



Article

The Analysis of the Maintained/Disowned Relationship among Firmitas, Utilitas, and Venustas to Preserve the Cultural Heritage: An H-BIM Approach for the Management of Historic Buildings

Alessandra Cernaro [†], Ornella Fiandaca [†], Raffaella Lione [†] and Fabio Minutoli ^{*,†}

Department of Engineering, University of Messina, Contrada Di Dio, Sant'Agata, 98166 Messina, Italy; acernaro@unime.it (A.C.); ornella.fiandaca@unime.it (O.F.); raffaella.lione@unime.it (R.L.)

* Correspondence: minutoli.fabio@unime.it

† These authors contributed equally to this work.

Abstract: Understanding the transformations of a historic building is a complex but necessary operation to plan future, more aware maintenance works that preserve the architectural quality. This study proposed to analyze the changes undergone by an edifice over time by virtue of the Vitruvian triad, namely the criteria formalised by Vitruvius to judge architecture: firmitas (construction system), utilitas (utility), and venustas (aesthetics). These criteria depend on the designer's mindset but also the influence of historical, cultural, or local factors. The theme required a prior reflection on the mutations of the Vitruvian triad over time. Based upon these relationships, the analysis of the architectural heritage of Messina was started because it is emblematic due to historical events: buildings constructed after the earthquake of 1908, subject to war damage repairs, and then maintenance. Their firmitas, utilitas, and venustas changed for historical, cultural, social, and normative reasons. In this regard, the former Fascist House has significant features: the repeated changes in intended use that produced planimetric variations, technical-constructive modifications sometimes connected to formal choices, and to the abolition, albeit partial, of fascist symbols. The current appeal to experiment with digital technologies has led to examination of the opportunities of the BIM methodology, finding in the model historicisation a way to document and record the triad variations of an existing building in the virtual environment. The research topic proposes an operative approach for more incisive analysis and digitalisation of historical buildings, trying to make a contribution to Target 4 of Goal 11 of the 2030 Agenda for Sustainable Development: to strengthen efforts to protect and safeguard cultural heritage.

Keywords: Vitruvian triad; Messina; former Fascist House; heritage BIM



Citation: Cernaro, A.; Fiandaca, O.; Lione, R.; Minutoli, F. The Analysis of the Maintained/Disowned Relationship among Firmitas, Utilitas, and Venustas to Preserve the Cultural Heritage: An H-BIM Approach for the Management of Historic Buildings. *Buildings* **2023**, *13*, 1045. <https://doi.org/10.3390/buildings13041045>

Academic Editors: Rosa Agliata, Muhammad Jamal Thaheem, Qi Han and Nouman Khadim

Received: 26 February 2023

Revised: 31 March 2023

Accepted: 13 April 2023

Published: 16 April 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Starting from the foundations of design culture—firmitas (construction system), utilitas (function), and venustas (aesthetics)—the results of the evolution over time of the Vitruvian triad were investigated (Figure 1). Specifically, this was conducted with reference to modern historical-architectural heritage, built between the two world wars, defaced by invasive maintenance/restoration actions that have denied its original value.

In the light of the exposed consideration, we analysed an emblematic case recognised in one of the ten buildings of the Palazzata of Messina: the former Fascist House, built in the late 1930s based on a project by two famous Italian designers, Giuseppe Samonà (1898–1983) and Guido Viola (1895–1984), and with technical-constructive features typical of many buildings of the time [1].

The objective of the research work was to verify a digital method of graphic and informative restitution, based on the Vitruvian triad, of all the transformations that took

place in the various historical phases, from the original project to the last extraordinary maintenance intervention. The proposed methodology concerns BIM (Building Information Model/Modelling/Management), an approach that is supporting the digitalisation of the AEC (Architecture Engineering Construction) sector and the existing and historical edifices. This methodology can be replicable for other buildings with cultural heritage that are often subject to interventions that compromise their architectural quality because an adequate critical analysis has not been made.

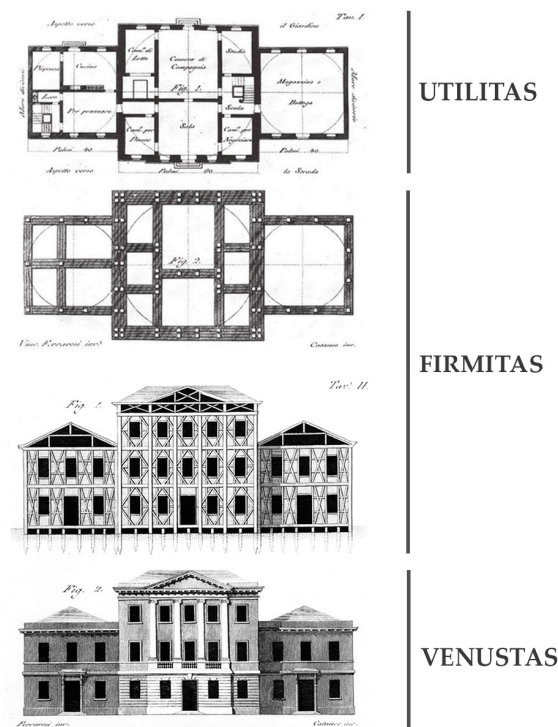


Figure 1. Exemplification of the Vitruvian triad: firmitas, utilitas, venustas [2].

2. State of Art

In the first chapter of the first book of *De Architectura*, Vitruvius traced the profile of the architect, a professional figure whose qualities must be: the *fabrica*, namely the manual ability, and the *ratiocinatio*, the theoretical concepts. The definition underlies a multidisciplinary education based on science, drawing, arithmetic, composition, and optics, supported by a broader general culture: literary skills to «leave a lasting memory with written explanations», knowledge of art history to identify the relevance of architectures, of medicine to meet hygienic/sanitary requirements, of astronomy to assess exposures and climate, of music for the design of theatrical buildings, of construction law and, more generally, of everything that can contribute to achieve the *summum templum architecturae*, that is, the maximum expression of a construction [3].

Nowadays, in light of the appeal to widely adopt the digital technologies in the AEC sector, the definition needs to be updated: IT skills must be associated with the aforementioned ones, as a consequence of a *ratiocinatio* that has had to be renewed to acquire the theoretical assumptions of BIM, the digitalisation approach established in the construction sector.

The methodology promises to represent, simulate, and govern every aspect of the design phase and the entire life cycle of the building up to its disposal, allowing us to obtain a plausible digital equivalent of the edifice through which to conduct evaluations that also have predictive purpose. The provided support is codified with the concept of the “BIM dimensions”, internationally, it is named “7D Facility Management”, but in Italy, the

expression is different because it derives from the national standard where the management belongs to the 6D dimension [4]

The foundations of the methodology allow us to hypothesise that the criteria for judging an architecture, formalised by Vitruvius as *firmitas*, *utilitas*, and *venustas* are neither lost nor compromised by resorting to digitalisation.

With the decline of analogical approaches, some scholars have tried to reread the Vitruvian triad by proposing its expansion in tetrad to accommodate the ongoing innovation. Some expressions have been formulated:

- “*firmitas, utilitas, venustas, digital-as*” in 2009, in order to include the new dimension for architecture in which matter and space are intangible, a paradoxical concept for the *res aedificata* [5];
- “*firmitas, utilitas, venustas, virtualitas*” in 2012, which looks at the opportunities of the metaverse for the construction sector [6] in a perspective that today is still futuristic;
- “*firmitas, utilitas, venustas, innovation*” in 2018, where the word “innovation” includes all the advantages derived from the adoption of technology in the AEC sector [7].

Beyond the proposed locutions and their aims, in the previous studies it is possible to perceive a sensitivity towards the paradigms of the architecture that cannot vanish with the transition to digital.

When the interest is for cultural heritage, the subject matter becomes more complex because, in almost all cases, the features established in the original design phase, in terms of *firmitas*, *utilitas*, and *venustas*, have been modified throughout the building’s life cycle. However, also the concept and the interest towards the Vitruvian triad has changed over time because it is influenced by cultural, historical, and local factors.

Trying to follow the transformations of the Vitruvian triad is a too difficult task because it would mean retracing the whole history of architecture. Instead, focusing on some cornerstones and contradictions of the relationship among *firmitas*, *utilitas*, and *venustas* could be useful to understand that they were not always equally involved in a project or maintenance work. In Italian design culture, a meaningful reference could be the thought of G. B. Milani, author of the book entitled *L’Ossatura Murale (Wall Framework)* published in 1920 and conceived to teach architecture [8]. Here, he wanted to focus only on the *firmitas*, denying the *venustas* and neglecting the *utilitas*.

To understand how a designer conceived the Vitruvian triad, it is also necessary to analyse events occurred in the building context. An example could be Messina, an Italian town destroyed by the earthquake of 1908 [9–11]. In the first phase of the town reconstruction, the criteria of the design were changed as below:

- *Firmitas*, influenced by the new regulations to build edifices according to anti-seismic needs;
- *Venustas*, influenced by the desire to recreate a history of architecture for the town, juxtaposing neoclassical, neogothic, and neobaroque styles to those of the 20th century (Deco, Art Nouveau, Coppedè, Modernism);
- *Utilitas*, influenced by security needs that determined the affirmation of the residential type of the block with a vast internal courtyard, guaranteeing with its shape a better response to dynamic actions.

Therefore, the experience gained with the post-earthquake reconstruction had introduced new canons for the Vitruvian triad, a few decades later changed for the emergency to repair the damages caused by World War II.

For these and other reasons, the digitalisation of an existing edifice cannot consist in an uncritical representation of its state of fact since the process of historical analysis, essential for the conception of any future intervention, would be missing. Hence, evaluations with predictive purposes cannot subsist without evaluations of previous events and vicissitudes, to be returned in the BIM environment.

Nowadays, the request to experiment with digitalisation lead us to understand how to transfer and manage the concept the Vitruvian triad in digital form.

3. Methods and Application

The methodological approach can be summarised in the operational phases shown in the following flowchart (Figure 2).

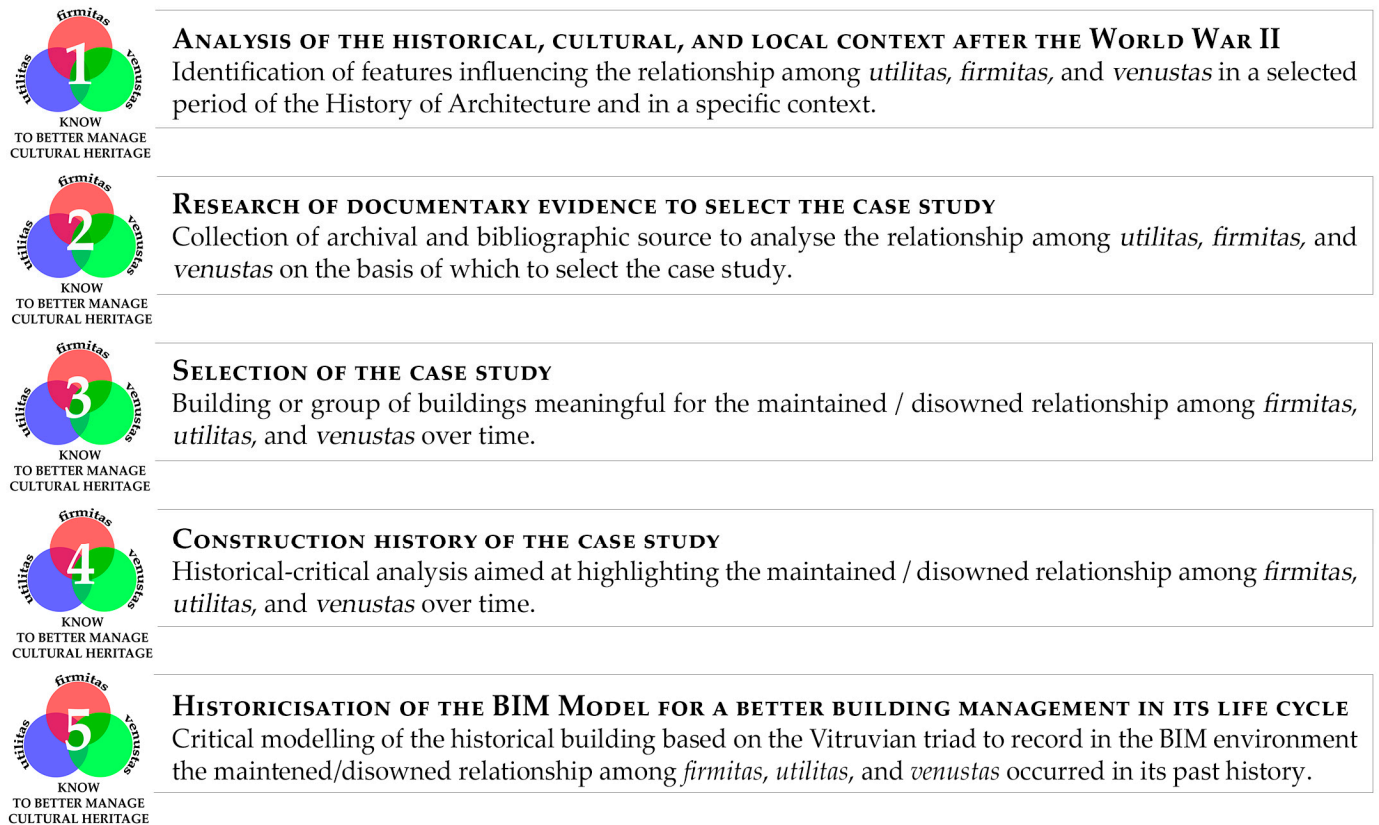


Figure 2. The methodological approach based on the Vitruvian triad for a more conscious digitalisation of the cultural heritage.

3.1. Analysis of the Historical, Cultural, and Local Context after World War II

Entering the logic of a war is a very complex operation that is beyond our competence. In general, some cities are more targeted than others due to the presence of sensitive targets or to their geographical location. This is the case for Messina, which is in the Italian region of Sicily. The scenario for which it was the theatre of World War II clarifies certain reconstructive dynamics.

For its strategic position, Sicily was identified by the Anglo-American Allies as a gateway to counter the forces of the Italo-German Axis. Only a few actions of the bomber command struck the Island in 1940. In 1943, and particularly in the weeks leading up to the liberation from Nazism–fascism, actions from the sea and from the air were aimed at annihilating the sensitive targets marked in a military map drawn up by the American command in 1942–43 [12]. The Anglo-American offensive and the Italo-German counteroffensive hit Messina, where the reconstruction operations after the 1908 earthquake were still ongoing. The post-war plans were not prepared for two reasons: the condition of the city, as Luigi Borzi’s general town planning (prepared in 1911 after the earthquake of 1908, revised in the ’30 s) was not completely carried out yet, and the apparent resistance of the reinforced concrete buildings to bombing despite the damage suffered, which proved to be huge and costly [13].

In this context, reconnaissance conducted with attention to sensitive targets and surviving monuments should have been enriched with additional investigation to consider the entire affected building stock and constructions in progress during those years as well as those vulnerable because they were suspended in the absence of finance.

The actions conducted after the bombings show uncertainties and inconsistencies depending on the “customer” and its purposes if compared with the photographs of the time [14].

Analysing the “Map of damages caused by the bombing of the blocks” drawn up on Borzi’s general town planning and based on the inspections carried out by the civil engineers (and on the Interior Ministry’s cables), the town was hit from north to south and from east to west with progressively greater intensity, affecting it almost entirely, with 75% to 100% destruction. Here, as elsewhere, it was a matter of amplifying the emergency to substantiate the need for reparations in a scenario in which war damage was added to that produced by the earthquake and not yet fully healed.

From the reports of the building reconstruction that took place in Messina after the 1908 earthquake, it is deduced that *venustas* was subject to *firmitas*, since anti-seismic regulations dictated structures resistant to earthquakes and conditioned heights, distances, mouldings, and projections, thus sacrificing compositional aspects because of the fear of new catastrophes.

It is a simplified vision that does not correspond at all to the intense experimentation both in the structural and decorative fields that characterised the constructive solutions of Messina blocks from the 1910s to the 1940s.

All post-war findings reveal a city mostly affected by the demolition of horizontal closures, starting from the roofs due to bombs from the air and from the sea, and of the external claddings, due to splinters and detonations. The reinforced concrete frame structures resisted to the point that during the Anglo-American offensive, flying over Messina did one could not perceive the effects of an initial bombardment and so bombers returned to conduct subsequent military actions.

The philosophy of intervention that unites post-war repairs prefers the reintroduction of the original architectural composition, purged of the fascist symbols where present, and subject to construction techniques conditioned by lack of culture or insufficient funding.

So, the desire was to repair the war damage while keeping the stylistic image unchanged, the *venustas*, but intervening on *firmitas* and *utilitas* in relation to economic contingencies as much as opportunistically possible.

Therefore, a first in-depth study based on all available sources concerned the consequences of the bombing with reference to the waterfront, in particular to the *Palazzata*, a continuous curtain of buildings that over the centuries has represented Messina in the collective imagination. It followed the vicissitudes of the town since the Middle Ages with a solid defensive walls system, replaced in the Baroque period by an elevation extended with continuity for a kilometre (18 gates) that was destroyed by the 1783 earthquake and rebuilt in the 19th century with denser subdivisions (37 gates) but not yet separations that was assaulted by the seaquake in 1908.

Reconstruction had to reckon with the permanence of some fragments deliberately destroyed; with an initial ban on residential buildings near the beach and the requirement of a distance of at least 70 m from the shoreline/port docks (R.D. 542/1909) (Figure 3); with the reconsideration of this constraint in 1918 because of an earthquake-proof design of buildings for commercial use; and with the holding of a “National competition for the new type of façade fronting the sea of the *Palazzata*” announced on 28 August 1930 [15].

The construction of the new *Palazzata*—*post fata resurgo*—after the inclusion of the Bank of Sicily, for which the project had already started in 1926, went on from 1931 to 1958 with a succession of public and private buildings. Only four buildings were built before World War II (Figure 4).

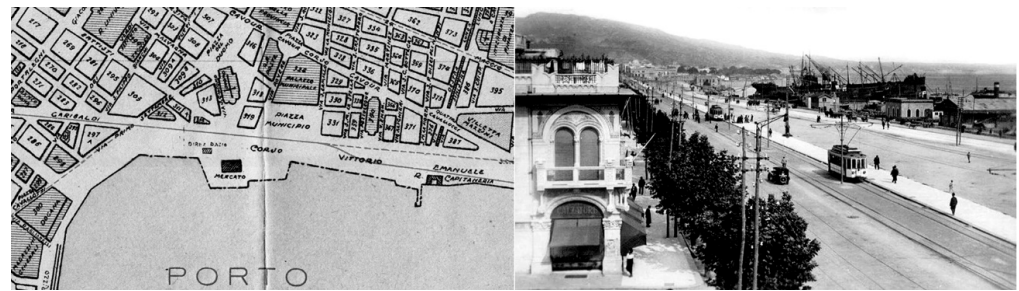


Figure 3. The seafront in the 1920s: the ban on rebuilding the *Palazzata*. Author processing/Private collection.

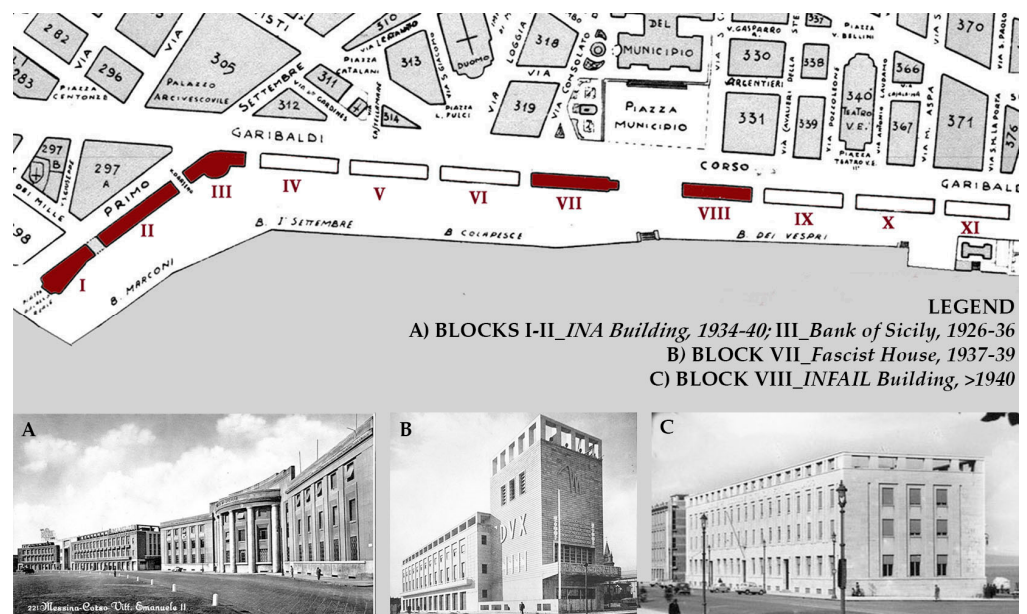


Figure 4. The sea front in 1943: the *Palazzata* under construction. Author processing/Private collection.

3.2. Research of Documentary Evidence

The study required an extended and rigorous documentary evidence research to collect information concerning the history of the *Palazzata* and its buildings that were most damaged during World War II. The synthetic planimetric restitution of the bombing effects shows sea front destructions from 50% to 75%. A more articulated history emerges by cross-referencing this data with period photos and archival documents (Figure 5).



Figure 5. The war damage detected by the civil engineers (left) and the photos that attest to the real state of consistency of the *Palazzata* (right).

This qualitative approach served to know historical events and technical and project choices that affected *firmitas*, *utilitas*, and *venustas* of the built environment, from the war damage repairs to the actual interventions.

It was conducted on three levels:

- Archival sources (Messina: State Archives, Civil Engineering Department, Superintendence of Cultural Heritage, Regione Sicilia; Rome: Central Archive of the State);
- Bibliographic sources (books on the reconstruction of the town from the earthquake of 1908 to today, with particular attention to the effects of the bombing in World War II);
- Photographic sources (to document the technical/construction transformations with historical pictures).

The comparison between the intentions of the designers and the maintained/disowned relationship among *utilitas*, *firmitas*, and *venustas* over time has guided the analysis of the collected documents as well as the search for answers in the observation of the state of fact.

3.3. Selection of the Case Study

The buildings of the *Palazzata* reflected the architectural language of the long period in which its buildings were built (1926–1958). Hence, the relationships among the three components of the Vitruvian triad continually changed.

The notice for the 1930 national competition (art. 3) prescribed an «architectural framing inspired by a single style» such as it was the seafront of the *Palazzata* destroyed by the earthquake of 1908. For the elevations, the baseboard had to be of cut stone from local quarries and the remaining super-elevation to have a plaster finish. With reference to the load-bearing framework (art. 5), the generalised use of reinforced concrete was indicated, whereas for the interior and exterior walls it was solid brick [16]. However, the exact re-proposition of the original design concerned only the *National Insurance Institute Building* (Italian acronym is *INA*), seeking adjustments for the Bank of Sicily since the foundations and part of the ground floor had already been built by that date. The seafront changed again with the introduction of the Fascist House's tower that should have emblematically represented the strength of the regime; it varied further by a stylistic adaptation of the *National Institute of Fascist Insurance for Work Accidents* (Italian acronym is *INFAIL*) side elevation in keeping with the decoration of the tower facing it. The execution of the *INFAIL* Building underwent a significant mutation for the load-bearing structure in the 1940s, from a reinforced concrete framework to ordinary brick masonry with two or more heads, in compliance with R.D. no 2105 of 22.11.1937, which required the use of cement and iron to be reduced to the bare minimum as they were necessary for wartime uses (art. 4). The prohibition became peremptory with R.D. no 1326 of 07.09.1939 [17,18].

The strict modularity, proposed in the original architectural composition, conditioned the size and position of windows and doors in these buildings, allowing no relation to the functional distribution of the rooms and their respective uses; hence, the same window openings are found for served and servant spaces regardless of the floor surface and the ventilation, light, and solar energy needs.

Only four of the thirteen blocks of the *Palazzata* existed in 1943, when the town was hit by bombing: the offices of the *INA* Building (blocks I-II, 1934–1940), the Bank of Sicily (block III, 1926/1936), the Fascist House (block VII, 1937–1939) and, still under construction, the *INFAIL* Building (block VIII, >1940). In the aftermath of liberation, these buildings, built in the fascist era, underwent several mutations from semantic to substantial, profiting from war damage.

The former concerned the denomination changes (*INFAIL* became *INAIL*, Fascist House became Palace of Freedom) and the suppression of the inscriptions that hymned the regime (in the *INA*, Bank of Sicily, and Fascist House buildings); the latter explicitly concerned the *utilitas* that was changed to give a new or revisioned function to buildings, above all to those built for fascist politics (such as Fascist House and the *INFAIL* building) [19].

No systematic investigation path has been found on Fascist House. Its multiple and inappropriate interventions have been undergone, starting from the World War II

damage repairs, that could represent the history of other regime edifices because their original architectural quality, which was independent of fascist ideas, was not respected for revisionism reasons.

3.4. Construction History of the Case Study

3.4.1. Introduction to the Original Project of the Fascist House in Messina

Within a climate of political austerity, severity, and discipline imposed by the fascist regime, the central government equipped itself with its own decors: architectural expression of the ideological and symbolic peculiarities of the art-like meeting rooms, offices, and libraries but also environments for physical activity, sport, theatrical performances, and conferences, all characterised by tower-shaped elements as symbols of power and military strength. Thus, the first half of the 20th century brought the development of a new building typology, called *Fascist House*. So, in a relatively short period, it witnessed the design, construction, and reuse of 11,000 buildings with more than 25,000 projects in Italy, which placed the main designers of the time at the centre of a fierce debate of confrontation and clashes with the fascist party that «carefully followed the professionals called to design the new headquarters of the *fighting bands*» [20].

The design process, started in March 1937 and completed in November 1939 (based on the technical reports of the two projects of 1935 and 1938), led to the inauguration in 1940. The shape was characterised by two connected volumes: a parallelepiped block and an adjacent tower, a constant symbol of fascist architecture (Figure 6).

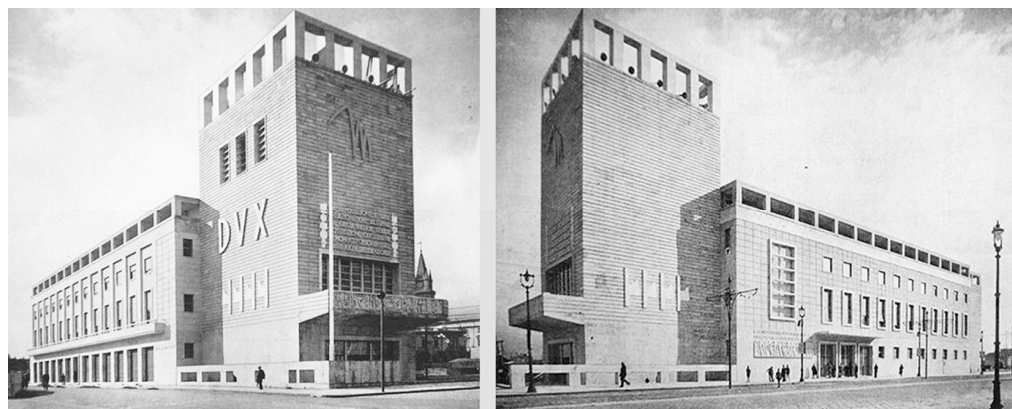


Figure 6. The Fascist House of Messina [1].

The project of Giuseppe Samonà and Guido Viola suggests the following interpretation of the Fascist House in terms of the Vitruvian triad:

- **Firmitas:** 1_reinforced concrete framed structures; 2_reinforced concrete brick slab and reinforced concrete pumice slab; 3_thin stone slabs cladding, a typical feature in the edifices built during the fascist period;
- **Utilitas:** 1_the use of the edifice for the regime's purpose; 2_the gallery, a median distribution system in a central position in the four levels of the building to serve the comb modular units; 3_the tower, inserted as a monumental and symbolic counterpoint to the horizontal composition, where the most representative rooms for the regime found place: the shrine on the ground floor, the assembly hall on the first with the historiated balcony, and the library in the attic culminating with the belfry;
- **Venustas:** 1_interior and exterior stone claddings according to the regime's request, here distinguished on the basis of the rooms use (precious marbles, including national ones for the most authoritative space and Sicilian stones and plaster simulations of stones and marbles for the others); 2_the fascist decorations (the large M, the lictor's fasces, the allegorical bas-relief and some inscription of Mussolini's phrases); 3_the balcony as the only cantilever element.

3.4.2. How to Trace the Changes Undergone by the Former Fascist House over Time

The research of documentary evidence allows us to retrace the main phases of the building history, each of which should be critically investigated for the maintained/disowned relationship among *firmitas*, *utilitas*, and *venustas*.

This new analytical approach is useful to understand how structural interventions or maintenance work and changes to building use and to the original technical–construction systems transformed the former Fascist House over time, as well as for historical revisionism reasons and to identify solutions that respect the architectural value of the edifice, regardless of the political purpose it was built for.

3.5. Historicisation of the BIM Model for a Better Building Management in Its Life Cycle

Firmitas (construction system), *utilitas* (utility), and *venustas* (aesthetics) are characteristics reproducible in the BIM environment. Software allows us to model the building in its disciplinary variants (architectural, structural, MEP—Mechanical Electrical Plumbing) at the level of construction detail; to repropose the intended uses; to reproduce form, function, materials, and appearance of components and their relationships; and to characterise performance profiles by attributing to digital objects the technical properties of real objects.

The model of a historic building cannot only be the reproduction of the state of fact but should keep track of its construction history: the most relevant modifications to structure, technical elements, materials, space distribution, and use are necessary information for understanding the actual configuration and for planning the most appropriate future ordinary or extraordinary maintenance interventions.

The explained aim requires the introduction of the time concept in the BIM environment to conceive a historicised model explorable throughout the main phases that characterised the edifice from the original design to today.

At the theoretical level, the attribution of temporal phases to a BIM model is formalised in the so-called “4D dimension”, namely the simulation of the edifice or its elements based on time [4]. This procedure is applied to digitalise the construction history of buildings important for cultural heritage [21,22].

The parametric modelling software chosen, Revit 2022 by Autodesk, allows the conversion into parameters of the main stages identified in the history of a building (deduced from documentary, bibliographic, and photographic sources) [1,14,19,23,24]. Their attribution to a BIM object, in order to specify the “Creation Phase” and “Demolition Phase” of the real equivalent, results in the historicisation of the virtual entity (Figure 7). The operation, applied to the components that in the various epochs have been part of the building, determines the historicisation of the model.

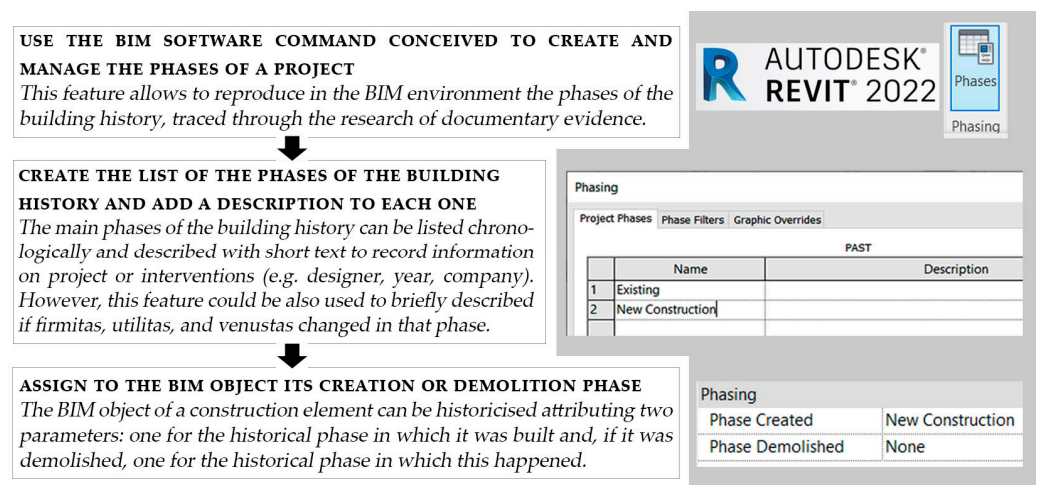


Figure 7. The method to historicise a BIM model.

4. Results and Discussion

To demonstrate the effectiveness of the proposed methodological approach, the evolution of the three criteria of the Vitruvian triad in the former Fascist House is presented in Figure 8. The results highlight which aspect had a greater impact in each phase of the building history.

1936-39_Original Project

Designers GIUSEPPE SAMONÀ and GUIDO VIOLA

[sources: AGC-Me, DH/476; IUAV, Fond Giuseppe and Alberto Samonà, File 03498-012-13,16,17]

1944-59_War damage repairs

Change to “firmitas” (structural repairs), “utilitas” (building use), “venustas” (fascist symbol removal)

[AS-Me Fond Danni Bellici, b.12/fasc.30, b.13/fasc.32; AGC-Me, III/DH/117]

1959-60_Conversion work of some spaces into Municipality offices

Change to “utilitas” (new building use)

[AGC-Me, III/DH/126]

1959-61_Repair work to the façade marble cladding

Preservation of “venustas” (reuse of original slabs)

[source AGC-Me, III/DH/126]

1961-66_Adaptation work to Maritime Station

Change to “utilitas” (new building use)

[AGC-Me, DH/250]

1964-65_Current maintenance

No significant changes to “firmitas”, “utilitas”, “venustas”

[AGC-Me, III/DH/146]

1977-89_Extraordinary maintenance

Change to “firmitas” and “venustas” (e.g., substitution of tower facade stone slabs with plaster)

[AGC-Me, DH/250]

1999-2000_Renovation, adaptation, modernisation project

Change to “firmitas” (e.g., services adaptation) and “utilitas” (e.g., partition wall), preservation of “venustas” (e.g., marble cladding cleaning, low relief restoration)

[Sopr. BB.CC.AA, prot. 2346]

2019-21_Extraordinary maintenance

Change to “firmitas” (e.g., substitution of windows, removal of damaged plaster)

[Sopr. BB.CC.AA., prot. 5863]

2023_Extraordinary maintenance ongoing

Change to “firmitas” (consolidation and waterproofing work), “utilitas” (use of fourth level), “venustas” (façade repairs)

[Regione Sicilia]

Figure 8. The variation of the Vitruvian triad of the former Fascist House over time.

The most relevant variations in *firmitas*, *utilitas*, and *venustas* are presented in a separated section. Nevertheless, it is necessary to declare that one influences the other.

4.1. *Firmitas*

The assessments conducted by the civil engineer appraisers from 1944 to 1950 show that the tower damage consisted of: Sicilian travertine slabs of the cladding collapsed due to vibrations; reinforced concrete slabs of the attic and second floor broken by bombs and brick or pumice partitions damaged; and brick or pumice masonry and Venetian mosaic floors with slight gaps [19,23]. In the rest of the building the intact recoverable slabs were relocated and the missing ones replaced with simulations (Figure 9).

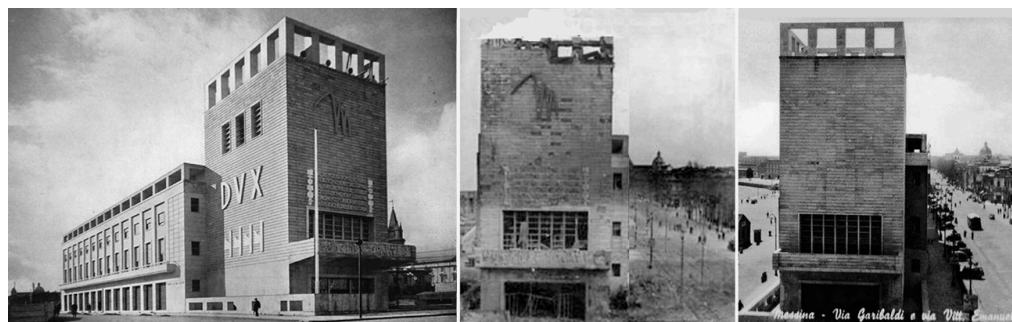


Figure 9. The Fascist House (block VII): from inauguration to post-war restoration of *firmitas* [1,14].

Since 1959 the Sicilian travertine slab cladding of the tower, the ground floor, the score pilasters of the facades, and the south elevation of the former Fascist House was subject to continuous detachments. As ascertained by the civil engineers on 27.08.1959 for the detachment of two slabs from the seaside façade, they were “walled without the necessary metal fastening system to the masonry and (for this reason) it can be assumed that this construction system has been adopted for the entire cladding”.

Then, subsequent rainwater permeations through the joints would have aggravated the problem. Until 1970 no incisive measure was documented—but there were interventions to dismantle the slabs and relocate them—for safety due to the absence of specific extraordinary funds in the financial programs. This makes it unequivocally clear that no action on the stone cladding has ever been performed after the bombing, except the relocation of the fallen slabs.

The demolitions inflicted by the bombs (on the horizontal floors in reinforced concrete and vertical partitions in solid brick or pumice for the attic level) allowed repairs/reconstructions to be carried out without departing from the original *firmitas*.

4.2. *Utilitas*

On the occasion of repairs/reconstructions, the damage caused by the bombs allowed reinterpretation of all the rooms, imagined for a different *utilitas*, and creation of ordinary premises suitable to accommodate the Real Estate Registry Office in the renamed the Palace of Freedom in 1950 (Figure 10).

More repairs were carried out in 1957. Some plan documents, bearing handwritten annotations dated 1959, highlight various transformations to accommodate, alongside to the Technical Tax Office functions, other institutions (18 rooms on the ground floor and 21 on the second floor ceded by the State Property Office to the Municipality of Messina and by the latter to other institutions) [23], inducing a fragmentation that has not yet stopped.

From 1943, this distribution scheme gradually and irreversibly underwent a compositional involution for new use of space due to different social, political, and cultural needs. The interventions that characterised the building until 2022 proposed new configurations due to the change to the *utilitas*, respecting the formal austerity and architectural rigorism of the prospects, albeit with material choices different from the primitive ones. This was

reflected in offices, services, and vertical communication elements, whereas the accesses to the palace had a different use, although maintaining their location.

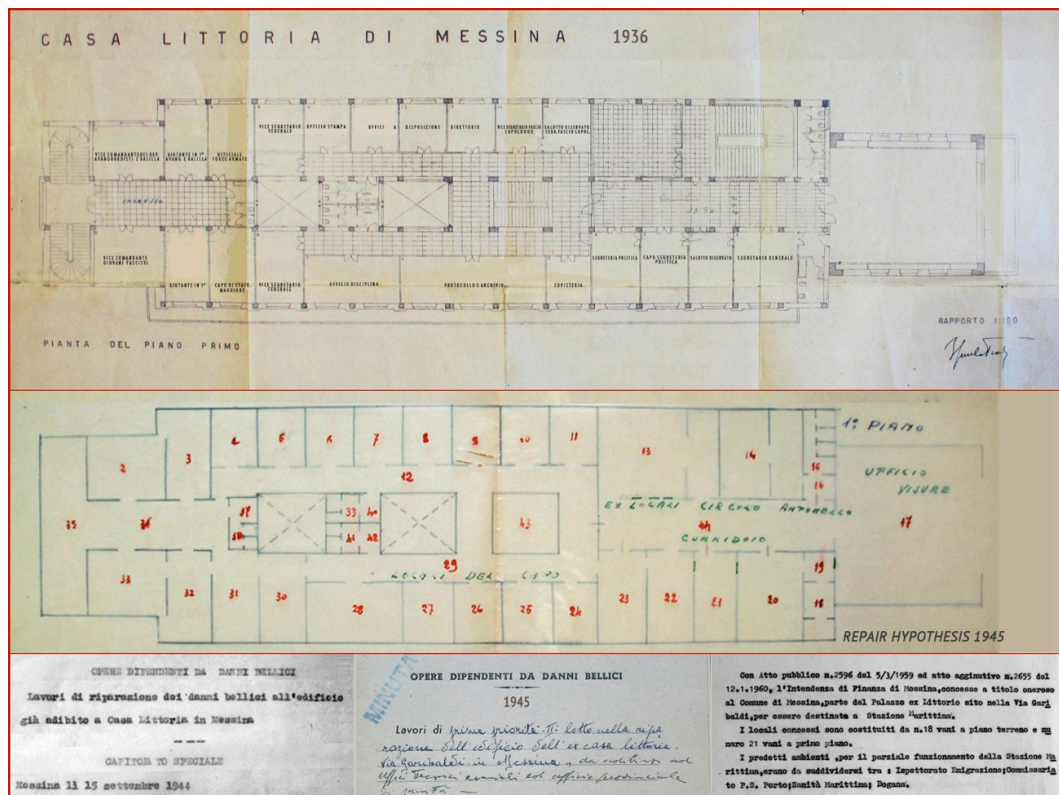


Figure 10. The Fascist House (block VII): hypotheses of post-war utilitas transformations for the first floor. (Above) Original design. (Centre) Sketch from the 1945 Measurement Works Book. (Lower) Excerpts from archive documents "Reproduced with permission from Archivio di Stato [19] and Archivio Genio Civile [23], 2023".

Therefore, it lost importance, not only the monumental entrance to the tower, which allowed access to the most representative offices, but also the ordinary ones. In fact, even if they are still arranged in a barycentric way with respect to the original plan, the sorting of employees and users is no longer differentiated. The same was for the central stairwell, designed "with double concentric ramps and independent of each other" to allow the public access "to the various floors in opposite directions" [25].

This building solution interrupted the distribution logic, repeatedly cleared by the designers in the descriptive report: «the ordinary public accesses to the offices have been arranged in the central part, accesses that will be very busy and that due to their central position allows achieving the various objectives with the minimum path (. . .). In this way the entrances, instead of being concentrated, are distributed in two nuclei, which better adhere to the elongated shape of the plant» [26].

Unlike as indicated in the report of 10.10.1944, some rooms on the ground floor were destined to the Agrarian Consortium, to the soldiers of the Allied Command, and others were used to accommodate war displaced persons for a brief period. The priority works for the repair of war damages were carried out between 1944 and 1949. These interventions returned a building with a planimetric distribution that was still respectful to the original model. The only exception was the closure of the vestibule in the parallelepiped block, which allowed access to the shrines of the fallen and Arnaldo Mussolini through the gallery.

Since 1950, with the entry of the Technical Tax Office a series of continuous updates of the utilitas began according to the different institutions that were hosted from time to time. Particularly when the need for obtaining a greater number of offices arose, with reference to the ground floor, the rooms with larger dimensions were divided. In this case,

it was conducted by eliminating one of the two corridors parallel to the central cloisters and reducing the development of the gallery present in the vestibule for the public on the south head. Similar operations were also carried out on the other floors.

The ground floor, including that of the tower, was assigned to the Emigration Inspectorate until February 1959. The Forces of Order (Port Police Commissariat) occupied the spaces facing the sea, whereas the Technical Tax Office was located near at the entrance, on the side opposite the sea and on the second and attic floors. Lastly, the first floor probably housed the premises of the *Antonello's Association*. With the acts n. 2596 of 05.03.1959 and n. 2655 of 12.01.1960, the *Finance Bureau* was granted consideration for a part of the palace to be used as a Maritime Station to the Municipality of Messina: precisely 18 rooms on the ground floor, the entire first floor consisting of 21 rooms and the large hall on the north side (although not expressly indicated in the legal papers).

The neglect of the assembly hall of the former *National Fascist Party* was testified by the notes of 18.10.1967 and 13.01.1968 by the same *Technical Tax Office*, which pointed out that since 1963 it has been used as a deposit of materials dismantled during the adaptation of part of the ground floor to Sea Station and also used as a service room of the civil engineers (Figure 11). The salon, now empty of materials, was first adapted to the New Urban Building Land Register (Italian acronym is *N.C.E.U.*) consultation room, then, with a further subdivision of the space, to a lithographic room and finally, from the 1990s to paper storage. Therefore, after the bombings and the partial destruction, the assembly hall has never regained its function as a representation space.

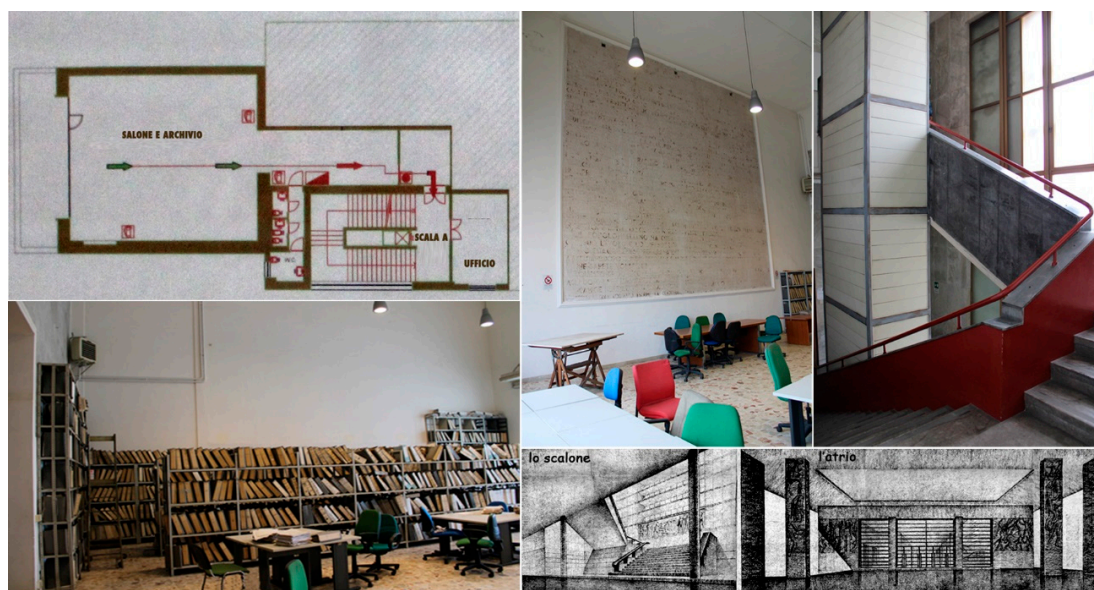


Figure 11. The transformations of the 1970s: the assembly hall becomes an archive and the main staircase welcomes an elevator that interrupts its monumentality.

Subsequently, the consultation room in the 1990s was moved to the ground floor of the tower to meet the requirements of the Ministerial Decree no. 236 of 1989 and the whole floor was reserved for the total use of the Real Estate Registry Office. The only except was for a seaside space where an additional entrance was obtained to the first floor where were located the State Police—Maritime Border and the Carabinieri Department—Agrofood Protection. Additionally on the first floor, pertaining to the Real Estate Registry Office, there are two spaces not communicating with each other: the tower room and the office's deposits, no longer used due to the lack of staff. On the second floor and in the attic, there are other offices of the Real Estate Registry Office, although since 2000 the last level, previously used as a paper deposit, has been emptied and the materials transferred to the basement.

No document has been found regarding the work carried out on the double concentric ramps, now made unusable for a long time due to the absurd interruption with brick masonry that precludes the use of the floors. One of the symmetrical stairwells present in the atrium of the south entrance had a similar fate: at the end of the 20th century the solution that was adopted to allow people in wheelchairs to access the upper floors was to eliminate, in two phases, one of the two mixtilinear stairs, installing an elevator that, after a fire, was no longer functional (Figure 12).



Figure 12. The transformations of the 1970s: one of two mixtilinear stairs is demolished to make way for an elevator.

4.3. Venustas

The decorations that praised fascism—the large M, the lictor’s fasces, and some Mussolini phrases—were dismantled during the war damage repairs, mainly as a symbol of variation of building utilitas. From a technical point of view, this operation left several gaps to be repaired along with the collapsed Sicilian travertine slabs. However, the allegorical bas-relief located on the west elevation was not removed.

After 1970, inappropriate restorations were conducted, with the introduction of new materials in addition to or in replacement of the original ones.

The maintenance works carried out on the elevations led to a new aesthetic for the building: the travertine cladding in the upper levels of the Tower was replaced with a plastic plaster in bands. This choice not only modified the texture of the tower but also erased the compositional geometry that returns a peculiar chiaroscuro [27] (Figure 13).



Figure 13. The transformations of the 1980s: the plastering of the travertine tower.

The building works conducted from the late 1990s and until 16.06.2021, which is the date of the last authorisation measure, concerned the renovation of the external and internal plasters, the replacement of the windows, the recovery of the room on the first floor of the tower and of the bas-relief writings and the Syracuse stone cladding (both hidden by plaster), the waterproofing of the walls of the cellar and the terrace, and the securing of the stone slabs of the ground floor, the parapets of the attic, and the south façade.

In other words, for safety and economic reasons, the building was given back a different architectural image. It was so much different that it is still difficult to recognise the “aesthetic functionalism” [28], reworked through a new correspondence between function and form, typical of the Samonà’s logic.

The current configuration of the building is totally different from that proposed by the architects, especially in terms of *utilitas* and *venustas*. With regard to *utilitas*, the need to accommodate several institutions on the same floor with their own pertinent spaces has overturned the median system of the gallery, which was abruptly interrupted, thus losing its original identity. Instead, with reference to the *venustas*, the reason why not all the fascist stylistic features have been removed is not clear, as the bas-relief and an inscription both present on the ground floor of the parallelepiped block persist today. Regarding the *firmitas*, interventions were planned for securing reasons due to war damage above all.

The analysis of the maintained/disowned relationship among *firmitas*, *utilitas*, and *venustas* has allowed us to conceive an H-BIM approach to document and digitally store the variations of the Vitruvian triad of a historic building. The advantage is that this historical information will be always available in the BIM environment, which can be updated and implemented to support the use of the model for the management of the edifice in its life cycle for the objectives of the 7D dimension of BIM (or 6D for the Italian standard).

Ideological and utilitarian motivations, degradations and pathologies, anthropic and natural damage, changed safety and accessibility needs, and new obligations and regulatory updates have determined the repeated variations of *firmitas*, *utilitas*, and *venustas* in the former Fascist House of Messina, from post-war repairs to today. It has been the concept of “variation” itself that has guided the elaboration of a digital model of the building that would respond to the aims of this study: to take advantage of the potentiality of Heritage-BIM approaches to document the evolutions and involutions of the Vitruvian triad criteria in a building of historical and architectural relevance.

The digitalisation of the changes to the intended uses and planimetric distribution, of the abolition of fascist symbols (above all those of the tower façades), and of the different technical choices during the repair and maintenance interventions had to be preceded by operations of model historicisation.

The ten main phases recognised in the construction history, available because of the research of documentary evidence, have been converted into parameters through which historicise the BIM model. The software has allowed us to add a “Description” to each historical phase. This opportunity was taken to report the changes the building underwent in terms of *firmitas*, *utilitas*, and *venustas* for every intervention recognised in its history (Figure 14) and is summarised in Figure 8.

Therefore, starting from the modelling of the original design of the Fascist House (1936–39), the transformations that have been undergone through time have been recreated in a digital environment with demolitions and virtual integrations of construction elements and changes to materials and their parameters. For example, to historicise the fascist symbols demolished during the post-war repair works, the related BIM objects were assigned to the creation phase “1936–39_Original Project” and the demolition phase “1944–59_War damage repairs” (Figure 14).

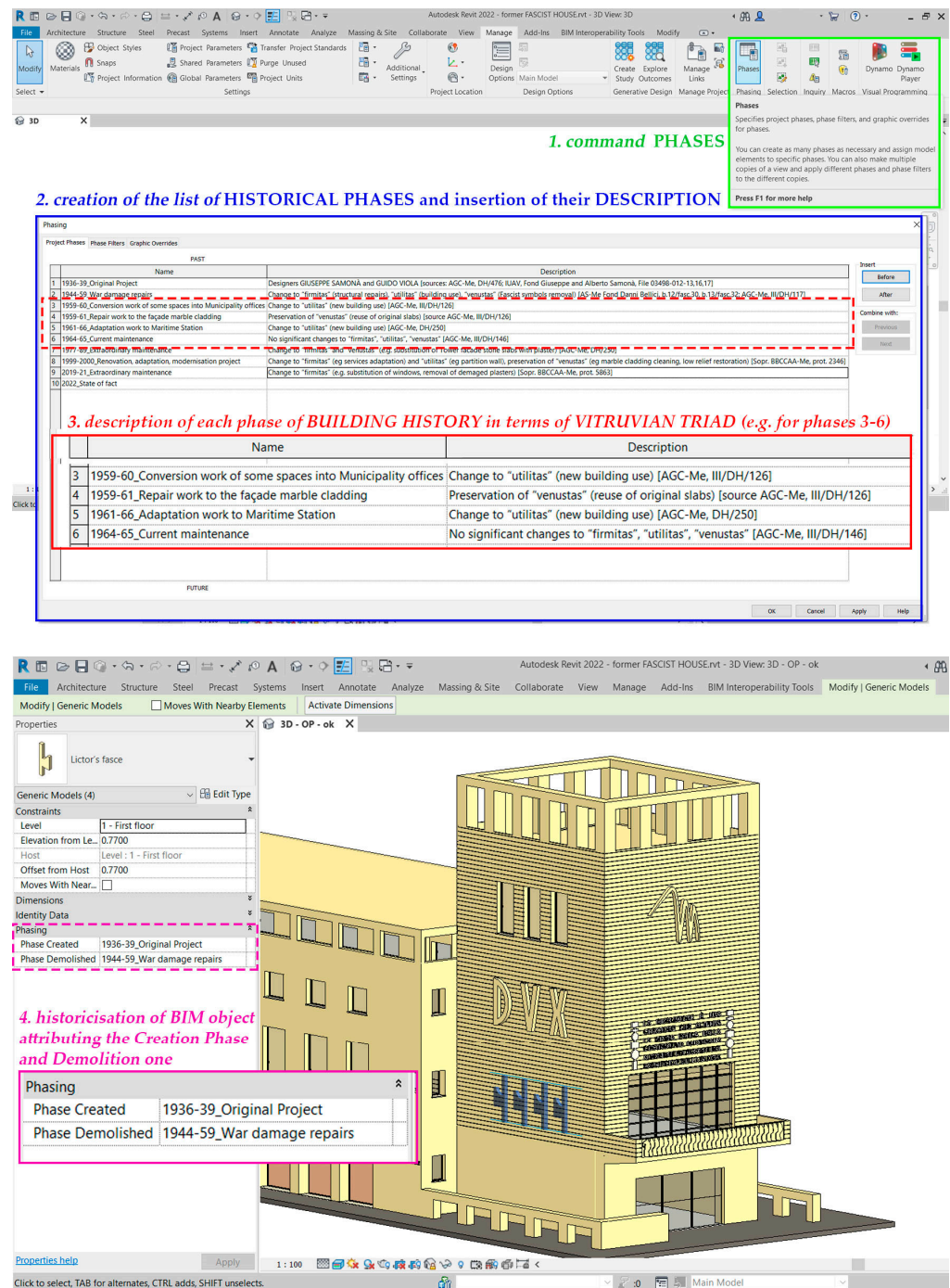


Figure 14. The model historicisation through the parameterisation of the main phases of the former Fascist House history and their attribution to *digital* objects to document the creation and demolition of *real* ones.

The benefit is to be able to document the variations of the Vitruvian triad over time. The results are shown below through some examples:

- Firmitas, the simulation of the original travertine cladding of the tower with a plaster finish, although stone traces remain on the parapets of the balcony (Figure 15);
- Utilitas, changes to the plan of the ground floor to meet the needs of the new public functions (Figure 16);
- Venustas, the removal (albeit partial) of the symbols of fascist ideology, conducted on the occasion of the war damage repairs (Figure 17).

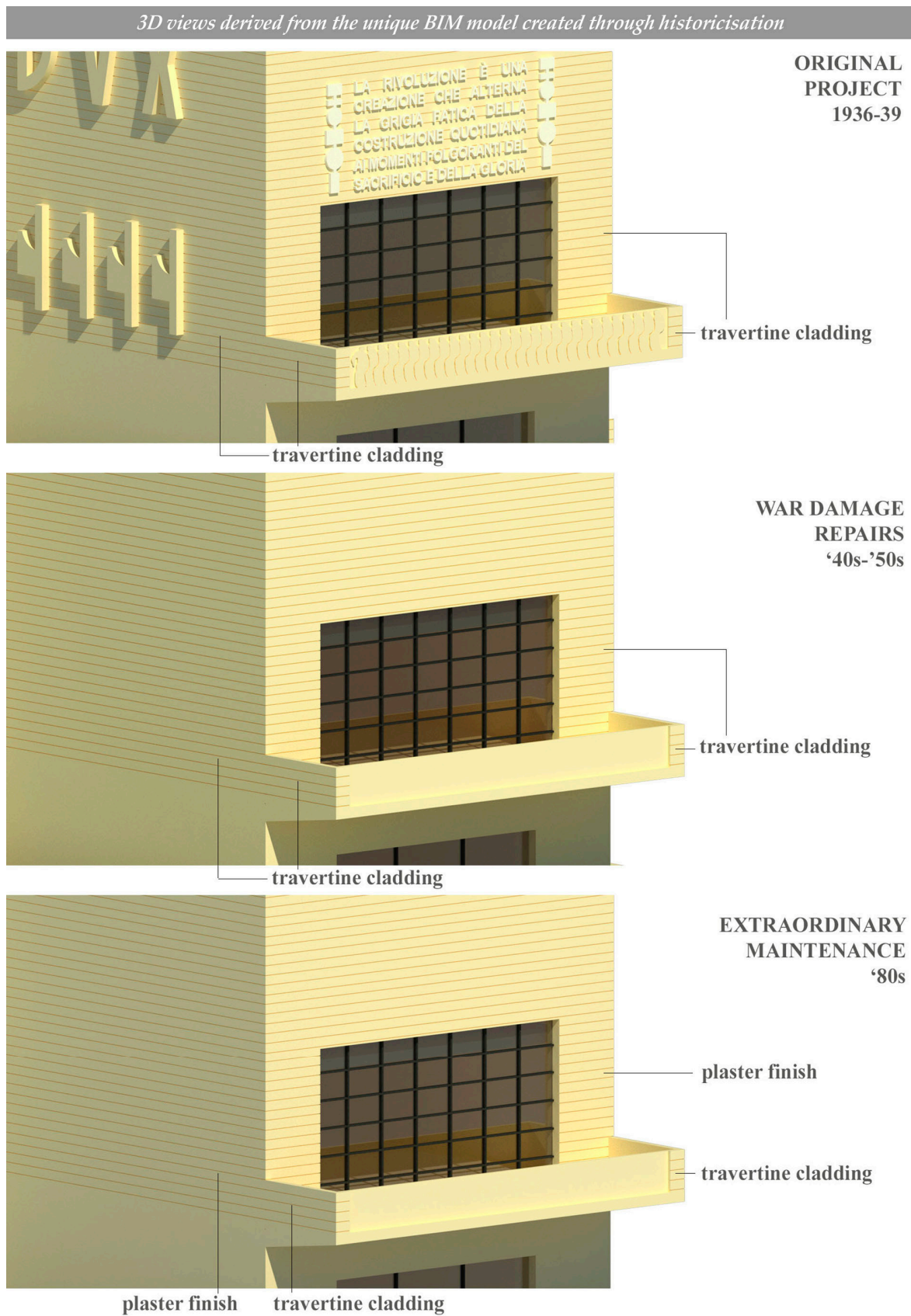


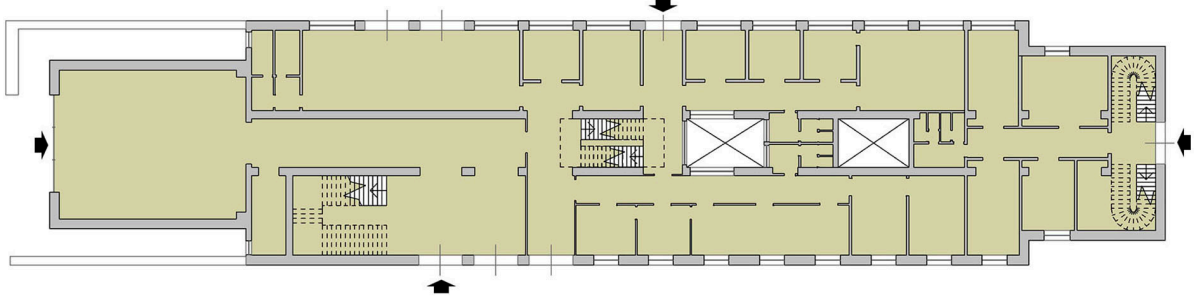
Figure 15. The model historicisation to document the variation of firmity of the former Fascist House. The changes to finish materials of the tower façades.

Plans with intended use derived from the unique BIM model created through historicisation

ORIGINAL PROJECT
1936-39

UTILITAS

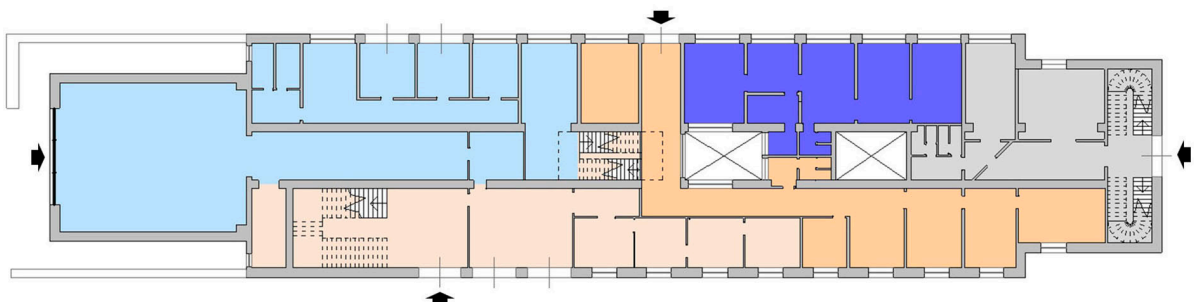
■ Fascist House



STATE OF FACT
'60s

UTILITAS

■ Commissariat of the P.S. of the Port ■ Emigration Inspectorate ■ Guardian's Accomodation
■ Maritime Station ■ Technincal Tax Office



Note The original document of the ground floor plan of the building in the '60s presents some inconsistencies on which the authors did not deem it necessary to make hypotheses in the absence of evidence.

STATE OF FACT
2022

UTILITAS

■ Real Estate Registry Office ■ Law enforcement (Polizia di Stato and Carabinieri)

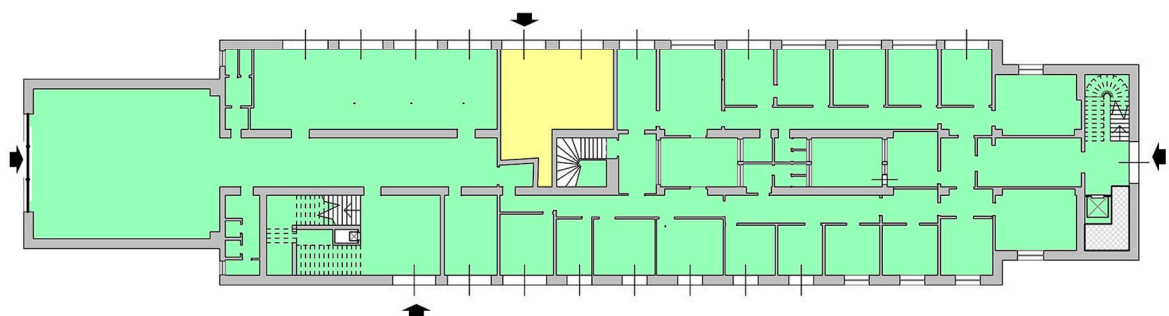


Figure 16. The model historicisation to document the variation of utilitas of the former Fascist House. The exemplification for the ground floor.

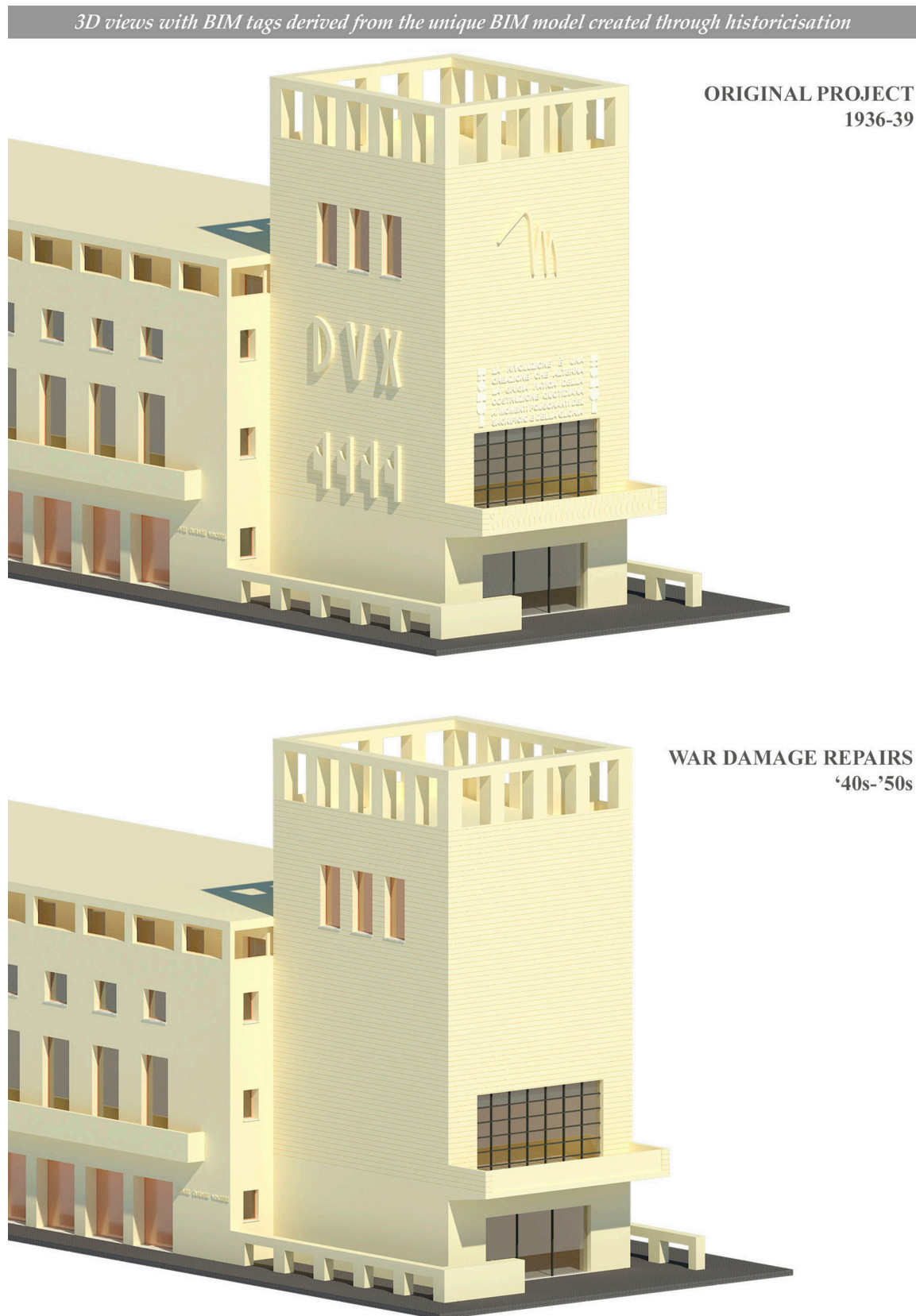


Figure 17. The model historicisation to document the variation of venustas of the former Fascist House. The removal of fascist symbols from the tower façades during war damage repairs (cf. Figure 6 for historical photos).

The results obtained explain that combining the criteria of the Vitruvian triad and the potential of the BIM methodology has positive effects in the creation of digital models useful for the management of cultural heritage. Therefore, as revealed in the analysis of the state of the art, it is convenient to think of an expansion of the Vitruvian triad to also include the digitalisation processes.

In particular, the digital model of the former Fascist House has made it possible to tell the complex relationships among *firmitas*, *utilitas*, and *venustas* in different historical periods from the original project to today. Because of this historicisation, all the critical analysis conducted on the building according to the approach based on the Vitruvian triad is now part of the BIM model, which can be investigated in each historical phase. The opportunity to associate information with it suggests a future development for the study: enriching the digital object with the main documentary sources found during the research stage of the methodology. This would facilitate the comprehension of what has been digitalised. Therefore, on occasion of future management interventions, designers could explore the building in the BIM environment to know the construction history and on the basis of which plan more conscious maintenance work.

This means that the original architectural quality could be rediscovered and enhanced, always within the limits of the now irreversible transformations and adaptations to the current regulatory provisions on safety, accessibility, and energy retrofitting.

The removal of the travertine slabs from the tower appeared to be countertrend with the decision to maintain the original cladding on the opposite side of the building. The historical reading would suggest the repositioning of the slabs with a metal fastening system as the correct solution to avoid their detachment and not replacement with a plaster finish. Therefore, if the *firmitas* were to continue to be solved in this latter way, the *venustas* would be compromised even more: removing the stone cladding would mean losing a peculiarity of the architecture of the 1930s.

Similarly, the need to adapt the interior spaces to the needs of present-day institutions should not lead to further distorting the *utilitas* and more specifically the position of hallways, stairs, elevators, windows, and doors. Compatible with the legislation on accessibility and comfort, the original distributive character should be recovered not only to re-evaluate the designers' idea but also because it was more suited to the shape of the building plan.

5. Conclusions

The aim of this study was to focus on the relevance of an accurate historical critical analysis to better manage cultural heritage, proposing a methodological approach based on the Vitruvian triad (*firmitas*, *utilitas*, and *venustas*) and the opportunity of the BIM methodology. The latter allows us to reproduce the three criteria and to record the transformations to which a historical building is subject, thanks to operations of the historicisation of a digital model.

As demonstrated, the concept of the Vitruvian triad changed over time for historical, cultural, and local factors. Some researchers have proposed to expand the group of the three foundations to take in account the actual appeal of digitalisation. If Vitruvius had lived in our time, maybe he would have added the use of digital technologies to his triad in support of the design or, certainly, of the modernisation of interventions that are required by obsolete cultural heritage.

Perhaps, interpreting the Vitruvian triad and knowing and recognising the intentions of the original designers would have motivated a greater awareness for those who introduced mutations into the former Fascist House of Messina. While taking into consideration the necessity of revisionism, the post-war reconstruction, the needs of institutional spaces, and the lack of performance or the degradation, a more careful reinterpretation of *utilitas* would have made it possible to respect the spatial quality created by the designers of the original project, well-known in Italy for their works; understanding *firmitas* would have imposed an adequate choice of materials to be joined to original ones with the expression

of the technical–cultural innovation of 1930s; and respect for the venustas would have protected the chiaroscuro effects, the skilful composition between natural and artificial stone cladding.

The application of the study on the former Fascist House of Messina could support the research and management of other buildings from the fascist period (there are around 11,000 of them). However, the research has some limitations to be solved by extending the number of the case studies and verifying the BIM approach with other software to generalise the method.

The approach, once perfected, can be applied to all historical buildings. Therefore, this could contribute to Target 4 of Goal 11 of the 2030 Agenda for Sustainable Development: to strengthen efforts to protect and safeguard the cultural heritage.

Author Contributions: Conceptualization, A.C., O.F., R.L. and F.M.; Methodology, A.C., O.F., R.L. and F.M.; Software, A.C., O.F., R.L. and F.M.; Investigation, A.C., O.F., R.L. and F.M.; Writing—original draft, A.C., O.F., R.L. and F.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available upon reasonable request from the corresponding author.

Acknowledgments: The authors are grateful to: the architect Diego Battaglia of the Real Estate Registry Office of Messina, the engineer Pietro Certo, and the surveyor Massimo Guerrera of the Civil Engineering Department of Messina.

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

References

1. La Casa Littoria di Messina-Arch. Giuseppe Samonà e ing. Guido Viola. *Archit. Riv. Del Sindacato Naz. Fascista Archit.* **1940**, *19*, 357–362.
2. Vivenzio, G. *Istoria e Teoria de' Tremuoti in Generale ed in Particolare di Quelli Della CALABRIA, e di Messina del MDCCLXXXIII*; Stamperia Reale: Napoli, Italy, 1783.
3. Krufft, H.W. *Storia Delle Teorie Architettoniche. Da Vitruvio al Settecento*, 2nd ed.; Editori Laterza: Roma-Bari, Italy, 2004; p. 8.
4. UNI 11337:2017; “Edilizia e opere di ingegneria civile—Gestione digitale dei processi informativi delle costruzioni” Parte 1 “Modelli, elaborati e oggetti informativi per prodotti e processi”. UNI, Ente Italiano di Normazione: Milano, Italy, 2017.
5. Fiamma, P. Firmitas–Utilitas–Venustas... “Digital-as”? In Proceedings of the Who Cares (?): Second International Conference on Critical Digital, Harvard University Graduate School of Design, Cambridge, MA, USA, 17–19 April 2009; pp. 221–225.
6. Hernández Ibáñez, L.A.; Barneche Naya, V. Cyberarchitecture: A Vitruvian approach. In Proceedings of the International Conference on Cyberworlds, Darmstadt, Germany, 25–27 September 2012; pp. 283–289.
7. Shangina, E.I. The Triad of Vitruvius in the Modern World. In *Advances in Intelligent Systems and Computing, Proceedings of the 18th International Conference on Geometry and Graphics, Milan, Italy, 3–7 August 2018*; Cocchiarella, L., Ed.; Springer: Cham, Switzerland, 2019; Volume 809, pp. 2095–2107.
8. Milani, G.B. *L'Ossatura Murale. Studio Statico-Costruttivo ed Estetico-Proporzionale Degli Organismi Architettonici, con Speciale Riferimento alle Strutture Elastiche Nelle Loro Varie e Moderne Applicazioni Pratiche*; Società Italiana di Edizioni Artistiche C. CRUDO & C.: Torino, Italy, 1920.
9. Arena, A.; Arena, M.; Fiandaca, O.; Passalacqua, F. *L'altra Messina: Una Città di Carta. Tracce di DNA Restituite dai Documenti dell'Ufficio Speciale Delle Espropriazioni*; Aracne Editrice: Canterano, Italy, 2018.
10. Cardullo, F. *Giuseppe e Alberto Samonà e la Metropoli Dello Stretto di Messina*; Officina Edizioni: Roma, Italy, 2006.
11. Tentori, F. Giuseppe Samonà e la Palazzata di Messina. *Casabella* **1959**, *227*, 29–36.
12. Army Map Service. *Town Plan of Messina*, 2nd ed.; G.S. No 4379; War Office: Washington, DA, USA, 1942.
13. Oteri, A.M. La città fantasma. Danni bellici e politiche di ricostruzione a Messina nel secondo dopoguerra (1943–1959). *Storia Urbana* **2007**, *114–115*, 63–112.
14. Verzera, E. *Bombardamenti Aerei Della Seconda Guerra Mondiale*; Edizioni G.B.M.: Messina, Italy, 1979.
15. Marconi, P. Il concorso nazionale per il progetto della nuova Palazzata di Messina. *Archit. E Arti Decor.* **1931**, *12*, 583–614.

16. Simone, R. Giuseppe Samonà a Messina: Un Racconto Dell'architettura Tra Linguaggi e Riscritture Mediterranee. In *Re-Reading Samonà*; Pujia, L., Ed.; RomaTrE-Press: Roma, Italy, 2021; pp. 127–156. Available online: <https://romatrepres.uniroma3.it/wp-content/uploads/2020/04/rile-lapu.pdf> (accessed on 20 July 2022).
17. *Regio Decreto-Legge 25.03.1935, n. 640*; Nuovo Testo Delle Norme Tecniche di Edilizia con Speciali Prescrizioni per le Località Colpite dai Terremoti. In G.U. (Gazzetta Ufficiale): Roma, Italy, 1935; n. 120. pp. 2453–2484.
18. *Regio Decreto-Legge 7.09.1939, n. 1326*; Nuove Disposizioni che Vietano L'impiego del Cemento Armato e del Ferro Nelle Costruzioni ed in Alcuni Altri Usi. In G.U. (Gazzetta Ufficiale): Roma, Italy, 1939; n. 218. pp. 4435–4436.
19. Archivio di Stato di Messina (AS-Me) Fondo Genio Civile, sez. Danni Bellici, Busta 12 Fasc. 30, Busta 13 Fasc. 32, Busta 14 Fasc. 140, Messina, Italy.
20. Mangione, F. *Le Case del Fascio in Italia e Nelle Terre D'oltre Mare*; Ministero Beni Attività Culturali: Roma, Italy, 2003.
21. Castellano-Román, M.; Pinto-Puerto, F. Dimensions and Levels of Knowledge in Heritage Building Information Modelling, HBIM: The model of the Charterhouse of Jerez (Cádiz, Spain). *Digit. Appl. Archaeol. Cult. Herit.* **2019**, *14*, e00110. [[CrossRef](#)]
22. Cernaro, A. Esperienze di Moderno a Messina: La Stazione Centrale e Marittima di Messina. Dalla Construction History Agli Oggetti H-BIM per la Conservazione dei Rivestimenti Lapidari “Moderni”. Ph.D. Thesis, Università Mediterranea di Reggio Calabria, Reggio Calabria, Italy, 2021. Cycle 33. pp. 164–183.
23. Archivio del Genio Civile di Messina (AGC-Me) Progetti Messina—Ex Casa Littorio, Titolo III Classe D Scaffale H voll. 117, 126, 146, 246, 250, 468, 476, Messina, Italy.
24. *Soprintendenza per i Beni Culturali e Ambientali di Messina [Sopr. BBCCAA-Me] Palazzo Littorio—Sede Ufficio del Territorio 2346/2000*, prot. 5863/2019; Sede Agenzia delle Entrate Adibita a Servizi Catastali: Messina, Italy.
25. Viola, G. *Progetto per la Costruzione del Palazzo Littorio in Messina, Relazione Tecnica, 18 febbraio 1936*. In Archivio del Genio Civile di Messina (AGC-Me) Progetti Messina—Ex Casa Littorio, Titolo III Classe D Scaffale H vol. 476, Messina, Italy.
26. Samonà, G.; Viola, G. Il progetto per la costruzione del Palazzo del Littorio in Messina: Relazione descrittiva, in Archivio Centrale dello Stato (ACS) di Roma, Italy. Partito Nazionale Fascista (PNF), Carteggio delle federazioni provinciali, S. II, B. 1173, pp. 1–2.
27. Archivio Centrale dello Stato (ACS) di Roma, Italy. Fondo del Ministero della Pubblica Istruzione—Attività del Ministero della Pubblica Istruzione per Prevenzione, Tutela, Riparazione del Patrimonio Monumentale Italiano in caso di Guerra: DGABA—Ufficio per la Conservazione dei Monumenti 1952–59, Pos. 6-Monumenti (Inv. 16/19.2/8) b 2 Fasc. 2 Sottofascicolo 8—Schedario degli Immobili Danneggiati dagli Eventi Bellici; b 163 Messina.
28. Palazzolo, G. *L'architettura di Giuseppe Samonà a Messina*; Grafill: Palermo, Italy, 2010; pp. 90–92.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.