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Credentials for an International Digital Register of 20th Century Construction Techniques—Prototype for Façade Systems

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Abstract

The architectural heritage of the 20th century has proved to be highly vulnerable to the test of time, with slight variations in different geographical contexts. The lack of value recognition, restrictions imposition, and resulting protection has led to the loss of memory of material and immaterial values. Restoring dignity has been the primary goal of those who have given substance and vitality to the theme of Modern Restoration, inheriting from the past the method that requires, in order to catalogue each work, the essential stages of knowledge and documentation, preliminary to conservation and enhancement. It is precisely in this scenario, after analysing the experiences of institutions, bodies and associations in the field of filing and cataloguing, that the needs brought about by the digital transition were taken on board; the aim is to define, within the PRIN 2022 DIMHENSION project, an innovative operative protocol that is economically, socially and technically sustainable, aimed at the computerised management of 20th century architectural heritage. The steps are the identification of the global description of the history of the building, translation of the entire body of data into information assets (H-BIR), and the possibility of consultation using parametric models (H-BIM). A Digital Register has therefore been designed, initially for an international sample of late 20th century façade systems, which goes well beyond their dynamic documentation, creating the conditions for a platform for consulting the complex of information, structured in an H-BIR archive interfaced with an H-BIM object library.

Keywords: H-BIR Historic/Heritage Building Information Repository; H-BIM object; 20th century architectural heritage; façade system from the late 20th century

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1. Introduction

Over the last century, vertical enclosures have undergone a profound transformation—driven by technological innovations, new materials, and energy efficiency regulations—which has inevitably contributed to defining new compositional images of the building structure. Although it is possible to find architectural solutions in the 20th century that appear very different from one another, from a technical and construction point of view, they can all be traced back to the transition from the wall box to the independent load-bearing skeleton, which becomes the substrate, visible or hidden, enhanced or concealed,

common to all façades. Despite the great aesthetic and formal variety, the vertical enclosure finds its expression in two functional construction elements: *infill*, a symbol of the wall philosophy, and the *curtain wall*, whose construction technique is well expressed by the literal Italian translation "parete-tenda" (curtain wall), which was preferred to "facciata continua" (continuous façade). This evolution is linked to that of reinforced concrete, which, since François Hennebique's first experimented at the end of the 19th-century, received widespread recognition in 1903 in Auguste Perret's house on Rue Franklin in Paris, confirmed in 1931 with the ribbon window of Le Corbusier's Villa Savoye in Poissy, which would have been impossible to incorporate into a traditional masonry structure.

This complex historical evolution accounts for over 50% of existing buildings, constructed before the energy crisis of the 1970s and Law No. 373/1976 on building insulation, for which appropriate performance efficiency measures must be considered [1]. The passage of time has inevitably changed the appearance of these modern buildings, which are often not protected due to deterioration, additions, or interventions that do not respect the historical value of the work. Therefore, it seems necessary to reflect on the knowledge of this important architectural heritage and on the digitalisation processes of information, which are functional to the tools and technologies used for the creation of 3D models (Digital Twin), the georeferencing of historical maps (implemented within GIS systems), and the conception of multimedia archives in which to store documents and data.

Hence, it seemed appropriate to develop—as part of PRIN_2022 DIMHENSION, *DIgital twin and Modern HEritage modelliNg towards Sustainable InfOrmed maNagement*, led by the University of Rome La Sapienza and local units at the Universities of Bologna and Messina—an *International Digital Register of 20th century construction techniques*, capable of collecting, classifying, comparing and making accessible information on façade systems, materials, compositional logic and production contexts, useful for guiding restoration, recovery and redevelopment interventions [2].

For many years, reliance has been placed on consulting analogue data sheets of Cultural Heritage, with the limitations that this imposes due to its static nature. This has been used to systematise primary sources, i.e., tangible and intangible evidence relating to a specific property, and secondary sources, which represent an additional level of documentation in which the acquired materials are processed by a producer based on other sources that have been previously researched and studied.

Today, digital transformation offers cultural institutions exciting opportunities not only to reach a wider and more diverse audience, but also to facilitate access to artefacts and collections for research purposes [3]. Furthermore, optimising digital accessibility makes it possible to enhance the economic and social value of Cultural Heritage, as it has been repeatedly emphasised in political terms [4], with implications in various areas, including economic management [5], ethics [6], and law [7].

This digitalisation cannot focus solely on the use of physical media and the World Wide Web—the latter allows multimedia documents to be shared via the Internet—but must also make use of Web 3.0 platforms and the Semantic Web, which would facilitate access to constantly updated technical documents that can be shared with libraries/archives, according to more sophisticated logic than simple hyperlink [8,9].

This paper, divided into four sections, focuses on façade systems as an emblematic case study to test the feasibility and usefulness of such an approach to cataloguing. Through the comparative analysis of case studies identified in European and non-European contexts, the examination of archival sources, and the survey of existing platforms at national and international level, the study aims to define the "credentials"—i.e., the informational, methodological and operative requirements—that such a register should possess in order to meet the needs of documentation, conservation and enhancement of 20th century architecture.

2. State of Art

The correct comprehension of architectural heritage—in particular that which represents and will represent an important testimony of the past and present in the future—allows us to preserve, conserve, enhance, and intervene on buildings, maintaining the original essence and identity of the work without betraying the designer's intentions. Since the 1970s, this has led to the spread, first in Northern Europe, the United States, and Canada, and then in the rest of the world, of museums, archives, and study centres for the preservation and consultation of documentation relating to architectural works [10]. For some time now, the need to find information online, by a diverse audience, scholars, enthusiasts or simply curious individuals, has promoted integration in the fields of Architecture, Engineering and Construction, such as Digital Information Management, computer science linked to BIM processes, robotics and various types of Artificial Intelligence (AI), in order to promote the digital and sustainable transition that is the goal of the 2030 Agenda for Sustainable Development. In fact, this transition has taken place very gradually, considering that until the 19th century, architects and historians relied on their drawings and notebooks to document historic buildings, monuments, and archaeological sites. It was only with the invention of the daguerreotype in 1837 that photography began to be used for the visual recording and archiving, albeit unstructured and uncodified, of objects worthy of attention. It was not until the 1930s and 1940s that the first paper records on architectural heritage were created by Cultural Heritage superintendents, with the support of public bodies and academic institutions, containing descriptive information on the building (date, designer, characteristics of the work), photographs, and drawings. The data sheets were kept in archives, divided into categories (e.g., monuments, religious buildings, civil buildings), which meant there were limitations in terms of accessibility, updates, and sharing of information. This important paper archive, which is still an essential basis for research today, has been systematised in some countries through important laws on cultural and documentary heritage (e.g., National Law 1089/1939 in Italy). With the introduction of the first computers in the 1970s and 1980s, the data collected in the data sheets was digitalised by hand, transcribed from paper documents to electronic databases, and stored on magnetic media such as hard disks and tapes. In the 1980s and 1990s, GIS systems made it possible to map and geolocate historic buildings in 2D [11]. In 1982, the Environmental Systems Research Institute (E.S.R.I.), now known as Esri, developed the commercial product Arc/INFO, used for cadastral purposes, land-use planning, and mapping buildings considered as 2D polygons with basic attributes (function, year of construction, height). This was an essential step not only for the subsequent transition to a 3D environment (with information on construction and interoperability with BIM) but also for the future cataloguing and management of Cultural Heritage, which will allow interactive maps to be viewed with accurate data on the location of buildings and monuments [12].

With the digital image acquisition in the late 1990s, all archive material (graphic, iconographic, and textual documents, archived in the first standard formats TIFF, JPEG, PDF, DWG) began to be scanned, making it easier to store and share data. With the evolution of informative management software (such as Access, Oracle, FileMaker Pro), digital data sheets began to be structured into relational databases, in which each building could be associated with a series of data (personal details, photographs, drawings, state of conservation) that could be easily consulted. Therefore, Universities, historical archives, cultural organizations and public and private administrations began to take a more specific interest in digitalisation, partly in response to political initiatives promoting the computerisation of Cultural Heritage, such as the "Internet Library of Early Journals", a joint project between the Universities of Birmingham, Leeds and Manchester and Oxford, which has digitalised around 200,000 pages of 18th and 19th century journals—undertaking

experimental projects [13,14] and establishing the first digital cataloguing systems such as MARC AMC (1985) (implemented via OCLC/RLIN to enable online exchange of archival descriptions and integration of archival material), NOTIS (1968) and Dynix (1983) in the United States, Photothek, Kunsthistorisches Institut (digital since 1993) in Italy, Swiss National Library–Prints and Drawings Department (1990) in Switzerland, Public Archives of Canada/National Archives (1984) in Canada, to name but a few. With the advent of the Internet and cloud systems, many public and private institutions have begun to publish digital archives online, where the data collected in the files are made available to the public through platforms that, thanks to international standards and the use of open formats (such as XML and JSON), have enabled interoperability and sharing between databases of different institutions and countries.

This switchover, a term often used to describe the transition from analogue to digital, sees global Cultural Heritage as the undisputed protagonist, and architectural and urban heritage as its prototype, representing a valuable legacy that must be protected in order to preserve and enhance its usefulness, while maintaining its essence and identity unchanged wherever possible. Therefore, the action of "digitalising built heritage" acts as a process of reintegration and protection, integrating 3D physical surveying techniques, building components, cataloguing and archiving [15], as well as non-physical data recording [16]. This has led to various short- and long-term initiatives involving digitalisation, annotation, the study of transformations, and the cataloguing of tangible Cultural Heritage [17–19]. These include the European Union's digital library EUROPEANA and its 3D repository (https://pro.europeana.eu/project/3d-content-in-europeana, accessed on 20 August 2025), various Horizon 2020 projects engaged in the development of Application Programming Interfaces (API) for the creation of 3D objects (https://share3d.eu, https://www.inception-project.eu/en, accessed on 20 August 2025), as well as online archives of 3D models covering various fields, including Cultural Heritage (https://sketchfab.com, accessed on 20 August 2025). Projects such as ANNFASS (An Artificial Neural Network Framework for understanding historical monuments, Architectural Structure and Style, http://annfass.cs.ucy.ac.cy, accessed on 20 August 2025) can be added to these; it is an online platform for digital humanities developed at the Cyprus Institute, which involves 3D convolutional neural networks (CNNs) trained to label and classify the architectural elements of surveyed Cypriot monuments (Table 1).

Table 1. List of the most visited international platforms by users with interactive and/or informative sheets on buildings, historical sites, and monuments.

Platform	Link	Year	Aim	n. Objects
DoCoMoMo International	www.docomomo.com/ accessed on 22 August 2025	1988	To compile an international register of the most significant examples of 20th century architecture, so that they can be documented and/or preserved	approximately 800 buildings
UNESCO World Heritage Centre	https://whc.unesco.org/ accessed on 22 August 2025	1992	To promote the identification, protection, and preservation of cultural and natural heritage throughout the world	1248 sites (including 972 cultural, 235 natural, and 41 mixed) in 170 countries around the world
EUROPEANA ECCCH	www.europeana.eu/it accessed on 22 August 2025	2008 2023	To bring together digitalised content from libraries, museums, archives, and audiovisual collections across Europe	>50 million

Table 1. *Cont.*

Platform	Link	Year	Aim	n. Objects
CyArk 3D Heritage Archive	https://cyark.org/projects/ accessed on 22 August 2025	2009	To collect 3D models of historic sites and monuments digitalised by CyArk and other partner institutions. The data includes LiDAR scans, photogrammetric images, and other spatial data	200 monuments around the world, including Angkor Wat, Pompeii, Teotihuacán, and Mount Rushmore
Google Arts and Culture	artsandculture.google.com accessed on 22 August 2025	2011	To include high-resolution images of works of art, photographs, manuscripts, monuments, historical sites, archives, 360° immersive realities, and virtual tours of museums	7 million digital objects—including artworks, artefacts, documents and curated stories—distributed across more than 3000 collections
Iconic Houses	www.iconichouses.org accessed on 22 August 2025	2012	To provide information and photos, and, in some cases, virtual tours of residential buildings designed by leading architects of the 20th century	Approximately 200 houses
ANNFASS	www.cyi.ac.cy accessed on 22 August 2025	2018	To use a neural network to identify and isolate the different architectural components of historic buildings	Not available
Open Heritage 3D	www.openheritage3d.org accessed on 22 August 2025	2019	To use advanced technologies such as LiDAR and photogrammetry for 3D documentation, enabling visualisation and interaction with detailed models of historical sites	664 datasets from CyArk

However, it has been noted that in most cases these are non-specific archives (EUROPEANA also shares films and music from thousands of cultural institutions and point clouds of monuments, which are not accessible because they are covered by copyright), sites that are not always updated or functioning correctly (Inception mainly describes the project and crashes continuously) or are subject to a fee, and with regard to the BIM objects processed, there is a lack of adequate information filing (Sketchfab).

The EUROPEANA digital library, developed in 2008 as part of the European Commission's eContentplus programme to promote and support the digital transition required by the "Digital Agenda for Europe", aggregates metadata from over 3500 European institutions (archives, museums, libraries), promoting the idea of Cultural Heritage shared by European citizens. Interaction with the platform by geographically distant countries, often with different levels of technological advancement, required the development of specific standards, tools, and technologies to ensure the easy use of digital data by different users and partners. To facilitate the digitalisation and aggregation of material relating to cultural and artistic heritage, EUROPEANA has developed a specialised data model known as the EUROPEANA Data Model (EDM), an extension of the Dublin Core model, which aims to record metadata relating to Cultural Heritage objects more comprehensively.

The digital objects that users can find on the platform are not centrally stored but are made available by partners who are responsible for their management and preservation. EUROPEANA collects contextual information—or metadata—about the objects, accompanied by a preview image. Once users have identified the resources they are interested in,

they can consult them directly at the data source, moving through a link on the provider's website to complete the process of use and knowledge. In addition, clear information is provided on the conditions of use and copyright of the resources.

Data collection is essential; national aggregators are particularly important because they support institutions wishing to join EUROPEANA in managing the workflow, from the application of standards to data normalisation procedures and automatic submission to the European portal. For Italy, this function is performed by the CulturaItalia portal managed by ICCU (Istituto Centrale per il Catalogo Unico, https://www.culturaitalia.it/, accessed on 22 August 2025).

On several occasions, the European Union has promoted the ECCCH—European Collaborative Cloud for Cultural Heritage [20] initiative to continue the EUROPEANA experience with legal establishment (2023), the design of digital tools (2024), and experimentation on real cases (2025) [21] (Figure 1).

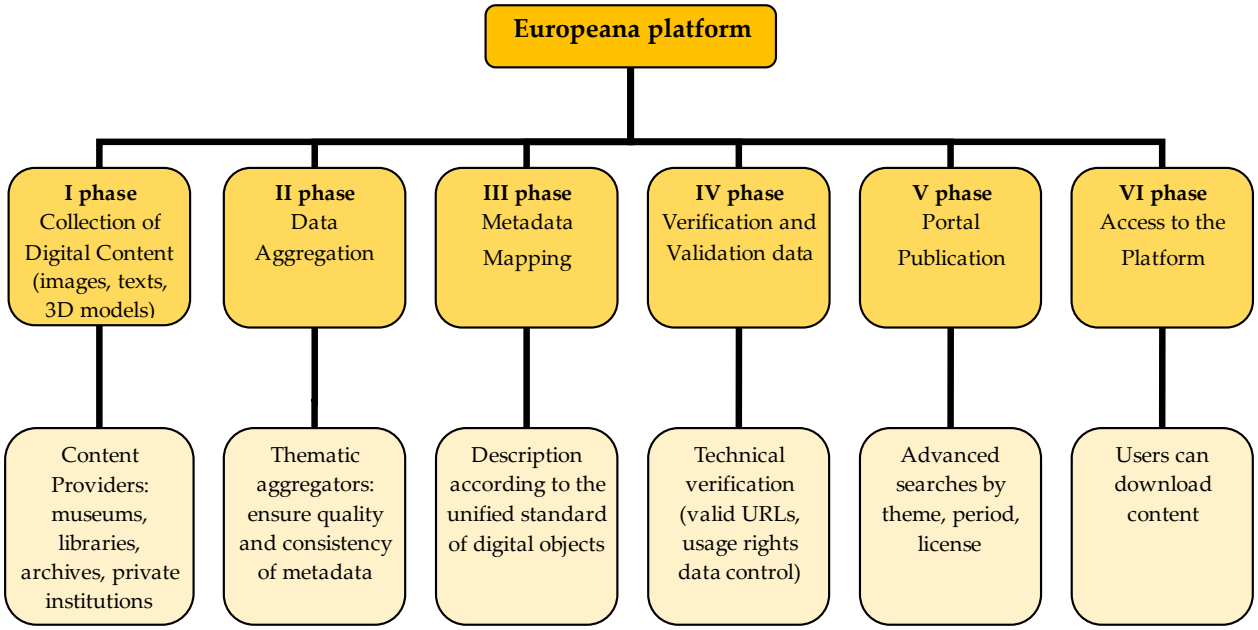

Figure 1. Diagram showing how the new EUROPEANA platform, ECCCH, works, divided into six phases.

The ANNFASS project, developed by the Cyprus Institute and the University of Cyprus in 2018, aims to create an advanced system for the automatic analysis of monumental architecture using artificial intelligence. The ANNFASS framework aims to segment historic buildings into architectural components, classify architectural style, and recognise the grammar of forms through self-learning.

Neural networks trained on 3D data integrated with AI methods are used to support the digitalisation of architectural heritage, analyse and compare architectural design rules for historical-critical analysis, and facilitate cataloguing, restoration, and virtual enhancement applications [22] (Figure 2).

To date, these two projects have not found real support that goes beyond the acquisition, analysis, recording, and monitoring of data to include the need for regular updating and implementation.

In Italy, there are several websites, generally accessible without registration, which present digital versions of paper data sheets on the web to facilitate downloading (not always possible), online reading, and searching for specific data. These include the virtual space of the international association DOCOMOMO, approved in Eindhoven in 1990,

which deals with the documentation and conservation of the most significant architecture of the 20th century, together with significant examples of modern urban planning after the Second World War. The catalogue proposed for Italy, covering around a hundred buildings, provides two different levels of detail, one more concise (Minimum Fiche) and the other more extensive and detailed (Full Fiche). In 2002, the project for the "Census of Italian architecture from 1945 to the present day" was launched, promoted by the Directorate-General for Contemporary Creativity of the Ministry of Culture, which analyses, through 4948 files (archived as of February 2023), the heritage of the period following the end of the Second World War, a time not only of reconstruction but also of technological experimentation in the field of construction. Other sites, such as SIUSA (Unified Informative System for Archival Superintendence), the Risk Map (ICR—Central Institute for Restoration), or those of some municipalities (e.g., Milan, Turin, Rome) have open databases with limited cataloguing and mapping of historical and modern buildings, which are not always accompanied by accurate informative paper data sheets. This type of inventory can be defined as static since it does not encourage user involvement and almost exclusively presents a transposition of material (plans, elevations, sections, images in general) from analogue to digital media without the possibility of interacting with either the data sheets or the building, for which there is never an editable model. Data sheets are generally prepared by scholars and, after being evaluated, are published in a format that includes information on location, author, period of construction, type of construction, etc.

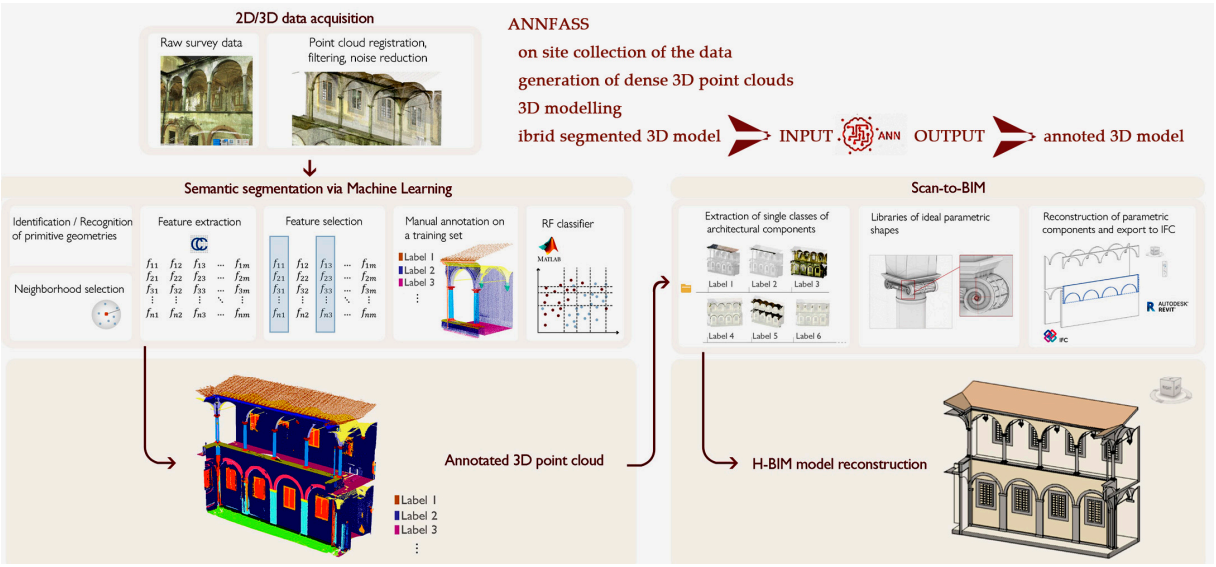

Figure 2. Three-dimensional digitalisation workflow_ANNFASS project [22] (reworked by the authors).

The transition from "analogue data sheet converted to digital", defined as static, to a dynamic transition can be seen in academic research into "filing prototypes converted into informative models" based on the use of digital technologies such as BIM. An example of this is the multidisciplinary research project Herit-IT Jordan—started in 2019 and completed in 2022, funded by the Royal Academy of Engineering with the support of the Newton Fund, in collaboration with the Supreme Council for Science and Technology of Jordan and the ICT centre of the University of Salerno—in which BIM objects (doors, windows, capitals, decorative elements) of two buildings that are symbols of Jordanian architecture have been created: the Qaqish House in As-Salt and Beit Al-Fann (House of Art) in Amman. The library is accessible upon registration, with the option to download objects in .rfa format. Three-dimensional scans using laser scanners are also available, with point clouds transferred to platforms such as Autodesk Revit to obtain HBIM models that integrate

geometric and informative data useful not only for conservation, but also for promoting tourism (thanks to virtual tours of buildings) and for the technical management and maintenance of architectural elements. The Herit-IT Jordan project has produced the first open library of HBIM objects of Jordanian historical architecture (over 40), making it the most comprehensive when compared to other digitalisation projects such as APAAME (with over 100,000 aerial photographs of Jordan), EAMEANA (for endangered archaeology), the MEGA-J geodatabase, the 3D models of the Wadi Faynan area in Jordan, and the virtual tour of Petra by the ZAMANI project. However, there are still some limitations in terms of information that can be overcome by "prototypes that combine digitalised analogue cataloguing with BIM objects having only geometric parameters"; one example is the Multimedia Inventory of Architectural Heritage (MIAH) platform. Please refer to paragraph 3.1 for a critical comparison of cataloguing systems (Figure 3).

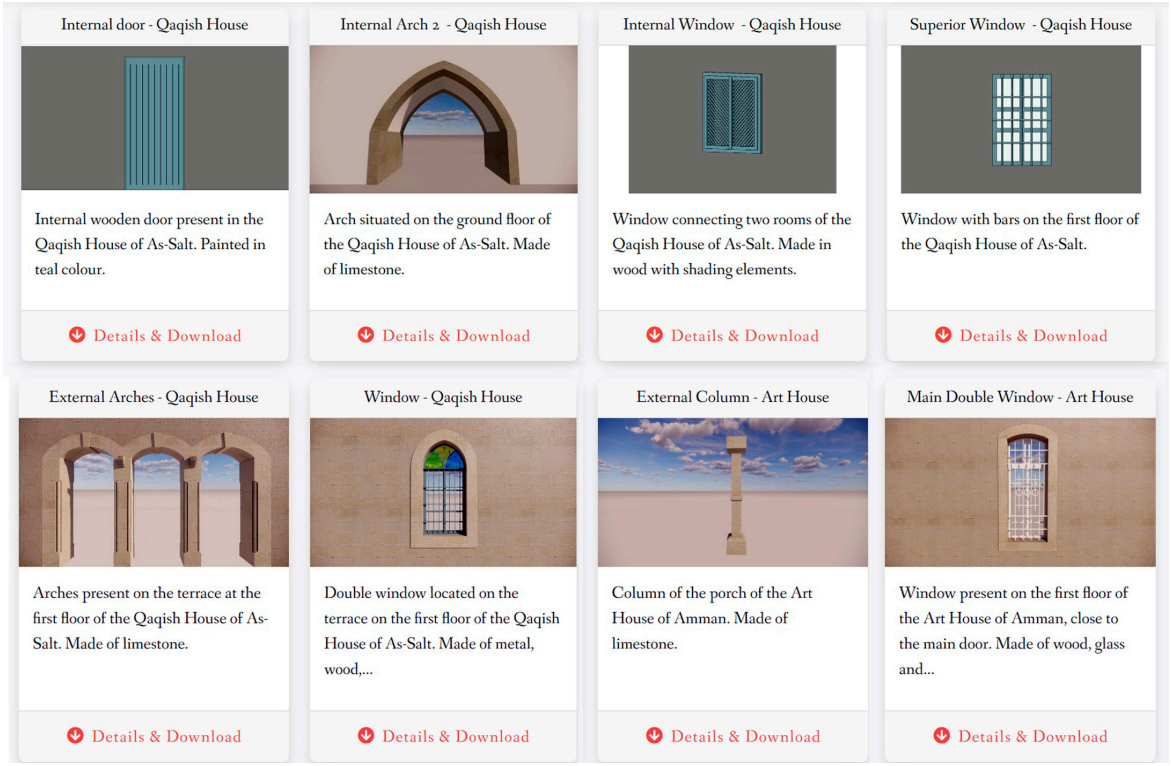

Figure 3. Three-dimensional models and BIM objects of Qaqish House (https://herititjordan.com/as-salt/, accessed on 22 August 2025).

3. Materials and Methods

The primary objective of the study has been to translate an analytical cataloguing project of 20th century works, structured as a critical inventory with documentary value of an analogical nature, into a Digital Register that aims to pursue the same criteria of accuracy and scientificity, but associating implementable informative contents.

The methodology has been structured in the steps outlined in Figure 4 and described in detail below.

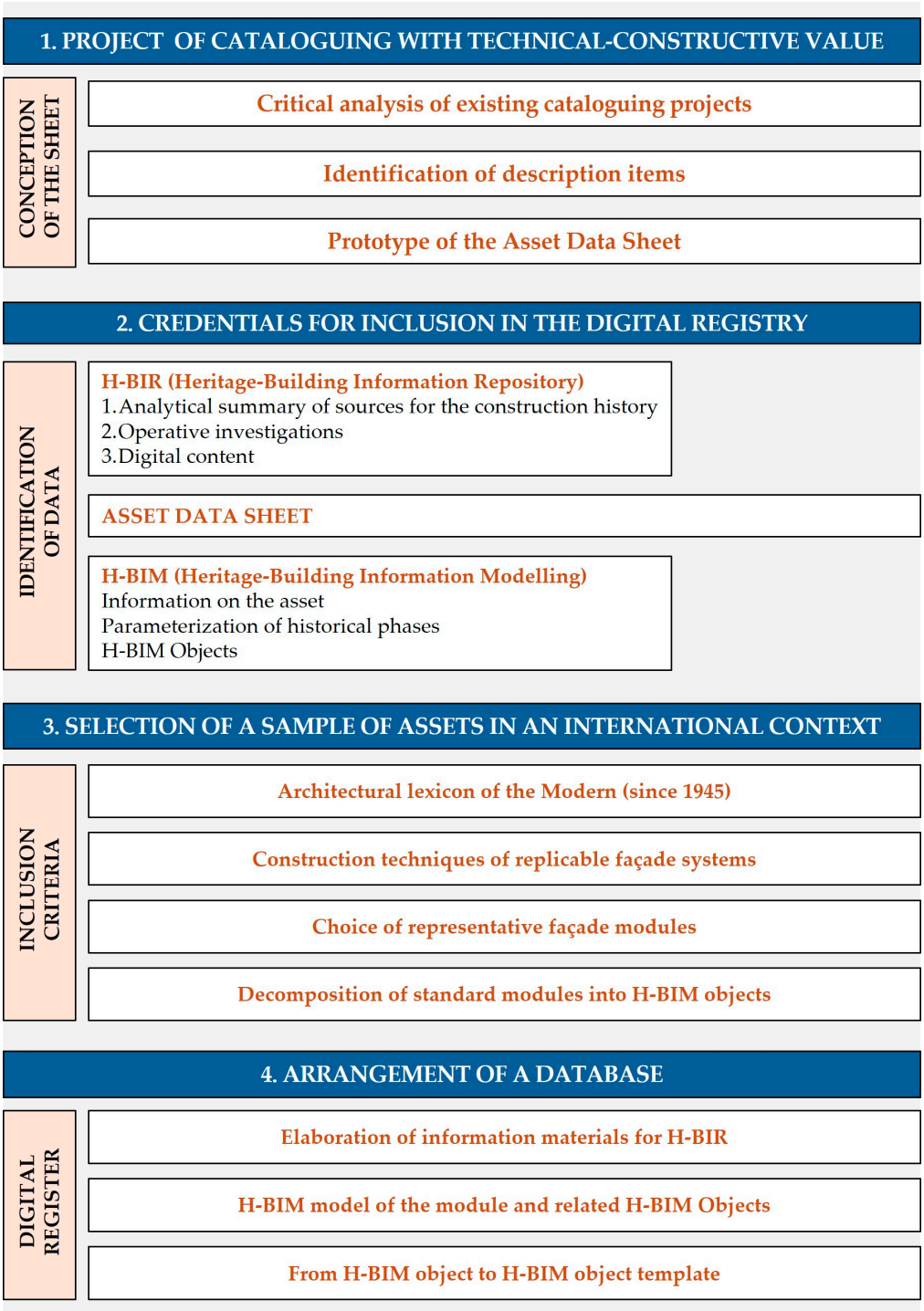

Figure 4. Methodological approach for the establishment of the *International Digital Register of 20th century construction techniques*.

3.1. Cataloguing Project with Technical-Constructive Value

Downstream of the analysed experiences in the context of the state of art, the undertaken path aims to find a fourth way with respect to what has been performed so far.

A method, preferred by bodies and associations for the protection of 20th century architecture, is a paper-based filing then implemented on digital platforms to facilitate and expand consultation [23–25]; however, this remains static (Figure 5). A prospect, which is spreading in research areas oriented towards the digital transition, concerns the elaboration of BIM models of the buildings under study, increasing some informative data on the

construction history among the parameters that can be consulted by the total or partial models (Figure 6) [26,27]. A more mature experimentation from the conceptual point of view, also developed in the academic field, proposes to combine documentary sources with total or partial models, even if still developed mainly on a geometric level (Figure 7) [28,29].

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1. Identity
1.1 Current name of building
1.2 Variant or former name
1.3 Number & name of street
1.4 Town
1.5 Province/state
1.6 Zip code
1.7 Country
1.8 National grid reference
1.9 Classification/typology
1.10 Protection status & date
2. History of building
2.1 Original brief/purpose
2.2 Dates: commission/completion
2.3 Architectural and other designers
2.4 Others associated with building
2.5 Significant alterations with dates
2.6 Current use
2.7 Current condition
3. Description
3.1 General description
3.2 Construction
3.3 Context
4. Evaluation
4.1 Technical
4.2 Social
4.3 Cultural & aesthetic
4.4 Historical
4.5 General assessment
5. Documentation
5.1 Principal references
5.2 Visual material attached
5. 3 Rapporteur/date

Direzione Generale Creatività Contemporanea
Asset information
Code | Denomination
Asset position
Region | Province | Town | Locality | Address
Asset typology
Category | Typology | Specific Typology
Asset Chronology
Start Year of the Project | End Year of the Project
Start Year of the Construction | End Year of the Construction
Architectural Information
Brief Description | Client | Cadastral Sheet | Parcel | Structure | Structure Condition | Façade Material | Façade Material Condition | Roofing | Roofing Condition | Windows | Windows Condition | Original Name | Current Name | Transformations
Legal information
Property Type | Specific Property | Measure Type | Measure Details | Regulatory Reference | Other Measures
Aggregate
Note
Authors
Phase | Author Name | Author Surname | Role | Architects Archive | Profile/Archive Url | Main Author
Artworks
Location | Typology | Subject | Material technique| State of conservation | Restorations
Bibliography
Websites
Archival sources
Attachments
Criteria
Among 7 predefined criteria, choose those for which the asset has been surveyed
Map
Credits

Figure 5. Analogue filing converted to digital: type and extent of data. Comparison between two cataloguing protocols adopted in Italy: an international one proposed by DOCOMOMO [24] (Minimum Fiche, more widely adopted than the Full Fiche from which it differs not in content but in the degree of depth [23]) and a national one proposed by the Directorate General for Contemporary Creativity of the Ministry of Culture [25].

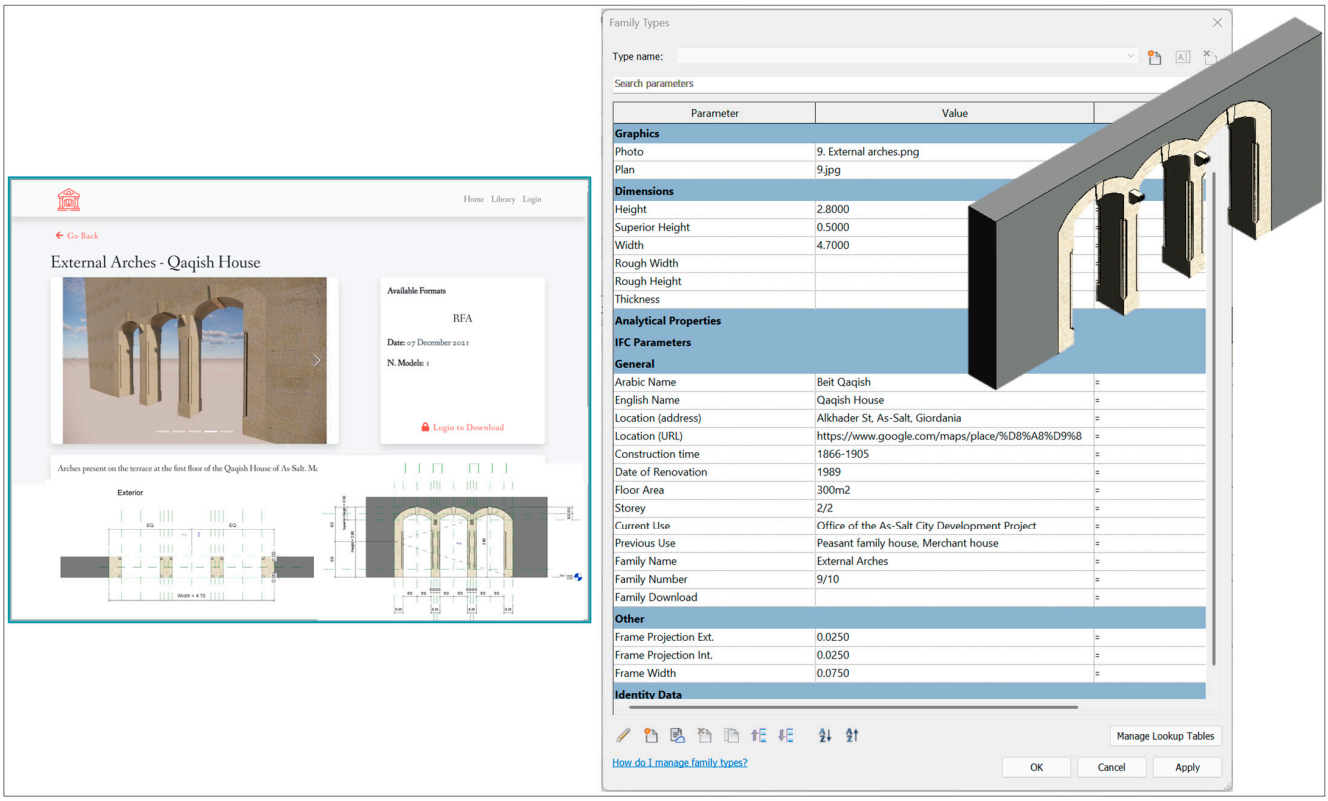


Figure 6. Prototype of cataloguing in informative models (H-BIM object extracted from the HERIT-IT JORDAN library: data regarding the history of construction) [27].

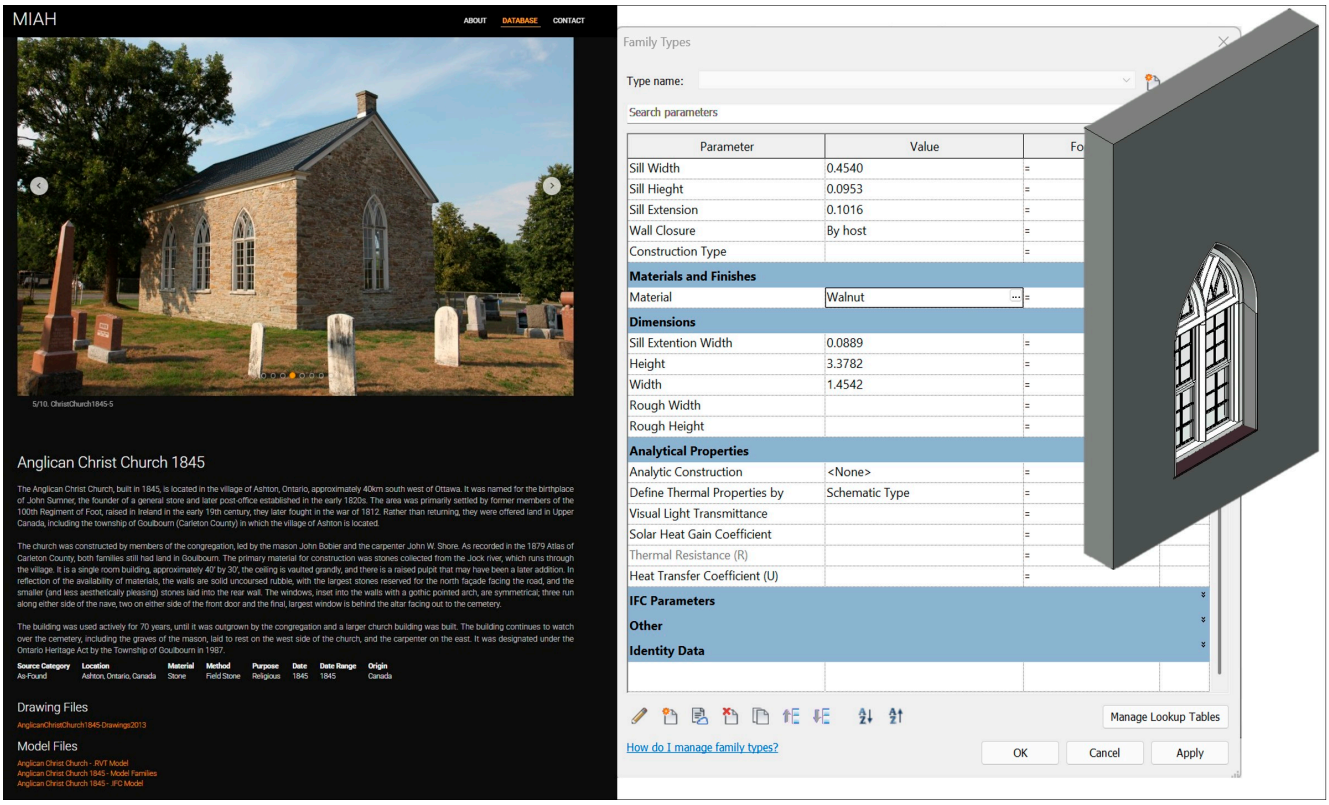


Figure 7. A prototype that combines digitalised analogue cataloguing with BIM objects having only geometric parameters (H-BIM object extracted from the MIAH library) [29].

The fourth way, starting from a specifically designed sheet (Figure 8), intends to deepen the technical-constructive aspects of the envelopes made in the 20th century, contemplating items purely dedicated to the analysis of the technological system, which are integrated with others dedicated to the construction history, stylistic and typological analysis, and conservation. The model, called *Asset Data Sheet*, was conceived on the occasion of projects for the cataloguing of cinema buildings in Italy in the second half of the 20th century and is derived from the critical analysis of the cataloguing protocols of DOCOMOMO International and the Italian Ministry of Culture [30]. Its structure, recently adapted to accommodate descriptions of passive cooling of residential buildings in the second half of the 20th century [31], is appropriate for thematic insights which, for the present study, have mainly concerned topics of technological and conservative nature.

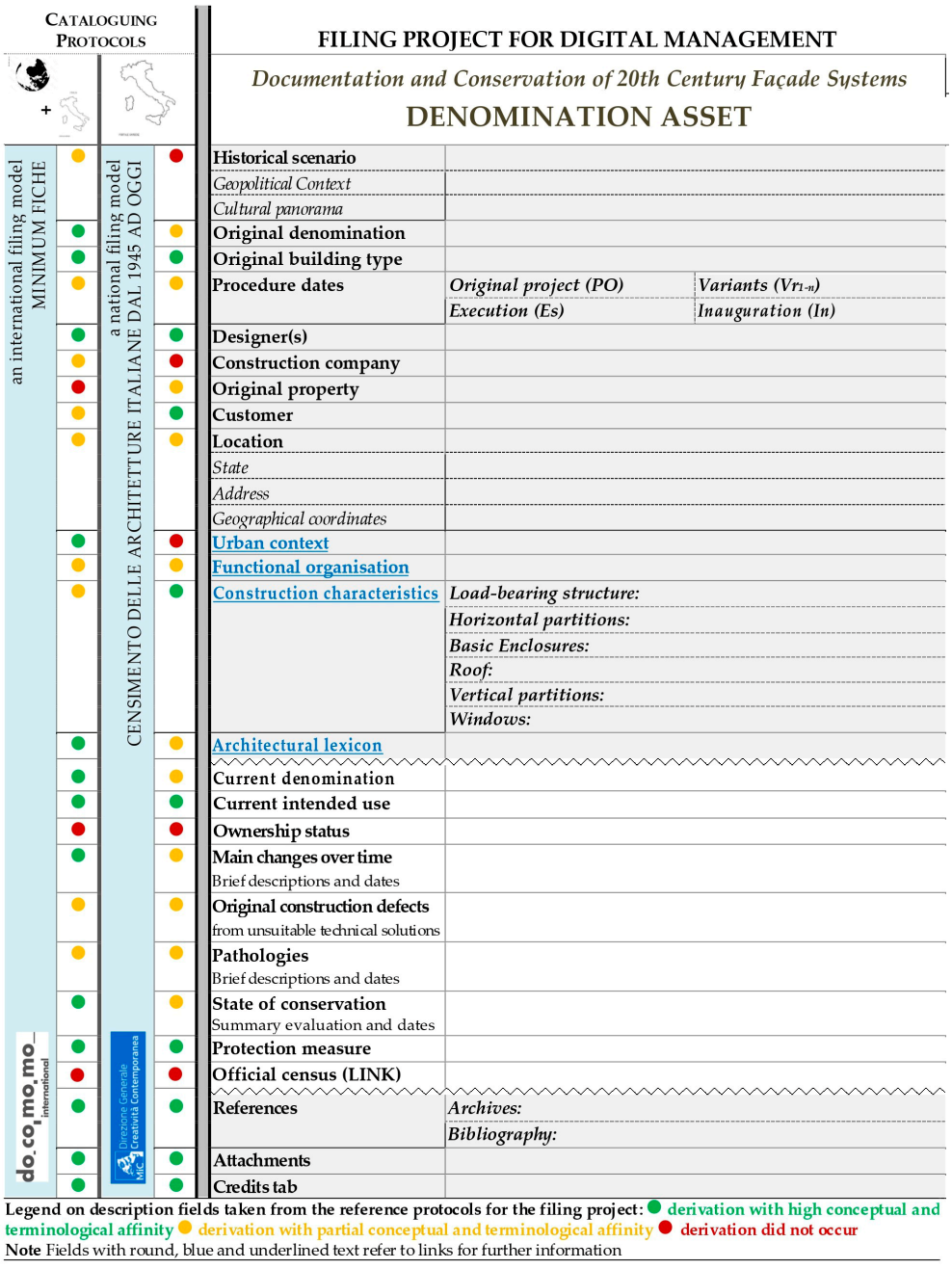


Figure 8. Prototype of the *Asset Data Sheet*, developed following a critical analysis of existing cataloguing projects.

The proposed cataloguing activity aims to contribute to the establishment of an *International Digital Register of 20th century construction techniques*, supporting the informative enrichment of the H-BIM models of the works belonging to the architectural heritage of the historical period under consideration. This study allows to develop the implementation stage of the DIMHENSION Library, a target result for the PRIN 2022 DIMHENSION Research Project which, for the purposes of the computerised management of the architectural heritage of the 20th century, provides for the creation of a library of H-BIM objects exemplifying the façade solutions, appropriately defined both from a geometric and an informative point of view (Figure 9). This proposal can be extended to other technological units and other historical periods.

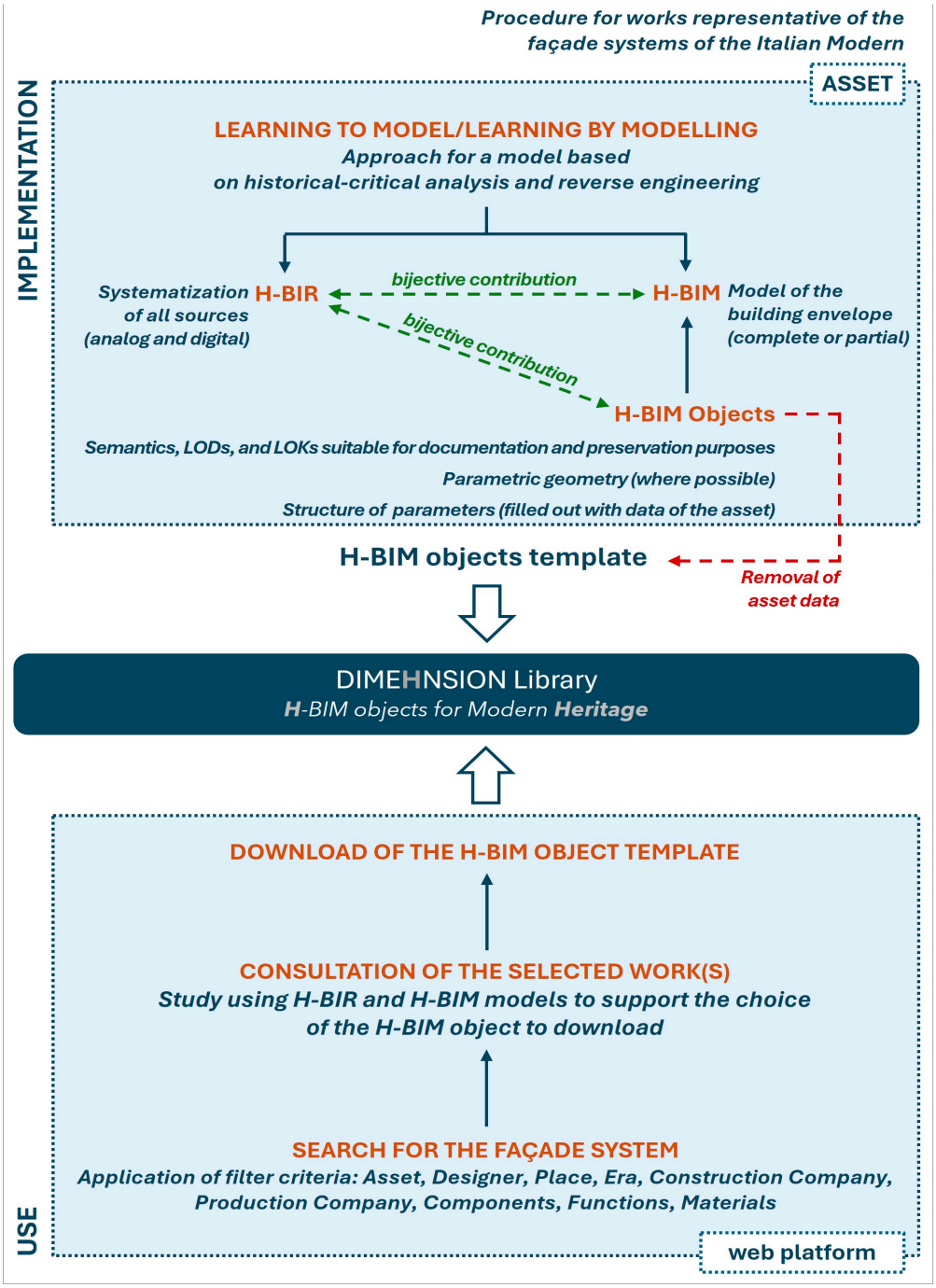


Figure 9. A goal of the Research Project PRIN 2022 DIMHENSION—DIgital twin and Modern HEritage modelliNg towards Sustainable InfOrmed maNagement.

3.2. Credentials for Inclusion in the Digital Registry

The inclusion of a work in the Register required a thoughtful identification of the access requirements necessary to meet the purposes of the digitalisation project.

The credentials have been recognised in the existence of a digital archive, called H-BIR, where all the knowledge acquired on the work can be systematized, and of a 3D model, conceived according to the H-BIM approach, which effectively emulates the real building from a technical-constructive point of view. The two tools are related by *the Asset Data Sheet*, the contents of which are taken from the H-BIR but become the informative apparatus of the H-BIM model. Their conceptualisation is the result of an analysis of the state of the art and previous study experiences of the research group [32–41].

H-BIR is the acronym for *Heritage Building Information Repository*, an expression that refers to a digital archive designed to contain information relating to a historic building and support its informative modelling. If from an IT point of view it can be conceived as a database [32] or a CDE—Common Data Environment [33], from a conceptual point of view the H-BIR is a solution in which to centralise the multidisciplinary knowledge that can be acquired on an asset of the architectural heritage, without placing restrictions on the type and extent of the contents and with the possibility of updating over time. The structure, slightly varied by its creators in a subsequent study [34], consists of six sections—*Source Management*, *Identification*, *Research*, *Protection*, *Conservation*, *Dissemination*—each of which is dedicated to collecting, by thematic areas, useful information for the knowledge of a work. In the literature there are other proposals for systematisation to be compared with the H-BIR that have different names but similar purposes although often oriented to emphasise certain issues (e.g., documentation of damage mechanisms [35]; energy performance of heritage buildings [36]; ease of use for the purpose of managing the work even by users who are not experts in BIM software [37]).

The examples described so far have contributed to the development of a personalised proposal for a digital archive that could meet the aims of the digitalisation project underway on 20th century construction techniques.

First of all, the name H-BIR found in literature has been accepted because it is believed that the assonance with the acronym H-BIM helped to focus attention on the need to have a digital archive from which to draw the data with which to enrich BIM models. If, from an IT and operational point of view, the preparation of a web platform (called DIMHENSION, to be published by February 2026, the closing date of the Research Project [2]) and of its related database is underway, from a conceptual point of view, the contents that will have to be accommodated have been defined:

1. *Analytical summary of sources for the construction history*

   The aim is to reconstruct the building history by testifying to it through the documents available. The name Analytical summary of sources derives from a method for the systematisation of the information acquired through consultation of all the existing sources on the work: archival, bibliographic, website, and photographic ones [38]. This is a tabular approach that, for each phase of the building's life (Area acquisition; Original project; Transformation; Maintenance; Restoration; Demolition), returns the salient facts and documents to prove the events that occurred from the initial phases of the project to the most recent state of fact (Figure 10). Each phase is described through items organised in macro-sections aimed at summarising the details of the project and the existing administrative, graphic, technical, and photographic documentation, as well as the references from which they were taken. The structure thus conceived facilitates the following: the compilation by the operator delegated to find the information; the reading by an external user who is looking for information on

the asset; the work of those who have to transfer the contents to the database that will support the web platform dedicated to the Registry.

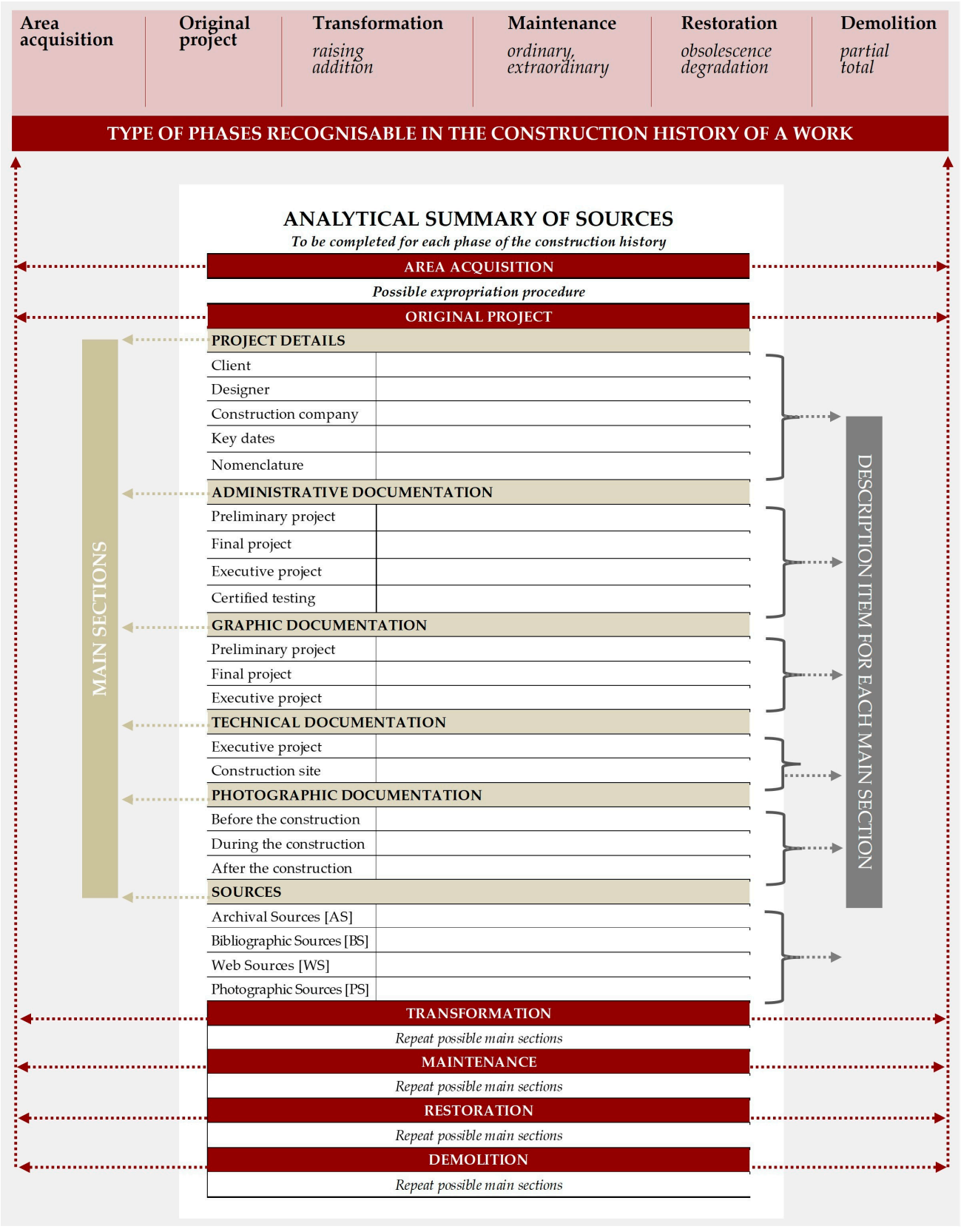


Figure 10. Example of "analytical summary of sources" to be filled in for recognisable phases in the history of a building.

2. *Operative investigations*

   The aim is to collect the results of the diagnostic programs on which the choices of transformation, maintenance, restoration, or demolition interventions have been based over time. Such documentation is essential to support the historical-critical analysis conducted through the *Analytical summary of sources*, providing answers to questions left unresolved by the documentation.

3. *Digital content*

   The aim is to accommodate digital products that are and will be increasingly elaborated for a historic building. The advent of more and more advanced technologies suggests that in the future, it will be very likely to find orthophotos, point clouds, 3D models of existing buildings, and digital twins created for interventions carried out during the life cycle. Moreover, as highlighted by the concept of *learning by modelling* [39], these digital approaches can themselves constitute a new source of knowledge of the work since reverse engineering and 3D modelling operations make it possible to reveal aspects that would otherwise not be easily deduced.

From a methodological point of view, the prior definition of the H-BIR has been considered fundamental for the development of the subsequent steps of the procedure designed to establish the Digital Register: its informative apparatus is called upon to support both the compilation of the *Asset Data Sheet* and the processing of the H-BIM model. Hence, this led to the need to qualify the existence of a resource archive as the first credential to guarantee access to a cultural asset to the digitalisation project. The second credential has been identified in the existence or production of an H-BIM model.

Its creation requires an assessment of the LOD (*Level of Development*) to strive for. In the operative and scientific fields, there is a growing awareness that for an existing building, it cannot be easily established; this could be due to the lack of knowledge in some aspects of the work that prevents the same geometric and informative accuracy for all the objects. This leads to the need to accept that it is possible to have different LOG—*Level of Geometry* and LOI—*Level of information* for the same BIM entity, therefore not necessarily corresponding to a certain stage of the LOD scale (from LOD A to LOD G in Italy, from LOD 100 to LOD 400 in the international context) [40,41].

Despite this awareness, for the purposes of this activity, the need to try to take care of the modelling in equal measure from both the geometric and informative point of view has been understood, trying to reach the highest LOD for a greater verisimilitude with the current state.

With reference to the first aspect—the geometric one—in order to start the constitution of the Register, the creation of the geometric model of the entire asset is not required; in this phase, the choice of one or more emblematic portions of the building envelope is also considered valid because it allows the production of digital objects of 20th century façade systems to begin to be disseminated.

With reference to the second aspect—the informative one—although H-BIM modelling software allows a consistent enrichment of the model data in terms of quantity and type, it cannot perform the function of H-BIR. Furthermore, it is never good to overload a BIM model with data that is not strictly necessary for the use that will be made of it.

Therefore, since the essential contents to be introduced in the H-BIM environment are those defined in the prototype of the *Asset Data Sheet*, one result of the research has been the conversion of the description items into parameters, by evaluating their assignment with two different BIM authoring software to validate and, as much as possible, generalise the methodology. To the parameters referring to the work, other specific to the digital objects that compose it have been added.

3.3. Selection of a Sample of Assets in an International Context

The methodological path has required reflection to identify, in the international panorama, recurring characteristics of the built heritage that could guarantee the replicability and scalability of the digital content (H-BIR/H-BIM) to be prepared for the Register. Within the scope of the PRIN 2022 DIMHENSION Research Project, the focus has been on the knowledge, digitalisation, and maintenance of 20th century façade systems [2]. Using the architectural lexicon and construction techniques as focal points, three time intervals have been identified: Early Modernism (about 1900–1930); Mature Modernism (1930–1945); International Modernism (1945–1980), which has been followed by contemporary architecture that has not been examined [42–44].

The study, initially aimed at the Italian context, can be extended to the geographical level. In this application, the period after 1945 has been explored, characterised by a development of problems related to urban expansion (United States, Scandinavian countries), reconstruction (Europe), and modernisation (Latin America, India), depending on the geographical contexts but with similar characteristics in terms of compositional choices and construction solutions. Dominant themes for the envelope, whether it belongs to public, social or residential construction, are the widespread use of reinforced concrete or steel and glass, the standardisation of prefabricated elements, the experimentation of lightweight materials for infill panels and cladding; these are factors that subjugated themselves or determined architectural expressions attributable to mature rationalism, with a brutalist meaning, evolving towards the International style [44,45].

Therefore, the selection of the sample involved Italy, Spain, and Chile in this phase of the research; from 1945, these countries were influenced by similar political contexts (post-war reconstruction or dictatorships) in which similar modernisation processes were implemented. Several buildings have now been analysed, and the following case studies have been considered representative of them:

ITALY, MESSINA:

- INPS headquarters—Block IX of the Palazzata, Giuseppe Samonà, 1954–1957, via G. Garibaldi n. 124
- Residential building—Block VI of the Palazzata, Giuseppe Samonà, 1953–1956, via Garibaldi n. 114–118

ITALY, PAVIA

- Building I INA, Guglielmo Ulrich, 1950–1953, Corso Cavour n. 51–59
- Don Bosco University College, Ottavio Bonomi, 1962–1965, via Via S. Giovanni Bosco n. 4

SPAIN, VALENCIA

- Grupo de Viviendas Santa María Micaela, Santiago Artal Ríos, 1958—1961, Calle de Santa María Micaela 18/avenida de Pérez Galdós

CHILE, SANTIAGO

- Unidad Vecinal Portales, Carlos Bresciani, 1950–1966, Quinta Normal district

Their façade systems are composed of compartments marked by a load-bearing framework made of reinforced concrete, generally protruding and further divided with frames that are not always statically relevant; the infill panels are mainly light with a metallic, brick, glass, or ceramic mosaic finishing, coinciding or not with the internal workmanship. The windows and doors also characterise the composition in terms of material, shape, colour, and partition. The analysis of the elevation modules (Figures 11–16) is a necessary guide not only for the technical-constructive understanding of the vertical enclosure but also to prepare the digital model of the envelope of a building to be included in the Register or for

the evaluation of existing virtual representations that could be adopted for the purpose of the digitalisation project.



Figure 11. Italy, Messina, INPS headquarters—Block IX of the Palazzata, Giuseppe Samonà, 1954–1957.



Figure 12. Italy, Messina, Residential building—Block VI of the Palazzata, Giuseppe Samonà, 1953–1956.



Figure 13. Italy, Pavia, Building I INA, Guglielmo Ulrich, 1950–1953.



Figure 14. Italy, Pavia, Don Bosco University College, Ottavio Bonomi, 1962–1965.



Figure 15. Spain, Valencia, Grupo de viviendas Santa María Micaela, Santiago Artal Ríos, 1958–1961.



Figure 16. Chile, Santiago, Unidad Vecinal Portales, Carlos Bresciani, 1950–1966.

The selection, preparation, and enrichment have been the subject of careful analysis to have a representative repertoire, differentiate the types, and allow the population of BIM objects library of the 20th century that is missing on the web. The intention has been to fill a gap to facilitate the heritage management and provide knowledge to protect the Modern.

3.4. Arrangement of a Database

The last step in the preparation of a Digital Registry is the creation of all the content necessary to implement the database of the conceptualised platform.

A filing elaborated on the proposed prototype will be used to elaborate on the construction history of the selected works from which to deduce the informative materials to attribute to the H-BIM models. The partial or total modelling will certainly concern the previously analysed modules, for which the geometric development will be enriched with a list of parameters that will host data relating to the construction phases, the characteristics of the materials, and the state of degradation. This file, emptied of specific contents, can contribute to the definition of an H-BIM template object that can be exported to any project, affirming the concept of replicability of the library that the Research Project intends to propose.

4. Results

A primary result of the study is the identification of a procedure to establish the *International Digital Register of 20th century construction techniques*, in this phase mainly aimed at façade systems. The novelty consists in providing, together with a descriptive sheet of the work, H-BIR digital archives with systematisation of the knowledge acquired and H-BIM models with a geometric representativeness and informative content useful for a full understanding of the historical-cultural and technical-construction specificities; these are the necessary credentials for the inclusion. In addition, the sharing of these digital entities through the web platform being prepared will allow their reuse in digitalisation projects of other works with similar characteristics.

Two buildings from the sample were emblematically selected, the INPS headquarters in Messina (Italy) and the Grupo de Viviendas Santa María Micaela in Valencia (Spain). There are many reasons for this: the choice of an Italian case and an international one, to expand the boundaries of a digitalisation project initially aimed only at the national context; different construction techniques but of interest to international users; extent and quality of the analogue and digital materials necessary for the definition of the credentials for access to the Register (H-BIR and H-BIM) and for the compilation of the *Asset Data Sheet*.

4.1. Credentials for Access to the Digital Register

For each work, the materials necessary to obtain the two credentials for access to the Digital Register have been researched and created: an H-BIR repository and an H-BIM model, at least reproducing a portion of the building envelope (Table 2).

Table 2. Check on the possession of credentials to access the Digital Register for the selected case studies.

REGISTRY ACCESS REQUIREMENTS	CASE STUDIES					
	Grupo de Viviendas Santa María Micaela *Valencia (Spain)*			**Block IX "Palazzata": INPS Headquarters** *Messina (Italy)*		
Credential 1	H-BIR	Analytical summary of sources	⊕	H-BIR	Analytical summary of sources	⊕
		Operative investigations	✓		Operative investigations	✗
		Digital content	✓		Digital content	✓
Credential 2	H-BIM	Complete model of the asset *elaborated with Edificius software by Acca*	✓	H-BIM	Complete model of the asset ---	✗
		Partial model of the asset *possibly obtainable from the previous*	X		Partial model of the asset *created with Revit software by Autodesk*	⊕
NOTES	✓ Existing data ✗ Missing data ⊕ Data created X Not necessary data					

With reference to the first credential, the operative procedure requires actions for the three parts constituting the repository: *Analytical summary of sources for the construction history*, *Operative investigations*, and *Digital content*.

The archival, bibliographic, website, and photographic research have made it possible to compile the *Analytical summary of sources* for both case studies; this step, in addition to allowing an in-depth knowledge of the work, has become the foundation for the subsequent stages of the study. The research has revealed operative investigations only for the residential complex of Santa María Micaela, of which direct surveys of the materials were carried out [46]. Should others be found, besides being archived for documentary purposes, they could support the creation of informative models, and at the same time be their information apparatus.

The check on the existence of digital content has once again given a positive result only for the complex of Santa María Micaela: there was a BIM model reproducing the entire work, developed with the Edificius software of Acca, from which other models were derived for energy analysis purposes [47]. Therefore, with reference to the second credential, the H-BIM model of the Spanish case study has been adopted, and the model of a façade with several modules representative of the building envelope selected for the Italian context has been produced. To compare results achievable with different programs, the latter has been created with another parametric modelling software, Autodesk Revit.

The results of the research and the creation of the credentials for the two buildings in question are presented below: for the INPS headquarters in Messina, Table 3 and Figure 17, and for the residential complex of Santa María Micaela in Valencia, Table 4 and Figure 18.

Table 3. INPS HEADQUARTERS—MESSINA. Credential 1_H-BIR. Analytical summary of sources.

ANALYTICAL SUMMARY ObsF SOURCES—BLOCK IX "PALAZZATA": INPS HEADQUARTERS—MESSINA	
1955–1961__ORIGINAL CONSTRUCTION PROJECT	
PROJECT DETAILS	
Commissioning	Local INPS (Italian National Social Security Institute) Headquarters
Designer	Giuseppe Samonà—Vincenzo Cacopardo
Construction company	--
Key dates	11/1954-08/1957_Executive project; No date for Start of construction works; No date for Completion of construction works; 03/1961_Acceptance of the works.
Nomenclature	"INPS-Nuova Sede di Messina da sorgere sull'Isolato IX della Cortina del Porto"
ADMINISTRATIVE DOCUMENTATION	
Final project	- 5 March 1955_INPS-Genio Civile Me: Presentation of the project with attached static calculations, already approved by the municipal administration, for approval. - 9 May 1955_Consiglio Superiore LL.PP. Genio Civile Me: Vote no. 1142 in favour of technical approval of the project examined, with requests for certain structural changes. - 4 July 1956_INPS-Genio Civile Me: Request for approval of calculations for changes to the construction project for the new INPS headquarters in Messina. - 16 August 1956_Genio Civile Me-INPS: Approval of project for INPS building construction on block IX of the Cortina del Porto in Messina.
Certified testing	- 11 October 1960_INPS-Genio Civile Me: Request for approval of the work carried out. - 2 March 1961_Genio Civile Me-INPS: Issuance of certificate of compliance with hygiene and technical standards for tax exemption on buildings.
GRAPHIC DOCUMENTATION	
Final project	Graphic works taken from: AS (1): INPS Technical Service—"Progetto Esecutivo Nuova Sede Messina-Novembre 1954" [Floor plan; Plans of all levels—from the semi-basement to the roof; North, south, Via del Porto, Via G. Garibaldi elevations; Cross-section; Elevation details]. AS (2): "INPS Messina: nuova sede—progetto esecutivo" [All elevations 08/1956-03/1957].
TECHNICAL DOCUMENTATION	
Final project	Technical construction data taken from: AS (1): "INPS—Progetto nuova sede di Messina da sorgere sull'isolato IX della cortina del Porto"—Stability calculations prepared by Dr. Eng. Vincenzo Cacopardo_15 January 1955.

Table 3. *Cont.*

ANALYTICAL SUMMARY ObsF SOURCES—BLOCK IX "PALAZZATA": INPS HEADQUARTERS—MESSINA	
1955–1961__ORIGINAL CONSTRUCTION PROJECT	
PHOTOGRAPHIC DOCUMENTATION	
Work completed	BS (4) General view of the INPS building located in block IX
SOURCES	
Archival [AS]	(1) Isolato IX—Cortina del Porto Vol 6/1_Archivio del Genio Civile—Messina [48] (2) INPS Messina: nuova sede—progetto esecutivo. Fondo Giuseppe e Alberto Samonà, IUAV UA 485111_IUAV Venezia, Archivio progetti. [49]
Bibliographic [BS]	(1) Tentori F. (1959) Giuseppe Samonà e la Palazzata di Messina. Dal concorso alla realizzazione (1929–1958), in "Casabella-Continuità" n. 227, Milano, pp 29–41. [50] (2) Cortese G., Corvino T. e Kim I. [eds.] (2002) Giuseppe e Alberto Samonà 1923–1993: inventario analitico dei fondi documentari conservati presso l'Archivio Progetti, Il Poligrafo, Padova. [51] (3) Pujia L. [eds.] (2020) Rileggere Samonà. Edizioni TrE.Press, Roma. [52] (4) SAN—Messina, Palazzata, Giuseppe Samonà (1929–1958) http://www.architetti.san.beniculturali.it/web/architetti/protagonisti/scheda-protagonista?p_p_id=56_INSTANCE_V64e&articleId=14129&p_p_lifecycle=1&p_p_state=normal&groupId=10304&viewMode=normal (accessed on 1 April 2025) [53] (5) DGCC—Censimento delle architetture italiane dal 1945 ad oggi: Scheda Opera—Palazzata Isolato IX. https://censimentoarchitetturecontemporanee.cultura.gov.it/scheda-opera?id=5481 (accessed on 1 April 2025) [54]
2022–2024__RECOVERY INTERVENTIONS CARRIED OUT	
PROJECT DETAILS	
Commissioning	Local INPS Headquarters
Designer	INPS Management of services, works, supplies, contracts, and social facilities Geom. Pietro Anzalone—Geom. Giuseppe Pulvirenti
Construction company	Emma Lavori Coop. Soc. Coop. a r.l.
Key dates	18 January 2022–16 March 2022 Final project; 23 December 2022 INPS Determination of awarding of works; 05/2023 Completion of construction works.
Nomenclature	"Sede INPS di Messina, Via Vittorio Emanuele II, n. 100"
ADMINISTRATIVE DOCUMENTATION	
Final project	- 18 January 2022_Final Project - 1 March 2022_Messina Superintendency for Cultural and Environmental Heritage: prescription of the blue colour of aluminium window frames. - 16 March 2022_Variant project. - 9 August 2022_Determination No 195 to contract. - 10 August 2022_Replacement of windowframe. Annex No 9—Special tender specifications. - 23 December 2022_ Award Determination No 291 - Negotiated procedure launched pursuant to Article 51, paragraph 1, letter (a), number 2.2, of Decree Law No. 77/2021, through a Request for Offer (RdO) on the Public Administration Electronic Market (MePA), for the award of «Extraordinary maintenance work for the replacement of external fixtures at the INPS headquarters in Messina, Via Vittorio Emanuele II, no. 100» [Lavori di manutenzione straordinaria per la sostituzione degli infissi esterni della sede INPS di Messina, Via Vittorio Emanuele II, n. 100].
GRAPHIC DOCUMENTATION—TECHNICAL DOCUMENTATION	
Final project	Graphic works and Technical documentation taken from: AS (1): Tavola 1 Pianta piano interrato; Tavola 2 Pianta piano rialzato; Tavola 3 Pianta piano primo; Tavola 4 Pianta piano secondo; Tavola 5 Pianta piano terzo; Tavola 6 Pianta piano attico; Tavola 7 Prospetti (stato attuale); Tavola 8 Prospetti (stato di progetto); Tavola 9 Abaco degli infissi (stato attuale); Tavola 10 Abaco degli infissi (progetto).
PHOTOGRAPHIC DOCUMENTATION	
Work completed	WS (1) View in May 2023 with original window frame; view in June 2024 with replaced window frame
SOURCES	
Archival [AS]	(1) Portale INPS Documentation of procedural process [55]
Web [WS]	(1) Google Maps Messina_Via Vittorio Emanuele No 100 Photo 07/2024-05/2023 [56]

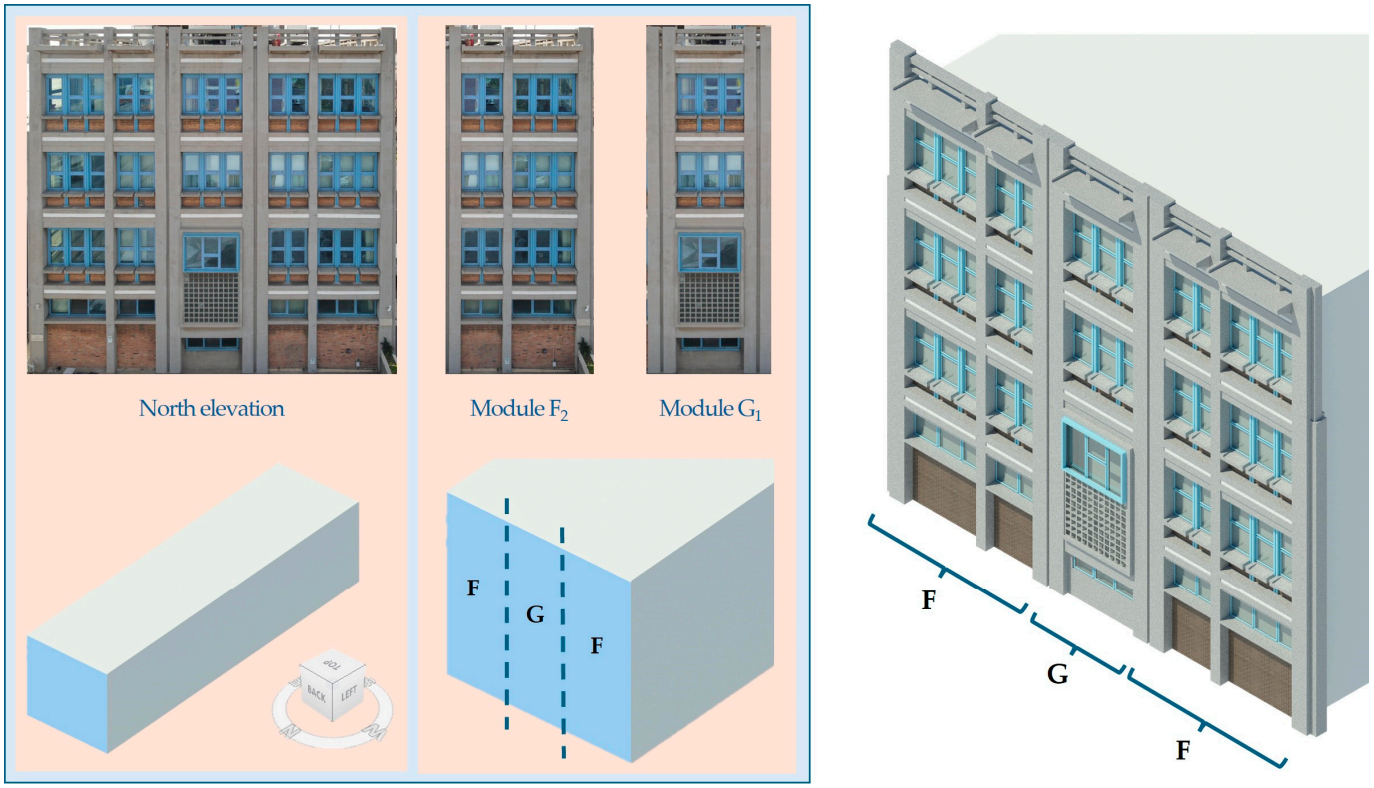


Figure 17. INPS HEADQUARTERS—MESSINA. Credential 2_H-BIM. Partial H-BIM model of the building envelope was developed following the study of the modules making up the elevations.

Table 4. GRUPO DE VIVIENDAS SANTA MARÍA MICAELA—VALENCIA. Credential 1_H-BIR. Analytical summary of sources.

ANALYTICAL SUMMARY OF SOURCES—SANTA MARÍA MICAELA—VALENCIA	
1958–1961__ORIGINAL CONSTRUCTION PROJECT	
PROJECT DETAILS	
Commissioning	Cooperative de Agentes Comerciales de Valencia—section F
Designer	Santiago Artal Ríos
Construction company	-
Key dates	11 October 1958_Final project; 24/03/1961_Completion of construction works; 03 May 1993_General Plan of Valencia—Cataloguing with Protection Level 2; 1996_Inclusion in the DOCOMOMO Iberian Register of Contemporary Architecture; 2010–2011_Recognition by the General Directorate of Valencian Cultural Heritage as a Locally Relevant Property (BIEN DE RELEVANCIA LOCAL (BRL); 03 July 2013_Revisión simplificada del Plan General de Valencia: Catalogo de bienes y espacios protegidos. GRUPO DE VIVIENDAS SANTA MARÍA MICAELA.
Nomenclature	GRUPO DE VIVIENDAS SANTA MARÍA MICAELA
ADMINISTRATIVE DOCUMENTATION	
- 15 August 1958_Request by Miguel Devasa (responsible for the Cooperativa de Agentes Comerciales) to the National Institute of Housing to grant an exemption for low-income housing according to the Law of 15 July 1954. - 11 October 1958_Granting of building permit issued by the Mayor of Valencia. - 28 October 1958_Provisional Qualification Certificate for Limited Income Housing, First Group, issued to Cooperativa de Agentes Comerciales—Section F. - 24 March 1961, 16 and 24 May 1961_Documents of the Final Certificate of Qualification for Limited Income Housing. - 1 February 1963_Check carried out by the municipal architect and the health inspector once the work has been completed to verify compliance with the conditions established for the exemption.	
GRAPHIC DOCUMENTATION	
Final project	Graphic works taken from: AS (1): Axonometría de la propuesta para alterar la distribución de volúmenes de la parcela. Archivo Histórico Municipal de Valencia (AHMV). D.U., 1958, caja 32, exp. RG. 20030 y H.505; Plano de planta de la propuesta para alterar la distribución de volúmenes de la parcela. AHMV. D.U., 1958, caja 32, exp. RG. 20030 y H.505 AS (5): Plano de situación del Proyecto de acuerdo al Plan General de 1946. Fondos de la CVAC sec. F, CVAC-F_SMM_1.4;

Table 4. *Cont.*

ANALYTICAL SUMMARY OF SOURCES—SANTA MARÍA MICAELA—VALENCIA	
1958–1961__ORIGINAL CONSTRUCTION PROJECT	
Final project	Plano n °1 de emplazamiento del Proyecto. Santiago Artal Ríos, junio de 1958. Fondos de la CVAC sec F, CVAC-F_SMM_1.4; Dibujo en perspectiva (tinta y acuarela) de la propuesta para la construcción de 148 viviendas. Septiembre de 1956. Autor: Emilio Artal Fos. Fondos CVAC sec F, CVAC-F_SMM_8.1.; Imágenes del jardín interior realizadas por Paco Alberola en 1968. Obsérvese los niños bañándose en la lámina de agua. En la segunda fotografía se ha coloreado en verde la zona que debería estar ajardinada. Fondos CVAC sec F, CVAC-F_SMM_11.2. BS (1-3-6)
TECHNICAL DOCUMENTATION	
Final project	Technical construction data taken from: AS (5); Fondos CVAC sec F, CVAC-F_SMM_1.1.; Resumen del presupuesto del proyecto. Fondos de la CVAC sec F, CVAC-F_SMM_1.3. BS (6-7)
PHOTOGRAPHIC DOCUMENTATION	
Work completed	AS (5) Estructura del bloque en construcción; AS (5) Vista general del Grupo de viviendas "Santa Maria Micaela" 5 de mayo de 1961. BS (1) Fotografía del conjunto desde la calle Santa María Micaela.
SOURCES	
Archival [AS]	(1) Cooperativa de Viviendas Agentes Comerciales (1958). Expediente, historial 505, nº 20030 del Registro General: solicita se le conceda alterar distribución de volumen en la construcción de un edificio. Av Pérez Galdós y otro. Arxiu Històric Municipal, Ayuntamiento de Valencia. [57] (2) Cooperativa de Viviendas Agentes Comerciales (1958–1961). Expediente, historial 1405, nº 46670 del Registro General: solicitud de construcción de un edificio en Av. Pérez Galdós y c/ En Proyecto, Zona Oeste, Arxiu Històric Municipal. Ayuntamiento de Valencia. [58] (3) Colegio Oficial de Arquitectos de la Comunidad Valenciana; Registro de arquitectura del s. XX Comunidad Valenciana. Generalitat Valenciana, Instituto Valenciano de la Edificación, 2002. [59] (4) Revisión simplificada Plan General de Valencia- Catalogo de bienes y espacios protegidos, Ayuntamiento de Valencia, 2013. [60] (5) Fondos de la Cooperativa de Viviendas Agentes Comerciales. CVAC seccion F: CVAC-F_SMM_1 Proyecto; CTAV_Artal_2 Planos de instalaciones del Arquitecto; CVAC-F_SMM_8 Propuesta para construcción de 148 viviendas;; CVAC-F_SMM_10 Memorias informativas del la cooperative de viviendas para Agentes Comerciales, seccion F; CVAC-F_SMM_11 Fotografías conjunto residencial. [61]
Bibliographic [BS]	(1) Artal Ríos S. Grupo de viviendas en Valencia, *Arquitectura*, 34, oct 1961, Madrid, p. 15–17. [62] (2) Comisión Mundial del Medio Ambiente y el Desarrollo (CMMAD). (1987). Nuestro Futuro Común o Informe Brundtland. Organización de las Naciones Unidas (ONU), A/42/427 [63] (3) Artal Ríos S. 138 viviendas de renta limitada. *Conarquitectura*. 2001, (2), 89–95. [64] (4) Sancho J.M. (architect snd inhabitant of the Santa Maria Micaela residential complex) (2010), Els arquitectes Artal i l'arquitectura residencial comunitària contemporània a València. Cronologia comentada [65] (5) COACV. Colegio Oficial de Arquitectos de la Comunidad Valenciana. https://www.coacv.org/ (accessed on 24 April 2025) [66] (6) Fundación DOCOMOMO Ibérico. https://docomomoiberico.com/ (accessed on 24 April 2025) [67] (7) Instituto Valenciano de la Edificación (IVE). Catálogo de soluciones constructivas de rehabilitación. Editorial IVE, Valencia, 2011. [68]
1970s–2024__RECOVERY INTERVENTIONS CARRIED OUT	
PROJECT DETAILS	
Commissioning	Owners of Building units
Designer	Not found
Key dates	Not found
Nomenclature	GRUPO DE VIVIENDAS SANTA MARÍA MICAELA
ADMINISTRATIVE DOCUMENTATION	
Final project	The entire architectural complex is considered a "BIEN DE RELEVANCIA LOCAL (BRL)": both the buildings, and the spaces that connect them. Therefore, the interventions permitted by the Valencian Law on Cultural Heritage (LPCV 4/1998) and the Valencian Law on Urban Planning (LUV 16/2005) were conservation, restoration, and reorganization of internal distribution.
GRAPHIC DOCUMENTATION—TECHNICAL DOCUMENTATION—PHOTOGRAPHIC DOCUMENTATION	
Final project	No graphic and technical documents and photo were found for the individual interventions, mainly for the reorganisation of internal distribution and energy requalification.
SOURCES	
Archival	Not found
Bibliographic	Angileri, G.; et al, The Santa María Micaela Residential Complex in Valencia (Spain) Study of the Original Design to Assess Its Bioclimatic Potentials for Energy Upgrading. Buildings 2024, 14, 3819. https://doi.org/10.3390/buildings14123819 [47]

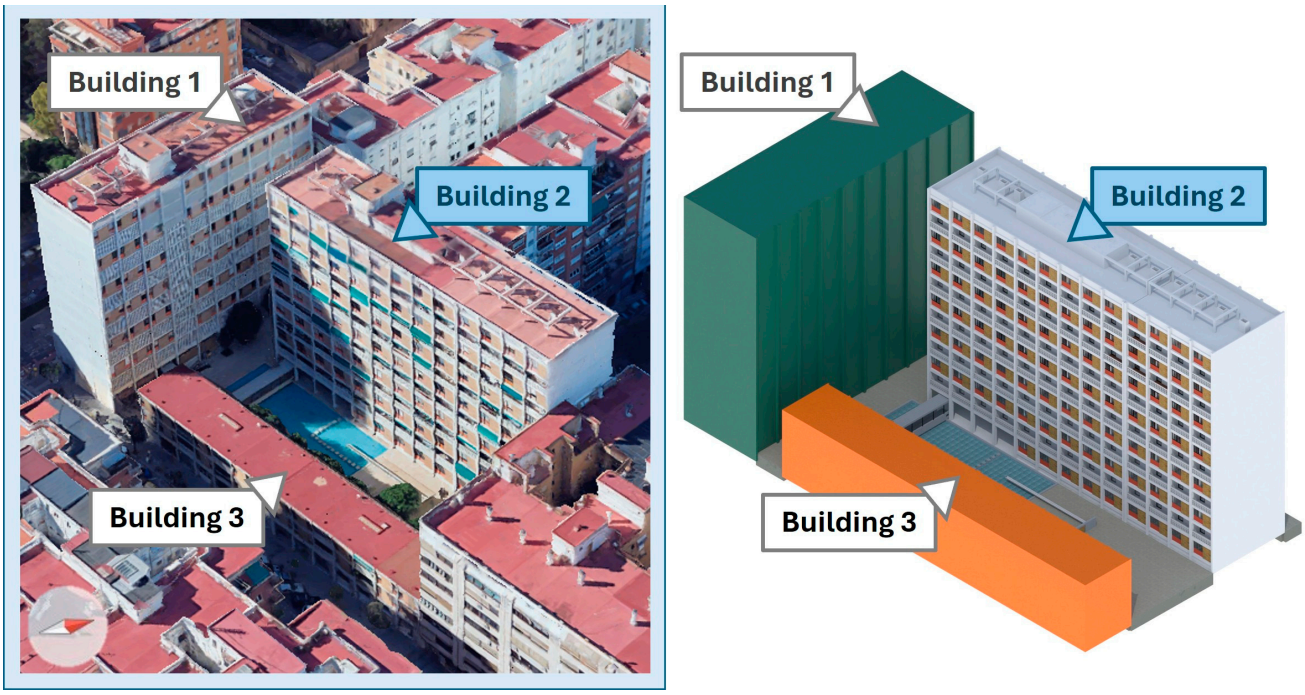


Figure 18. GRUPO DE VIVIENDAS SANTA MARÍA MICAELA—VALENCIA. Credential 2_H-BIM. H-BIM model of the entire work, developed on the occasion of a previous study [47].

The Santa Maria Micaela complex consists of three buildings, and the architectural BIM model was available only for one of them, Building 2. Specifically, the modelling quality of the two elevations with windows, the northwest one (Figure 19) and the southeast one (Figure 20), has been verified using the modular breakdown presented in Figure 15 as an evaluation method.

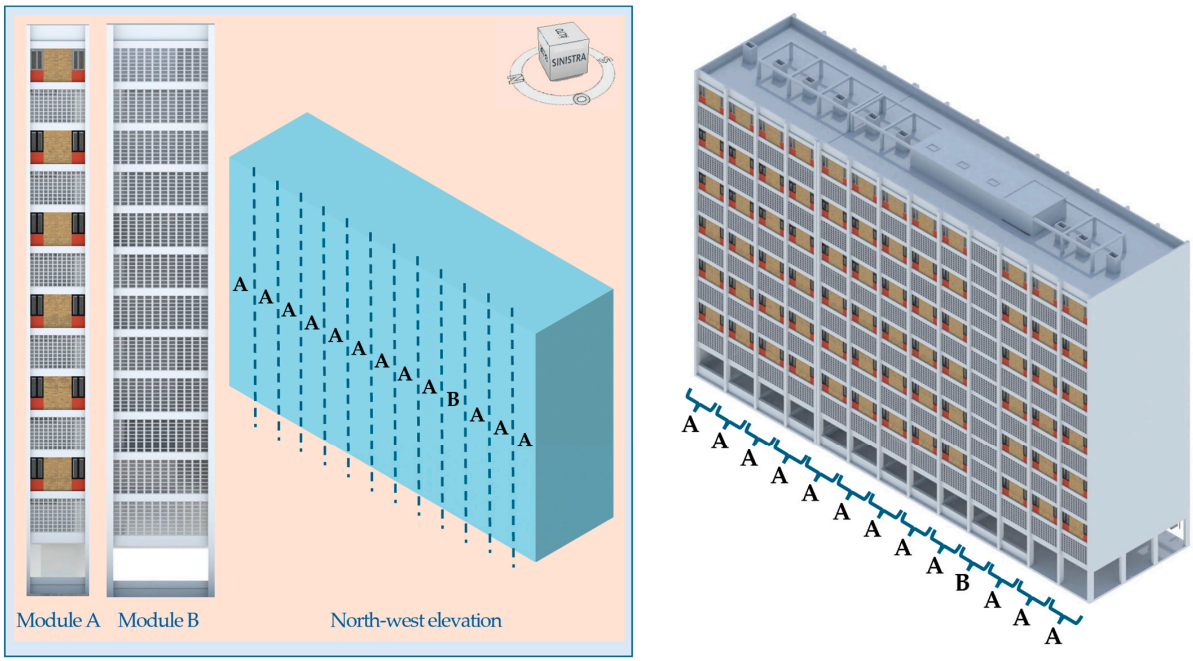


Figure 19. GRUPO DE VIVIENDAS SANTA MARÍA MICAELA—VALENCIA. Credential 2_H-BIM. Check on the model adequacy in terms of geometric modelling of the modules of the north-west elevation.

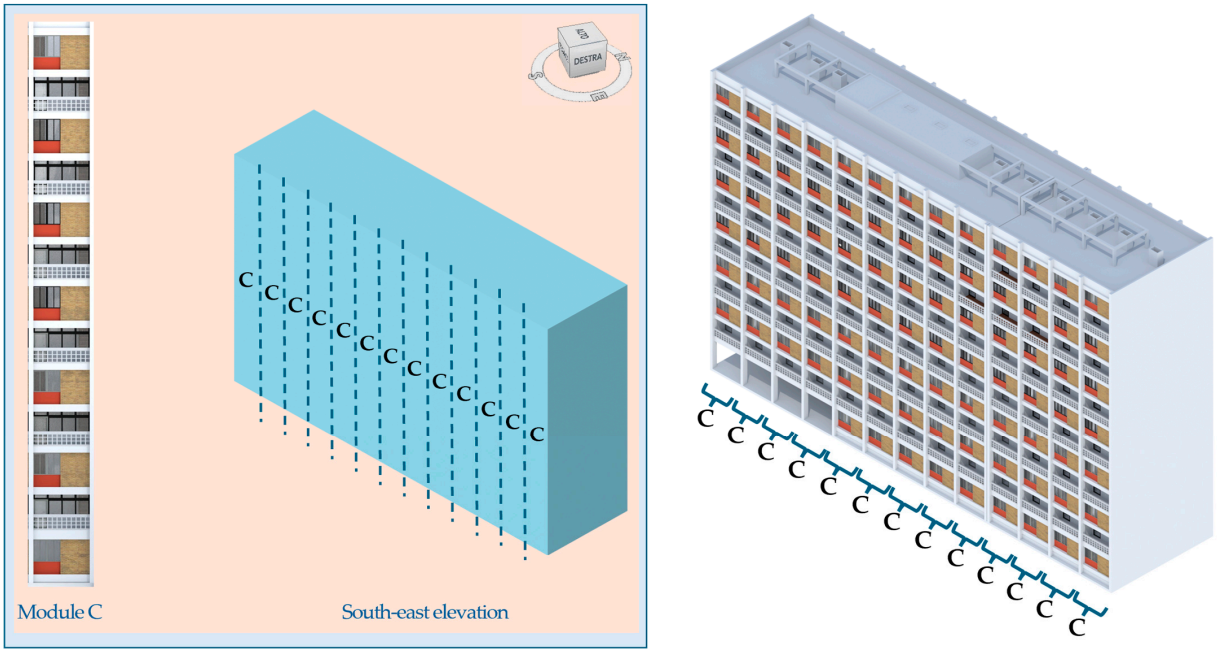


Figure 20. GRUPO DE VIVIENDAS SANTA MARÍA MICAELA—VALENCIA. Credential 2_H-BIM. Check on the model adequacy in terms of geometric modelling of the modules of the south-east elevation.

4.2. Asset Data Sheet and Its Transposition into the BIM Environment

A novelty introduced has been to exploit the cataloguing project to obtain the contents with which to enrich the related H-BIM models. This required an analytical approach on how to convert the descriptive items of the *Asset Data Sheet* into parameters, to constitute the informative component of the digital equivalents of the case studies (Table 5). The compilation for all the works included in the sample confirmed its validity (see Appendix A).

The conversion has required a distinction between the information to be assigned:

- To the entire model, as they relate to the work as a whole;
- To individual H-BIM objects, as they are specific to the technical elements;
- To both, as it is fundamental content for the two levels of interpretation of the asset.

For each description item of the sheet, the relative parameter has been prepared, identifying eleven thematic groups: *1. Identification data*; *2. Position*; *3. Stakeholders*; *4. Historical Scenario*; *5. Description of the work*; *6. Construction History*; *7. Preservative framework*; *8. Types of degradation*; *9. Official censuses*; *10. References*; *11. Attachments*. This operation has been necessary because modelling software may require the preparation of specific sets to organise the data or not allow the customization of the order of appearance (sometimes the parameters are automatically listed in alphabetical order, a criterion not suitable for the purpose of this research since the way of reading the information in a BIM model also facilitates the understanding of the work). In Table 5, for each parameter, the following features have been specified:

1. The attribution to the entire work, to the single entity, or to both;
2. The most suitable type for digitalising the data (text, image, URL, Yes/No).

With regard to the first point, the decision arises from the fact that it is, for example, useful to attribute the parameters belonging to group "1. Identification data" only to the entire model and not to individual BIM objects; those of the group "8. Types of degradation" only to BIM objects emulating the technical element affected by the degradation process; those of the group "3. Stakeholders" and "6. Construction History" to both to identify, also at the level of construction detail, the authors, building companies and production companies involved and any transformations over time.

Table 5. Processing of the parameters to be assigned to the H-BIM model of the asset, to the H-BIM objects of the façade system, or to both.

Items of the "Asset Data Sheet" to Be Converted into Information Parameters	For the H-BIM Model of the Asset		For the H-BIM Object of the Façade	
	Attribution	Type	Attribution	Type
1. Identification data (ID)				
1.1_ID_Original_denomination	✓	text	✗	---
1.2_ID_Original_building_type	✓	text	✗	---
1.3_ID_Current_denomination	✓	text	✗	---
1.4_ID_Current_intended_use	✓	text	✗	---
2. Position (PO)				
2.1_PO_State	✓	text	✗	---
2.2_PO_Address	✓	text	✗	---
2.3_PO_Geographical_coordinates	✓	text	✗	---
2.4_PO_Urban_context	✓	text	✗	---
3. Stakeholders (ST)				
3.1_ST_Client	✓	text	✓	text
3.2_ST_Designer/s	✓	text	✓	text
3.3_ST_Construction_company/ies	✓	text	✓	text
3.4_ST_Production_Company/ies	✓	text	✓	text
4. Historical scenario (HS)				
4.1_HS_Geopolitical_context	✓	text	✗	---
4.2_HS_Cultural_panorama	✓	text	✗	---
5. Description of the asset (DA)				
5.1_DA_Functional_analysis	✓	text	✗	---
5.2_DA_Technical_analysis	✓	text	✓	text
5.3_DA_Architectural_analysis	✓	text	✗	---
6. Construction history (CH)				
6.1_CH_Procedure_dates	✓	text; phase *	✓	text; phase *
6.2_CH_Main_changes_over_time	✓	text; phase *	✓	text; phase *
7. Preservative framework (PF)				
7.1_PF_Original_construction_defects	✓	text; image; URL	✓	text; image; URL
7.2_PF_Pathology_(detected_in_MM/YY)	✗	---	✓	text; image; URL
7.3_PF_State_of_conservation_(detected_in_MM/YY)	✓	text	✓	text
7.4_PF_Protection_measure	✓	text; URL	✗	---
8. Types of degradation (TD)				
8.1_TD_Denomination_of_degradation_type	✗	---	✓	Yes/No
8.n_TD_Denomination_of_degradation_type	✗	---	✓	Yes/No
9. Official censuses (OC)				
9.1_OC_Census_name	✓	URL; text	✗	---
9.n_OC_Census_name	✓	URL; text	✗	---
10. References (RE)				
10.1.1_RE_Archival_source	✓	text; URL	✓	text; URL
10.1.n_RE_Archival_source	✓	text; URL	✓	text; URL
10.2.1_RE_Bibliographic_source	✓	text; URL	✓	text; URL
10.2.n_RE_Bibliographic_source	✓	text; URL	✓	text; URL
11. Attachments (AL)				
11.1_AL_Attachment	✓	URL; image	✓	URL; image
11.n_AL_Attachment	✓	URL; image	✓	URL; image

Note * The BIM software Revit by Autodesk has a specific function to parameterise the historical phases.

With regard to the second point, the nature of each parameter has been indicated, also imagining possible variants. For example, information on the pathology detected on a given date (see 7.2 of the table) can be witnessed by means of text, images, or a link to an external file, a cloud, or a website.

After having analogically compiled the Asset Data Sheets for the selected case studies (Tables 6 and 7) and having defined the parametric transposition of the description items, the method of creating the parameters within the related H-BIM models has been evaluated, analysing at the same time the functionalities offered by the software, since the digitalisation paths often have to be reformulated due to the operations possible with the tools in use.

Table 6. Asset Data Sheet, filled in for the case study: INPS Headquarters—Block IX of the Palazzata, Giuseppe Samonà, 1954–1957, Messina (Italy).

CATALOGUING PROTOCOLS				FILING PROJECT FOR DIGITAL MANAGEMENT	
				Documentation and Conservation of 20th Century Façade Systems	
				INPS (Istituto Nazionale della Previdenza Sociale), BLOCK IX of the PALAZZATA	
an international filing model MINIMUM FICHE	●	a national filing model CENSIMENTO DELLE ARCHITETTURE ITALIANE DAL 1945 AD OGGI	●	**Historical scenario**	Italian post-war
				Geopolitical Context	The post-World War II period brought about a phase of reconstruction and redemption in republican Italy, which in Messina merged with the completion of buildings begun following the earthquake and unfinished or subject to the bombings of 1943.
				Cultural panorama	The revival in the 1960s was no longer inspired by the original criteria of the design of the façade on the harbour curtain wall of the 1930s, with its scenic and symbolic imprint desired by the Fascist regime, but adhered to modernist dictates that gave a new physiognomy to blocks IX, X, XI, IV, V, and VI of the Palazzata.
	●		●	**Original denomination**	---
	●		●	**Original building type**	---
	●		●	**Procedure dates**	***Original project (PO)*** 1954 ***Variants (Vr$_{1-n}$)*** 1956–1957 ***Execution (Es)*** 1957–1960 ***Inauguration (In)*** -
	●		●	**Designer(s)**	Eng. Giuseppe Samonà—Eng. Vincenzo Cacopardo
	●		●	**Construction company**	---
	●		●	**Original property**	National Social Security Institute
	●		●	**Client**	Local INPS office
				Location	Cortina del Porto
	●		●	*State*	Italy
				Address	Vittorio Emanuele II, 100—Messina
				Geographical coordinates	38.19555151338364, 15.557392981130388
	●		●	Urban context	Cortina del Porto in the central area was rebuilt in the 20th century
	●		●	Functional organisation	A four-story building plus a semi-basement. Original layout: ground floor with a sea-facing commercial area and city-facing offices and storage in the basement; first floor with the office manager's quarters, clinics, and visiting rooms; second and third floors with archives and staff offices. The rhythmic repetition of exposed vertical and horizontal structural elements creates a modular grid entirely occupied by windows and doors, divided into three sections on the floors above the ground floor, indifferent to the layout of the interior spaces, each with its own freely conceived heterogeneous dimensions and functions. Only the two stairwells are visible from the outside with semi-opaque glass-brick walls.
	●		●	Construction characteristics	***Load-bearing structure:*** reinforced concrete skeleton protruding from the facade line and left exposed ***Horizontal partitions:*** brick block slab ***Basic enclosures:*** brick, block, slab ***Roof:*** terrace, brick, block, slab, surrounded by insulated reinforced concrete shelves ***Vertical partitions:*** exposed brick parapets surmounted by projecting reinforced concrete bracket sills ***Windows:*** iron window, heat-insulating glass, blue Venetian blinds

Table 6. *Cont.*

CATALOGUING PROTOCOLS	FILING PROJECT FOR DIGITAL MANAGEMENT
	*Documentation and Conservation of 20th Century Façade Systems* **INPS (Istituto Nazionale della Previdenza Sociale), BLOCK IX of the PALAZZATA**
● ●	**Architectural lexicon**	Modernist architecture with brutalist elements.
● ●	**Current denomination**	INPS
● ●	**Current intended use**	INPS administrative headquarters and offices
● ●	**Ownership status**	National Institute of Social Security
● ●	**Main changes over time** Brief descriptions and dates	Replacement of windows with thermal break profiles, powder coated in bright blue, and double glazing for energy requalification [2022–2023]
● ●	**Original construction defects** from unsuitable technical solutions	---
● ●	**Pathologies** Brief descriptions and dates	Slight deterioration of the exposed reinforced concrete [2024]
● ●	**State of conservation** Summary evaluation and dates	Good (Excellent—Good—Fair—Bad) [2024]
● ●	**Protection measure**	---
● ●	**Official census (LINK)**	https://censimentoarchitetturecontemporanee.cultura.gov.it/scheda-opera?id=5481 (1 April 2025) [54]
● ●	**References**	***Archives:*** Isolato IX—Cortina del Porto Vol 6/1_Archivio del Genio Civile—Messina [48]; INPS Messina: nuova sede—progetto esecutivo. Fondo Giuseppe e Alberto Samonà, IUAV UA 485111_IUAV Venezia, Archivio progetti [49]; Portale INPS Documentazione iter procedurale intervento di sostituzione dei serramenti: Determinazione n. 195/Determinazione 291 [56]. ***Bibliography:*** Tentori F. (1959) *Giuseppe Samonà e la Palazzata di Messina. Dal concorso alla realizzazione: 1929–1958*, in "Casabella-Continuità" n. 244, Milano, pp. 29–41. [50] Cortese G., Corvino T. e Kim I. [eds.] (2002) *Giuseppe e Alberto Samonà 1923–1993: inventario analitico dei fondi documentari conservati presso l'Archivio Progetti*, Il Poligrafo, Padova. [51] Pujia L. [eds.] (2020) *Rileggere Samonà*. Edizioni TrE.Press, Roma. [52] SAN—Messina, Palazzata, Giuseppe Samonà (1929–1958) http://www.architetti.san.beniculturali.it/web/architetti/protagonisti/scheda-protagonista?p_p_id=56_INSTANCE_V64e&articleId=14129&p_p_lifecycle=1&p_p_state=normal&groupId=10304&viewMode=normal (accessed on 1 April 2025)) [53] DGCC—Censimento delle architetture italiane dal 1945 ad oggi: Scheda Opera—Palazzata Isolato IX. https://censimentoarchitetturecontemporanee.cultura.gov.it/scheda-opera?id=5481 (accessed on 1 April 2025) [54]
● ●	**Attachments**	**Graphic works [1954–1957]—Vintage and recent photographs**
● ●	**Credits tab**	Research Team CEAR08-A UniME

Legend on description fields taken from the reference protocols for the filing project: ●derivation with high conceptual and terminological affinity ● derivation with partial conceptual and terminological affinity ●derivation did not occur.
Note: Fields with round, blue and underlined text refer to links for further information

Concerning this point, it has been understood that the two software allow us to attribute information to both the entire model and individual objects. However, two limitations have been found, one of a substantial nature and the other of a formal one, which become an element of discrimination in the choice of programs with which to obtain the models intended for the Registry.

Table 7. *Asset Data Sheet*, filled in for the case study: Grupo de viviendas Santa María Micaela, Santiago Artal Ríos, 1958−1961, Valencia (Spain).

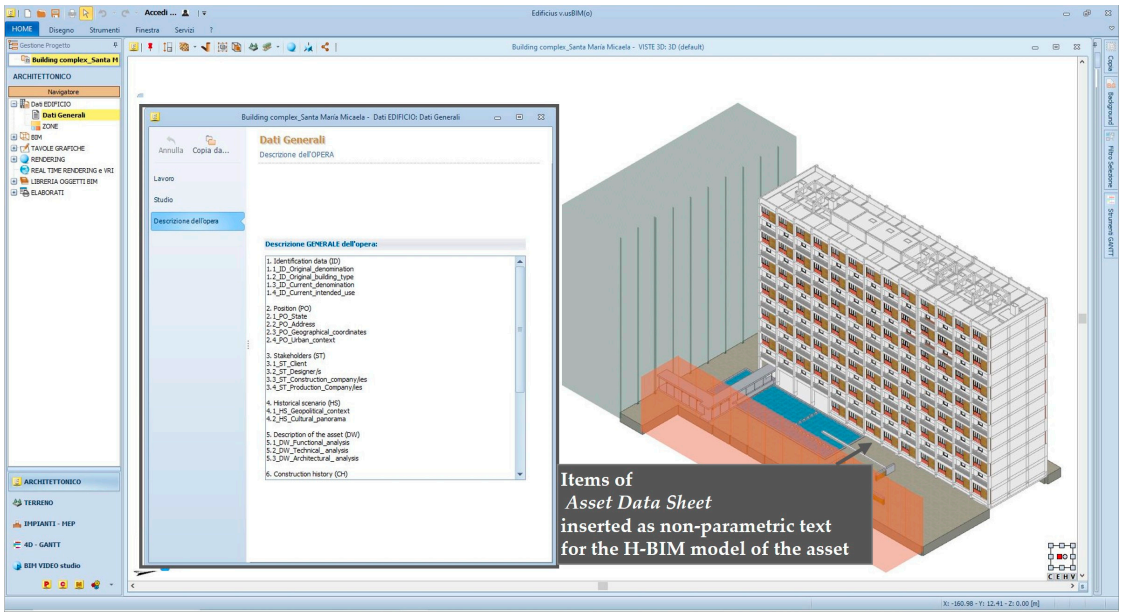
CATALOGUING PROTOCOLS			FILING PROJECT FOR DIGITAL MANAGEMENT	
			Documentation and Conservation of 20th Century Façade Systems	
			GRUPO DE VIVIENDAS SANTA MARÍA MICAELA	
	a national filing model CENSIMENTO DELLE ARCHITETTURE ITALIANE DAL 1945 AD OGGI			
●		●	**Historical scenario** *Geopolitical Context*	Spanish post-war period In the 1950s, Francoist Spain was in an autarkic economic regime that limited foreign capital and imports, adopting a policy of strict self-sufficiency. This certainly influenced the way of building, the materials used, and the capacity for public investment in the housing program.
			Cultural panorama	The Law of Popular Houses of 1911, which facilitated cooperatives for the construction of housing at moderate rents, favoured projects such as that of the Agentes Comerciales cooperative in Valencia: this was a non-profit mutualist organisation, constituted by the agents themselves, with the objective of building housing for its members; it took care of obtaining subsidised loans, acquiring land and tracking down the technical study that would draw up the project.
●		●	**Original denomination**	Grupo de viviendas Santa María Micaela
●		●	**Original building type**	Multi-storey building—Residential building
●		●	**Procedure dates**	***Original project (PO)*** *1958* ***Variants (Vr$_{1-n}$)*** - ***Execution (Es)*** 1958–1961 ***Inauguration (In)*** -
●		●	**Designer(s)**	Arch. Santiago Artal Ríos
●		●	**Construction company**	-
●		●	**Original property**	Cooperativa de Agentes Comerciales
●		●	**Client**	Cooperativa de Agentes Comerciales
			Location	Valencia—La Pextina Neighborhood
●		●	*State*	Spain
			Address	Calle de Santa María Micaela 18, Avenida Pérez Galdós
			Geographical coordinates	Latitude: 39.47200805 N Longitude: –0.392735053 W
●		●	**Urban context**	The project is implemented in the southern area of Valencia's "Segundo Ensanche", an area undergoing urban expansion after the demolition of the city walls.
●		●	**Functional organisation**	The residential complex consists of three blocks with 138 flats. Two of the buildings have 13 floors, and the third, the one on Santa María Micaela Street, has 3 floors with commercial premises on the ground floor and duplex housing in the high blocks. Vertical communication is provided by a stairwell and two lifts for the high volumes, and only by stairs for the lower volumes. The flats have a living area on the ground floor with service, kitchen, and living-dining room, and an upper floor used as a sleeping area with two bedrooms and a bathroom. The dwellings in the lower building consist of a dining room, a study, a living-dining room, a kitchen, a bathroom, a terrace, and the bedrooms.
●		●	**Construction characteristics**	***Load-bearing structure:*** reinforced concrete skeleton ***Horizontal partitions:*** brick block slab + ceramic flooring ***Basic enclosures:*** brick block slab + concrete flooring for exteriors; ceramics for interiors ***Roof:*** terraces, brick, block, slab + ceramic cladding (if practicable) or waterproof sheathing (if not practicable) ***Vertical partitions:*** precast concrete panels with double liner and exposed brick finish, concrete grid, and glass brick. Interior finish: plaster or mosaic tiles. ***Windows:*** iron casement with shutter
●		●	**Architectural lexicon**	Rationalist
●		●	**Current denomination**	Santa María Micaela Residential Complex
●		●	**Current intended use**	Residential building
●		●	**Ownership status**	Private citizens, heirs of cooperative members, or new buyers. The management is the responsibility of the Comunidad de Propietarios, formed by the owners of the units, according to the Spanish condominium law.

Table 7. *Cont.*

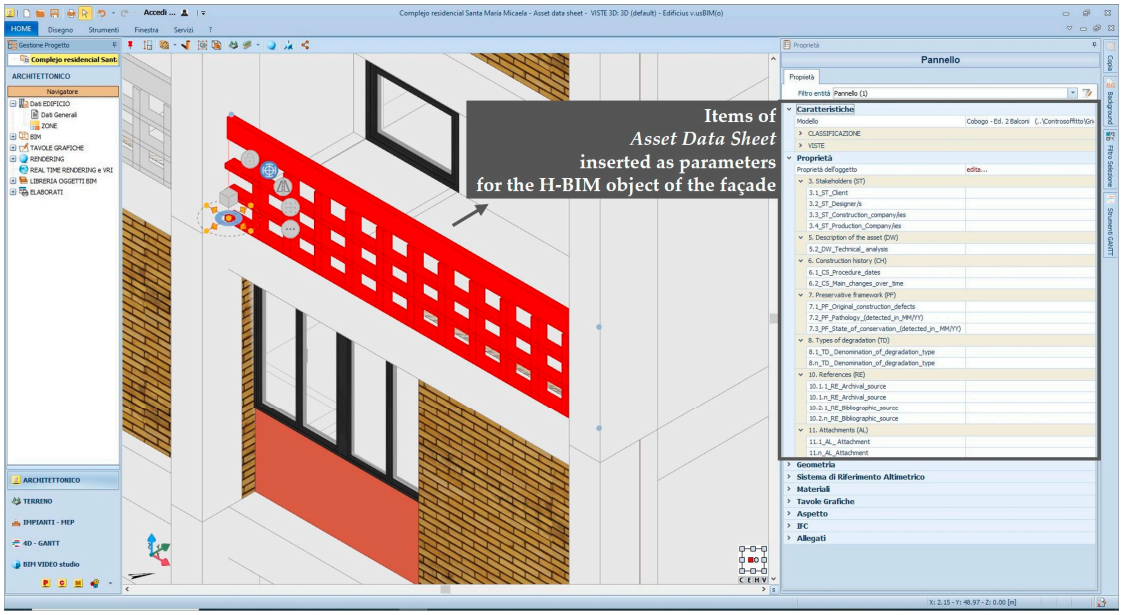
CATALOGUING PROTOCOLS	FILING PROJECT FOR DIGITAL MANAGEMENT
	*Documentation and Conservation of 20th Century Façade Systems* **GRUPO DE VIVIENDAS SANTA MARÍA MICAELA**
● ●	**Main changes over time** Brief descriptions and dates	The interventions, permitted by the Valencian Law on Cultural Heritage (LPCV 4/1998) and the Valencian Law on Urban Planning (LUV 16/2005), were conservation, restoration, and reorganization of the internal distribution.
● ●	**Original construction defects** from unsuitable technical solutions	-
● ●	**Pathologies** Brief descriptions and dates	Leakage problems at the non-walkable terrace.
● ●	**State of conservation** Summary evaluation and dates	Good (Excellent—Good—Fair—Bad) [2025]
● ●	**Protection measure**	It has local urban protection within the General Plan of Valencia, but has not been declared Bien de Interés Cultural (BIC) at the regional or state level.
● ●	**Official census (LINK)**	Listed in the General Plan Catalogue (PGOU) of Valencia as "Monumento de Interés Local" with code BRL 03.03.15 since 1993.
● ●	**References**	***Archives:*** Cooperativa de Viviendas Agentes Comerciales (1958). Expediente, historial 505, nº 20030 del Registro General: solicita se le conceda alterar distribución de volumen en la construcción de un edificio. Av Pérez Galdós y otro. Arxiu Històric Municipal, Ayuntamiento de Valencia. [57] Cooperativa de Viviendas Agentes Comerciales (1958–1961). Expediente, historial 1405, nº 46670 del Registro General: solicitud de construcción de un edificio en Av. Pérez Galdós y c/ En Proyecto, Zona Oeste, Arxiu Històric Municipal. Ayuntamiento de Valencia. [58] Colegio Oficial de Arquitectos de la Comunidad Valenciana; Registro de arquitectura del s. XX Comunidad Valenciana. Generalitat Valenciana, Instituto Valenciano de la Edificación. 2002. [59] Revisión simplificada del Plan General de Valencia- Catalogo de bienes y espacios protegidos, Ayuntamiento de Valencia, 2013. [60] Fondos de la Cooperativa de Viviendas Agentes Comerciales. CVAC seccion F: CVAC-F_SMM_1 Proyecto; CTAV_Artal_2 Planos de instalaciones del Arquitecto; CVAC-F_SMM_8 Propuesta para construcción de 148 viviendas; CVAC-F_SMM_10 Memorias informativas del la cooperative de viviendas para Agentes Comerciales, seccion F; CVAC-F_SMM_11 Fotografías conjunto residencial. [61] ***Bibliography:*** Artal Ríos S. *Grupo de viviendas en Valencia*, Arquitectura, 34, oct 1961, Madrid, p. 15–17. [62] Comisión Mundial del Medio Ambiente y el Desarrollo (CMMAD). (1987). *Nuestro Futuro Común o Informe Brundtland*. Nueva York: Organización de las Naciones Unidas (ONU). [63] Artal Ríos S. 138 viviendas de renta limitada. Conarquitectura. 2001, (2), 89–95. [64] Sancho J.M. (architect snd inhabitant of the Santa Maria Micaela residential complex) (2010), Els arquitectes Artal i l'arquitectura residencial comunitària contemporània a València. Cronologia comentada [65] COACV. *Colegio Oficial de Arquitectos de la Comunidad Valenciana* [66] Fundación DOCOMOMO Ibérico. [67] Instituto Valenciano de la Edificación (IVE). *Catálogo de soluciones constructivas de rehabilitación.* Editorial IVE, Valencia, 2011. [68]
● ●	**Attachments**	Plants of all levels—Photographs
● ●	**Credits tab**	Research Team CEAR08-A UniME/UniPV/UniCile

Legend on description fields taken from the reference protocols for the filing project: ●**derivation with high conceptual and terminological affinity** ● **derivation with partial conceptual and terminological affinity** ●**derivation did not occur.**
Note: Fields with round, blue, and underlined text refer to links for further information

With reference to the substantial limitation, the Edificius software does not allow you to manage the data referring to the entire work as specific parameters, unlike Revit. In the "General Data" section there are three tabs: "Work" ("Lavoro") and "Study" ("Studio") where you can enter the details of the project and "Description of the work" ("Descrizione dell'opera") consisting of a single field for information content, only texts (therefore not images or links to external files), without the possibility of managing them individually at a parametric level (Figure 21). This opportunity is instead guaranteed by Revit, which, in the "Project Information" section, can accommodate as many parameters as those designed for each description item indicated in Table 5, being able to choose the type among all those possible for a modelling software (text, number, image, URL, etc.) (Figure 22).

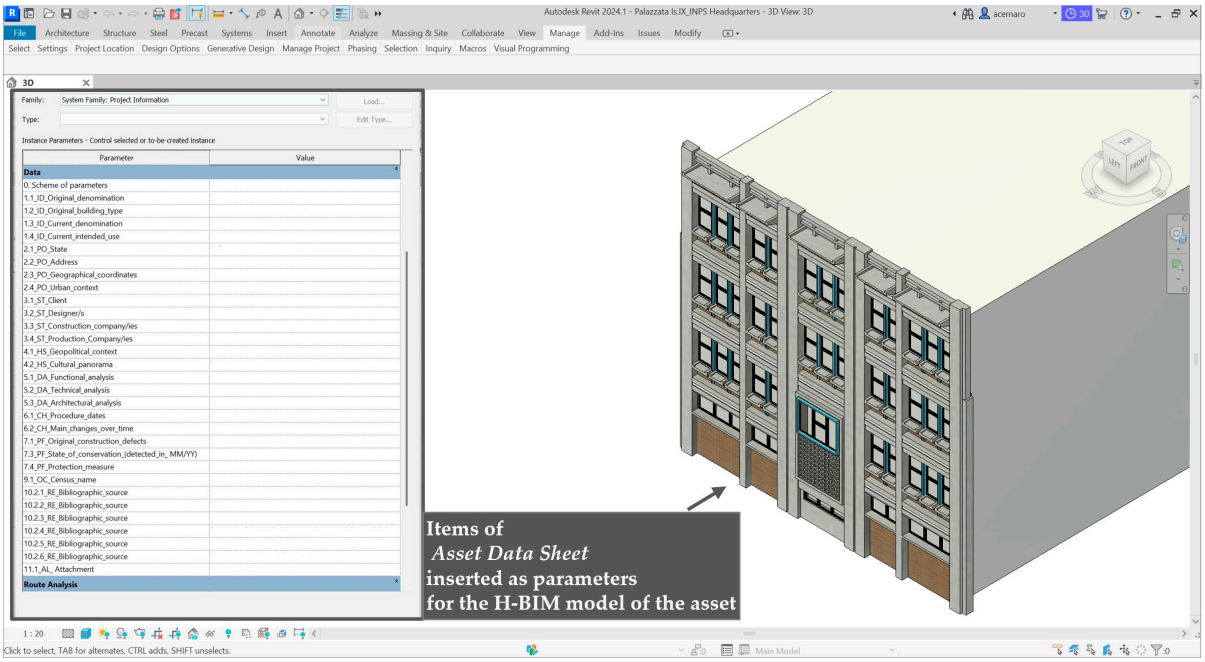


(**a**)

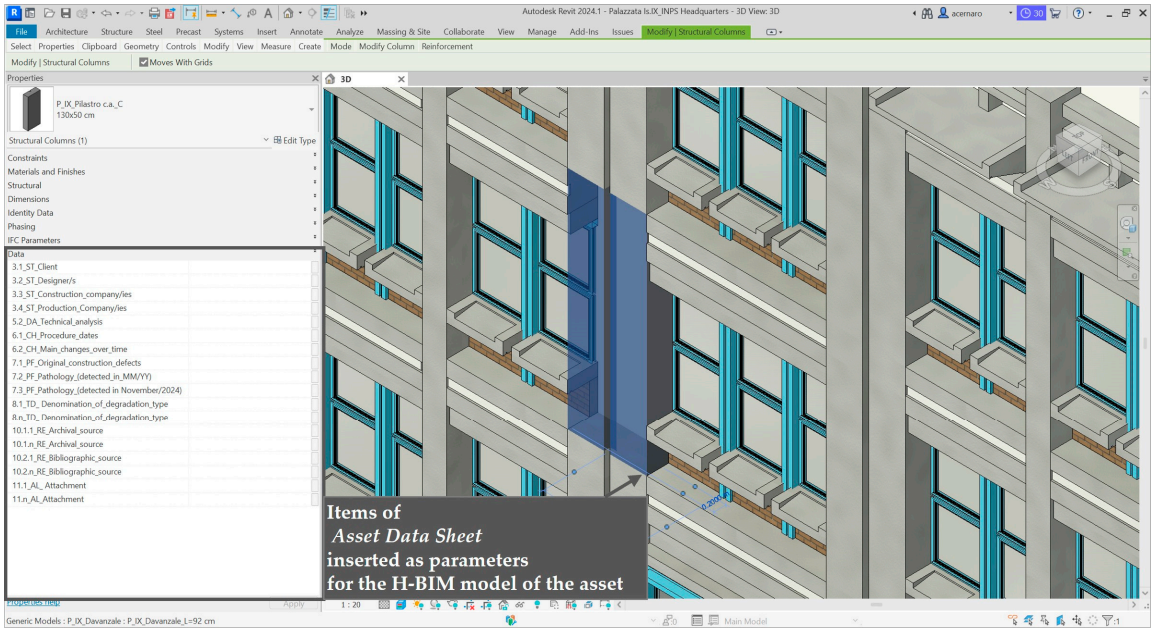


(**b**)

Figure 21. Transposition of the *Asset Data Sheet* into the Edificius software: (**a**) partial parametric conversion of the description items relating to the asset; (**b**) total parametric conversion of the description items relating to the object. Substantial limitation: the attribution of data to the model is reductive because it is only textual and not parametrisable.



(**a**)



(**b**)

Figure 22. Transposition of the *Asset Data Sheet* into the Revit software: (**a**) total parametric conversion of the description items relating to the asset; (**b**) total parametric conversion of the description items. Formal limitation: uncomfortable organisation of the data translated into parameters that must be organised in predefined thematic groups, here "Data".

The formal limitation, on the other hand, has been found using Revit software. Unlike Edificius, the former does not allow for presenting the parameters according to the thematic groups identified in Table 5, but only in sets to be chosen from those available, therefore predefined in number and denomination (Figures 22 and 23). For the case study, we have had to opt for the "Data" group as it is more generic and similar to the parametric conversion of the *Asset Data Sheet*. Hence, reading the informative content is less easy than desired, both with reference to the data associated with the work and to those assigned to the individual BIM object. The limitation has not been found in Edificius since the creation of sets with customisable names is allowed; however, this advantage is partial because it

occurs only at the level of the object (as previously pointed out with regard to the limit of a substantial nature, the data attributed to the work are not conceived parametrically but as simple texts).

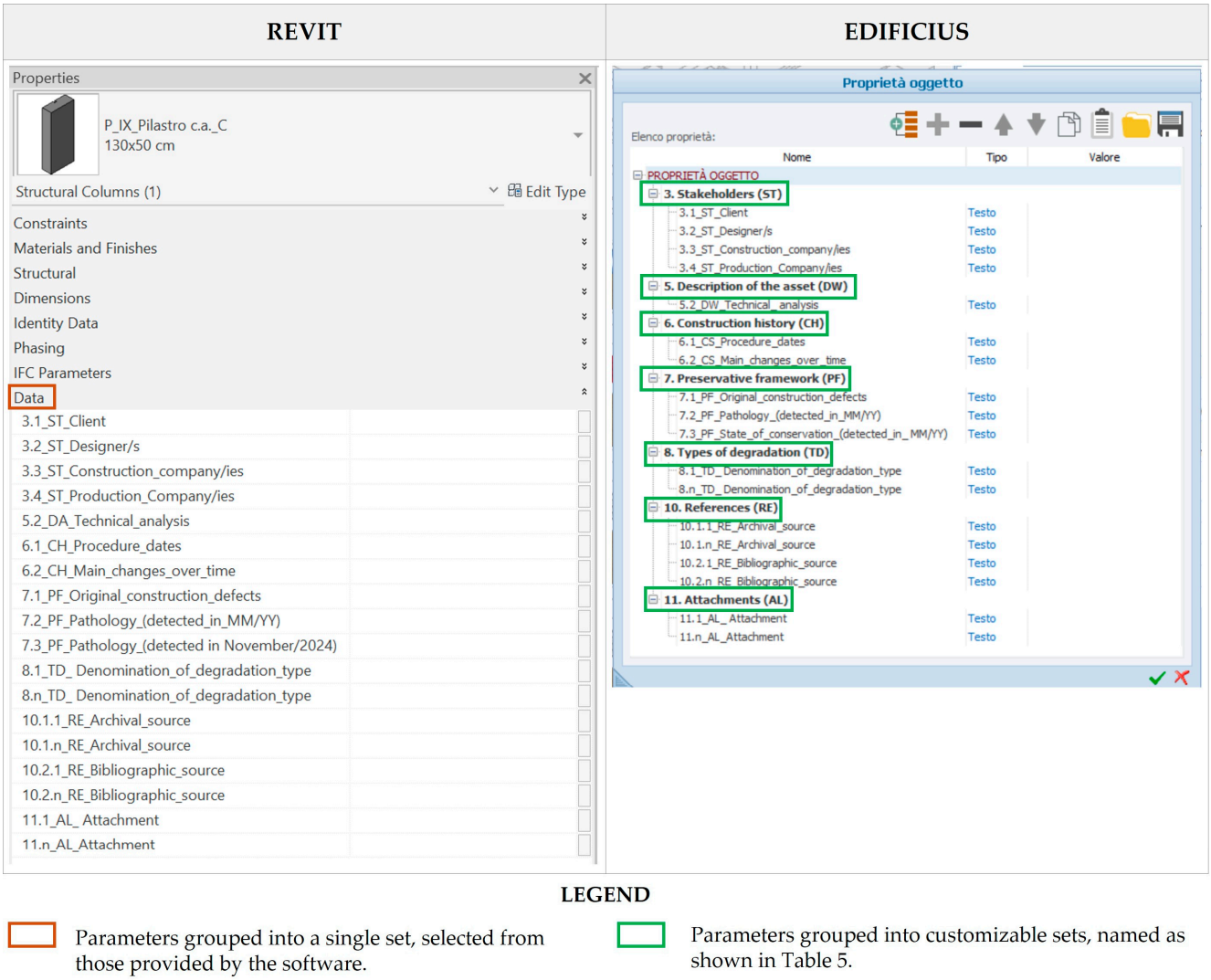


Figure 23. Formal limitation in the transposition of the *Asset Data Sheet* into the Revit software and comparison with the Edificius software (example conducted through the attribution of parameters to a BIM object since the latter software does not allow the parametric management of the asset data).

A possible solution to be implemented in Revit is to associate a preliminary parameter as image or URL through which to attach the scheme for transposing the sheet items into the BIM environment (cf. Table 5); so the user can trace the description items back to the relevant groups also thanks to the numbering criterion adopted (for example, "1.1_ID_Original_denomination" read in the software panel belongs to the group "1. Identification data (ID)" read in the attached file). The solution is presented through the case study of the INPS headquarters in Messina and through the data to be attributed to the entire model of the work: the list of parameters, compiled with the data reported in *Asset Data Sheet*, is preceded by the URL parameter, called "0. Scheme of parameters", which allows consultation of the data structure (Figure 24). The procedure is also valid for the parameters to be assigned at the object level.

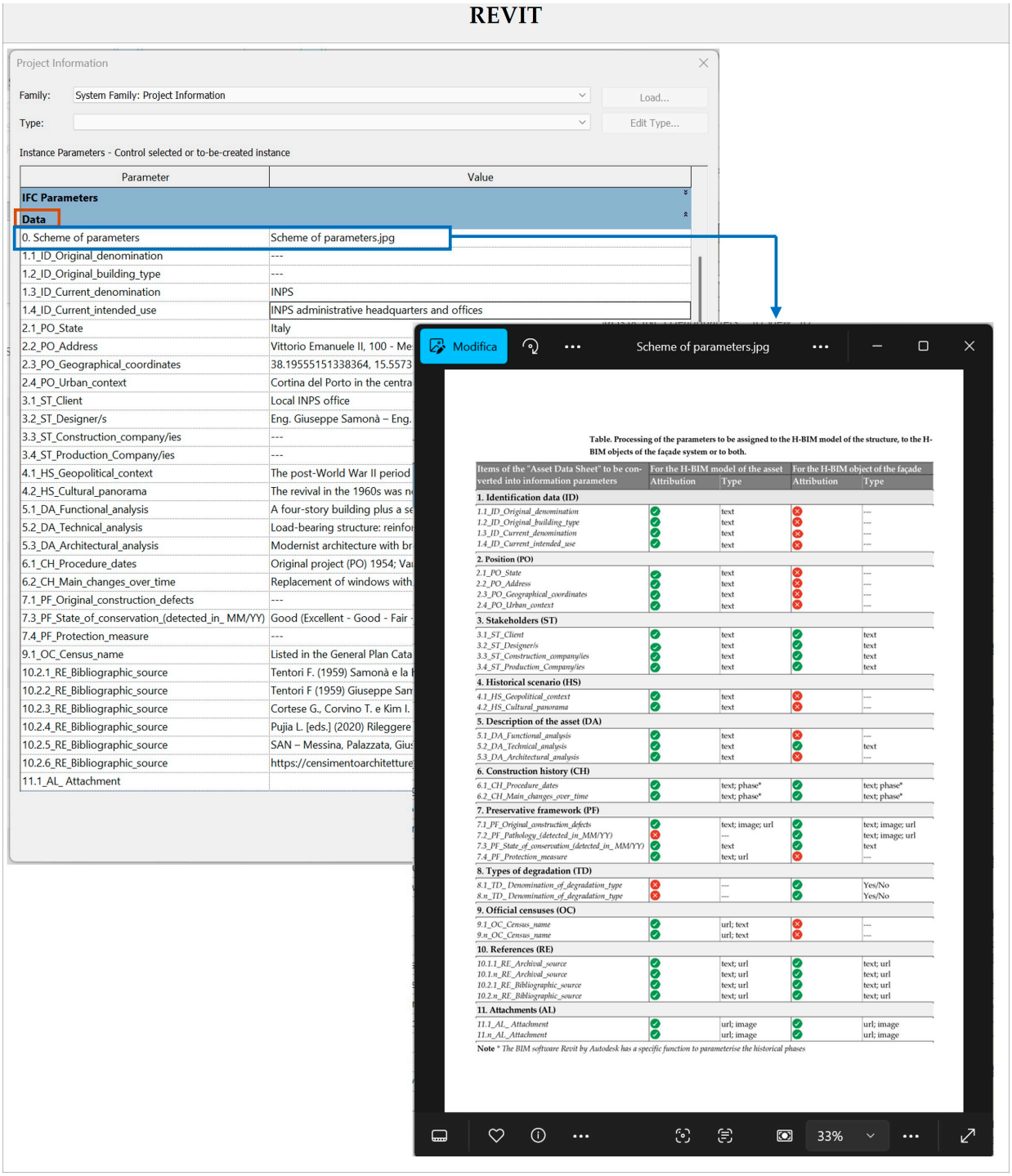


Figure 24. Proposal to solve the formal limitation in the transposition of the *Asset Data Sheet* into the Revit software. Example presented through the case study of the INPS headquarters in Messina for the parameters attributed to the entire model of the work, but also valid at the level of the object.

In conclusion, for the purpose of a full parametric conversion of the *Asset Data Sheet* and taking into account the current functionalities of the software, at this stage, it is necessary to give less weight to the formal limitation and ensure that all the information associated with the model of the work or the single digital entity is parametrically manage-

able. This approach is necessary in order to be able to develop automations, in the future, in the assignment of information from the sheet to the BIM model, in this phase of the research, which is conducted manually by the operator.

5. Discussion

The creation of a Digital Register of 20th century façade systems required the establishment of two tools: the H-BIR, a repository for putting together and organising the information on case studies, and the H-BIM, a parametric model designed to receive and return data. Strengths and weaknesses of both will be examined for future research projections.

With reference to the H-BIR, the experimentation process focused on its structure. The information gathered was compiled into an "Analytical summary of sources", which made it possible to identify the stages in the entire construction history of each work examined, from the original project to all its transformations throughout its life cycle. Therefore, the section on operative investigations could have been included in one of the restoration interventions carried out over time, but it was deemed appropriate to extrapolate this technological cross-section, then linking it back to one of the systematised phases, in order to have a homogeneous outline of the phases and give greater prominence to the results of the various diagnostic investigation campaigns. The last isolated aspect, the digital content, is interpolated with everything that precedes and follows the creation of the H-BIM model of the work, from the SCANtoBIM surveys to the models developed for previous occasions, from BIM objects found in libraries to specially created parametric and informative entities.

In dealing with the different sections of the H-BIR for the two historic buildings selected—the Santa María Micaela residential complex in Valencia and the INPS headquarters in Messina—the opportunity to highlight the undergone transformative phases and the possibility of bringing out conservation policies, adopted in relation to different geographical and chronological contexts, were counted among the strengths. In Valencia, the presence of a level 2 protection status established by the *Plan General* and the inclusion in the *Catalogo de bienes y espacios protegidos* have preserved the original façade systems, on which only conservation and restoration work that protects their original integrity and material and historical-architectural value has been permitted. In Messina, the attention given to the *Palazzata* (the row of eleven Modern buildings that delimits an area of the historic port and to which the INPS headquarters lot belongs) is entrusted to the examination of projects by the Superintendency because a restriction regime is absent; the body, in the context of the replacement of windows and doors of this building, has imposed the choice of a colour previously reserved solely for internal shading systems.

However, finding information is a weak point, as sources are often physically and logistically scattered; their incompleteness can interfere with the organisation of the phases proposed in the analytical summary. The more the documentation is inventoried and catalogued in advance by the relevant bodies and institutions, the more reliable and effective the reconstruction will be in terms of subsequent interventions. In Valencia, it was possible to observe the structured preservation of sources in the historical archives of the City Council, of the client, and the architects' association, sometimes in original or copy form, but with the intention of providing a protocol to guarantee the conservation of the asset.

Although Italy, and therefore Messina, has a regulatory framework for the protection of Cultural Heritage, buildings less than 70 years old and whose designer is still alive are not covered by it. There are alternatives, such as copyright, which is difficult to apply for and obtain, or very mild restrictions imposed by the Town Planning Scheme. As highlighted, this results in little attention being paid to various types of work on buildings

dating from after the Second World War. However, a similar operative difficulty can also be seen for earlier periods.

Hence, a tool such as H-BIR, conceived and created to be made available on a platform that can be implemented by anyone with validated data, would support not only a process of knowledge acquisition but also more accurate management of Cultural Heritage.

The preparation of H-BIM objects, to be structured in a digital repertoire for 20th century construction techniques, faces a problem related to the choice of information content with reference to two aspects: one concerns LOI, the other concerns BIM.

The list of informative parameters drawn up is certainly a necessary enrichment of the model to obtain, alongside geometrically flawless and realistic objects, a level of development adequate to a cognitive awareness necessary for conservation and/or transformation interventions on buildings. A complete compilation is desirable but not easily achievable. The second obstacle encountered in practice depends on the type of software used. Two cases modelled with different software were presented, and the internal logics for attributing data enrichment to each were proposed. Other logics concern Archicad, Allplan, Bentley, and FreeCAD. In an open BIM perspective, the path of the information parameterisation process should be unique or easily convertible from one mode to another.

A significant aspect of this study is the possibility of making a concrete contribution to the digital transition for Cultural Heritage. The BIM entities created for the Digital Register will be downloaded from the DIMHENSION web platform and reused to create models of works with similar characteristics. The ability to manage geometries and data parametrically allows for customisation according to the specific characteristics of the case in question. The proposal differs from the state of the art because it emphasises the information apparatus, which is essential in a BIM model, and suggests a connection with architectural heritage cataloguing projects, which have been in place for decades to promote knowledge and dissemination of the built environment. For these reasons, the creation and dissemination of "H-BIM template objects", which are BIM entities produced for works included in the Register but stripped of specific data so that they can be reused in other digitalisation processes, is a result that goes beyond the limitations highlighted.

6. Conclusions

One of the most debated issues concerning the conservation of world architectural heritage is the lack or sporadic recognition of the cultural value of 20th century works. This awareness, which has been felt since the 1980s when the first needs for intervention on buildings constructed in previous decades began to emerge, has led the scientific community to find ways to raise awareness among professionals, scholars, and non-specialists about the stylistic and technical-constructive peculiarities of the 20th century. These are the origins of analogue cataloguing projects, which, with the advent of information technology, have also found a place on the web, to the benefit of the fundamental objectives of dissemination and distribution. In this era of transition to digital, there is a growing need to support these census and knowledge diffusion activities by sharing parametric-informative models, which, however, are still developed mainly from a geometric point of view, neglecting the content they could accommodate. This study, developed as part of the PRIN 2022 DIMHENSION research project—DIgital twin and Modern HEritage modelliNg towards Sustainable InfOrmed maNagement, aims to contribute to the development of this topic by devising a methodology that will be used to create *an International Digital Register of 20th century construction techniques*.

In particular, the credentials required for the inclusion of a work in this tool have been identified, and the web platform that will host it is currently being set up. Following an

analysis of the state of the art and previous research experiences of the research group, the access requirements have been recognised:

- In a repository, called H-BIR, designed to store all the knowledge that can be acquired about the building, including historical documentation and digital materials that will become increasingly important in the future;
- In an H-BIM model, reproducing the entire building or, in this first phase of the project, an exemplary portion of the building envelope that will allow the digitalisation process to begin.

The two credentials are linked by the *Asset Data Sheet*, a format inspired by recognised protocols for cataloguing architectural heritage but with a greater focus on technological and conservation issues. A new feature is that its data structure is the necessary information that an H-BIM model should possess, filling a gap found in current parametric libraries aimed at historical architecture, which develop digital designs mainly from a geometric point of view, neglecting data enrichment.

The proposed methodology, validated in an experimental phase on a number of case studies selected from a sample of works on an international scale, can be replicated regardless of cultural context and stylistic and technical-construction characteristics; it will allow the dissemination of H-BIM template objects to be reused for the production of H-BIM models of similar architecture, extending the digitalisation process in the field of Cultural Heritage. Here, an international overview of the second half of the 20th century was presented, based on analyses conducted on buildings constructed in Italy during the Fascist period and in Messina during the first phase of post-earthquake reconstruction.

Future developments in research on the currently being established Register will focus on optimising digital conversion processes so that the process becomes increasingly independent of the specific functionalities of the IT tools adopted and, through IT automation, facilitates the exchange and updating of data between HBIR, the Asset Data Sheet, and the H-BIM model.

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Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

The *Asset Data Sheets* compiled for the case studies not presented in the Results section have been added in the appendix in order to understand the reasons for inclusion in *the International Digital Register of 20th century construction techniques*, by virtue of the historical scenario in which they were designed and the stylistic and technical-construction specificities (Tables A1–A4).

Table A1. *Asset Data Sheet*, filled in for the case study: Residential building—Block VI of the Palazzata, Giuseppe Samonà, 1954–1957, Messina (Italy).

CATALOGUING PROTOCOLS		FILING PROJECT FOR DIGITAL MANAGEMENT	
		Documentation and Conservation of 20th Century Façade Systems	
		RESIDENTIAL BUILDING BLOCK VI OF THE PALAZZATA	
an international filing model MINIMUM FICHE	a national filing model CENSIMENTO DELLE ARCHITETTURE ITALIANE DAL 1945 AD OGGI		
●	●	**Historical scenario**	Italian post-war
		Geopolitical Context	The post-World War II period brought about a phase of reconstruction and redemption in republican Italy, which in Messina merged with the completion of buildings begun following the earthquake and unfinished or subject to the bombings of 1943.
		Cultural panorama	The revival in the 1960s was no longer inspired by the original criteria of the design of the façade on the harbour curtain wall of the 1930s, with its scenographic and symbolic imprint desired by the Fascist regime, but adhered to modernist dictates that gave a new physiognomy to blocks IX, X, XI, IV, V, and VI of the Palazzata.
●	●	**Original denomination**	Block VI—Cortina del Porto
●	●	**Original building type**	Facilitated residential construction
●	●	**Procedure dates**	***Original project (PO)*** 1953 ***Variants (Vr_{1-n})*** 1954 ***Execution (Es)*** 1954–1956 ***Inauguration (In)*** -
●	●	**Designer(s)**	arch. Giuseppe Samonà—engg. Giuseppe Cacopardo and Salvatore Capraro
●	●	**Construction company**	-
●	●	**Original property**	Rizzotti e condomini
●	●	**Client**	Immobiliare CIFRES per la Sicilia
		Location	Cortina del Porto—Messina
●	●	*State*	Italy
		Address	Via Garibaldi
		Geographical coordinates	38.1925355,15.5569345
●	●	Urban context	Cortina del Porto in the central area was rebuilt in the 20th century
●	●	Functional organisation	A four-storey building with a double staircase: ground floor occupied by shops and entrance halls to the three upper levels with seven flats per floor. The rhythmic repetition of the structural elements, vertical and horizontal projecting elements, identifies a modular grid that is further divided into the three upper floors by string courses. Here, in the bays thus bipartitioned and symmetrically mirrored, window openings and balconies are arranged, reflecting in size and location the internal distribution of the perimeter living and sleeping areas. All the services overlook internal cloisters.
●	●	Construction characteristics	***Load-bearing structure:*** reinforced concrete skeleton protruding from the facade line ***Horizontal partitions:*** cross-ribbed hollow core slabs + cobblestones of various colours and sizes on floors 2, 3, 4 ***Basic enclosures:*** brick, block, slab ***Roof:*** terrace with cross-ribbed concrete slab, projecting flush with the façade, with a cantilever roof supported by brackets bordered by a metal mesh parapet ***Vertical partitions:*** solid brickwork + travertine plinth on the ground floor and grit-plastered foundations on the upper floors. The parapets have reinforced concrete sides and galvanised sheet metal fronts. ***Windows:*** iron casement with shutter
●	●	Architectural lexicon	Modernist architecture with Brutalist elements
●	●	**Current denomination**	Block VI of the Palazzata
●	●	**Current intended use**	Shops on the ground floor and flats on the upper floors
●	●	**Ownership status**	Private citizens
●	●	**Main changes over time** Brief descriptions and dates	Individual and uneven replacement of wooden windows and doors with aluminium ones and functional redistribution [since the 1990s]
●	●	**Original construction defects** from unsuitable technical solutions	-
●	●	**Pathologies** Brief descriptions and dates	Slight deterioration of fair-faced reinforced concrete
●	●	**State of conservation** Summary evaluation and dates	Good (Excellent—Good—Fair—Bad) [2024]
●	●	**Protection measure**	-
●	●	**Official census (LINK)**	https://censimentoarchitetturecontemporanee.cultura.gov.it/scheda-opera?id=5299 (accessed on 25 May 2025) [69]
●	●	**References**	***Archives:*** Isolato VI—Cortina del Porto Vol 5/3_Archivio del Genio Civile—Messina [70]; Urbanistica—Archivio corrente: Isolato VI -Cortina di Messina [71] ***Bibliography:*** Tentori F. (1959) *Samonà e la Palazzata di Messina. Dal concorso alla realizzazione (1929–1958)*, in "Casabella-Continuità" n. 227, Milano, pp. 29–41. [50] Pujia L. [eds.] (2020) *Rileggere Samonà*. Edizioni TrE.Press, Roma. [52] SAN—*Messina, Palazzata, Giuseppe Samonà* (1929–1958) http://www.architetti.san.beniculturali.it/web/architetti/home access on 25 August 2025 [53] DGCC—Censimento delle architetture italiane dal 1945 ad oggi: Scheda Opera—Palazzata Isolato VI. https://censimentoarchitetturecontemporanee.cultura.gov.it/scheda-opera?id=5299 access on 25 August 2025. [69]
●	●	**Attachments**	Graphic works [1953–1956]—Recent photographs
●	●	**Credits tab**	Research Team CEAR08-A UniME

Legend on description fields taken from the reference protocols for the filing project: ●derivation with high conceptual and terminological affinity ●derivation with partial conceptual and terminological affinity ● derivation did not occur.
Note: Fields with round, blue and underlined text refer to links for further information.

Table A2. *Asset Data Sheet*, filled in for the case study: BUILDING I INA, Guglielmo Ulrich, 1950–1953, Pavia (Italy).

CATALOGUING PROTOCOLS				FILING PROJECT FOR DIGITAL MANAGEMENT
				Documentation and Conservation of 20th Century Façade Systems
				BUILDING I INA
an international filing model MINIMUM FICHE	●	a national filing model CENSIMENTO DELLE ARCHITETTURE ITALIANE DAL 1945 AD OGGI	●	**Historical scenario** — Italian post-war
				Geopolitical Context — Included in the national public housing programme of the years 1949–1963 (Fanfani Plan), commissioned by INA Casa after World War II to cope with reconstruction and the housing shortage.
				Cultural panorama — At the approval stage and during construction, the building was challenged for its high height and modern language that was out of keeping with its surroundings.
	●		●	**Original denomination** — Building I for INA Casa
	●		●	**Original building type** — Multi-storey building
	●		●	**Procedure dates** — ***Original project (PO)*** 1950; ***Execution (Es)*** 1951–1953; ***Variants (Vr$_{1-n}$)*** -; ***Inauguration (In)*** -
	●		●	**Designer(s)** — Guglielmo Ulrich- ing. Pietro Maffai [DL]
	●		●	**Construction company** — -
	●		●	**Original property** — INA Casa
	●		●	**Client** — INA Casa
				Location — Historical centre—Pavia
	●		●	*State* — Italy
				Address — Corso Cavour, 59.
				Geographical coordinates — 45.187140, 9.147957
	●		●	**Urban context** — The final part of the street that defines the decumanus of the urban layout of Roman origin that characterises Pavia.
	●		●	**Functional organisation** — 7-storey building with double stairwell: basement used as cellars and technical rooms; ground floor for commercial use; first floor for offices; second to sixth apartments (2 apartments per stairwell).
	●		●	**Construction characteristics** — ***Load-bearing structure:*** reinforced concrete skeleton resulting in a modular scanning of the façade; ***Horizontal partitions:*** brick block slab + different finishes depending on use (in flats, marble, porcelain stoneware, and parquet); ***Basic enclosures:*** -; ***Roof:*** pitched roof, brick, block slab + practicable terraces; ***Vertical partitions:*** at ground floor, stone basement alternating with large shop windows; from 1st floor, cassette masonry without thermal insulation with quartzite plaster finish; ***Windows:*** iron and glass (ground floor); wooden or aluminium (replacement) frames (on the other floors)
	●		●	**Architectural lexicon** — Late Rationalism
	●		●	**Current denomination** — Building INA
	●		●	**Current intended use** — Shops and offices on the ground floor; residences on the other floors.
	●		●	**Ownership status** — Private citizens
	●		●	**Main changes over time** Brief descriptions and dates — Since 1998, when it was subdivided and the residential units were sold to private individuals, there have been several internal reorganisations of the dwellings; the commercial units on the ground floor have been refurbished with each change of ownership
	●		●	**Original construction defects** from unsuitable technical solutions — -
	●		●	**Pathologies** Brief descriptions and dates — Over time, ordinary wear and tear of plaster and windows, and doors required repair work and/or replacement of deteriorated parts or components.
	●		●	**State of conservation** Summary evaluation and dates — Good (Excellent—Good—Fair—Bad) [2025] Coherent with the renovations that have taken place over time.
	●		●	**Protection measure** — -
	●		●	**Official census (LINK)** — https://www.wearch.eu/architettura-moderna-in-pavia-e-provincia-i-maestri-1946-1993/ (accessed on 15 April 2025) [72]
do.co.mo.mo international	●	Direzione Generale Creatività Contemporanea MiC	●	**References** — ***Archives:*** Archivio storico civico di Pavia, Archivio comunale parte mo-derna—1941–1950 b. 812, X-2-5, prot. gen. n. 2583 del 195 [73]; ***Bibliography:*** Prina V., *Pavia moderna. Architettura moderna in Pavia e Provincia. 1925–1980*, Edizioni Cardano, Pavia, 2003, pp. 200–201. [74] Bruschi S., Palestra G.W. *Edilizia a Pavia 1945–2005*, Edizioni Cestedil- ANCE, 2007. [75] Itinerari WeArch Scheda 05 Guglielmo Ulrich, *Edificio 1 per Ina*, 1950–1953 redatta da V. Prina, https://www.wearch.eu/05-guglielmo-ulrich-edificio-1-per-ina-1950-53/ accessed on 25 August 2025 [72]
	●		●	**Attachments** — Available at the Civic Historical Archives of Pavia
	●		●	**Credits tab** — Research Team CEAR08-A UniME/UniPV

Legend on description fields taken from the reference protocols for the filing project: ●**derivation with high conceptual and terminological affinity** ●**derivation with partial conceptual and terminological affinity** ●**derivation did not occur.**
Note: Fields with round, blue and underlined text refer to links for further information.

Table A3. *Asset Data Sheet*, filled in for the case study: Don Bosco University College, Ottavio Bonomi, 1962–1965, Pavia (Italy).

CATALOGUING PROTOCOLS			FILING PROJECT FOR DIGITAL MANAGEMENT	
			Documentation and Conservation of 20th Century Façade Systems	
			DON BOSCO UNIVERSITY COLLEGE	
n international filing model MINIMUM FICHE	a national filing model DAL 1945 AD OGGI			
●	●		**Historical scenario**	Italian post-war
			Geopolitical Context	The welfare centre was inaugurated in 1961 in an Italian republic undergoing institutional and social adjustment, but at the height of an economic boom.
			Cultural panorama	It was founded by the Salesians of Don Bosco as part of an international network of Catholic educational institutions to offer hospitality and value formation to university students.
●	●		**Original denomination**	Youth Welfare Centre Salesian Works
●	●		**Original building type**	Accommodation—collective residence
●	●		**Procedure dates**	***Original project (PO)*** 1962 ***Variants (Vr_{1-n})*** - ***Execution (Es)*** 1962–1965 ***Inauguration (In)*** -
●	●		**Designer(s)**	Eng. Ottavio Bonomi
●	●		**Construction company**	Garbelliabe
●	●		**Original property**	Catholic religious body—Salesians
●	●		**Client**	Salesian Society of Don John Bosco
			Location	Borgo Ticino—East garden city Pavia
●	●		*State*	Italy
			Address	St. John Bosco Street, 4
			Geographical coordinates	45.18090057424019, 9.17137349999464
●	●		Urban context	Early suburban residential and university district
●	●		Functional organisation	Building on 4 floors and a basement. Original organisation: ground floor with recreation rooms protected by porticoes; first floor with classrooms for teaching; second floor with refectories and 10 lodgings for priests; third floor with 22 lodgings for students. The living quarters are twins and consist of an entrance hall, bedroom, bathroom, and terrace. The internal functions are legible from the outside due to the different treatment of the façades: ample glazing for the common areas, loggias and bow-windows for rooms and services, three stairwells with recessed elevations emerging from the roof are located between the projecting structural grids. Individual episodes, such as projecting volumes, wall partitions, and holes, complete the building's formal articulation.
●	●		Construction characteristics	***Load-bearing structure:*** reinforced concrete skeleton ***Horizontal partitions:*** brick block slab + grès p1 flooring; resilient p2-p3 flooring ***Basic enclosures:*** brick block slab + porphyry flooring for exteriors; grès for interiors ***Roof:*** pitched roof, brick, block, slab + marseille tile roofing ***Vertical partitions:*** bare solid bricks ***Windows:*** iron pivot; aluminium south sunshade
●	●		Architectural lexicon	Brutalist architecture—Simplified rationalism
●	●		**Current denomination**	Don Bosco University College
●	●		**Current intended use**	University residence
●	●		**Ownership status**	EDISU- Ente Regionale di Diritto allo Studio Universitario
●	●		**Main changes over time** Brief descriptions and dates	PNRR funds: purchase of the University of Pavia [2023]; intern works project [2023]; energy rehabilitation project [ongoing]
●	●		**Original construction defects** from unsuitable technical solutions	-
●	●		**Pathologies** Brief descriptions and dates	As a result of the internal redistribution, the rooms occupying formerly communal rooms are subject to ab-glare due to the large glass surfaces present; there is no longer the original correspondence between uses and perimeter walls [2023].
●	●		**State of conservation** Summary evaluation and dates	Fair (Excellent—Good—Fair—Bad) [2024]
●	●		**Protection measure**	-
●	●		**Official census (LINK)**	https://www.lombardiabeniculturali.it/architetture900/schede/p3010-00143/?offset=5 (accessed on 1 April 2025) [76]
●	●		**References**	***Archives:*** EDISU drafts-Internal works project 2023 [77] ***Bibliography:*** Bonomi O./Calvi G.P., *Costruire, Centro di assistenza giovanile salesiana a Pavia*, Milano 1966, n. 37 [78] Prina V., *Pavia moderna. Architettura moderna in Pavia e Provincia. 1925–1980*, Pavia 2002, p. 229 [74] Prina V., *AL—Mensile d'informazione degli architetti lombardi, Ottavio Bonomi e Pavia*, Milano 2004, n. 3, p. 55. [79] https://www.lombardiabeniculturali.it/architetture900/schede/p3010-00143/?offset=5 (accessed on 1 April 2025) [76]
●	●		**Attachments**	Plants of all levels [2023]—Vintage and recent photographs
●	●		**Credits tab**	Research Team CEAR08-A UniME/UniPV/

Legend on description fields taken from the reference protocols for the filing project: ●derivation with high conceptual and terminological affinity ●derivation with partial conceptual and terminological affinity ●derivation did not occur. Note: Fields with round, blue and underlined text refer to links for further information.

Table A4. *Asset Data Sheet*, filled in for the case study: Unidad Vecinal Portales, Carlos Bresciani, 1950–1966, Santiago (Chile).

CATALOGUING PROTOCOLS				FILING PROJECT FOR DIGITAL MANAGEMENT
				Documentation and Conservation of 20th Century Façade Systems
				UNIDAD VECINAL PORTALES
an international filing model MINIMUM FICHE	●	a national filing model CENSIMENTO DELLE ARCHITETTURE ITALIANE DAL 1945 AD OGGI	●	**Historical scenario** — Chile in the democratic transition period
				Geopolitical Context — A social housing complex built under the principles of the rationalist movement during the mid-20th century in Santiago, Chile.
				Cultural panorama — It is a paradigmatic example of a housing solution from this period, featuring a failed brutalist housing proposal. Several other examples have been implemented in Chile, with various variations in the design and spatial characteristics of their architecture.
	●		●	**Original denomination** — Unidad Vecinal Portales or Villa Portales
	●		●	**Original building type** — Social housing
	●		●	**Procedure dates** — ***Original project (PO)*** 1950; ***Variants (Vr_{1-n})*** -; ***Execution (Es)*** 1954–1966; ***Inauguration (In)*** 1966
	●		●	**Designer(s)** — architects Carlos Bresciani, Héctor Valdés, Fernando Castillo y Carlos García Huidobro
	●		●	**Construction company** — Caja de Previsión de Empleados Particulares (EMPART)
	●		●	**Original property** — Caja de Previsión de Empleados Particulares (EMPART)
	●		●	**Client** — Caja de Previsión de Empleados Particulares (EMPART)
				Location
	●		●	*State* — Chile
				Address — El Belloto, Las Sophoras, El Arrallán, Las Encinas streets and Portales y General Velásquez avenues
				Geographical coordinates — −33.44703998327084, −70.69021198420545
	●		●	**Urban context** — It is located in a lower-middle-class district west of the historic center of Santiago.
	●		●	**Functional organisation** — A social housing complex consisting of buildings and single-family homes on an area of approximately 6 hectares, located in the Quinta Normal district, west of Santiago, Chile. It consists of 1940 homes distributed across 19 blocks, comprising one- to two-story houses, single-story apartments, and two-story apartments. The blocks range in height from five to seven stories.
	●		●	**Construction characteristics** — ***Load-bearing structure:*** reinforced concrete skeleton ***Horizontal partitions:*** brick block slab ***Basic enclosures:*** brick, block, slab ***Roof:*** terrace with asphalt and galvanized iron sheets ***Vertical partitions:*** reinforced concrete and brick masonry ***Windows:*** glass windows. Metal railings; Brick masonry shutters; Metal-framed sunshades with a sliding system.
	●		●	**Architectural lexicon** — Modernist architecture
	●		●	**Current denomination** — Unidad Vecinal Portales or Villa Portales
	●		●	**Current intended use** — Residencial building
	●		●	**Ownership status** — Private citizens
	●		●	**Main changes over time** Brief descriptions and dates — Modifications to exterior enclosures and metal protections; installation of access controls and gates.
	●		●	**Original construction defects** from unsuitable technical solutions — -
	●		●	**Pathologies** Brief descriptions and dates — Deterioration of the reinforced concrete due to rust on its interior reinforcements. Deteriorated and rotten masonry bricks on the sunshades. Rickety and loose sunshades with damaged metal profiles.
	●		●	**State of conservation** Summary evaluation and dates — Good (Excellent—Good—Fair—Bad) [2025] Poor maintenance and deteriorated concrete. Deterioration of windbreaks and parasols.
	●		●	**Protection measure** — -
	●		●	**Official census (LINK)** — -
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	●		●	**Attachments** — **Documents and photographs. Author: Jaime Migone Rettig**
	●		●	**Credits tab** — Research Team CEAR08-A UniChile

Legend on description fields taken from the reference protocols for the filing project: ●derivation with high conceptual and terminological affinity ●derivation with partial conceptual and terminological affinity ●derivation did not occur.
Note: Fields with round, blue and underlined text refer to links for further information.

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