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Envisioning the Futures – Designing and Building for People and the Environment

Proceedings of Colloqui.AT.e 2025, Volume 1

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Preface

The annual series of technical conferences on Architectural Engineering (AE) brings together academics and experts to discuss recent advancements in building sector research, assess the performance and impact of existing and new buildings, evaluate technological solutions at different project scales, analyse complex systems to identify intervention scenarios, and provide processes, tools and models to improve the safety, resilience, and sustainability of the built environment.

The 2025 edition of Colloqui.AT.e took place at the University of Trento in Italy. The event aimed to give all participants the opportunity to share their technical and scientific experiences, particularly in light of its thematic focus: Envisioning the futures: Designing and Building for People and the Environment.

The recent history of the construction sector can be divided into three main phases of development. The first phase occurred at the beginning of the so-called green revolution and was characterised by a prevailing focus on the environment at different scales, as well as the definition of sustainability issues in all their nuances, such as adaptation, mitigation, resource protection, reduction, recycling, and circularity. The second phase aimed to renew interest in people and their needs, including primary needs such as safety and security, user-centred environments, comfort, well-being, and health. The third phase, which is still ongoing, has focused more on digitalisation tools in various fields, ranging from data acquisition (sensors, IoT, 3D scanning) and process automation (robotics, 3D printing and drones) to digital analysis and information (multi-dimensional BIM, virtual and augmented reality, digital twins, and AI-based technologies).

This process, which is now almost 40 years old, has been supported and guided by European programmes (to which national and local programmes have referred over time, most recently the PNRR), which have attempted to coordinate and revitalise the sector jointly. Examples of these programmes include the Green Deal, Horizon Europe, Digital Europe, the New European Bauhaus, the Recovery and Resilience Facility and InvestEU.

However, the construction sector, which is an important part of the economy of both our country and the EU, is in a state of continuous crisis, largely due to economic factors hindering its development, such as temporary building bonuses and tax incentives, limited public investment, the low liquidity of enterprises, and the progressive impoverishment of households. This is compounded by the difficulty of constantly updating the technological (including digital) and managerial skills of those involved in the construction process, whether public or private. Finally, there is an apparent dichotomy between the needs of the industry and those of users, which are difficult to formalise in rigid and often poor-quality logic, even if it is economically advantageous.

Therefore, there is a need to systematise the essential aspects of the construction sector according to three criteria: integration (of people, buildings and communities); circularity (efficient and economic use of resources); and simplicity (in planning, design and construction). This will enable us to envisage not just one possible future, but multiple

"futures" that align with the aspirations of the younger generation and offer principles, processes, solutions, technologies, and products linked to digital transformation, both in new constructions and in the existing heritage. These must be addressed in a synergistic and integrated manner to meet the evolving needs of people and enhance the quality of indoor and outdoor environments.

As for the first Colloqui.AT.e conference launched in Vico Equense, Naples, Italy 2014, also the 2025's one has been centered on three different topics related to the main fields of research in AE: "Construction and Conservation History"; "Construction and building performance"; "Building Design and Technologies". These topics have allowed researchers and engineers to discuss the latest developments in the AE area at an international level, particularly by providing tools, methods, and models (including digital ones) for the knowledge and design of buildings from critical, systemic, functional, typological, technical, and constructive points of view. This has also involved exploiting technology transfer from other fields of research belonging to different scientific sectors close to AE.

The three topics have been defined as follows:

A_Construction and Conservation History
A1. Materials and construction techniques in historical architecture
A2. Recovery, valorization, and reuse of existing building heritage
A3. Examples of interventions on monumental architecture
A4. Examples of industrial archaeology between knowledge and reuse
A5. Vernacular architecture: lessons learned and future projects
A6. Projects and policies for the regeneration of historic centers and suburbs
A7. Digital twins and immersive visualization for the valorization, management, and fruition of historical building heritage

B_Building Construction and Performance
B1. Traditional and innovative technologies and materials for buildings
B2. Modeling, simulation, and diagnostics under uncertainty for performance control
B3.Building pathologies and intervention strategies
B4. Building-human-environment relationships: extended accessibility
B5. Building management and maintenance for safety and quality of living environments
B6. Mitigation and management of vulnerabilities and risks for the preservation of the built environment
B7. Regulatory updates, quality control of the project, and construction process

C_Building Design and Technologies
C1. Form, technique, and technology
C2. Circular design, embodied carbon, and extended buildings life cycle
C3. Digital transition and design of 4.0 buildings
C4. Technological innovation: processes, patents, and products for the construction of the future
C5. Integral and participatory design for the quality of the built environment
C6. Adaptive and responsive buildings
C7. DfMA–Design for manufacturing and Assembly and DfD–Design for disassembly

During the conference, 12 selected papers (out of the 140 scientific contributions received) and three keynote lectures were presented. The invited keynote speakers were: Eugenia Gasparri, Senior Lecturer in Architectural Technologies and Associate Dean of Research Education at the University of Sydney, Australia, whose speech was titled "Rethinking Building Skins: What's Next on the Façade Horizon"; Charles Spence, Professor of Experimental Psychology and Head of the Crossmodal Research Laboratory at the University of Oxford, UK, whose speech was titled "Sensehacking Wellness"; and Werner Tscholl, architect in Laces, Val Venosta, Province of Bolzano, Italy, whose speech was titled "Concept Follows Context".

The three volumes collect all the papers that were submitted and underwent double-blind peer review, and they demonstrate that an AE multidisciplinary approach can effectively contribute to analysing and solving problems affecting buildings, cities, and the built environment. This can be achieved by suggesting innovative technical solutions, materials, components, and strategies that can guarantee the preservation of building heritage, the well-being of users and appropriate action to counteract climate change.

The Colloqui.AT.e2025 conference has been jointly organized by Ar.Tec. Scientific Society and the Department of Civil Environmental and Mechanical Engineering of the University of Trento, with the Patronage of: Municipality of Trento, Order of Engineers of the Province of Trento, Order of Architects of the Province of Trento, Habitech–Technological district of Trentino, Ance Trento-Trento Building Association, Universitat Politecnica de Valencia. The conference was sponsored by: INNOVA S.r.l. (www.innovaenergie.com), Riwega S.r.l. (www.riwega.com), Rockwool Italia S.p.a. (www.rockwool.com), Rothoblaas S.r.l. (www.rothoblaas.it), Miniera San Romedio S.r.l. (www.tassullo.it), XLAM Dolomiti S.p.A., together with Banca per il Trentino-Alto Adige (www.bancapts.it), Sovecar S.r.l. (www.sovecar.com), LSI-LASTEM S.r.l. (www.lsi-lastem.com), Manni Group S.p.A. (mannigroup.com), Ri-Legno S.r.l. (ri-legno.it), and supported by Melinda (melinda.it).

On behalf of the Colloqui.AT.e 2025 organising committee, we would like to express our gratitude to all the keynote speakers and authors, as well as the members of the international scientific and advisory committees. We would also like to thank all the participants who took part in this important international scientific event.

Special thanks goes to the publisher, Springer Nature Switzerland AG, and in particular to Pierpaolo Riva, for his support in publishing the Colloqui.AT.e 2025 proceedings. This contribution has significantly enhanced the dissemination and impact of our research activities in the field of architectural engineering. As members of Ar.Tec. Scientific Society, we are committed to continuing the tradition of the Colloqui.AT.e International Conferences in spreading the knowledge, excellence, and innovation of our research in the building sector.

Rossano Albatici

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Conservation and Valorisation of Modern Heritage: The Case of the Restoration of Ludovico Quaroni's Church in La Martella

Antonello Pagliuca and Gianluca Angelastri(✉)

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Abstract. After World War II, post-war reconstruction and the construction of new rural villages in Italy represented an opportunity to experiment with modern ideas in urban planning and architecture in a context different from Fascist ruralisation but still strongly influenced by it. Modernity is often associated with cities, where urban planning and architecture have rationalised space; in the twentieth century, rural modernization transformed the physical and settlement geography of many regions. This research focuses on the rural village of La Martella in Matera, specifically on the Church of San Vincenzo de' Paoli, designed by Ludovico Quaroni, a manifesto of the rural-Modern architectural language used in Southern Italy. This study aims to highlight the importance of preserving Modern architecture by proposing a methodology that enhances knowledge of architectural heritage through documentary and archival analysis, the study of construction manuals (which facilitate understanding standard building solutions), and on-site surveys. The critical analysis of this case study, with particular attention to construction techniques and materials used, becomes an essential tool for defining a correct and informed methodological approach for a restoration (or restoration of the restoration) project of this architectural heritage.

Keywords: Knowledge · Conservation · Modern Heritage · Restoration of the Restoration · Valorisation

1 Introduction

Twentieth-century architecture has only recently become prominent in contemporary architectural debate, leaving the question of its cultural value open. There is a continuous effort to understand what constitutes this heritage to define, preserve, and enhance it, making it accessible to future generations. However, to this day, this heritage has not yet been fully recognised as a shared element of cultural value. Moreover, in the collective perception, except for significant infrastructure projects and public heritage, rural villages and working-class neighbourhoods are often seen as symbols of past hardships and poverty, condemned to a form of "*damnatio memoriae*", as they are considered part of one of the most tragic chapters in Italian political history [1]. These experiences embody the intrinsic historical value of places, which cannot be separated from the events that led to their existence. Therefore, they should be recognised as a heritage to be preserved [2].

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In addition, objects that have reached the age of 70 and are works by authors no longer living become *ope legis* (art. 12 Cultural Heritage and Heritage Code, 2004) subject to verification of cultural interest. However, uncontrolled transformations are common before reaching this time [3]. Consequently, the focus on these works is growing, intending to promote and support knowledge, use, and conservation of this heritage through restoration [4]. As a practice for historical heritage, the restoration of 20th-century architecture also requires working according to criteria closely related to the design process, from conception to construction development. The time gap between the moment of the realisation of these architectures and our contemporaneity is short enough that their modern expressiveness, although widely shared, emerges as a dominant cognitive basis. At the same time, this proximity imposes an indispensable deepening, much more stringent than that required to intervene in architectures of more remote times [5]. In addition, intervention in structures already undergoing previous restoration significantly increases the complexity of operational choices. Although scientific literature is plentiful on valorisation and conservation, the same cannot be said for the concept of "restoration of the restoration" [6]. The "critical analysis" of these works, considered anachronistic today compared to contemporary thinking, is fundamental in the debates on recovering existing heritage. The construction techniques, materials used, and analysis of the consistency of previous interventions constitute the starting point for designing interventions for heritage characterised by a strong cultural identity. Within this framework of critical and methodological reflection, the analysis of Borgo La Martella in Matera is conducted with a particular focus on the Church of San Vincenzo De' Paoli, designed by architect Ludovico Quaroni, as an integral part of the interventions related to the Italian Agrarian Reform of the Post-World War II period. This research, part of a broader investigation into Twentieth-Century Architectural Heritage, highlights the construction, technological, and urban developments that numerous cities experienced during a period of great experimentation, mainly through the application of an architecture that, balancing technique and form, expressed an innovative and Modern language.

2 Critical Analysis as a Tool for Defining Protective Measures

This research aims to promote virtuous paths of knowledge and valorisation of Modern heritage and to define an intervention methodology in which analysis and critical reading of architecture are fundamental tools essential for proposing safeguarding and recovery actions. The phase of knowledge represents the most important step in designing a "conscious" restoration [7]. This knowledge develops indirectly through critically studying original archival materials (such as cost estimates, project drawings, and contract specifications) and analysing bibliographic sources. Additionally, a careful examination of sector-specific manuals allows for the identification, by analogy, of the most recurring technological solutions and construction features from the Post-War years, thus providing a practical understanding of Twentieth-Century Italian architectural production. Direct knowledge plays an equally central role in the methodological research process. The survey documentation represents the result of "*in situ*" observation of the building, carried out through a series of direct investigations aimed at interpreting its multiple aspects (structural, functional, material, and constructive). The interaction of these tools

leads to the creation of a comprehensive knowledge-based framework of information and data, which serves as a valid support for the "de-construction" of these architectures and outlines an approach aimed at the conservation and maintenance of the assets under intervention [8].

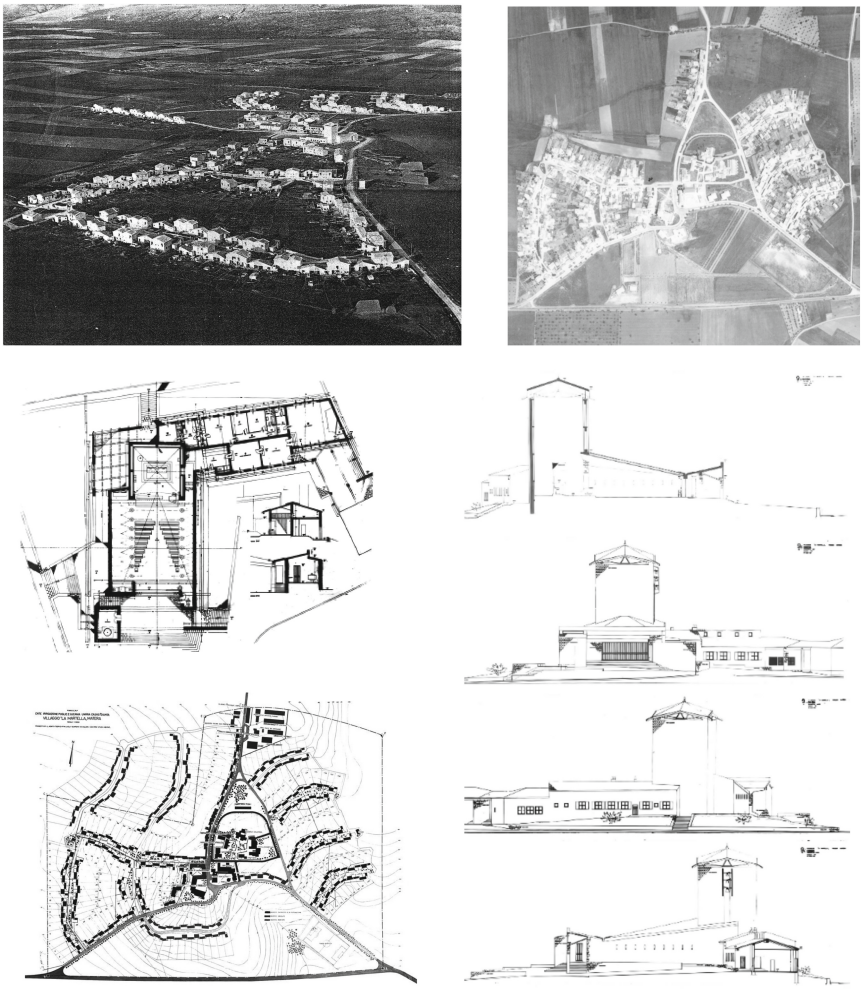

Fig. 1. Above from left to right: Aerial Photography Borgo La Martella, right: orthophoto Borgo La Martella in 1961 (source: M. Tafuri, «Ludovico Quaroni e lo sviluppo dell'architettura moderna in italia» Edizioni di Comunità, 1964). Below: Urban project of the village and architectural project of the church (source: Archivio di Stato Matera).

3 The Church of San Vincenzo de' Paoli in La Martella

3.1 The Foundation of the Village La Martella

After World War II, the construction of new rural villages in Italy allowed experimentation with modern ideas in urban planning and architecture. This process was supported by funding from the Marshall Plan (1947), which contributed to the country's economic reconstruction and was further consolidated through the implementation of the Agrarian Reform [9]. The reform, enshrined in Law No. 841 of 1950, promotes the redistribution of uncultivated or unproductive land belonging to latifundia in favour of farmers, involving the foundation of new rural villages with a quality urban and architectural plan inspired by traditional architecture but reinterpreted according to "Modern" styles. The Agrarian Reform in Basilicata saw the expropriation of more than 75,000 hectares of land, distributing about 12,000 farms to settlers [10].

Borgo La Martella is located on a natural elevation about 7 km from Matera and was built as part of the evacuation and rehabilitation process of the Sassi districts in a dynamic political and cultural climate strongly influenced by the strategic and social initiatives of Adriano Olivetti, then President of the INU and vice-president of UNRRA-Casas. The project, led by Ludovico Quaroni, Federico Gorio, Pietro Maria Lugli and Michele Valori and involving Roman experts since March 1951, is based on an in-depth study of the neighbourhoods of the ancient Rioni Sassi through an anthropological and sociological study [11].

"In the project of La Martella village, an effort was made to strip the architectural language of any rhetorical phrases (…) not with the intention of achieving pure lyricism, the jewel in the casket (…) but simply to provide the farmers, those farmers who would carry with them a history of thousands of years, with a "clean" environment, free from absurd intellectual embellishments and ephemeral tastings of style, which are absolutely frivolous in comparison to the seriousness of the purpose" [12]. The construction programme of the Village, in addition to the construction of housing, also includes the construction of a civic centre that houses a cine-theatre, a post office, a municipal delegation, a grocery store and a bar restaurant with some rooms for overnight stay. In addition to these buildings, there is a nursery, a primary school, a medical clinic, a hostel and a limited number of social welfare offices. The pivot of the Village is the church, designed as a focal point in the urban setting of the Village, so much so that it constitutes an important landmark of the territory (Fig. 1).

3.2 The Church of Ludovico Quaroni

Figure 2 shows how the design of the church followed the principle of creating an economic, religious building for a rural village, simple like the other public buildings of the municipality, but "*finished and decorated with the dignity necessary for its specific use*" [13]. The church project was realised in 1952, after the UNRRA-Casas had rejected two earlier designs, and construction was completed in April 1953; the church was later consecrated under the title of San Vincenzo de' Paoli in 1955 (Fig. 3).

The final design was developed in response to a specific request of the client, who wanted to create a building with a more prominent volumetric presence that would serve

Fig. 2. Above from left to right: completion of the church 1955 (source: Archivio Fotografico Vasari); below from left to right: church during construction (source: Archivio Ettore Stella Jr).

as a visual, urban and symbolic point for the entire village. Although the inclusion of a central symbolic element in the almost homogeneous structure of residential and service buildings does not fully align with the planners' original intentions, the church's configuration in its current form has become the architectural and identity-forming symbol of the village (Fig. 4).

The church of Borgo La Martella, entrusted to Ludovico Quaroni, represents a compositional evolution compared to previous interventions in religious architecture. It transitions from the traditional nave configuration, characterised by regularity and symmetry, as seen in the case of the project of Prenestino, to a spatial deformation leading to a single hall, as in the Francavilla project, and finally to a dual typology, articulated in the *Aula* and *Tiburio*, in the village of La Martella [13]. In his search for an expressive form, Quaroni conceives "form" as the meeting point between the mystical and secular dimensions, distancing himself from strictly religious concerns. His formal expression is realised through reinforced concrete, which he considers the ideal material to embody the desire for a plastic continuity in architecture [14]. The *Aula*, intended for the faithful, is low,

Fig. 3. Consecration of the church under the title of San Vincenzo de' Paoli 1955 (source: Archivio Chiesa San Vincenzo De' Paoli).

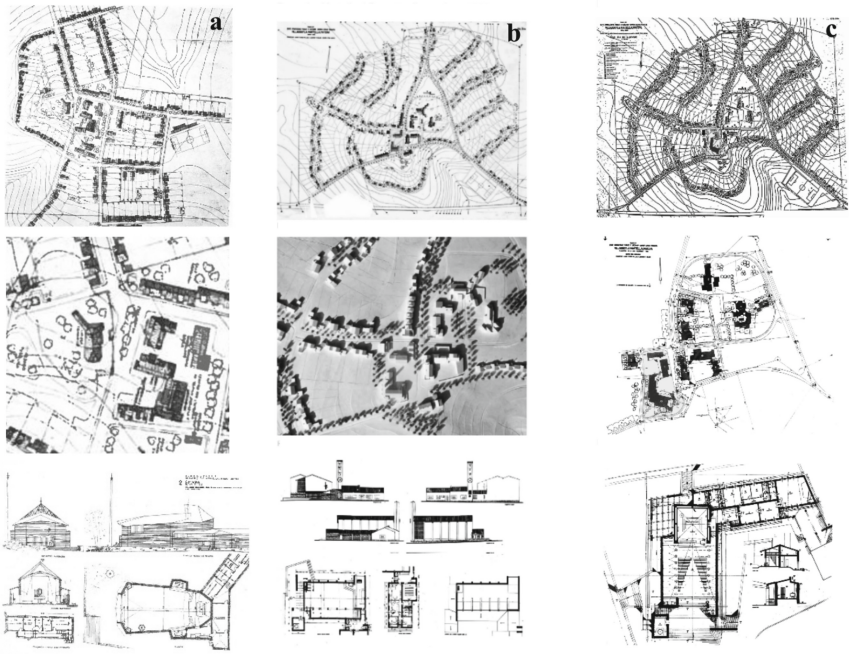

Fig. 4. The project's development for Borgo La Martella: the first and second columns show the first two preliminary projects for the village, the civic centre and the church (source: Archivio Ludovico Quaroni). The third column shows the executive project for the village, the civic centre and the church (source: Archivio di Stato Matera).

dimly lit, and characterised by an austere and essential form in its lines and decorations. It is illuminated only by small, "slits windows" in the perimeter walls. Externally, it features a white plaster finish, has a slightly elongated rectangular plan, and is covered by a three-pitched roof. These pitches are arranged to project the faithful's space toward the presbytery's centrality, a movement further emphasised by the inclination of the central pitch, which, together with the lateral wings, facilitates the connection between the *Aula* and the *Tiburio*. At the church's centre, the faithful's pews are arranged to create a free triangular space that narrows towards the altar, reinforcing the spatial perspective towards the presbytery (Fig. 5).

The *Tiburio*, conceived as a symbolic space of light and transcendence, is designed as an elevated, distinct volume illuminated from above. It has the shape of a prismatic structure about 20 m high and is clad on the outside with exposed tuff. It serves a triple function as a dome, *Tiburio*, and bell tower. Its top is enclosed by a square-plan roof composed of eight triangular folds. Inside is the presbytery, which houses the essential elements for liturgical functions (Fig. 6).

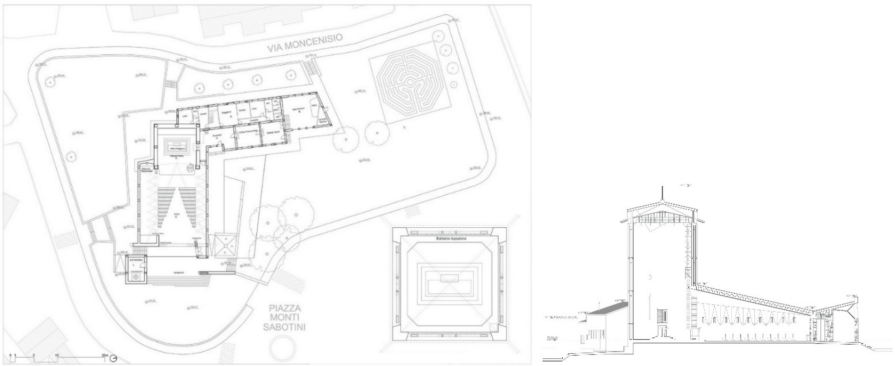

Fig. 5. Left: survey ground floor and bell tower; right: longitudinal section (elaborations by the authors).

4 The "Restoration of the Restoration" of Ludovico Quaroni's Church in La Martella

As mentioned, in recent years, the topic of Modern restoration, with all the challenges it entails, has become an increasingly debated issue in the architectural field [15]. This subject is particularly complex, especially when interventions involve buildings designed by great masters of the past. The complexity is further heightened in cases where the monument has already undergone previous restoration efforts. A notable example is the church of La Martella in Matera, for which, in 1990, the *Provveditorato alle opere pubbliche* of Basilicata approved interventions on the building just forty years after its construction. The decision was driven by the severe decay affecting the structure, attributed to a combination of factors such as lack of maintenance, original construction defects, and damage caused by the 1980 Irpinia earthquake [16].

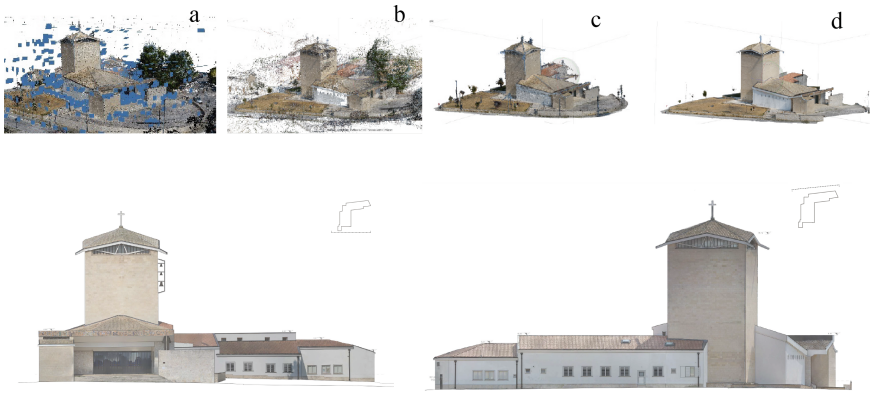

Fig. 6. Above from left to right: (a) The process of obtaining Orthomosaics through the relief by drone photographic survey campaign; (b) Sparse cloud; (c) Dense cloud (d) Textured model; below from left to right: Orthomosaic east elevation and orthomosaic west elevation (elaborations by the authors).

The operations to be carried out did not correspond to routine maintenance work on an active building nor to the restoration of a long-abandoned structure. At the time, the intervention took on the characteristics and objectives of a "restoration of contemporary architecture" project. The restoration assignment was entrusted to architect Mauro Sàito, who developed a plan based on four key directives: structural analysis and consolidation, improvement of energy efficiency, technology, and functionality, liturgical adaptation, and a proposal for the completion of the architectural complex. At the time, as still today, there is a need to reflect on the values to be preserved and, above all, on the most appropriate methodological approach to ensure the authenticity of the work and its long-term preservation. The analysis of previous decisions, an in-depth study through direct and indirect investigation methods, the investment of resources and time and the diagnostic measurement and survey possibilities offered by today's technology and science, together with the 'de-construction' of the monument, constitute the fundamental tools for a critical evaluation of the building's development process and the necessary interventions to minimise the risk of compromising the work. This results in the need to approach the restoration of Modern architecture with a comprehensive perspective and consider the entire building as a structured system of elements and functions.

4.1 Material and Structure as a Harmonic Unity

The first phase involves the investigation and survey of the building according to the previously described characteristics, followed by material and structural analysis to evaluate the building's response to seismic loads based on current legal standards. In this phase, diagnostic studies and thermographic analyses were carried out, including an assessment of the state of conservation of both the original elements and the restoration interventions of 1990 (Fig. 7). These interventions involved structural consolidation, including the enlargement of the foundations of the tower and the baptistery, as well as

Fig. 7. Above, from left to right: detail of reinforced concrete pillar, interventions carried out on the facades (2018), bell tower (2024); below, from left to right: thermographic surveys – hall floor, hall masonry (photos by the authors).

the reconstruction of the rectory "in philological respect of the original project's forms and volumes" [16].

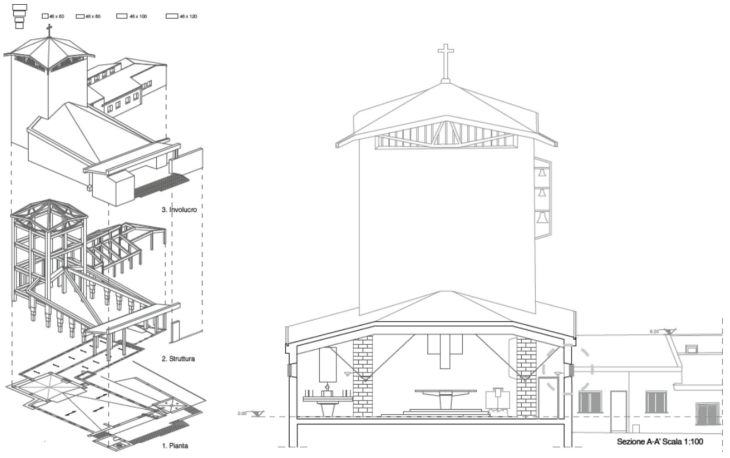

Fig. 8. Left, exploded Structural diagram; right, cross-section of San Vincenzo De' Paoli Church (elaborations by the authors).

It should be emphasised that, unlike others, this structure does not follow a standardised typology, but has a particular configuration of pillars that taper downwards (Fig. 8). These elements allow a "de-construction" of the typological, constructive and structural aspects of the building and emphasise the fundamental characteristics of the building and its historical identity [17]. Alongside the structure with "tapered" pillars

and the "collaborating" presence of local tuff masonry, the horizontal sections respond to the widespread types of clay/cement mix slabs, the result of national experiments and "declined" by the local workforce.

In particular, it was possible to identify the type of floor structure used in the *Aula*, which is of the "Bidelta" type, confirming on-site the correspondence between the design documentation and the slab model executed during construction (Fig. 9). This system, widely used in the first half of the 20th century for its ability to span distances exceeding 15 m with significant thicknesses—up to 80 cm in proportion to the span—was composed of four perforated clay brick elements arranged in a parallelepiped shape, with two lateral ribs, a top clay tile, and a larger bottom clay tile [18].

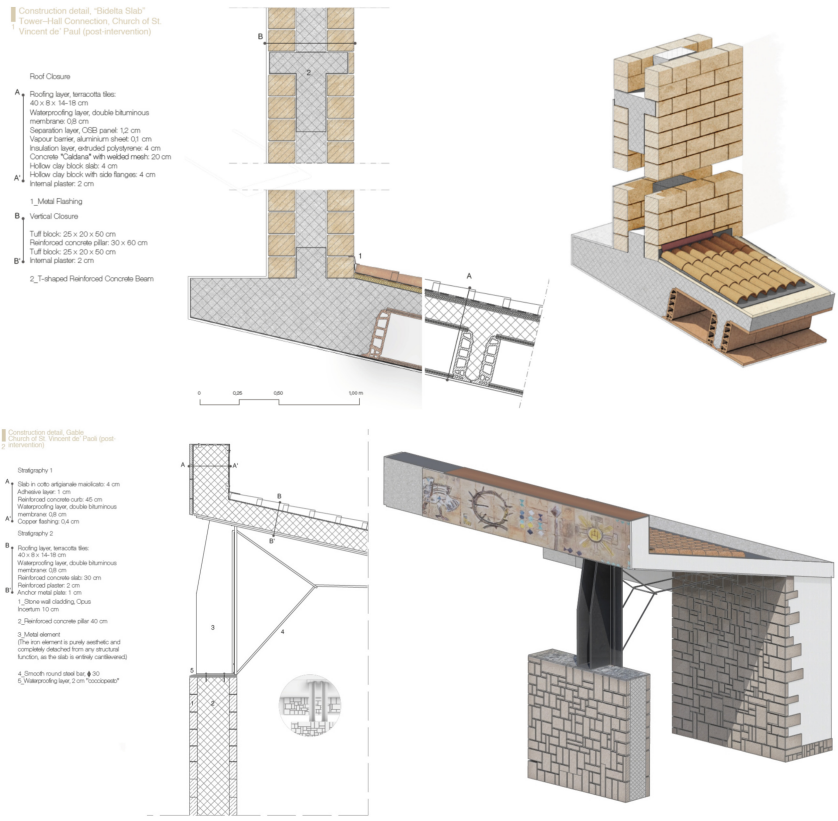

Fig. 9. Above: Construction detail, "*Solaio Bidelta*" Tower-hall detail (post-intervention) section and axonometric view; below: Construction detail, gable of the church (post-intervention) section and axonometric view (elaborations by the authors).

4.2 Improvement of the Energy, Technological, and Functional Performance of the Envelope

Nowadays, energy refurbishment is promoted to improve the thermal performance of buildings, often at the expense of their historic appearance. In this context, careful attention to such interventions is necessary in order to preserve not only environmental resources but also cultural resources. Architecture from the second half of the 20th century, which accounts for almost 45 percent of the existing cultural heritage, is considered the main target of these interventions. Despite its value as a cultural heritage, it is an endangered category [4].

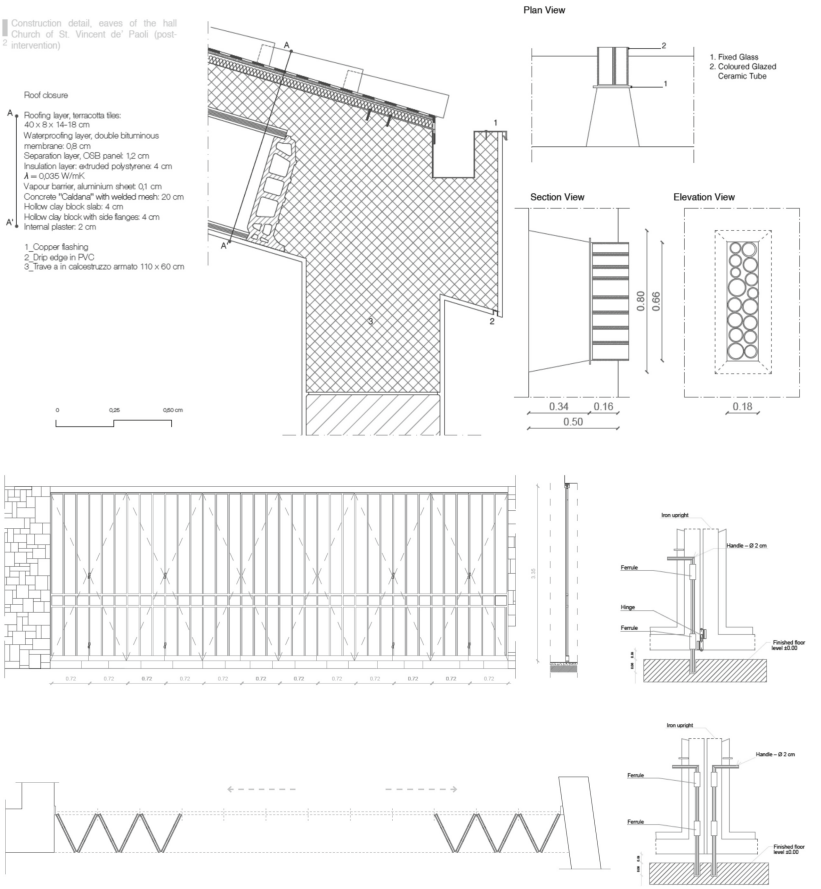

Fig. 10. Above, from left to right: redesign of the construction details of the church hall; survey and redesign of the *Aula* slits windows; below: survey and redesign of the entrance door (elaborations by the authors).

The 1990 restoration interventions aimed at improving the building envelope involved redesigning the building's ground connection, particularly the relationship between the tuff and the soil, and disposing of rainwater. To achieve an improvement in

energy, technological, and functional performance, it would be essential today to start with a thorough analysis of the building envelope. However, common practice would suggest applying an inner or outer insulation layer, which seems less practical. Externally, the difference in materials between the surfaces, such as plaster and exposed tuff, would make the intervention incompatible with the aesthetics of the building. Inside, the increase in wall thickness could alter the perception of natural light and thus compromise one of the fundamental concepts on which the church was designed. For this reason, interventions such as the replacement of obsolete fixtures and materials with poor thermal performance, the restoration of the mortar joints corresponding to the "slits windows" of the *Aula* with appropriate "sealing", and the redesign of specific construction details represent compatible solutions to improve the overall energy efficiency of the building. An important intervention point could be to reconsider the relationship between the masonry and the roof covering concerning rainwater run-off and to plan the installation of metal elements made of copper. Another step could be to replace the insulation layer installed on the roof in the 1990s with more sustainable materials and techniques, favouring thermal insulation materials made from natural or animal fibres. These materials align with the principles of the green economy, improve energy efficiency, and meet the requirements of a market increasingly focussing on environmental sustainability. The redesign of the entrance door, made of "*ferrofinestra*" and currently unused, could be a solution both to improve energy and security performance and to allow its use as a space for expanding the liturgy towards the outside, ensuring a folding opening in line with the original intentions of the designer (Fig. 10).

4.3 Liturgical Adaptation and Functional Enhancement

The conservation and valorisation of a religious building are complex operations that must address liturgical adaptation and functional recovery themes. Ludovico Quaroni's interpretative ability of the "*Sensus Fidei*" at the design stage proves particularly significant. Ten years before the promulgation of the "*Sacrosanctum Concilium*" of the Second Vatican Council (December 4, 1963), he strongly anticipates a sense of community participation in religious spaces. The presbytery is no longer "closed" to the congregation but opens up perspectively to it and, through the glazed entrance, to the entire village.

The 1990 restoration work included several liturgical adjustments due to the post-1963 changes, which introduced significant innovations, including the "versus populum" altar, where the officiant no longer performed the liturgical rite with his back to the congregation and in Latin but rather in the vulgar tongue, facing the faithful. In this context, the relocation of the altar required repositioning all the majolica tiles and the addition of a new step between the nave and the presbytery, finished in blue majolica, though undecorated. The wooden and iron balustrade, which conceptually marked the boundary between the nave and the presbytery, was removed as it had become obsolete according to liturgical norms. The repositioning of the baptismal font and the Paschal candle was also planned.

Further operations could be undertaken to complete the liturgical adaptation and functional recovery, for example, by making the project more in line with the designer's original idea through the integration of the weekday chapel, which envisioned a pergola intended for outdoor celebrations in the space located northwest of the bell tower. Over

the years, the church has been enriched with works of art that complete and enhance its identity, animating the Borgo through a harmonious dialogue between domestic and religious dimensions. Among the artists who contributed, the masters Pietro and Andrea Cascella stand out as the creators of the ceramics for the liturgical spaces, Luciano Nioi for the wooden works, Enrico Castelli for the metal artworks, and Giorgio Quaroni, brother of the architect, who crafted the Crucifix [19]. Many of these works of art now show evident signs of decay. Therefore, it would be desirable to undertake a critical reassessment of the original pieces to catalogue and enhance them and, where necessary, evaluate restoration interventions (Fig. 11).

Fig. 11. Above: Critical analysis of the liturgical furnishings and artistic works; below from left to right: executive project plan, scheme and a render regarding the addition of the weekday chapel (elaborations by the authors).

4.4 Completion Hypothesis: Additions and Integrations

The evaluation of the "restoration of the restoration" is perfected with a hypothesis of completion for the architectural complex through a reinterpretation of Quaroni's original idea. The project on the built structure is a careful balance between conservation, understood as a moral obligation, and transformation, which is inevitable and necessary. Buildings must respond positively to the evolving and inescapable needs of the users [20]. The monument, in order to be truly preserved, must be lived and experienced; otherwise, it is destined to be lost. Quoting Tommaso d'Aquino: "*Conservatio est continua creatio*" (Conservation is continuous creation). The design proposal continues the body of the rectory through a portico that connects and organises the main spaces to serve the community. In terms of plan and volume, it follows the original proposal for the

area, resulting from an in-depth study on axiality, heights, rotations, translations, and the relationships between the buildings, which the design team had developed at the time (Fig. 12). However, the functions planned differ from those originally envisioned by Quaroni, as the needs of contemporary living are profoundly different from those of the post-war context linked to agrarian reform. In light of these new requirements, today, the possible function for the proposed area could be that of a community centre, organised into temporary housing for the less affluent population, a social kitchen with a multifunctional space, and an area with the museum and celebratory functions (Fig. 13).

Fig. 12. Show the sequence of diagrams illustrating the evolution of Ludovico Quaroni's project, highlighting the translations, rotations, heights, axial alignments, and relationships developed during the various design phases. This sequence reaches the current state (IV), laying the groundwork for the project's further development (V) (elaborations by the authors).

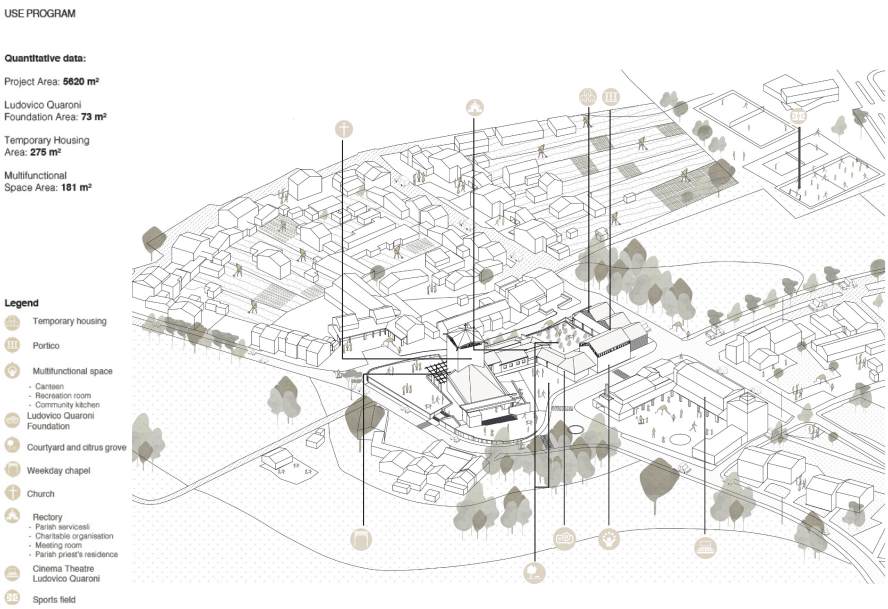

Fig. 13. Functional program of the project proposal (elaboration by the authors).

5 Conclusions

> "*The story of Quaroni is complex, tangled, contradictory, dramatic. (...) Dissatisfied with the society in which he moves, with himself and others, he desperately seeks new truths in things and people (...). Architecture reflects the peaks and depths of this alternating feeling: it begins with a courageous adherence to rationalism, declines with the illusion of a Scandinavian neoclassicism, surrenders in the Imperial Square of E 42 (...), reemerges in the structuralist conceptions of the Rome Station and two cathedrals, and resolves (...) in the social and human interests of urban planning, freeing itself in the creation of La Martella*".

Thus, Bruno Zevi (1956) comments on Ludovico Quaroni's personal and professional journey in receiving the Olivetti Prize for Urban Planning, awarded to him [21]. Ludovico Quaroni's figure remains highly relevant today due to his complexity and his intrinsic ability to understand social and environmental needs within a broader context. His talent for navigating between different disciplines and languages, combined with his inclination for experimentation, allowed him to propose architectural and urban models that are still recognised as innovative [22].

However, only just over 70 years after its construction, the issue of restoring this type of architecture arises, not for the architectural models and languages used, but for what was the fundamental factor of the era that determined the value of these buildings: the experimentation in detail, materials, and construction systems, which in a certain sense define the essence of 20th-century building art and therefore must be analysed in order to intervene on them methodically [23].

The study of the church of La Martella has allowed for the validation of this process of analysing 20th-century heritage, highlighting the avant-garde and experimental identity typical of works from that era. Through a process of "de-construction", fully aligned with the theme of "restoration of the restoration", a holistic approach to architecture is adopted, analysing the multidisciplinary nature of interventions in more complex projects [24]. Through this approach, it is possible to develop a methodology for intervention that can guide the meta-design phase for the recovery and valorisation of the asset. A scrupulous preventive knowledge fits perfectly with the needs of Modern heritage architecture, where structural components are often hidden by complex construction artefacts, and greater awareness can lead to a more cautious and respectful intervention.

The proposed methodology could also be applied to other modern buildings in similar contexts, characterized by comparable typological, material, and construction features. The criticality of this approach lies precisely in the extent of the intervention: it is up to the designer to take a learned and conscious direction based on the deep knowledge of the monument itself [20]. This approach becomes essential, mainly when intervening on an asset that has already been restored in the past (restoration of the restoration), as is the case with the analysed study. From the examination of Quaroni's church at La Martella, it is clear that the conservation of 20th-century architectural works requires a deep understanding not only of the technical and technological elements of the asset but also of all the cultural and social factors that have shaped them. The frequent presence of materials and construction solutions that are now obsolete and out of production in the historical heritage becomes a significant factor in their protection and preservation. These

principles should guide conservation efforts, requiring a sense of deontological responsibility, which can only be developed through a deep familiarity with the monument; construction techniques, the materials, and the logic of thought of the time constitute, in fact, the fundamental stage in the design of a "conscious" recovery (Fig. 14).

In conclusion, it can be stated that the "restoration of the restoration" is a complex and delicate concept involving not only the preservation of original structures but also attention to the interventions/transformations that have occurred over time. It is, therefore, a process that must also address the history of restoration, guaranteeing the "philological dignity" of each intervention without compromising the formal and cultural integrity of the original architectures, enabling future generations to appreciate their cultural value.

Fig. 14. Above: Sketch by Ludovico Quaroni for the church of Borgo La Martella (source: Archivio Ludovico Quaroni); below: representation of the completed church complex (elaboration by the authors).

Author Contributions. Conceptualization AP; methodology AP; historical resources GA, AP; technical resources GA, AP; writing and editing GA; review and supervision AP. All authors have read and agreed to the published version of the manuscript.

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