

MECHANICAL ENGINEERING | PHYSICS |
PRESERVATION OF THE ARCHITECTURAL
HERITAGE | STRUCTURAL, SEISMIC
AND GEOTECHNICAL ENGINEERING |
URBAN PLANNING, DESIGN AND
POLICY | AEROSPACE ENGINEERING
| ARCHITECTURAL COMPOSITION |
ARCHITECTURE, BUILT ENVIRONMENT
AND CONSTRUCTION ENGINEERING |
ARCHITECTURAL, URBAN AND INTERIOR
DESIGN | BIOENGINEERING | DESIGN |
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CHEMICAL ENGINEERING | INFORMATION
TECHNOLOGY | MANAGEMENT ENGINEERING
| MATERIALS ENGINEERING | MATHEMATICAL
MODELS AND METHODS IN ENGINEERING



Chair:
**Prof.
Mariacristina
Giambruno**

DOCTORAL PROGRAM IN PRESERVATION OF THE ARCHITECTURAL HERITAGE

The Doctorate Course in Preservation of the Architectural Heritage was first held at Milan based Politecnico back in 1983. On the strength of a solid, long-standing research tradition, today overarching attention will be paid to currently crucial themes such as protection, design, intervention over the built heritage and landscapes, developing sustainable uses of natural and man-made resources 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 Napoli Federico II; Università degli Studi di Bergamo; Istituto Superiore per il Restauro e la Conservazione ISCR; ICVBC-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 and restoration 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 ICVBC-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: research about the energy response of buildings or the studies carried about the seismic vulnerability of buildings and in the military conflict areas.

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KNOWLEDGE, DESIGN AND PRESERVATION OF THE RURAL ALPINE LANDSCAPE. CURRENT RELEVANCE OF EDOARDO GELLNER'S WORK

Angela Gagliardi - Supervisor: Prof. Maria Antonietta Crippa

The thesis investigates Gellner's methodology, that had not been systematically studied yet, including its implication on design or landscape and rural architecture conservation. The research started from the understanding of the strong link that, in Gellner, connects research and architectural designs on multiple scales. My hypothesis was that this connection stem from a precise and original methodology, particularly noticeable in the architect's work on landscape. The current relevance of Architect Edoardo Gellner's work cannot be limited to his most visible architectural designs (e.g. Villaggio ENI in Borca di Cadore) and has to be envisioned in the entirety of its components in order to be fully understood. Gellner's methodology, in his designs as well as in his research, is based on a framework that uses analysis of rural alpine landscape and conservation principles not to merely imitate traditional forms but to respect the identity of the place.

Gellner's personal life has had a great influence on his vision and work. Even if he can be considered a Dolomites's architect since he has lived there for half of his life, he had Istrian origins. Edoardo Gellner was born in 1909 in Abbazia (Fiume), still part

of the Austro-Hungarian empire at that time. The first part of his cultural education is therefore strongly influenced by Austria. The knowledge of German language would later allow him to access a greater variety of bibliographical references and would reveal crucial for the understanding of a border area such as the Dolomites. The second world war would bring another change in Gellner's life. Actually, having been enlisted in the army, he moved to Venice and attended IUAV University, thereby entering the Italian cultural sphere with masters such as Giuseppe Samonà or Carlo Scarpa. This cultural sedimentation of various layers would predispose him to open-mindedness and intellectual flexibility. In spite of offers to pursue the academic career, in 1946 he chose to open an architecture studio in Cortina d'Ampezzo and started to work on understanding the forms of rural mountain settlements and architecture.

The Gellner archive that the architect himself donated to the IUAV university at the end of the nineties has been a decisive help in this research work. The archive covers a long time period ranging from Gellner's transfer to Cortina in 1946 to his death in 2004. The analysis focus on the part gathering publications, editorial

projects, material for conferences and research project.

The analysis of bibliographical references used by Gellner has in part contributed, along with the rich literature already published on the theme, helped building a reference framework in which is situated Gellner's work on the general historiography of the main investigations on rural architecture lead from the end of 19th century on in the alpine arc. The research then progressively involved more academic fields (ethnography, geography, history, aesthetics, ecology), stimulating the debate on historical landscapes.

This knowledge path has been intertwined, from the early 20th century, with the construction process of a modern design on mountains and the discussion it allowed about antique settlements. Researchers and designers started understanding the historical and formal value of rural alpine architecture when the agricultural economic and spatial planning model, of which they are the expression, entered in a crisis and that mass tourism dictated rhythm and functions. The design issues brought by these phenomena has implications not only for the individual architectural projects, but also for the realization of new alpine cities dedicated to winter sports (e.g. the French *Ville de*

Neige) and spatial planning.

Gellner takes part in the debate on landscape, planning and conservation of the alpine territory from the INU convention in 1957. Through his correspondence and the materials, he kept, often yet unpublished, it was possible to retrace his involvement in APAO and INU, with the contribution of Samonà, and his participation in IN/arch.

Documents concerning Gellner's collaboration with IAM and INAUM and his correspondence with Mario Cereghini, unpublished and almost only traces of these institutions' work, have been particularly relevant.

The analysis of some of Gellner's contributions to the conventions allowed me to understand in depth his position on some of the themes inherent to the alpine landscape. In particular, the contribution presented to INAUM 1973 convention, to this date unpublished, allowed to deepen Gellner's position on the relationship between tourism and landscape transformation, including critical thoughts on speculation, guidelines for spatial planning and reflections on some examples of winter resorts. This contribution from Gellner is not only coming from theoretical analysis but is grounded in design experience, which is why I chose to include in my thesis a discussion of the architect's project for Sampeyre winter resort. This example allows us to deepen the problem, already tackled in Borca di Cadore, on an intervention leading to the anthropization of an almost intact natural landscape and of a development that

would have a strong relationship with ancient relations of rural landscape.

One of Gellner's guiding principles is the choice of less praised or even degraded locations where it was possible, thanks to an adequate design, to achieve operations of "landscape improvement". Gellner understood, already from the late fifties, that the problem was not inherent to tourism itself or new constructions but rather in the practical modalities of interventions and in a lacking of coordinated actions and a real landscape culture, leading to a land consumption of the best locations. The scale of interventions and the choice of locations therefore became of the foremost importance, taking into account not only visual alterations but also environmental and physical impact on the territory.

Gellner's point of view also grants importance to landscape ecology and forestry. His interest regarding that field dates back from the late sixties when he was invited by Lucio Susmel, ecology and silviculture professor at Padova University, to give a class of landscape historiography in San Vito di Cadore's mountain ecology school. Even though Gellner does not develop scientific theories on ecology, one can understand from his late sixties' works and research that he was one of the first ones to be able to connect ecology, planning and landscape conservation in a reflection that is still relevant nowadays. In a way, he event anticipates the orientations taken by the Alps Convention (1994) and the European Landscape Convention

(2001), particularly regarding the attention dedicated to degraded landscapes.

In his Misurina Lake recuperation project for instance, his ecological preoccupation influenced not only his definition of "landscape restoration", but also his intervention proposals. According to Gellner, rural landscape preservation should be achieved through design and planning tools, especially when dealing with compromised natural ecosystems. He therefore singles out bioengineering techniques new to the Italian context of the time as a means to mend the alterations thanks to nature itself.

Throughout his fifty years of professional activity and life among the Dolomites, Gellner developed criteria that remain relevant: the analysis of the environment and pre-existing structures, the valorization of degraded landscape, the attention to multiple angles of perception of the mountain, the quest of a language adequate to the particular location that would not depend on the commercial request for "fake rusticism". Gellner develops other themes in his in-depth study of eastern Alps, collected in his last editorial project (analyzed in the final chapter of my work) that could be developed further since they still are relevant nowadays. The analysis of the effects of fire and water on landscape, of the evolutions of land design, of the "death" of abandoned landscapes still are necessary to understand and maintain the resilience of territories.

STORAGE FACILITIES FOR THE COLLECTIONS OF ART MUSEUMS: EXPERIENCES IN ITALY AND ONGOING DEBATES AND PERSPECTIVES AFTER THE SECOND WORLD WAR

Marzia Loddo

This research focuses on the specific topic of storage facilities in art museums. The consideration and management of storage facilities is becoming an increasingly important issue due to the fruition of museums and their growing role in contemporary society. It is believed that in about 60% of institutions worldwide the conditions of storage areas are so devastating that using the collection for any museum activity has been rendered entirely impossible.

One of the aims of the research was to understand the role of storage facilities in art museums today is and what their future uses will be. Italy in particular was chosen as a case study because very little research has been carried out on this topic. Art museums have been examined more closely with different questions posed to museum directors and those responsible for the management of storage spaces at museums across Italy. The main investigation of the thesis focuses on when the debate regarding storage facilities began and when was it possible to see for the first time an organised storage for the preservation of the collection in Italian art museums.

The study was divided into four

main sections which aim at highlighting some fundamental aspects of the situation of storage facilities today and the various types found in the majority of European and North American museums (Chapter 1). Next, the situation of storage facilities in Italian museums today and historically since the period between the two World Wars (Chapter 2) was addressed. The thesis then frames Italian legislation (Chapter 3) and finally discusses the role of storages in a small circle of case studies identified in Italian State Museums following the Franceschini Reform of 2014 (Chapter 4).

The originality of this work has

been in the collecting of data and implementing the research (through archival documents, personal inspections and interviews with professionals) in order to provide a first understanding of the Italian context regarding art museums' storage facilities, a work never before proposed or carried out.

Beginning with the first two chapters, the results of the research have led to the characterization of different types of deposits in the art museums. These can be divided into two categories: on-site (fig. 1) and off-site storage facilities (fig. 2). Both these types have developed differently over time and are



Fig. 1 - Rijksmuseum, Amsterdam: the on-site storage facility in 1967 (Rijksmuseum, Amsterdam)

discussed and presented in this work.

The questions raised in the introduction are ultimately answered by this thesis. By starting with a historical description of the debate taking place in Italian museums before and immediately after the WWII, it was possible to analyse the circumstances that led to the creation of the first storage facilities in Italy. The main thinking during that period in Italy was the emerging concepts of the modern museum brought about by new models of storage, which with time came to be considered essential for museums. This period became the starting point for the development of other typologies that continue to reinvent the experience and enjoyment of museums for visitors even today. This phenomenon and the evolution of these places and their future transformation have been thoroughly described through the examples presented in the thesis.

Chapter 3 explains the various steps of the reform following a careful description of the Italian legislation after the Unification of Italy until the 2014 Reform. Moreover, it highlights Italian legislation and how it did not fully comply with ICOM standards. In particular, MIBAC continues to refer to the professional profiles of MIBAC 2010 where there is not, for example, the profession of registrar, among many others. This was also highlighted during the interviews with some directors who, having entered the autonomous museums in 2014, have found inconsistencies with international standards.

Through interviews with the directors of the State Museums, Chapter 4 explains the steps taken by newly autonomous museums in the last few years. This analysis of the contemporary situations of several Italian state museums, after the important reform of

2014, provided an understanding of the new importance of storage facilities in art museums and a renewed interest in the unexposed collection, compared to other museum activities. The results of the research are relevant in order to consider the historical moment in which they are located, providing a snapshot of the Italian museum situation during the Franceschini Reform. The situation in Italy has already changed with the arrival of a new government in June 2018, therefore this work serves as an important resource for future studies.

This work is the first step in recognising the problems related to storage facilities and to opening up this question to other researchers in order to improve and expand our knowledge of this important, yet understudied topic.



Fig. 2 - Centre de Conservation du Louvre, Liévin: rendering of the off-site facility, which should be inaugurated in 2025 (Rogers Stirk Harbour & Partners 2015).

PRESERVATION OF THE ARCHITECTURAL HERITAGE OF ARMENIA: A HISTORY OF ITS EVOLUTION FROM THE PERSPECTIVE OF THE EARLY 19TH CENTURY EUROPEAN TRAVELERS TO THE SCIENTIFIC PRESERVATION OF THE SOVIET PERIOD

Andreh Marouti - Supervisor: Professor Maurizio Boriani

Prior to the formation of the first Republic of Armenia in 1918, the general image of Armenian cities was similar to those of oriental Islamic world. The heritage of the traditional medieval Armenian architecture was not properly acknowledged by scholars. The non scientific, partial descriptions and representations of the nineteenth century European travelers was the only source available for Western architectural historians. The first comprehensive scientific study of Armenian architecture was published in 1918 by Josef Strzygowski based on the materials provided by Toros Toramanian and the systematic excavations by Nicholas Marr at Ani between 1904 and 1917. Strzygowski's polemical theory, claiming that Armenian architecture being the source of European Gothic architecture, ignited a long academic debate which marred further studies for at least the next half century. The revival of academic study of Armenian architecture in west occurred in late 1960s and early 1970s by the efforts of French and Italian pioneers. This thesis explores the history of the preservation of Armenian monuments starting from the late nineteenth century by scientific preservations at Ani up to the fall of the Armenian Soviet Socialist

Republic in 1991.

The first section provides a reconstruction image of Yerevan and Gyumri and their main monuments during the nineteenth century as projected by European travelers. The condition of major monuments including Yerevan Fortress and its mosques, the Sardar Palace, stone buildings of Gyumri and the Russian fortifications are studied in detail. This section ends with an appendix introducing twelve significant European travelers, concentrating on how their educational background, occupation and motif for travel affected their description of the monuments.

Section two starts with a discussion on the representation techniques used by travelers to record the image of Armenian architecture in their travelogues and follows by studying the European traveler's opinion regarding the origin of Armenian architecture and how it affects the European architecture.

In section three, the first systematic study of Armenian architecture is discussed and three pioneer characters, Nicholas Marr, Toros Toramanian, and Josef Strzygowski and their role in preserving the built heritage of Armenian architecture is studied in detail.

Section four is dedicated to the

opinions of significant architectural historians regarding the origin of Armenian architecture and its impact on European architecture. This section starts with a statistical study of two bibliographies including the publication of monographs and academic articles in Western languages. Based on the results of this study, this section is divided into three parts: 1- The Western, non Italian scholars, 2- Italian scholars, 3- Armenian scholars.

In section five, the theories and projects of preservation is discussed during the Soviet period. The attention to non-religious monuments and folk architecture, the excessive use of reinforced concrete in preservation projects, and the scientific restoration of Garni temple is explored. This section follows by three appendixes. Appendix two includes a catalog of twenty-eight restoration projects during the Soviet period and a study of Yerevan master plan concentrating on understanding the relation between generating a master plan and preservation of historic monuments in urban context. Appendix three introduces the administrative structure of the entities responsible for preserving the historical monuments in Soviet Armenia, attention to tourist complexes,

identification and registration of cultural monuments, the types of protective zones, and the education system of Moscow Architectural Institute. In appendix four, the author tries to represent the current situation of the preservation of historic monuments in Armenia by listing the major problems. Addressing the problems is out of the scope of this dissertation.

ALBANIAN TRADITIONAL ARCHITECTURE TRADITIONAL TIMBER ROOFS IN GJIROKASTËR, ALBANIA FROM KNOWLEDGE TO PRESERVATION

Federica Pompejano - Supervisor: Prof. Stefano F. Musso

Co-supervisors: Prof. Claudio Chesi; Prof. Giovanna Franco

The study of traditional architecture in the Balkans is always influenced by a variety of factors. Among these factors indeed, the Balkan peninsula's 20th century political context caused the proliferation of national architectural studies always contained within the borders of each of the modern Balkan states. Despite the limitations, achievements in the study of individual traditional architectural examples within each Balkan state have been considerable. However, a large synthesis of Balkan traditional architecture is still missing and, until now, the effort to go beyond the imposed national constraints has been rare. Concerning the Albanian case study, since the main parameters of any given architectural tradition are both cultural and historical, this research work firstly addressed the need to investigate Albanian architectural heritage protection issue, through a critical review of its legislative framework development and chronology, strictly connected to the recent country's historic communist past, to the consequent post-communist period and finally, to the implications induced by the inscriptions of the historic centres of Berat and Gjirokastrë in the

World Heritage List. This effort aimed to provide an overview of the Albanian legislation context in the field of architectural heritage safeguarding, which is currently appearing as a national priority for the Albanian Government and plays a very important role within the country cultural debate. In this way, traditional architecture also became for the author a tool for a better understanding of a certain cultural and historical context. The first Albanian research studies on traditional architecture were led during the Communist Regime (1944-1992) focusing the attention on the typological classification of rural and urban traditional architecture examples while pointing out the common and distinct characteristics enclosed in every type belonging to diverse

geographical areas. Thus, the thesis returns a detailed and critical narrative of the results of those extensive studies and specific surveying campaigns. From those studies, experts deduced that the Albanian traditional dwelling house exemplified, in its composition and architectural features, the dynamic evolution of its historical and sociocultural context. Historic centre of Gjirokastrë and its traditional architecture examples were previously studied and identified by Emin Riza, one of the first most important protagonist in the field of architectural restoration in the country. His intensive research work focused on architectural plan and volume development and characterization of the so



Fig. 1 - View of Teqe and Dunavat on the background (above) and Pazar i vjetër (below) neighbourhoods, Gjirokastrë (Pompejano, 2015)

called Banesa Gjirokastrite. In fact, they turned out to be a very peculiar type within the Albanian context, in which the long Ottoman domain influence contributed to shape different architectural characteristics even keeping local architectural and technological features. However, this research highlighted how the attention of the experts on traditional architecture omitted to deepen the technological aspects of Gjirokastrë traditional timber roof typology and related roof frameworks.

Timber roofs and timber-reinforced masonry were widely and systematically used in local traditional architecture all around Eastern Mediterranean countries. Traditional building technique in Albania, as well as in other areas of South-East and South-West of the Balkans, were characterized both by the use and availability of local materials and by skilled craftsmen who based their work on the experience and on the well-known use of these resources' properties, to better respond to the housing needs of the time. Concerning historic structures, traditional timber roofs were conceived

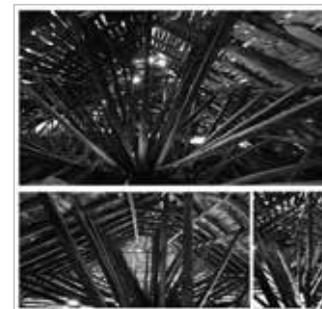


Fig. 2 - Examples of Gjirokastrë traditional timber roofs (Pompejano, 2015)

as load-bearing structures made of wood according to a heuristic and intuitive design, without structural engineering theory support. In Albania, the technological study of this kind of roofs, characterized by a very simple and poor constructive technology and deeply influenced by local constructive tradition, still turned out to be not adequately investigated.

The Albanian published sources shortly report that, all over the main cities and villages of that time, there was a spread of a common roof structure, called *stropil*, while in Gjirokastrë a completely different roof framework system was developed. No further details were provided about this last-mentioned peculiar traditional roof typology. Too long these structures have not considered worthy of the same attention as well as the buildings of which they are an integral part. Moreover, both their technological meaning and structural behaviour, are not completely understood by local professionals. Due to these issues, the final original contribution aims to fulfil this cognitive gap existing within



Fig. 3 - Handmade sketches representing joints between the timber roofs structural elements (Pompejano, 2016)

the technological analysis of the Albanian traditional building techniques. The aim is to provide a first and original contribution about traditional timber roofs in Gjirokastrë, which resulted to be very peculiar within the entire country.

How many different morphologies of these traditional roofs exist in Gjirokastrë? How many of these testimonies have come to us in their peculiar heuristic structural design? What are their recurrent timber frameworks and what their bearing timber elements? How are the members of the roof framework joined and stand together? What are their common failure mechanisms and recurrent decay causes?

Thus, the purpose of this research is two folded: to contribute to increasing knowledge of traditional building techniques in Albania while raising awareness of local professionals and institutions, inducing them to the need of deepening study and comprehension of the most frequent issues concerning the preservation of traditional timber roof frameworks of Gjirokastrë architectural heritage.

ALDO ANDREANI IN MANTUA: THE “CONSTRUCTION” OF HISTORICAL BUILDINGS

Niccolò Tasselli

The Mantuan twentieth century architecture was deeply marked by the figure of the architect Aldo Andreani. After a period of total disinterest and repudiation, in 1980, following the architect's death, the art critic brought to light a starting point of study. Recently the artistic activity of Andreani has been subject of new studies and Palazzo Te in Mantua dedicated him an exhibition curated by Roberto Dulio and Mario Lupano. The exhibition was showing an architect who «lives within the limits, attends a territory that is capable to produce fantastic accelerations while being internal to a solid and multifaceted disciplinary culture, modulated between architecture and other arts, plastic and decorative». The exhibition event also represented my first scientific approach to Aldo Andreani. This research work carried out during the exhibition built a solid foundation for this doctoral work which tries to provide a new interpretation to the artist personality, focusing on his relationship with the past architecture. The monographic exhibition has only rapidly taken into consideration the construction works carried out in Mantua, where, in the first half of the twentieth century, the architect

worked on some important monuments located in the city and the province. His creations were splitted between two very different worlds: the first is the late eclectic of the beginning of the century, and the second is the regime typical rationalist. His activity, started with “artistic” interventions, on the edge of *ex novo*, evolves according to a more modern line of respect of the building's history. The theme of the relationship with the antique becomes much more important in Mantua, where he grew up studying every single stone of the town. Andreani said: “I feel, I have inside me: Giulio Romano's broad and garden-like architecture, rhythmic and imaginative, and Alberti's infinitely large, severe and musical architecture. The art of the two masters felt the climate of the place and local materials were used: not stones, not marbles, but poor gravel and partially treated Mincio's sand”. When Andreani first approached the construction's world, a lot of ancient Mantuan monuments were left in abandon. It was a common thought that the beauties of the city had been stolen and the monuments got defaced by the Austrians first and by the French later. So the recovery of the ancient monuments followed the

same path as the one taken for the cult of the Martyrs of Belfiore, fallen for the independence of Mantua. Since the first restoration works, promoted and guided by the most important historians of the time, the key point was cancelling the traces left by the invaders, as a sort of post-unification *damnatio memoriae*. This principle is reflected both in the restoration works and in the new Andreani's architecture, which is not simply trying to “take back the buildings to its past glory”, as his colleague Luca Beltrami said, but is telling a new story, in parallel to the real one and free from any intruders oppression. The feeling that leads him is not nostalgia, but rather a fantastic and romantic vision of the past, which is visible in project tables



Fig. 1

and in some realizations like Casa Schirolli in Mantua (1911) and Casa Risi in Pietole (1912). Andreani's architecture often proposes a parallel story to the established one, in which the turbulent events of the past are erased and where the complex interlocking of volumes and shapes turn to an idea of harmony between arts, styles and people that always seems to be existed and destined to last forever. In this context, the Rocchetta in Bosisio Parini (1920-21) has to be taken as exemple. The visitor first impression is like observing a medieval castle with a tower. During a hypothetical “Renaissance” reuse of the first building, a new loggia with twisted columns was added. In the imaginary, this lodge had not been completed, leaving all the wooden decks in sight and only later on, temporary superstructure in pebble and rough wood completed the building. Despite the many citations of antiquity, his vision of history does not enter into mimesis, but is oriented towards the romantic



Fig. 2

idea, freely inspired by the thought of John Ruskin, of the building as a living being which it is destined to die. Ruskin's thought is reflected in Andreani's work and in the relationship with ruinism. The ruin isn't seen as a trace to follow in the reconstruction, but as a relic to be integrated with different and always distinguishable elements. This aspect is distinguishable in some Andreani's projects such as the building in via Rizzoli in Bologna (1911) and the sanctuary of Cittadella (1914-19). In addition to the constructive aspect, Ruskin suggests that at the basis of the “romantic revival” there should be an identity of mythology and history from which neoclassical and neo-Gothic elements can coexist within the same building, as in Schinkel or Jappelli's architecture, and as it can be found in Andreani's project. Myths and stories narrated in his architecture are evident from the moment of conception and are transformed into animated perspectives as in the case of the competition project for the Palazzo dei Sindacati (1927) or into

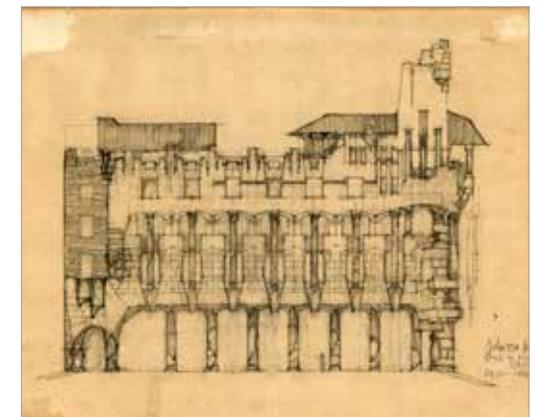


Fig. 3

drawings with particularly ornate details, such as the one of the new Camera di Commercio in Mantua (1910-14). In order to carry out this study, it was necessary to focus the attention over projects and construction sites in Mantua, where Andreani was able to experiment his first approaches to architecture and carried out some of the main interventions on buildings that strongly marked his entire work. In particular, great emphasis was placed on the construction sites of the monastic complex of San Francesco (1941-45) and the Palazzi Comunali (1913-44), whose project endured for most of the architect's life. The analysis is also extended to the construction practices adopted by Andreani within different materials and processes and to the relationships with the workers involved in the building construction. Each topic treated in this thesis investigates in order to insert the architect in the national and international artistic panorama.

HYBRID DOUBLE DOME: BUILDING PERFORMANCE AND CABLE-NET STRENGTHENING OF ESFAHAN SHAH MOSQUE DOME

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On 7th May 1611, the construction of the Esfahan Shah Mosque, became a part of the re-modeling of the Safavid capital. It is a building that adopts a glazed bulbous curvature as a hybrid double dome (HDD) of brick and wooden elements. This is one of the enormous masonry double domes (MDD) which suffers from the lack of knowledge in their building technology and structural behavior. This research aims to present the building techniques, construction sequences and conservation actions of the complex HDD of Shah Mosque through historical evidence, onsite surveys as well as structural analysis. This work also proposes a cable-net strengthening of the dome, based on its intrinsic capacities and an inspired pattern of HDD in the Chahar Bagh dome (1704), to reach a reversible, cost-effective, optimized and sustainable intervention that responds to the original concept and construction technique of the structure.

For these purposes, an overview on the development of MDD in Persia is provided. The different typological categories of MDD and HDD allow extending the discussion about constructive components and techniques, basic principles of form, structure

and equilibrium of domes. In particular, the investigation explores the geometry, interventions and consequences of both Safavid domes, the Shah and Chahar Bagh HDDs, during the last century. In the case study, the construction sequences and structural features constitute fundamental knowledge to recognize the role of each wooden element of Shah's HDD as well as any deflection in intermediate configurations of the dome which support in diagnosing the causes

of damage. To assess the dome's safety, the investigation examines subsequently the structural behavior of the Shah Mosque's HDD, through finite element (FE) modeling and analysis with Midas FX+ and DIANA 10.2, including non-linear analysis due to vertical and horizontal loading. Historical studies indicate that economic, social and aesthetic reasons required a lofty double dome structure in Naghsh-e Jahan meidan, which had to be optimized and hybridized by

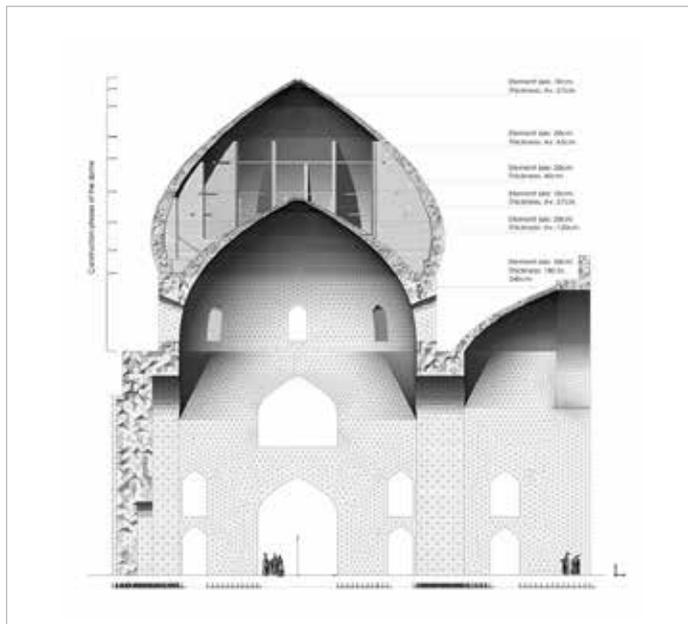


Fig. 1 - FE modeling at Midas FX+ for DIANA including 621,496 nodes. (A.T.Dinani, 2018)

walls and wooden elements. Time limitations of the initial construction, the earthquake of 1844 and the modern strengthening of 1932 are particularly relevant historical events. The techno-poetic solution for strengthening the frontal semi dome proposed by Moarefi in 1932 used an integrated structural system that gives an appropriate lesson for the proposal developed in this work.

The structural analysis reveals that the radial walls and the wooden ties prevent horizontal thrust of the bulbous dome and increase the capacity of the structure. The discussion on the crack patterns and the structural condition leads to plausible

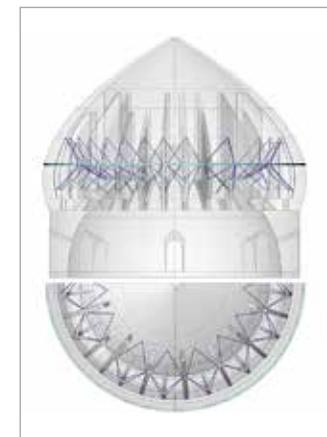


Fig. 2 - Cable-net strengthening for Shah HDD. (A.T.Dinani, 2018)

strengthening alternatives which would enhance the structural capacity of the existing Shah's HDD by tie-encircling components and deploying the pattern of wooden tie system in Chahar Bagh's HDD in order to join the walls to the domes.

All in all, this investigation primarily echoes that on-going conservation requires structural analysis that deeply considers historical evidence and performance. An attempt to bring together the contribution of the structural knowledge of Chahar Bagh and scientific measures of cable-net system has been made to achieve a more durable, flexible and compatible strengthening. As such, the obtained result is a combination of local practices and global modern codes.

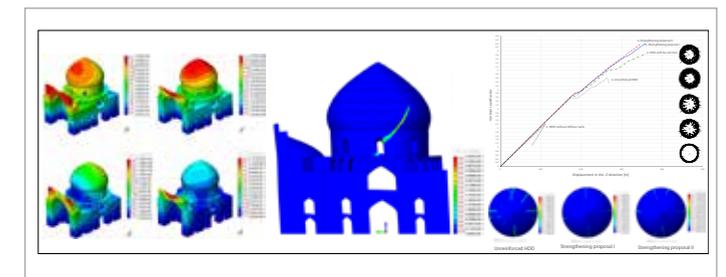


Fig. 3 - Results from DIANA 10.2 FEA: (left) Structural Eigenvalue; (middle) Pushover analysis +Y, maximum principal strain at post peak of capacity curve; (right) Nonlinear analysis, Capacity curve due to the vertical loading for different strengthening proposals. (A.T.Dinani, 2018)

FOR A DYNAMIC CONSERVATION OF THE RURAL CULTURAL LANDSCAPE. CRITERIA FOR MONITORING THE EFFECTIVENESS OF PROTECTION AND MANAGEMENT PLANS IN THE ASIAN CONTEXT

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Co-Supervisor: Prof.ssa Mariacristina Giambruno

The thesis places the conservation and management of historical rural landscape as the main focus of the research, by reconstructing how this peculiar heritage has to be considered a fundamental theme in the debate on the protection and management of the cultural landscape, giving the fact that it considers the role of man as agent on nature. The anthropic component is therefore decisive not only for the creation of the landscape itself, but above all for its protection and management over time.

Attention is focused on the change in meaning of the "landscape" concept in the debate that has risen in different disciplines (e.g. geography, ecology, history): a continuous change that has led to the need of a precise connotation in the concept of "cultural landscape".

The research has firstly addressed the effects that different disciplinary approaches have had regarding applied tools for rural landscape protection and conservation. Alongside the tools applied in the field of cultural heritage conservation, the approaches of environmental sciences, agronomy, and social sciences have therefore been

studied, in a holistic and inclusive perspective, which has to be considered as indispensable for the governance of historical rural landscapes. At first instance, still, preservation approaches applied over historical rural landscapes focussed more on a "crystallization" of these sites, taking only partially into consideration the sudden changes acting on them and, more important, the role of communities inhabiting and maintaining these sites.

In fact, the critical and multifaceted frame of issues presented by a continuously changing heritage led to the urgent need to define a combined and intersectoral

methodology of management and conservation, which emerged in particular in the last decade. Such approach should therefore deal with a complex background of matters and needs.

In order to better understand the impact of different methodologies developed on time, four different sites of historical rural landscapes in the Asian context have been analysed, in which the work of man has allowed the transformation of sites characterized by scarce resources and difficult access in territories still inhabited today.

It is highlighted how the application of the same plans



Fig. 1 - Sri Ksetra, Myanmar: Pyu site. The traces of the walls are highlighted in white, while the citadel is in red. In the archaeological area, within the walls, are still inhabited 18 villages and the presence of rural activities is prevalent.

and policies of protection and management (e.g. Management plan UNESCO - World Heritage Centre, GIAHS-FAO) have had even completely different effects depending by the context. The sites, located in Myanmar, Indonesia, the Philippines and China, are from this point of view particularly interesting for the rapid socio-economic changes that interest them, and therefore for the possibility to detect the impact of these transformations both in qualitative and quantitative terms.

The current active tools for the protection and conservation of historical rural landscapes, in particular those relating to management plans, although posing shareable objectives, appear instead lacking in monitoring the actual policies realized. The effective risk is that of not being able to control the real implementation of the proposed policies in a timely manner. These considerations have therefore led to an initial assessment of the



Fig. 2 - Sri Ksetra, Myanmar. Manual harvesting and irrigation in a field near the artificial lake

common problems encountered in the case studies examined, with the aim of setting up a flexible tool that allows to understand quantitatively and qualitatively the impact of the transformation phenomena underway, so as to propose a strategy of protection and specific management for each situation. Historical rural landscapes represent a dynamic heritage: therefore, such sites can represent clearly the picture of the quantitative and qualitative impact of macro-phenomena associated to the rapid development they are subjected to. Thus, the aforementioned outline can be expressed by monitoring transformations acting over these sites, in order to design appropriate policies that might act in contrast to threats and critical aspects. The interpretative model presented by the thesis, with the relative selected indicators for the evaluation of the phenomena in progress and the consequent management policies promoted, is structured starting from the critical analysis of research already

underway in the agronomic and economic field.

Thus, an attempt was made to propose an interpretative framework that would be applicable to the investigated historical rural sites, through a possible definition of site-specific management plans able to change correspondingly to the outcomes of a monitoring shared by all the stakeholders involved over time.

The proposed evaluation and operative methodology are therefore structured by starting from the needs that were deemed as most relevant and urgent in the analysis of the approaches applied to case studies taken into consideration, by the specific analysis of the criticalities detected in each of the analysed contexts and the evolution of the parameters of the transformation phenomena underway in them.



Fig. 3 - Sri Ksetra, Myanmar. The Baw Baw gi stupa (in the background), part of the built heritage listed as World Heritage within the site, is currently still used for ritual purposes. The artificial water lake, used as agricultural resource, is located at short distance from the southwestern city gate and the walls of the Pyu site.