the common damages Paglione (2017) typically found in documents made of paper: 1. Abrasion; 2. Corrosive action; 3. Insect attack; 4. String; 5. Brittle edge; 6. Loose cover; 7. Cut; 8. Discoloration of the supported element; 9. Discoloration of the support; 10. Folds; 11. Rust; 12. Adhesive tape; 13. Elastic band; 14. Separate sheet; 15. Foxing (rounded spots); 16. Fungi; 17. Previous inadequate intervention; 18. Stain; 19. Acid migration (yellowish spots); 20. Warping; 21. Detached folder (the cover comes off the spine); 22. Burn; 23. Tear; 24. Wrinkle; 25. Ink bleed; 26. Dirt; 27. Fold; 28. Lost area (physical damage or tear), where the separated area no longer exists or cannot be located; 29. Separated zone (when a material (sheet of paper) is cut or torn).
It is plausible to think that even when kept in map

ings were inserted between typed paragraphs with a typewriter. Another strategy was to type the texts on transparent vellum paper, leaving spaces between paragraphs to insert small explanatory sketches of the design process, resulting in strips of vellum paper with typed texts (Figure 6e).
From the 1990s, the architect adopted computers and graphic programs to aim to produce his drawings. The plotted drawings were presented to the clients and explored to showcase their projects in architecture competitions (Figure 6f).
The architect has donated some very special bound books. One of them is a set of perspective drawings artistically made by the architect and designer Valandro Keating for the Vila Itororó project in São Paulo (Figure 7). Valandro created these

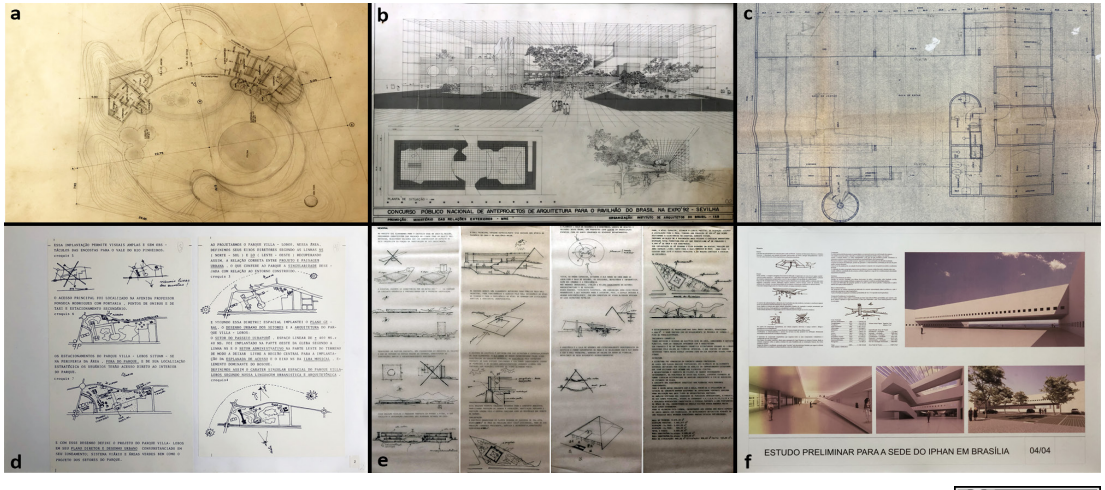

Fig. 6 - Six manners to present the project. Source: Authors, 2022.

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

Fig. 7 - Perspective drawings artistically made by Valandro Keating. Source: Authors, 2022.

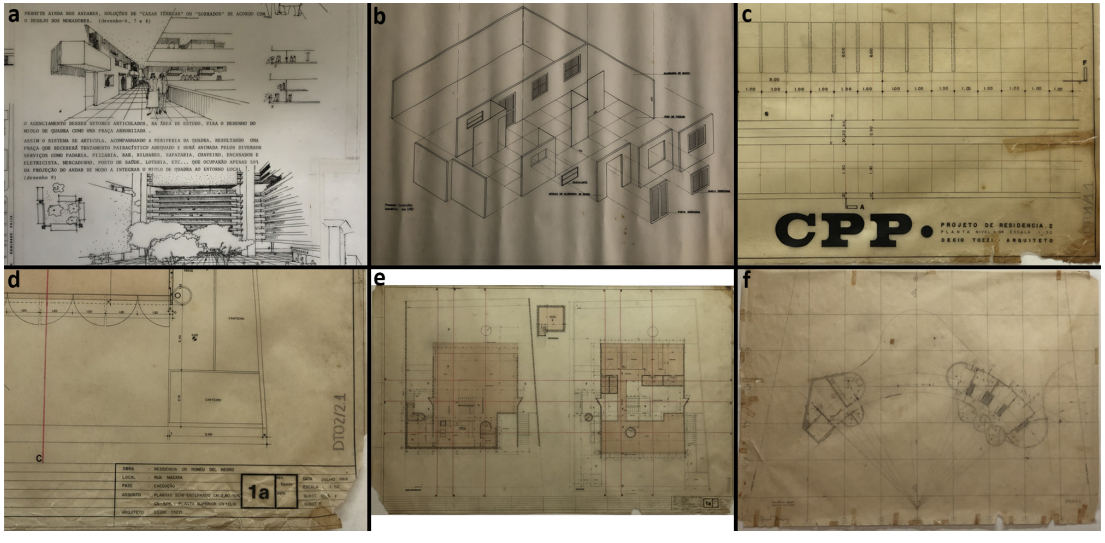

Fig. 8 - Most of the common damages found in the Decio Tozzi Collection: a. adhesive tape; b. wrinkle; c. cut, rust, and stain; d. foxing and lost area; e. acid migration and foxing; f. cut, dirt, and brittle edge. Source: Authors, 2022.

cabinets and tubes from 1960 to 2000, many architectural projects were handled and maintained in inadequate conditions (Figure 8), causing damage to drawings such as discoloration, stains, folds, adhesive tape marks, and brittle edges.

We had to wear protective gear to keep ourselves and the collection safe. This included disposable gloves and caps, safety goggles, aprons, long pants, closed-toe shoes, and masks for dust, mechanically generated aerosols (PFF1), and biological agents (PFF2). The librarian in charge of BAE UNICAMP made sure we did this.

With guidance from the BAE librarian, we followed the recommendations of Cassares and Moi (2000) regarding preventive preservation procedures for analog documents: a) cleaning; b) demetalization and removal of oxidation spots; c) flattening; d) minor repairs; e) sterilization.

DIGITIZATION AND MODELING

Recently, the digitization of projects and buildings has become fundamental for project analyses as well as for technical analyses. Researchers (Balzani et al., 2017; Cheng et al., 2018; Dong, 2020; Borin; Balzani et al., 2023; Rossato, 2023) have demonstrated that point cloud scanning has become a highly reliable technological procedure for obtaining accurate data. In this study, we intended to use three different methods for capturing images: 1. Digital camera; 2. Drone; 3. Laser scanner, which will be used to capture the three-dimensional geometry of constructed buildings.

Access to the original documents always facilitates the true interpretation of the artifact, since most digitized files will appear on a reduced scale on computer video monitors. However, you can format digitized files in different dimensions based on your needs, either in digital or analog (printed) formats.

We have consulted some specialists to analyze the possibility of using some kind of scanner for digitalization. We came to the conclusion that the poor conservation state of the drawings would cause major problems, as the fragility of the original material in contact with the machine could alter its consistency, a risk Vernizzi (2022) warned about. The viable alternative was to use a digital camera that doesn't require physical contact with the support.

The digital camera allows for the digitization of projects and documents in the collection, as well

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

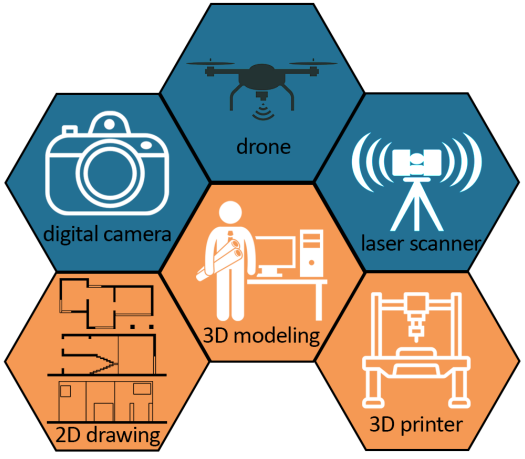

Fig. 9 - Three methods for capturing images, as well as three methods to materialize drawings and physical models. Source: Authors, 2024.

as photographic documentation during technical visits to residences built with significant value for modern heritage (Figure 10).
Recently we initiated the use of drones for aerial photographic surveys, as well as for aerial filming of the constructed residences. This year, we planned to use the laser scanner to enable three-dimensional digitization of three or four residences that were constructed using a point cloud.
It is important to highlight that, in addition to the 14 constructed residences, there are 16 unbuilt residence projects. Hence the importance of using digitization techniques that allow for the proper capture and analysis of these two components that make up the set of modern residences by Decio Tozzi.

2D REDRAWING AND 3D MODELING

According to research on digital architecture (Kolarevic, 2003; Picon, 2010; Carpo, 2011), 3D geometric models are essential for the construction and development of modern projects. On the other hand, current studies on digital fabrication (Garcia-Alvarado et al., 2024; Bañón; Raspall, 2021) show that it is becoming more and more possible to create models and construction elements using 3D printing. In fact, as Caterina Palestini (2022, p.7) affirmed, "*what archives suffer most from is the static dimension*".

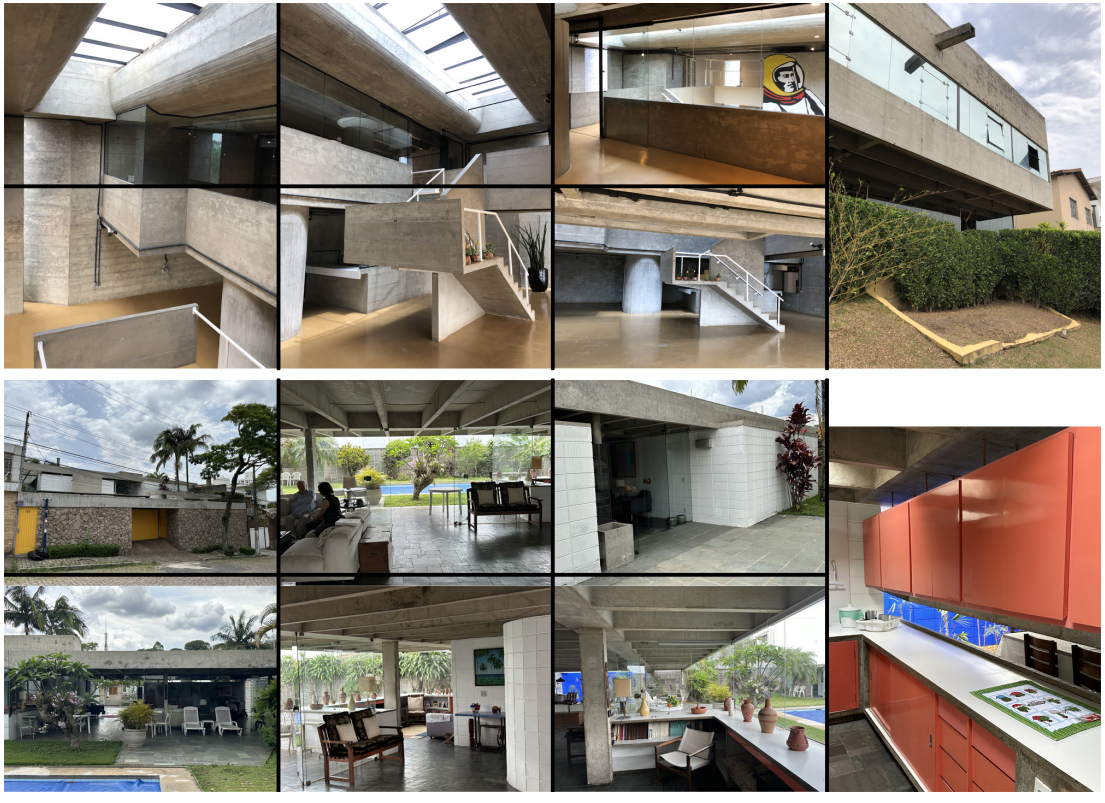

Fig. 10 - Top: Photos of the Romeu Del Negro House. Bottom: Photos of the Élio Tozzi House. Source: Authors, 2022/2024.

Following the 2D digitization of the projects, in the last five years we have been producing the redrawing (Figure 12), which include floor plans, sections, and elevations. We started 3D modelling (Figure 13). Finally, these 3D models will be materialized into scale models using 3D printers (Figure 13, center-right).

The 2D redrawing (Figure 11) is used to create two-dimensional graphic analysis (Figure 13), while the three-dimensional digital models (Figure 12 and 13) are used for simulating internal and external spaces and making physical models. In the first group, we will look at the design principles and strategies; in the second group, we will perform technical checks on the structure and identify any issues. So, keeping the digital records of the projects for design analysis and the "*as built*" buildings for technical analysis is essential for preserving heritage. In the first group, the compositional principles and design strategies

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

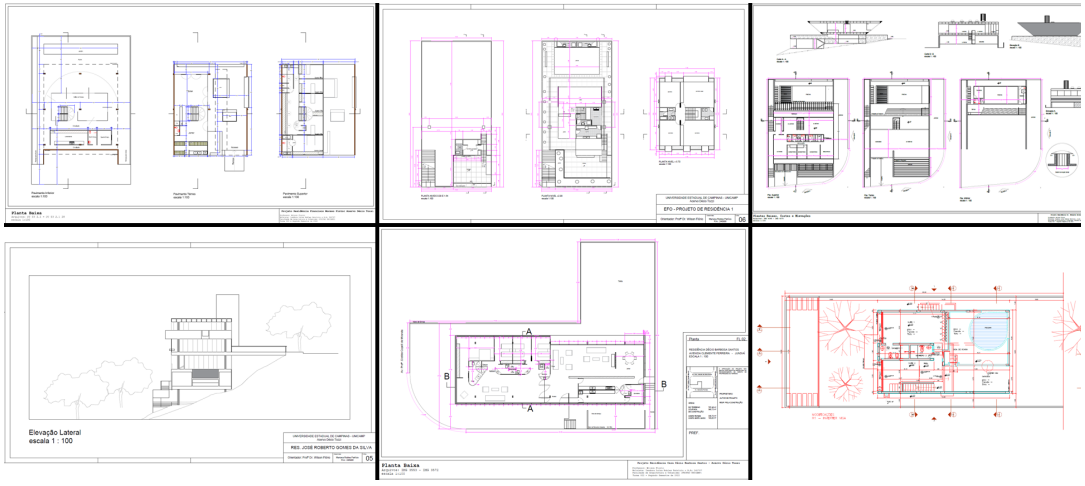

Fig. 11 - 2D redrawing of six residences. Source: Authors, 2023-2024.

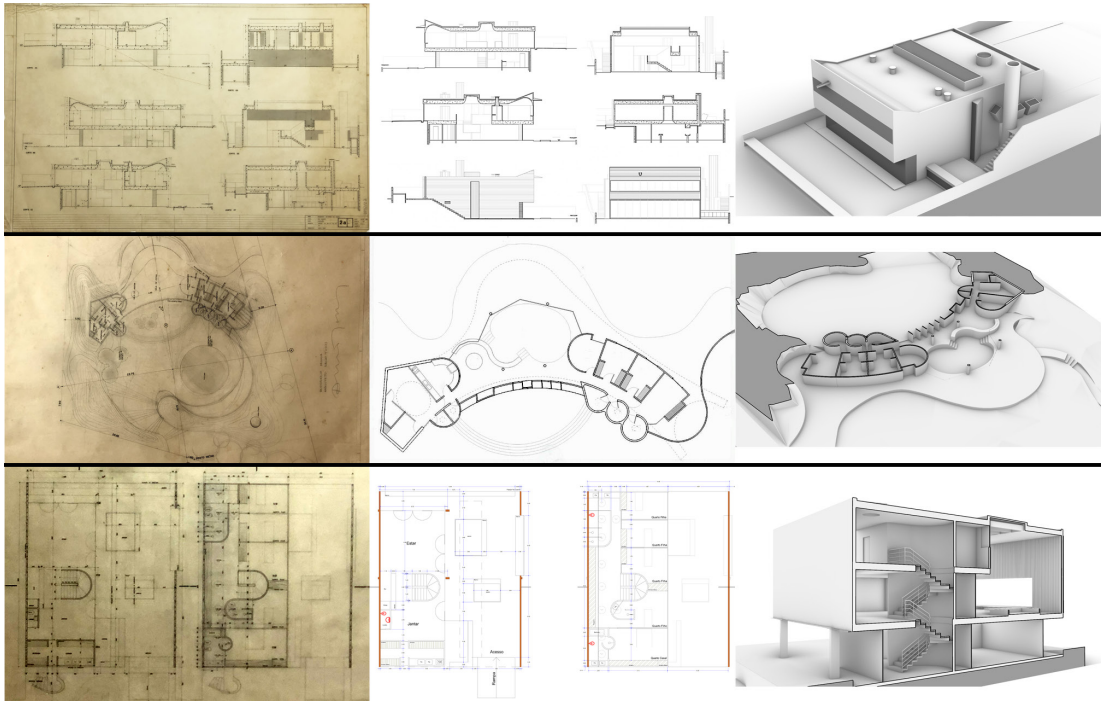

Fig. 12 - From left to right and top to bottom, digitalized drawing, 2D redrawing, and 3D geometric model of the residences Romeu Del Negro, Carmem Carvalhal, and Francisco Moreno Pintor. Source: Authors, 2022-2024.

will be analyzed; in the second group, technical analyses of structure and identification of pathologies will be conducted. Thus, preserving the digital documentation of design analyses and the "*as-built*" buildings for technical analyses is vital to heritage preservation.

DISCUSSION

At this moment, our research achieves important results from six years of the work team. The ten main activities were: 1. research planning; 2 cleaning and storage; 3. digitalization; 4. image editing and retouching; 5. investigation of the projects; 6. 2D redrawing; 7. 3D modeling; 8. Identify architectural features; 9. Conceptual thinking; and 10. Archives organization. Furthermore, since 2023, four buildings have been visited and photographed. As expected, there are specific differences between the project and the built work. We executed the ten activities in a non-sequential manner, with some occurring alternately and others simultaneously. In some cases, image editing and retouching were necessary to clarify some kind of information in the drawings, but we have preserved the original too.
Due to unbuilt projects, the slow execution of each redraw led us to pay attention to every de-

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

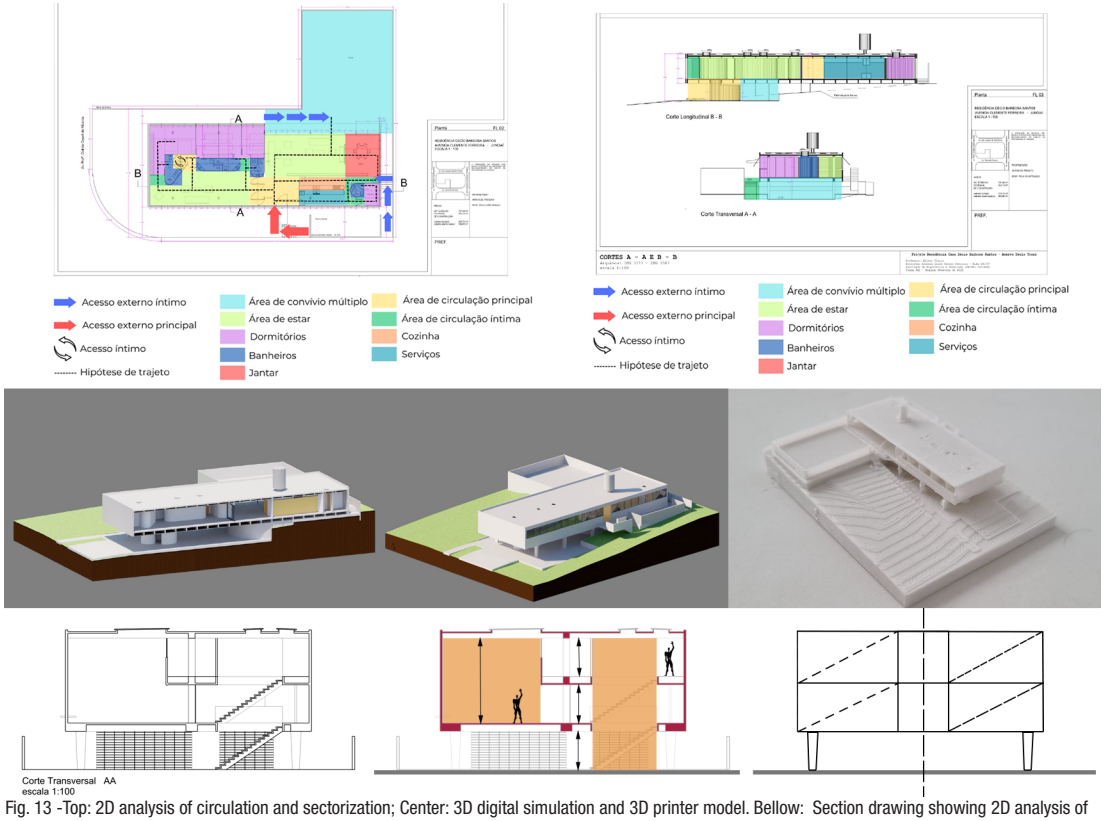

Fig. 13 -Top: 2D analysis of circulation and sectorization; Center: 3D digital simulation and 3D printer model. Bellow: Section drawing showing 2D analysis of double height ceiling and geometry. Residence Francisco Moreno Pintor. Source: Authors, 2022-2024.

tail. These results demonstrated that identifying architectural features in each drawing while redrawing contributed to clarifying implicit intentions in documents. Three-dimensional digital models of unbuilt projects are essential for clarifying intentions in documents and enhancing spatial understanding. We also concluded that research through redrawing contributes to preserving archives by producing new artifacts, including physical and digital three-dimensional models.

The three-dimensional modeling of projects, whether built or not, has substantially contributed to the identification of characteristics present in the architect's work. Consequently, the 3D digital models being produced have allowed us, in summary, to obtain: a. different angles of view of the same project; b. more refined assessments of technical-construction details; c. deeper analyses of sunlight incidence at different times and seasons; d. analyses of internal spaces and internal circulations; e. analyses of the indoor-outdoor relationship and landscape framing through openings; and f. analyses of the relationship with the topography and the levels of each floor in relation to the street.

Drawings in the architecture archives promote a valuable source of information about the design process as well as a true testimony of cultural heritage. The careful analysis of the drawings revealed that the architect proposed different versions of the project until finding one that could meet the client's needs as well as his expectations. In the case of different versions of the same project, we chose to select the most complete and most recent idea to model and simulate in three dimensions, understanding that in the future we will need to complete the study and perform simulations of the other versions to establish relationships and comparisons within a transformative thinking of the project. Besides the factors mentioned above, the graphic analysis supported by redrawings has shown excellent results in deepening the investigation of the architect's projects.

While 3D digital models can also generate new products, such as physical models and scale models of the projects investigated, 3D printing technology has expanded the scope of investigations through physical artifacts, complementing the research conducted through two- or three-dimensional drawings.

William Mitchel (1996, p. 203) was right when he declared that "*floppy disks, hard disks, digital tape, and so on are not archival media*" because they would not have a long life. Most of the digital files donated by architect Decio Tozzi to the collection were lost. This fact demonstrates that although the various types of paper normally used by architects are extremely fragile, the rapid and frequent changes in digital technologies have rendered technological resources obsolete in much less time. Preservation will not be possible without a policy of periodic updates of digital media.

Research on collections requires special care due to the poor conservation state of some drawings. Despite the fragility of the analog physical support, which deteriorates over the years, slow digitization is becoming possible. With practice, we have learned to handle the originals without damaging them and with special care to avoid losing extremely damaged parts.

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24

ISSN 1828-5961

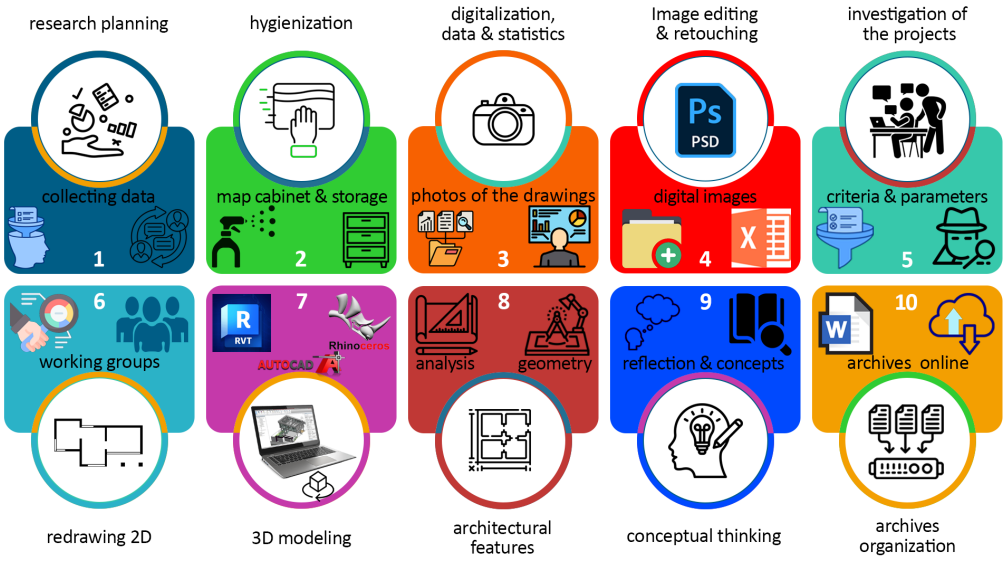

Fig. 14 - Ten main activities made in this research. Source: Authors, 2024..

Since 2019, we have found small drawings from one project mixed in the roll of another project, indicating a lack of concern in the handling of the projects by the architect's team or the architect themselves. With the growing knowledge about the projects, it has been possible to identify to which project a certain drawing belongs, which was improperly mixed with another.

Upon examining the residential projects in the collection, it was possible to gradually identify and understand the compositional solutions proposed by the architect for each project, the importance of the construction technique (reinforced concrete), and the relentless pursuit of formal simplicity.

Archives, particularly architectural drawings, require preservation, just as built cultural and architectural heritage does. The preservation of the graphic documentary heritage of modern architects is of utmost relevance, as it reveals the thinking of an era.

The digitization of collections and modern built heritage is fundamental for conducting high-level research. But at least three factors must be considered. The knowledge generated should be accessible to researchers, students, and the public for online consultation. Secondly, we must guarantee their ethical use. Third, the institution and the researcher should duly credit those who digitize as promoters of cultural preservation.

ACKNOWLEDGEMENTS

The authors thank the collaboration of architect Decio Tozzi, the support of BAE, and the financial assistance of CAPES, FAEPEX, and SAE UNICAMP.

REFERENCES

Balzani, M., Maietti, F., Raco, F., Rizzi, D. & Rossato, L. (2023). Ipirangadigital: 3D documentation activities for conservation and awareness increasing of cultural heritage in Brazil. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences,* XLVIII-M-2-2023, 163-169.

Balzani, M., Maietti, F., Kühl, B. M. (2017). Point Cloud Analysis for Conservation and Enhancement of Modernist Architecture. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences,* Volume XLII-2/W3, 71-77.

Bañón, C. & Raspall, F. (2021). *3D Printing Architecture*. Workflows, and Trends. Singapore: Springer.

Borin; E. & Rossato, L. (2023). Sustainable Management of International Partnerships for Cultural Heritage Digitization in Brazil. Sustainability. *Sustainability*, 15, 15302, 1-17.

Carpo, M. (2011). *Alphabet and the Algorithm*. Cambridge: MIT Press.

Castriota, L. B. (org.). (2011). *Arquitetura e Documentação*. São Paulo: Annablume.

Cassares, N. C. & Moi, C. *Como Fazer Conservação Preventiva em Arquivos e Bibliotecas*. São Paulo: Imprensa Oficial, 2000.

Cheng, L., Chen, S., Liu, X., Xu, H., Wu, Y., Li, M. & Chen, Y. (2018). Registration of Laser Scanning Point Clouds: A Review. *Sensors*, 18, 1641, 1-25.

Dong, Z., Liang, F., Yang, B., Xu, Y., Zang, Y., Li, J., Wang, Y., Dai, W., Fan, H., Hyyppa, J. & Stilla, U. (2020). Registration of large-scale terrestrial laser scanner point clouds: A review and benchmark. ISPRS *Journal of Photogrammetry and Remote Sensing*, 163, 327–342.

Farroni, L. & Faienza, M. (2024). *Gli Archivi di Architettura nel XXI Secolo: luoghi delle idee e delle testimonianze*. Roma, Edizioni Rome Tre-Press.

Garcia-Alvarado, R., Soza, P., Moroni, G., Pedreros, F., Avendaño, M., Banda, P. & Berríos, C. (2024). From BIM model to 3D construction printing: A framework proposal. *Frontiers of Architectural Research*, 13 (1), 912-927.

Kolarevic, B. (2003). *Architecture in the digital age: Design and manufacturing*. New York: Spon Press.

Larson, K. (2000). *Louis I. Kahn: Unbuilt Masterworks*. New York: The Monacelli Press.

Marques, E. de A. (2006). Serviços de biblioteca e informação da FAUUSP. *Pós FAUUSP,* (20), 226–238.

Mitchell, W. (1996). Architectural Archives in the Digital Era. The *American Archivist*, 59(2), 200-204.

Olsberg, N. (1996). Documenting Twentieth-Century Architecture: Crisis and Opportunity. *The American Archivist*, 59, 128-135.

Paglione, C. Z. (2017). *Glossário Visual de Conservação: Um Guia de Danos Comuns em Papéis e Livros*. São Paulo: Biblioteca Brasiliana Guita e José Mindlin.

Palestini, C. (2022). Research and Archives of Architecture. The Roles and Disseminations of Drawing. *Disegno*, 10, 7-17.

Picon, A. (2010). *Digital Culture in Architecture*. Basel: Birkhäuser.

Piva, A. & Galliani, P. (2005). *Gli archivi del progetto*. Milano: Lybra Immagine.

Roe, K. D. (2016). Why Archives. The American Archivist, 79 (1), 6-13.

Rossato, L., Planu, F., Montanari, G., & Rizzi, D. (2023). The Rocca Malatestiana of Verucchio_Scan to HBIM process for the digitalisation of cultural site. *Disegnarecon*, 16 (31), 2.1-2.12.

Tozzi, D. (2005). *Arquiteto Decio Tozzi*. São Paulo: D'Auria.

Vernizzi, C. (2022). Architecture Drawings and Digital Archives: Acquisition, structuring, preservation. *Disegno*, 10, 27-38.

DOI: https://doi.org/10.20365/disegnarecon.34.2025.24