

MECHANICAL ENGINEERING / PHYSICS /
PRESERVATION OF THE ARCHITECTURAL
HERITAGE / STRUCTURAL, SEISMIC AND
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CHEMICAL ENGINEERING / INFORMATION
TECHNOLOGY / MANAGEMENT ENGINEERING /
MATERIALS ENGINEERING / MATHEMATICAL
MODELS AND METHODS IN ENGINEERING



DOCTORAL PROGRAM IN PRESERVATION OF THE ARCHITECTURAL HERITAGE

Chair:
**Prof.
Mariacristina Giamb Bruno**

The Doctorate Course in Preservation of the Architectural Heritage was first held at Milan based Politecnico back in 1983.

The PhD program focuses its attention to some currently crucial themes for the preservation, conservation, and management and valorization of Architectural Heritage. Starting from the fundamental topics of knowledge, preservation, design and intervention, the PhD program takes care of the most important and urgent problems affecting the built Heritage and Cultural Landscapes: the fragility and the abandonment of historic marginal areas; the climate change and its effects on the built environment; the improper pressure of mass tourism on our historic settlements and sites of cultural interest, the needs for a wider social involvement in the field also through appropriate ICT mediums, the management and the use of architectural Heritage.

The conservation of Architectural Heritage is, in fact, a strategic field as well as one of the main important resources for worldwide economy and for a sustainable future in different areas of the world.

In addition to the professors of architectural restoration, history of architecture and structural strengthening of the Politecnico di Milano, the Faculty Board includes representatives from other well-known universities and research institutes (Università IUAV, Venezia; Università di Genova; Politecnico di Torino, Università di Napoli Federico II, Università degli Studi di Bergamo; Istituto Superiore per il Restauro e la Conservazione ISCR; ISPC-CNR, Milano); they collaborate actively in the teaching and research activities.

The ultimate purpose of the Faculty Board not only resides in broadening the experiences that the PhD candidates acquire over the first three years of the course, where they have the opportunity to interact with scholars from different backgrounds; it chiefly aims at providing the PhD candidates with a unique training experience in the Italian panorama, so far unparalleled also in domains other than the preservation of the cultural heritage. Such context investigates the synergies and responses to the modern themes of cultural heritage protection.

The PhD programme is meant as the place where theorization, methodology, investigation into the most significant chapters of the protection of historic architectural and cultural heritage are connected to complex, challenging operating research themes, on-site and lab experimentation of analytical and diagnostic stages.

The relationship with Italian Ministero per i beni e le attività culturali e il turismo - Mibact has been definitely fruitful, especially when we consider that many among

the best PhDs in Preservation of Architectural Heritage have been hired as officers and executives to the above ministry; recently (February 2018) twelve PhD from the PAH Programme won the competitive exam to become officers in the Ministry of Cultural Heritage

Teaching aims

The Faculty Board organization allows to investigate and share extremely relevant, up-to-date topics that, architectural heritage being the high spot of research, describe the complex domain of preservation, a strategic field and, at the same time, one of the chief resources of the Italian economy and future.

Being a mix of differentiated research, experimentation and operating methods, the PhD programme provides the candidate with a rich and very interesting experience. The on-going contact with the breakthroughs from studies and research carried out in Italian and international contexts and the will to promote joint projects are fostered through expanding the network of relations the university entertain with other universities and research centres in different geographic areas of the world.

In this regard, over the past 5 years the PhD programme in Preservation of the Architectural Heritage has been committed to promoting and coordinating inter-doctoral courses contributed by foreign professors from different European countries.

Coursework

The PhD programme, lasting three years, calls for the acquisition of 180 credits overall. 25 credits are offered by PhD courses (ten of them by PhD School).

The academic plan of the PhD programme revolves around 3 main research areas, corresponding to the core courses:

- 1) Heritage and landscape preservation: culture and practice
- 2) Methods and themes of historical research. Construction History
- 3) Science and innovation in diagnostics of materials and structures. Rehabilitation of historical buildings

Within this plan, different experiences are organized in order to get PhD candidates in touch with study and research developed in Italian and International context.

Visits to important restoration site are organized, such as the ones to the area in the central part of Italy damaged by the earthquakes (Amatrice Accumoli, etc.); to the Procuratie, Rialto Bridge and the Palazzo Vendramin Calergi in Venice; to the Colosseo in Rome under intervention of maintenance

(with ISCR, formerly Istituto Centrale del Restauro), to the Sanctuary of Vicoforte (in collaboration with Politecnico di Torino); to the underwater archaeological site in Baia (Napoli) in relation to the ISCR project "Restoring Unerwater".

The remaining credits are aimed at personal study and research for the PhD thesis.

The activities undertaken during the second and third year also include attendance of workshops, seminars, international meetings related to individual research, with great attention to conferences wherein PhD candidates present the results, even partial, of their research theses.

Research organization and topics

Educational activities are related to research either under way or at an early stage of development, some of which addresses major monumental structures and some of the most renowned sites of the world. This aspect increases the technical characteristics and will make PhD immediately competitive at the European level.

To the aim of their thesis research, PhD candidates have the opportunity to rely on facilities and laboratories, both inside and outside the University, the breadth and width of which provides them with a crucial support to the aim of acquiring "competence for highly qualified research activities" in the domain of cultural heritage protection.

In this connection, the PhD programme deems to carry on the long - standing collaboration with the ISPC-CNR (the Institute for the Preservation and Enhancement of Cultural Heritage).

As for the thesis research, candidates thus have the opportunity to address and investigate in-depth the wide-ranging themes connected to heritage knowledge and preservation broadly meant, such as advanced methods of investigation.

The multi-disciplinary nature of the doctoral courses, encouraged in the framework of the PhD programme since its establishment, equally values the fundamental contribution of historical research and its methods; at the same time it features innovative, pioneering themes: impacts of climate change on architectural heritage and cultural landscapes; Inner Areas: census, conservation and re-use of Architectural Heritage; strategic approaches for the preservation; social involvement and Communities engagement in the protection and management of their Heritage; Impact of mass tourism on architectural heritage and cultural landscapes; cultural and sustainable tourism policies and practices; Architectural Heritage at risk in seismic or in conflict areas; Architectural Heritage and Cultural Landscapes in Countries in transition.

DOCTORAL PROGRAM BOARD

The Board of Professors comprises the following members:

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Antonella E. SAISI, Associate Professor - Diagnostics of Historic Buildings (Politecnico di Milano)

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Marco REALINI, ISPC-CNR Milano
Antonio SANSONETTI, ISPC-CNR Milano
Maurizio BORIANI, former Full Professor – Urban restoration (Politecnico di Milano)
Maria Antonietta CRIPPA, former Full Professor – History of Architecture (Politecnico di Milano)
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Hans-Rudolf MEIER, Professur fuer Denkmalpflege und Baugeschichte, Bauhaus-Universitaet Weimar
Bruno REICHLIN, Honorary professor in the Université de Genève, past head of the 3rd cycle study in *Sauvegarde du patrimoine bâti*, member of the Comité des experts pour l'oeuvre architecturale della Fondation Le Corbusier and of the Commission Nationale des Monuments Historiques (France)

CONSTRUCTION AND TRANSFORMATION IN GIUSEPPE TERRAGNI'S ARCHITECTURE. HOUSING BUILDINGS BETWEEN COMO AND MILANO

Marta Casanova - Supervisor: Stefano Francesco Musso

Co-supervisors: Giovanna Franco, Ornella Selvafolta

This research originates from the will to spread the knowledge of buildings planned by Giuseppe Terragni, one of the most important figures of the Italian architecture between the two world wars. Starting from a careful research work at the Giuseppe Terragni Archive, the planning criteria and the building techniques have been examined, and also the modifications that such buildings have undergone through the years have been analysed, in order to finally assess their current preservation conditions, so to highlight their preservation problems, lacks and risks.

This study aims at foregrounding these buildings in their material quality, where the historical aspects of the early planning and building have summed to those occurred through the years and have led to the current architectures that are absolutely less clear and more complex, but not less interesting or significant.

This research contributes to the creation of the material history of these architectures, as essential condition for their future preservation and spots some open questions and strategies for the private residential building preservation, where its requests often go against the owners' needs and the lack of awareness of their values.

Since the beginning of this study, the need of restarting from the documents and drawings of the plan, kept in the architect's archive, has arisen.

Although most of the drawings had already been published, historians and architects' interest had never been focused on the construction phases of the buildings, and the reading of the rich Terragni's correspondence between his purchasers and collaborators has allowed to fill some gaps, and sometimes to give a different interpretation of the history which had already been written about the planning of these buildings.

The work started with the consultation, the reading, the digitalization and the storage in a data base, suitably created, of the information deriving from the documents kept in the private archive of Giuseppe Terragni, thus not limiting to the ones kept in the plans' files of different buildings, but enlarging the research to the

correspondence Terragni had through the years with purchasers, collaborators, suppliers and friends, kept in files chronologically ordered, which do not refer to specific plans. Such documents, in various cases, had never been considered integrally, above all the information concerning the residential buildings and have allowed to give a new reading to the planning and building phases of the buildings, to open new interpretations of the documents and drawings already published and to place new questions about the history of the construction of the buildings. The storage research has been enlarged to the archives of the municipalities and bodies which have authorized the building and, concerning the following modifications, even the archives of the preservation



Fig. 1 - "Casa Pedraglio" at the conclusion of construction work and today.

bodies and some architects who have after planned interventions on the buildings. All this documentation has been stored in a database structured to obtain a digital archival dossier about every single building, including the documents taken from the archives concerning the planning, authorization,

building and following transformation phases.

The direct analysis of the buildings and the study of their following transformations have allowed to highlight the fact that, in most cases, the interventions on those buildings were the result of decisions taken

without a preliminary study of the project and of the building. In some cases, because of the unawareness of the building and author's value, where the interventions have been carried out, and in some other cases because of the will of returning to the original version of the building planned by Terragni, the interventions had caused the loss of materials, finishing and elements which the research has revealed being original.

Today the buildings not only are the result of Terragni's project and realization, but they are also the sum of small and big modifications, additions and substitutions which have transformed them and have added meaningful value to that initially wanted by Terragni. For this reason, it has been essential to follow the same route back to the history of this information to arrive at the description of their current preservation condition, even though it has not been an easy and surely complete operation. This passage is a sort of starting point to think back to these architectures taking into account their complex history before intervening again on them, differently from what occurred in the past, even the last few years, with partial or fragmented interventions, but on the contrary basing ourselves on an increased knowledge, and thinking of interventions which can keep and preserve what has arrived until today.



Fig. 2 - Archival document listing the construction companies involved in the building of "Casa Pedraglio" and Terragni's remarks on the problems that emerged.



Fig. 3 - Details of the staircases of "Case Popolari in Via Anzani", "Casa Pedraglio", "Casa Giuliani Frigerio" and "Casa Rustici".

CONDITIONS, DESTINY AND POTENTIAL OF THE HISTORIC BUILDINGS IN THE INNER AREAS OF ALTO OLTREPÒ PAVESE, ALTA VALLE BREMBANA AND ALTO LARIO OCCIDENTALE

Benedetta Silva - Supervisor: Mariacristina Giambruno

Co-supervisors: Carolina Di Biase, Gabriele Pasqui

The research examines the state of conservation and transformation of widespread heritage in the territories classified as “inner areas” by the National Strategy for Inner Areas (SNAI) in Lombardy. Despite being among the most economically dynamic regions in Europe, areas characterized by territorial periphery have been identified also in this region: these areas represent 46% of the municipalities at the regional level.

The research project started almost simultaneously with the beginning of the second phase of the implementation of the SNAI in Lombardy (2016), when the scientific community began to question what the first results of this innovative territorial cohesion policy were. In the light of the relevant demographic and socio-economic phenomena of depopulation and abandonment, it appeared interesting to verify what the current condition of the historic building was, what were the permanencies and transformations of traditional buildings. The complexity of the proposed theme required a multidisciplinary approach, with an effort in the critical assumption also of literature not specifically in the field of restoration, often ignored by architects and scholars specialized in restoration.

The first part of the research analyses the territories identified by SNAI in

Lombardy. In the implementation of the SNAI there are no specific studies on the state of conservation and transformation of traditional buildings and there is no large-scale vision of the widespread heritage. The addresses for the historical heritage are concentrated on individual publicly owned buildings to facilitate tourist use or to reduce heat loss. The analysis of the demographic and socio-economic trends that characterize these areas, outlining what the changes have been, show how polarization exists even within the Lombardy inner areas and how substantial continuity in dynamics often remains. Although large portions record a demographic decrease and a generalized agricultural abandonment, the increase in homes

registered as “unoccupied” (not for this reason not maintained or in a state of ruin) raises important questions on the transformations of the territorial and urban planning of the Lombard inner areas. To better investigate the research topics, three case studies were identified, for a total of 42 municipalities. The case studies are the Alto Oltrepò Pavese, the Alta Valle Brembana, the Alto Lario Occidentale. The overlap of historical cartography and recent aerial images has made possible to describe the urban expansions of the last centuries, verifying their development in time. In Alta Valle Brembana area, the important urban growth coincided with the tourist development of the last century; in the case of Alto



Fig. 1 - The replacement of a roof of a rural building in Valtorta (BG). The roof, although the wooden material, appears out of portion compared to the structure below (photo taken in 2018)

Oltrepò Pavese, the development of inhabited areas coincided with the

construction of some infrastructures towards the regional capital; in the



Fig. 2 - State of conservation of widespread heritage in Menconico (PV). On the right, the building has undergone a total scrape of the plaster; on the left, a large opening has been opened to create a garage on the ground floor and the plaster has been replaced with a plastic material. Both buildings have been replaced the roofs and the shutters (photo taken in 2019)



Fig. 3 - Buildings in a state of ruin in the ancient part of the settlement of Livo (CO). The abandonment involved the collapse of the roofs and the perimeter walls (photo taken in 2018)

Alto Lario Occidentale area, on the other hand, construction activity was weaker, with reduced expansions. The current use of the historical heritage was explored through surveys, verifying the extension of non-use and abandonment: the state the art appears much more complex than what was initially assumed. Although there are few examples of total “ruderization”, traditional buildings appear to have been profoundly transformed, in terms of techniques and materials, even with total replacements. The study of the current regulatory framework (regional law no. 12/2005 and local planning tools) draws attention to the limits and criticalities for the conservation of the so-called “nuclei di antica formazione” (nucleus of ancient formation). The investigations explore the role that the historical architectural heritage has and its potential, also in the light of the Sustainable Development Goals. Some observations were proposed on the destiny of these architectures in view of the 2021-2027 European Community programming and the important debate on the possible return to these settlements after the Covid-19 health emergency: critical considerations were formulated on the possibilities of intervention and those for the protection of permanence.

CHINESE DONG MINORITY DRUM TOWER: FROM KNOWLEDGE TO PRESERVATION

Shiruo Wang - Supervisor: Francesco Augelli

The Dong minority people are one of China's 56 ethnic groups, who live in the region delimited by southwest Hunan, southeast Guizhou, and north Guangxi. With a population of almost three million and a long history of more than 1,000 years dating back to the Tang Dynasty. Their architecture is intrinsically connected with the land and the topography, generating a harmonious relationship between nature and man-made structures. The Drum Tower is the most crucial public building and the landmark venue. Dong people identify strongly with the wooden Drum Tower.

Over the last two decades, the first stage of Dong buildings studies has been carried out focusing on the buildings typology. However, a

synthesis of the study of Dong Drum Tower, which involves an in-depth knowledge is still insufficient; current safeguard system concerning Dong Drum Tower are complicated as they require a re-organization and critical evaluation; the subject of preservation of the Dong Drum Tower has been rarely gained academic attention; The local villagers have insufficient financial support and knowledge for the preservation and maintenance although some of them have recognized the current problems.

Accordingly, this PhD thesis has been developed in two parts, part I is about the Knowledge of Dong Minority Drum Towers, part II is about Preservation of Dong Minority Drum Tower.

Part I includes two chapters, chapter 1 offers an in-depth description of the knowledge of Drum Tower with abundance of materials and documents based on the in-situ survey; chapter 2 displays an overview of the Chinese legislation context of Dong Drum Towers based on the previous exploration of Chinese vernacular architecture.

Part II also includes two chapters. Chapter 3 develops first research on the subject of recurrent problems of Drum Towers, ranging from fire risks, modifications, and bad maintenance interventions; chapter 4 starts from the Scandinavian experience of Stave Church Program, aiming to inspire and enlighten the preservation of Drum Towers; subsequently, the

protocol for knowledge activities, which suggests how a knowledge activity should be carried out, is analyzed; thirdly, vanishing Dong taboos and customs are addressed, aiming to regain the traditions of fire prevention; fourthly, multi-risks prevention in the Drum Tower is discussed, a huge project that integrates policies, regulations, technologies, engineering, local

culture and other measures. Finally, recommendations are proposed with the purpose of controlling the most fatal risks, ranging from fire, insect and fungi risks, with operable acceptance by local people and authorities.



Fig. 1 - Map of Drum Towers attacked by fire

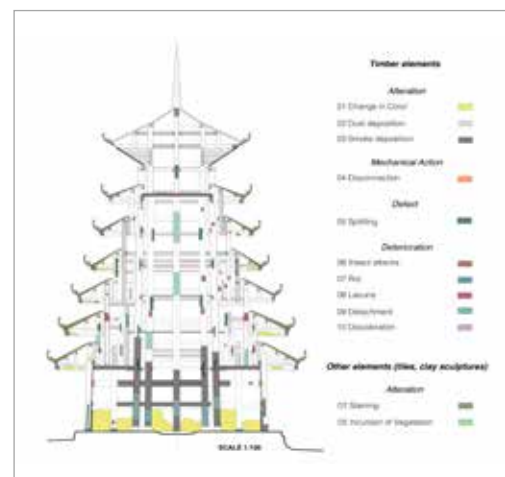


Fig. 2 - Damage mapping of representative section of Drum Tower



Fig. 3 - Dong locals around the fire-place in Drum Tower



Fig. 4 - A Dong village and Drum Towers