

quaderni di assorestauro



WORKSHOP ITA-ASSORESTAURO LEBANON 2017

FOR ARCHITECTS,
RESTORERS &
ARCHEOLOGISTS

JULY, 24TH-28TH 2017

TRAINING WORKSHOP SEMINARS & COMMERCIAL MEETINGS IN LEBANON

ITA®
ITALIAN TRADE AGENCY

assorestauro®



Quaderni di Assorestauro



YEARS 06 | NUMBER 03
JULY 2017

edited by
Andrea Grilletto
Sonia Vallese

Graphic Project



Blumorgana | Viviana Maria Lucia Volpini
info@blumorgana.it

© copyright 2015
Assorestauro Servizi Srl

ISSN 2499-1864 (Print) - ISSN 2499-1503 (Online)

INDEX

■ SPONSOR PRESENTATION

— PRESENTATION OF “ITA”	4
— PRESENTATION OF “ASSORESTAURO”	5
— INTRODUCTORY NOTE - President of Assorestauro	6

■ PREFACE | A METHODOLOGICAL OVERVIEW

— GREEN ARCHAEOLOGY. LANDSCAPES, GARDENS, RUINS. INTEGRATING VOIDS AND IMAGES IN ARCHAEOLOGICAL SITES. Antonella Ranaldi	8
— MIND THE HERITAGE. Davide Del Curto	18

■ WORKSHOP SESSION

■ RESTORE IN LEBANON: A JOINT VENTURE COOPERATIVA ARCHEOLOGIA - ITALIANA COSTRUZIONI Cooperativa Archeologia Italiana Costruzioni spa	28
■ PRESERVING, KEEPING AND TRANSFERRING CULTURAL HERITAGE TO THE FUTURE: A FOCUS ON RESTORATION AND ARCHAEOLOGY. B5 srl	34
■ DESIGN AND SUPERVISION OF RESTORATION OF KHAN EL ECHLE (SAIDA) AND BAALBEK SERAIL (BAALBEK) AND TECHNICAL ASSISTANCE TO DGU (DIRECTORATE GENERAL OF URBAN PLANNING). Ars Progetti spa	42
■ RESTORATION OF THE TEATRO SOCIALE IN CAMOGLI, GENOVA Studio Berlucchi srl	46
■ THE RESTORATION OF THE PINNACLES OF CERTOSA DI PAVIA Kairos Restauri snc	54
■ THE SPANISH WALLS OF MILAN: MICROINJECTION AND GROUTING SYSTEM. Bresciani srl	62
■ LASER CLEANING OF CULTURAL HERITAGE. EL.EN spa	66
■ THE USE OF COMPOSITE MATERIALS IN STRUCTURAL CONSOLIDATION Fibre Net srl	70
■ ALTERNATIVE APPLICATIONS OF INNOVATIVE FRP-ANTI DELAMINATION AND ANCHORING DEVICES: THE PIETA' RONDANINI CASE STUDY. Kimia spa	76

■ INTERNATIONAL PROJECTS 82



ITALIAN TRADE AGENCY

The Italian Trade Agency - ITA is the Government agency that supports the globalization of Italian firms, implementing the strategies of the Ministry of Economic Development.

The Italian Trade Agency - ITA helps to develop, facilitate and promote Italian economic and trade relations with foreign countries, focusing on the needs of SME's, their associations and partnerships.

The Italian Trade Agency - ITA sustains Italian firms in their internationalization processes, in the marketing of Italian goods and services while promoting the "Made In Italy" image around the world, and it is directly involved in attracting foreign direct investments.

The Italian Trade Agency - ITA provides information, support and consultancy to Italian companies on foreign markets, promoting and fostering exports and cooperation in all areas – industry (consumer and capital goods), agricultural technology and agri-food, services, and training - with the aim of increasing and making more effective their presence on international markets.

The Italian Trade Agency - ITA works closely with the Italian Regions, the network of the Italian Chambers of Commerce, business organizations and other public and private entities.

The Italian Trade Agency - ITA headquarters is in Rome and its network of offices around the world act as "Trade Promotion Offices and/or Sections" of the Italian Embassies or Consulates.



asso**restauro**®

associazione italiana per il restauro architettonico, artistico, urbano
 italian association for architecture, art and urban restoration

Project coordinator:
Andrea Griletto

Assorestauro is the first association established in Italy for materials, equipment and technology producers and service providers for the restoration and heritage conservation sector. Among the associations involved in this sector, which includes various institutional bodies that represent designers or restorers, ASSORESTAURO is the first to finally give voice to the industry and the sector of specialised services, promoting their interests in promotional, legal and cultural areas. ASSORESTAURO seeks to represent the sector, both nationally and internationally. In regard to the Italian market, an increased sensitivity towards our architectural heritage, together with the diffusion of new technologies, point to a growth in the sector in recent years, both from the cultural point of view (debates, magazines, conventions, exhibitions) and from that of technology (innovative materials, machines and equipment, software, plant design etc.). This provides the industry with a great opportunity for increasing and strengthening the occasions for dialogue, which are often lacking, with professionals, on the one hand, and with institutions (Government departments, Universities) on the other. As far as foreign markets are concerned, there is a clear perception of the need to capitalise on the great prestige that Italy enjoys abroad in matters of cultural heritage and on the remarkable investment in cultural technology that Italian companies have made in recent years, in order to translate specialist skills and know how into business opportunities abroad.

ASSORESTAURO therefore has the scope of coordinating, protecting and promoting the interests of its associated companies, and fostering their progress and development, endorsing their products and services and representing them in their relations with the institutions and organisations working in the field of research and training, regulations and promotion. It also acknowledges the support and patronage of the main restoration Italian Trade Show and Events, recognising, together with its associated companies, the value of a trade fair appointment that has become an international point of reference.

The company carries out the following specific activities:

- it promotes studies and research and collects news, items and statistical data useful for sector information, and carries out studies, monitoring and analysis of the situations and developments in the markets;
- it participates in the elaboration and publishing of international regulations for the qualification of associated companies, assisting them and protecting them in the certification of the quality and security systems of their products and services;
- it directly and indirectly organises training or updating courses, research and conferences for the development and dissemination of technologies and the use of their products;
- it promotes and holds conventions, synergies and agreements among associations throughout the world.



Alessandro Zanini
Assorestauro President

Assorestauro is very glad to come back to Lebanon.

We strongly believe that the conservation of Cultural Heritage is one of the most powerful weapons for promoting peace and for joining different communities.

For that reason, last year, in march 2016, we renewed a collaborative relationship with Lebanon and its Cultural Institutions. Together with ITA Beirut, we promoted a fruitful meeting with nine Italian companies, involved in restoration and conservation of Cultural Heritage. The excellent dialogue with our counterparts gave us a great opportunity to learn and better understand the sector and the Country. The delegation visited some of the most important archaeological site of the Country, such as the Sidon Sea Castle and the Al Baas site in Tyre. Both the visits and meetings with the local cultural institutions emphasised the richness and high value of the Lebanese Cultural Heritage and the willingness of the Country to preserve it for the future as a determination of maintain alive its own root.

Today, in this workshop, due to the established relationship and the cooperation of our members Cooperativa Archeologia and Italia Costruzioni, joint-ventured on the archaeological sites of Baalbek e Tyre, we have the possibility of showing the Italian technologies and materials to Lebanese companies directly into the archaeological sites.

Thanks to the collaboration of UNESCO, it has been possible to widen the horizon of the meeting to the much-appreciated presence of the Syrian delegation, to whom we give our encouragement for the difficult task of the reconstruction that they would face.

Assorestauro won't miss its support and collaboration, guaranteeing from now on its maximum support for any possible common project or action.

Through the development of our relationship we shall build a bridge "made in Culture", innovation, mutual knowledge and respect.

Our Millennial Mediterranean History, must be a tangible sign and a real opportunity of development for our countries, and certainly a tool to break down several walls that are going to be built along the Mediterranean Sea.





Antonella Ranaldi
Head of the Commission
of Archaeology, Fine Arts
and Landscape of
the metropolitan city of Milan

GREEN ARCHAEOLOGY. LANDSCAPES, GARDENS, RUINS.

Integrating voids and images in archaeological sites

Integrating voids is a specific issue in restoration. A void may be more or less large, but generally not as much as to spoil both the structure and the image of architecture. The guidelines of any methodological approach to restoration are based on such principles as minimum intrusion, reversibility, authenticity-recognizability, which apply to all sectors and disciplines, including archaeology, architecture, the arts. In archaeology, the replacement of materials makes an exception and should be avoided altogether. In fact, matter – rather than form – makes the archaeological record. Only from the original materials can scholars infer the marks left behind by the past and interpret them, with a circumstantial approach, reasoning and modern analysis. History is written on matter, although the message needs to be decrypted. If the clues are not sufficient as yet, the day will come for others to succeed. Hence, while impaired, patchy, or wrecked, archaeological materials maintain their capacity of retrieving forms and stories long lost. Their value as antiquities remains prevalent and intangible. Therefore, the principle of authenticity-recognizability must rule over any reconstruction or anastylosis. The replacement or lining of masonry elements I have seen also in recent restorations in Italy, with the learned execution of *opus reticulatum*, *opus mixtum*, *opus testacium* with materials similar to the original stones or bricks, must be avoided. As a general rule, integrations should be restricted to what is necessary to guarantee stability; however, if the artistic value of a monument is prevalent – I am thinking of the Pantheon in Rome for instance –, wise and careful replacement can make sense for the sites that, thanks to recurrent restorations and reparations over time, have maintained continuity of usage and have remained “living monuments”.

Park of the
Amphitheatre in
Milan. Project of a
viridarium outlining the
elliptical plan of the
Roman amphitheatre
with boxwood, myrtle
and privet hedges,
surrounded by a green
arbour or a row of
cypresses along the
outer ambulatory (2017)



Siponto (Italy),
an interesting 3-D
installation
used to reconstruct
the early Christian
basilica with wire
mesh elements
(Edoardo Tresoldi, 2015)



Theatre of Sagunto
(Spain), restoration
and rehabilitation
project (Giorgio
Grassi and Manuel
Portaceli, 1993), with
a striking dominance
of new elements to
the detriment of the
remains of the theatre,
now reduced to a
typological record



Canopus of Hadrian's Villa (Italy) as restored by anastylosis in the 1950s, with reconstructed elements, replicas and rehabilitation of the pool



These principles have been made crystal clear in the Charters of restoration, but they have been often forgotten or neglected, also in recent times. As a consequence, some massive reconstructions are now seen, which are largely equivocal because they use the same materials and forms as the ones that were lost because of time, human action or nature. One should not forget that destruction can be memory.

After the Acropolis in Athens was destroyed under the Persian siege, the Athenians vowed that its debris would be kept as memory of the traumatic defeat. Some time later, Pericles broke the oath and asked Ictinus and Callicrates to erect the new Parthenon. The Parthenon, the Erechteion and the Propylea are the result of that anathema, one only an ambitious and promising prince could undo. A different story is when the arsonist and fame-seeker Herostratus destroyed the Temple of Artemis at Ephesus; in that case, the monument was soon rebuilt equal to the original one, with its forest of columns, in the ancient obsolescent style, which became topical again thanks to the reconstruction. These two examples so distant in time can be certainly associated to some more recent events.

How far can the integration of image be pushed to?

Can reconstruction be accepted?

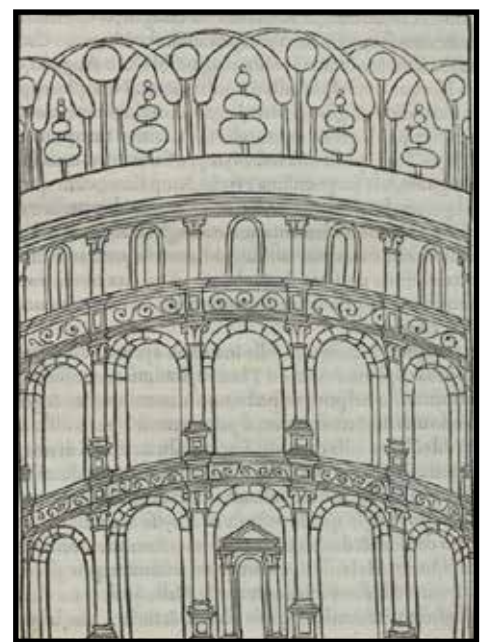
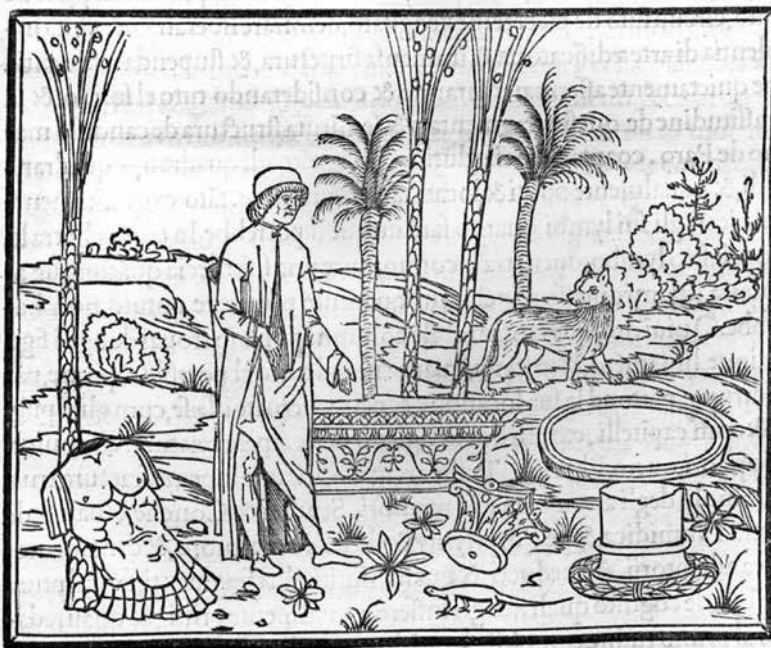
The risk of loss because of wars or natural disasters is extremely high today. The memory is still excruciating of the destructions perpetrated in Palmyra in August 2015 and, before then, of the Buddhas of Bamiyan being blown up in 2001. Among other projects in Bamiyan, architect Andrea Bruno, already a consultant to UNESCO for several sites in Afghanistan and the Middle East, suggested not to reconstruct. On the contrary, the architect sought help from geologist Claudio Margottini to prevent the rock from crumbling down. Here, the monks had dug a number of small cells near the two oversized niches that used

to accommodate the statues of the Buddhas, one for the taller one, 57 metres high, and one for the smaller one, 38 metres high. Andrea Bruno had already worked in the restoration of the site back in 1964, when he executed the channelling and drainage of rainwater that infiltrated the rock, the static consolidation and removal of the rubble that concealed a portion of the monumental complex, and the restoration, where possible, of the statues themselves. In 2015, a virtual reconstruction of the Buddhas as holograms was completed by the Chinese couple Zhang Xinnyu and Liang Hong, who sponsored their laser projection. On the other hand, I am little convinced by the recent proposals for the site of Palmyra, whose destroyed monuments are planned to be reconstructed as laser printed copies. Projections and virtual reconstructions may be a viable tourist attraction, a sensory experience helping to learn better, but they are only a performance, exactly like the light and sound effects – very captivating indeed – sometimes shown in archaeological sites, like in Luxor and, recently, in Pompeii.

An interesting solution lies in the work by Edoardo Tresoldi in Siponto, Puglia (Italy), who managed to resurrect the space of an early Christian church now in ruins with the help of self-bearing transparent wire mesh elements, 14 metres high, in an original match of archaeology and “air-drawn” contemporary art.

The restoration and rehabilitation of the Roman Theatre in Sagunto, Spain, by Giorgio Grassi and Manuel Portaceli (1993) met applause but also criticism to a much greater extent, especially after the completion of the works. As a matter of fact, the balance between reconstructed and original parts tilts to the great advantage of the new architecture, so that the remains of the ancient theatre are sacrificed and treated as a mere typological record, not as surviving archaeological materials.

Symbiotic relation between archaeological remains and wilderness in Poliphilo's *Dream (Hypnerotomachia Poliphili, Venice 1499)*. Poliphilo describes the plant species among the wrecked architecture and imagines the Colosseum crowned by the trees of a garden



A good example of reconstruction by anastylosis, including integrations and replicas, in a setting of high landscape value is the Canopus of Hadrian's Villa in Tivoli (Italy). Here, the fills of the 1950s were removed and the former pool rehabilitated, so that water now mirrors the columns with serliana arches and the replicas of sculptures. The reconstruction evokes the original complex built on the initiative of Emperor Hadrian, which included a *triclinium* for banquets down the channel and a Nilotic garden, reminiscent of the channel on the river Nile delta, hence the name of Canopus.

The topic I suggest here is exploring the potential of archaeological sites in the images of landscape and habitat painting, and namely that ruins are ideally suited to match the vegetation, lines and colours of landscape.

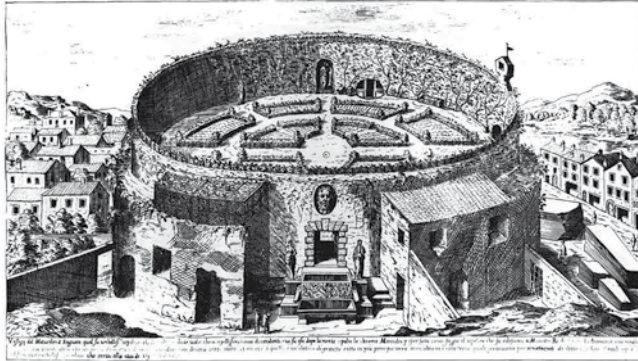
The myth of vestiges associated to nature is described in *Hypnerotomachia Poliphili* (Venice, 1499), in the dreamlike encounter of Poliphilo, the main character, with Polia, his lover, in the midst of ancient ruins lost in the wilderness.

"Among the broken and decayed places, wherof great sundrie wall weeds and hearbes, especially the unshaking Anagyre, the Lentisk of both kindes, bear's foot, dog's head, Gladen green, spotted luie, Centarie, and diverse suchlike. And in the myldered places of broken walls grew Howslike, and the hanging Cymbalaria bryers, and pricking brambles"

Francesco Colonna



Italian style garden planted on top of the Mausoleum of Augustus in Rome (16th century)



The Temple of Venus and Rome as restored by Antonio Munoz in the 1930s, with boxwood hedges in place of the ancient columns (Rome)



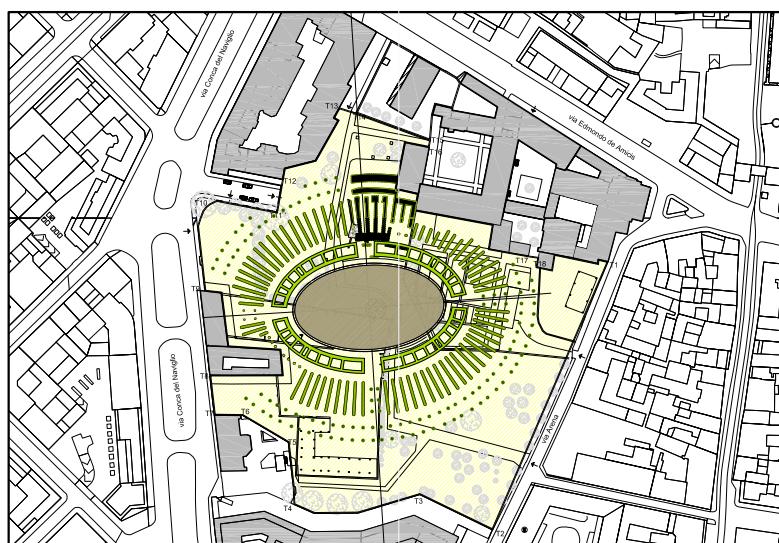
Valley of the Temples of Agrigento (Italy), Kolymbetra garden, an orchard rich in ancient citrus, fruit and centuries-old olive trees restored and reopened with the sponsorship of FAI (2013)

In the paintings by Bellini and especially by Mantegna from the late 15th century, antiquities are always seen wrecked, as their value originates from the aesthetic appreciation of the ruins themselves. The same applies to the drawings and paintings of vestiges of later times. The Dutch painter von Heemskerck (1498- 1574), after filling his notebooks with sketches of the vestiges of the Forum of Rome, portrays himself with the Colosseum set in a background invaded by vegetation (1553, Cambridge-Fitzwilliam-Museum). The landscapes of wrecked archaeology, either copied or imaginary, became a subject and a genre much sought after by collectors to decorate their estate houses. Also, the ruins themselves made an ideal setting for gardens and trails where peaceful walks could be enjoyed. Arcades and exedrae would be built to house statue collections, like in the 18th century residence of Cardinal Alessandro Albani in Rome, who appointed Winckelmann as curator of his collection. An unexpected while entirely realistic and documented image of the Colosseum colonized by vegetation is offered by some painters, like Abraham Louis Rodolphe Ducros between 1787 and 1793, and Rudolph Ritter von Alt in 1835.

In the early 19th century, the French architects who reached Rome in Napoleon's wake imagined a large garden interspersed with isolated ruins and tree-lined boulevards on the site of the Forum (*project Jardin du Capitol* by Louis Berthault, 1813).

Giacomo Boni, the distinguished archaeologist who started the scientific investigations of the Roman Forum, strongly believed in the association of ruins and vegetation. In the early 20th century, at the end of the excavations carried out on the Palatine hill to bring the Emperors' residences back to light, the archaeologist organized an Italian-style garden on the site, and planted cypresses and laurels along with some new species, like peonies and camellias. He wrote in his work *Flora Palatina* in 1912:

«My wish is to create a lush vegetation on the Palatine; I wish I can make people sense the educational influence generated by the loving care for plants, which some visitors seem to need urgently».



"VIRIDARUM, AMPHITHEATRUM NATURAE" • PARCO ARCHEOLOGICO DELL'AMFITEATRO ROMANO

1971 MARZO 2017

Park of the Amphitheatre in Milan. Project of a viridarium outlining the elliptical plan of the Roman amphitheatre with boxwood, myrtle and privet hedges, surrounded by a green harbour or a row of cypresses along the outer ambulatory (2017)

«The fur-like turf growing on a thin layer of humus on top of the ruins protects them against the scorching heat and frost, and creates a fabric of rootlets. The top of walls, made of brick or concrete and therefore prone to crumbling under weathering action, can be protected against infiltration by a layer of *cocciopesto*, on top of which a mixture of soil and hay seed is laid to trigger the growth of a green carpet. To this end, the meadow-grasses, among the fibrous rooted gramineous plants, and *Lippia repens*, a gracious and draught-resistant plant from the verberna family, make an excellent solution».

«Let any trees with a fairly wide crown stay well away from the monuments; therefore, exclude the invasive false acacias and ailanthus trees, which can tear the masonry apart until it crumbles. All countries should strive to protect their monumental flora».

Giacomo Boni

Ruins need to be maintained with care and love, not unlike a garden. Obviously, one has to distinguish between good and friendly plants, the ones with a limited growth, and evil weeds not adapted for archaeological sites, which must be defended against invasive roots. Giacomo Boni interpreted the adaptation of plants to the ruins according to a Romantic mood and to the educational function of caring for and respecting archaeological sites.

The site of Ninfa, in southern Lazio, Italy, dubbed “the Pompeii of the Middle Ages” by historian Gregorovius back in the 19th century, was resuscitated thanks to the reclamation and restoration of the wrecked stronghold carried out by Gelasio Caetani starting from 1921. Under the supervision of his mother, the architect transformed the area into a lavish garden fed by water and planted some rare species. The richness and amenity of the site today is owed to its thriving diversity.



In the 1930s, Antonio Munoz made an experiment of reconstruction and integration of the Temple of Venus and Rome, an elevated site on top of a platform overlooking the Colosseum, by planting boxwood hedges in place of the ancient columns of the temple. Raffaele De Vico suggested to redesign the garden found on the Oppian Hill with the same layout as the Roman baths erected on top of the Domus Aurea. Corrado Ricci conceived the exedrae of pine trees now standing on both sides of Piazza Venezia, at the beginning of Via dei Monti and Via del Mare.

In the examples mentioned above, the symbiosis of greenery and archaeology offers the chance to provide a 'romantic', or otherwise architectural and evocative, setting for the ruins. By greenery I mean not only the plants, but the overall arrangement and decoration contributing to turning an archaeological site into an enjoyable park. Such vestiges as the Aqueducts to the south of Rome have never failed to inspire a feeling of melancholy and torment, not even when the neighbouring landscape has changed, as shown in some scenes of the movie *Mamma Roma* by Pierpaolo Pasolini (1962), where the construction of the new Tuscolano district is seen progressing in the background of the ruins.

Recently, the FAI – Fondo italiano per l'ambiente (Italian Environment Trust) rehabilitated the garden of Kolymbetra, an orchard rich in ancient citrus, fruit and centuries-old olive trees in the Valley of the Temples in Agrigento, Sicily. Back in Antiquity, the garden featured a fish pond fed by artificial canals. In this protected haven, where pure water springing from ancient underground caves is still used for irrigation today, the monks of a neighbouring abbey originally started a kitchen garden, which would grow into an orchard in the 18th and 19th centuries. The Sicilians still call "jardinu" (garden) what has become a popular tourist attraction after the irrigation system was repaired.

To conclude, I will speak about the project of an *Amphitheatrum naturae* – a green amphitheatre – I am currently developing in Milan. Few people know that Milan used to have an amphitheatre almost as large as the Colosseum. The city's representation of its own past and vestiges has been distracted to the point that their enhancement has been largely neglected. The care, custody and maintenance of historic sites can find new design solutions in the symbiosis of ruins and greenery, with a landscapist, romantic, architectural approach respectful of the principles of conservation, authenticity, reversibility. While adding or integrating architectural elements is not a very convincing solution, greenery opens the way to creating overtly transient settings capable of improving the enjoyment and enjoyability of a landscape of archaeological ruins. Of course, some precautions must be taken; for instance, trees must be planted into buried vats to avoid contact and the risk of root infestation, and vestige-friendly species must be chosen, as maintained by Giacomo Boni. I have mentioned above landscape painting, the experiences of Giacomo Boni in the Forum, of Antonio Munoz in the Temple of Venus and Rome and of Corrado Ricci for the pine tree exedrae of Piazza Venezia: all these are representative of the basics of an archaeological park, the union of nature and archaeology. Vegetation, terrain modelling and green furniture can be designed purposefully for archaeological sites.

In line with this idea, I suggested to create a viridarium to revive the archaeological park of the Roman amphitheatre of Milan. An unprecedented *Amphitheatrum naturae* of ancient topiary species (boxwood, myrtle, privet, cypress), the large elliptical garden replicating

the shape of the missing amphitheatre will match and integrate the archaeological finds on site, that is, some stretches of the radial walls of the Roman monument.

The original Ceppo lombardo stones of the Roman amphitheatre were recycled to build the Basilica of San Lorenzo nearby and are now visible, as enhanced by Gino Chierici, in the foundations of the church down the stairs leading to the chapel of Sant'Aquilino. The new *Amphitheatrum naturae* will be included in an itinerary linking the archaeological park, the standing columns nearby, San Lorenzo church and the park of the Basilicas. In the same area, a stretch of the medieval walls and of the banks of the waterways of Milan was brought back to light during the excavations for the subway. Some of the finds will become permanently displayed in the hall of the subway station.

The world's awareness must be raised to the protection of highly vulnerable sites. To this purpose, during Expo 2015, the city of Milan hosted the *States-General for Culture* rallying the ministries of culture of over 80 countries worldwide, the representatives of UNESCO and of other international organizations, who were called to commit jointly to the protection of the world cultural heritage now endangered by natural disasters and wars. The exchange of international experiences can help direct and support the protection of archaeological sites, with special care for such sites as Baalbek and Tyre in Lebanon, which make the object of the present mission and workshop named "Lebanon – Ws ITA" (Beirut, July 24th-28th, 2017), organized by ITA (Italian Institute for Foreign Trade) and Assorestauro (Italian Association for the Architectural, Artistic and Urban Restoration).

I'd like to thank the Lebanese authorities for their warm welcome and wish them a profitable collaboration with Italy. Lebanon's flag shows a green cedar, a beautiful majestic tree found as ornament of several parks and gardens, which once grew extensively in the mountains of most countries of the Near East. The cedar is a symbol that ideally matches the history and rich cultural heritage of this Country.

The flag of Lebanon,
the green cedar standing
in the middle matches
the country's history
and rich cultural heritage



Davide Del Curto
Associate Professor in
Architectural Preservation

davide.delcurto@polimi.it
www.diagnosticacostruito.polimi.it

MIND THE HERITAGE

Life is increasingly being conditioned by the widespread digital technology and the internet. They have also entered the field of historic heritage and conservation for a long time, with academical researches, high-skill job opportunities in the field of 3D survey and modeling, dissemination and services to the public. To what stage is the relationship between digital technology and historical heritage?

These lines offer some hints, starting from recent outcomes in the field of neuroscience investigating as the internet and digital technologies are changing some of the core functions of our mind, such as the ability to pay attention and remember. Can historic heritage play a role in this process? What consequences to the conservation field?

CONSERVATION AND PRODUCTION

Conservation is nowadays an autonomous discipline, since heritage was recognized as a capital asset. Heritage conservation is thus an economic sector with many professionals and interests involved. Nevertheless, conservation was a field of social commitment for decades. Building conservation, in particular, has defended the historic cities against the pressure of urban speculation in Europe for two centuries, since the rise of modernity to the post-crisis reaction. A certain primacy of practical aspects and application technologies in the field of conservation has to be traced back to the early 1980s when the hard sciences entered the field of conservation and moreover of building restoration. Chemistry, physics, mineralogy, etc. have thus found a great opportunity of development in these areas, for both research and industry, from the production of special materials for strengthening or hi-tech systems for surface cleaning, to the large chemical industry of polymers for the building and restoration sector. Assorestauro and its members were undoubtedly born just downstream of this process.

CONSERVATION AND CONTEMPORARY VALUES

As a consequence, it has been recently observed as the so-called contemporary theory of conservation focused on the conservation activities and professionals, more than on the value-base for such an activity (MUNOZ VINAS 2012; CLAVIR 2002).

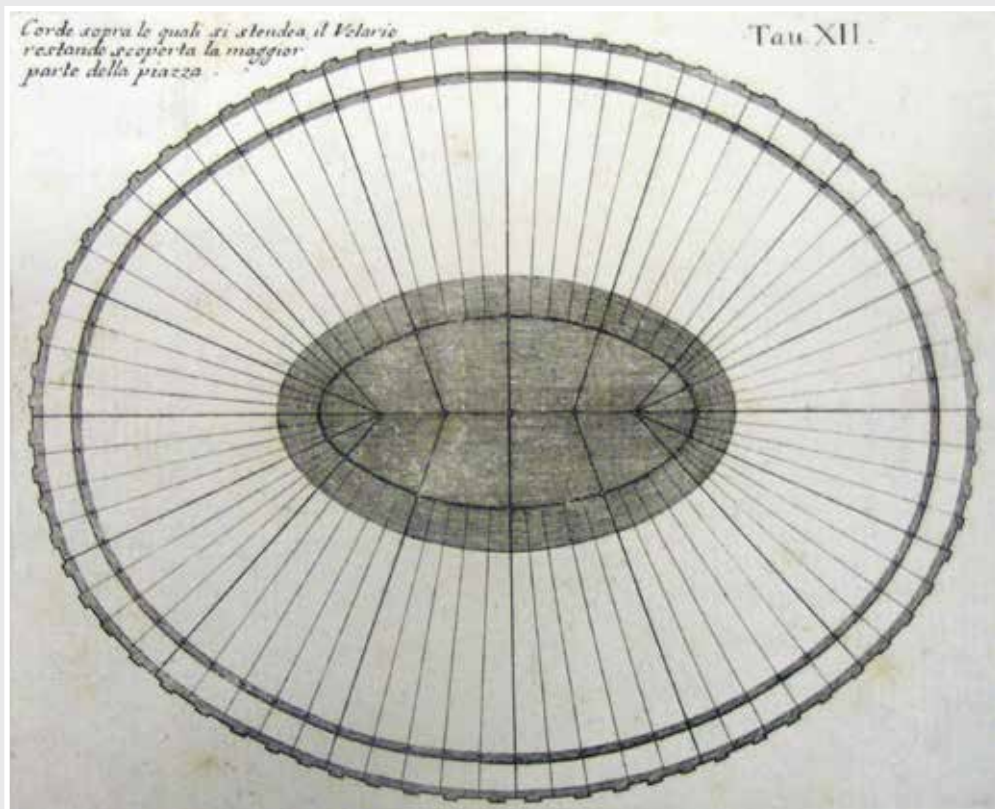
The framework of cultural values where conservation of built heritage rests on has significantly changed in the last decades. Conservation is inherently a part of modernity, since it has developed in Western Societies in the late XIX century, as an intellectual reaction to industrialization and urbanization. Some architects, historians and intellectuals looked for tangible objects, which could be preserved, reminding of the past and thus criticizing such a way of development. The effort was to define the past as a different world from the one we live in and positive (LOWENTHAL 1985). Conservation has aimed to make the past possible to relive by preserving the tangible evidence of its existence, that is heritage. This way national identities have been built in the XX century. More recently, the so-called cultural turn has stressed a postmodern view on cultural heritage as the product of

uneven power relations in our society where weaker groups lack the possibility to define what they believe is worth preserving. According to this view, such a possibility just belongs to the experts of heritage, which may represent the ethnic majority in society (cultural imperialism). Conservation has thus been criticized for its tendency to consider heritage as a field exclusively defined by experts (SMITH 2006).

Conservation has been then asked to follow the shifting political views and changes in society such as de-industrialization, immigration and the quest for inclusivity in the global climate change scenario. Nations are today only one of the places where collective identities take place, along with the biggest cities, the Mediterranean basin or the European community. They are understood as a mosaic of ethnicities where, at least theoretically, every piece has the same value. Since late XX century, the attempt to update the value-base for Europe has stressed the idea of a community not primarily based on national, but rather on ethnic identities. The cultural pluralism of Europe is nowadays challenged by a number of identity markers such as class, gender, generation or lifestyle, and there is no longer a consensus that cultural heritage is a resource of benefit for the whole society, but rather for groups or even individuals. In such a scenario, a question may be: whose values building conservation is preserving?

We may ask conservation to be up to date in a rapidly changing society, to acknowledge the social quests of multiculturalism, community involvement and local development. It means to re-assess the cultural, economic and social values of the built environment, even asking if values are still so intrinsic to the materials of a heritage building (AVRAMI&MASON 2000). In this perspective, we thus consider some possible updates to the relationship between the real historical heritage e.g. an object, building, landscape, and its digital image which has been the object of debate since years (DEZZI BARDESCHI 2005).

Plan of the velarium over the Arena in Verona. Engraving by Scipione Maffei, *De gli anfiteatri, e singolarmente del veronese*, Verona, 1728, pl. XII. COARELLI, F. & FRANZONI, L. *Arena di Verona: venti secoli di storia*. Verona, Ente autonomo Arena di Verona, 1973



CONSERVATION AND DIGITAL TECHNOLOGY

A couple of weeks ago, I prepared some photo-rendering of a decorated room at Palazzo Diotti in Milan, which is undergoing restoration to remove the monochrome painting of the 1980s and to highlight the previous decorated walls. Photo-rendering was to predict and illustrate the possible outcome of the restoration, based on the already existing stratigraphic essays. Palazzo Diotti was built in the 17th century, restored in the 18th and 19th century. The point was to determine how many layers of paint to remove that is to decide whether to highlight the 19th or 18th century decoration.

When the restorer began to remove the painting, the sequence of decorations concealed under the most recent revealed as we expected. We thus decided to remove the 20th century layer (worthless) and the 19th century (very deteriorated) to highlight the 18th century decoration. After removing several square metres of both layers, the restorer revealed how much the 18th century decorations were difficult to recover as it was much more deteriorated than I had designed with Photoshop. At that time, my first thought was not “you have to find another solution” but “press CTRL+Z”. (Fig.1)

Though only for a while, my technology-accustomed brain thought I could cancel an erroneous action in the real world just as I am accustomed to retouch a bad image on the computer. This made me reflect about two things.

First: technology is actually changing the way we live, from doing digital shopping, to the way we communicate and work. Technology has penetrated my life so deeply that the more I spend time online, the more the border between “real” life and “virtual” life tends.

Second: what impact may such a pervasive technology have on historical heritage, that is my job and my passion? I wondered what stage is the relationship between the real object that is the historical monument and its digital image, at every moment and everywhere present on a mobile and internet?

Fig 1.
SPalazzo Diotti, Milan:
stratigraphic samples (by
CIPE, Milano), photo-
simulation (By L. Valisi
and S. Celli), a phase of
the ongoing restoration.
Photo: DDC



Ante 1803

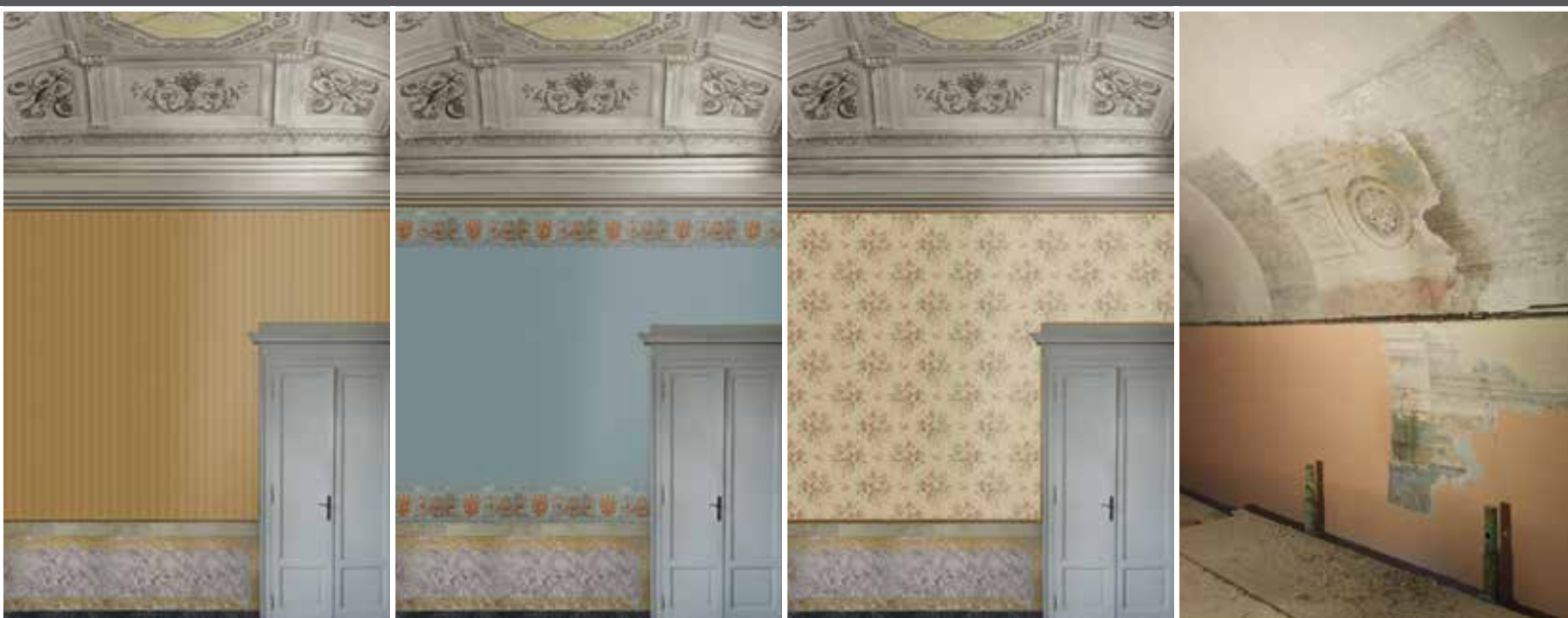
CONSERVATION AND ATTENTION

Everyone has experienced how the ability to concentrate for hours is challenged by the fast and tech-driven world we live in. According to a research published by Microsoft, the ability to pay attention decreased by 12 to 8 seconds from 2000 to 2013. Our attention dropped because we are so stressed with new information that if any content takes longer than a few seconds, our brain starts searching for the next hit of excitement. In fact, the number of “jolts per minute” is the unit of measure for media content producers and advertisers to comply our demand for new information via TV and mobile devices (a “jolt” is a change in action that keeps us watching a show). Our reduced attention spans links to the so called “attention economy”:

the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes. What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it (SIMON 1971, pp. 40-41).

Historic heritage is not immune to the “attention economy” and may benefit or disadvantage from it depending on its ability to stimulate this constant demand for new information. Heritage is then called to produce images able to capture attention when viewed on the small screen of a mobile phone or tablet.

A recent example is the Paleo-Christian Basilica of Siponto, Italy. The archaeological remnants of the basilica were used as the basis for building an artistic installation consisting of a 14 meters high wire mesh structure suggesting the “wireframe” volume of



Ante 1870

Ante 1942

Ante 1953

the ancient basilica. A heated debate sparked about this achievement weighing 7 tons and costing 3.5 MEuros. According to the opponents, it does not protect the archaeological remains and, on the contrary, carries them an additional weight and exposes them to the risk of contamination due to the rust. According to the supporters, however, the volume of “wireframe” helps site visitors interpret the archaeological remains (PANE 2017, p. 129). For sure, the operation was done with great care for communication via TV, newspapers and internet. The images of the large metal structure in the warm sunset light are much more seductive than those showing the only archaeological remains, especially when viewed on the small screen of a mobile for eight seconds or less (Fig. 2).

Fig 2. A 14-metres tall wire mesh installation reproduces the shape of the 12th century Basilica of Santa Maria in the Archaeological Park of Siponto, following the shape of the remains (Ministry of Cultural Heritage and Tourism, Superintendence of Puglia (Artist: E. Tresoldi; curator: S. Pallotta; structures: Cobar SpA) Photo: B. Mondelli/gigart. altervaist.org

A second example is the international competition promoted by the City of Verona in 2016 to design a roof protecting the Roman amphitheater from the weather. Most of the entries have proved to be of high architectural quality and supported by interesting solutions both from a constructive, and historical/philological point of view. However, it is quite evident to those who have familiarity with architecture and archaeology how such an idea is inadequate from a scientific point of view and disproportionate to the problem it aims to solve. Even in this case, the media resonance of the competition, here condensed in a couple of more imaginative than explanatory photo-rendering, has produced the media resonance that was so desired during the election period. Fortunately, other studies have been working over the past 10 years to reduce the amphitheater’s degradation due to rain and moisture. These researches have developed much simpler and cheaper solutions based on planned and seasonal maintenance. After the hangover of the roof, they will hopefully work again on this serious issue (CASTIGLIONI&COFANI, 2017). (Fig. 3)





Fig 3.

Architect R. Ventura's was awarded 3rd place within the competition for an openable roof to protect the Roman Amphitheatre of Verona from the decay due to weathering. A central ring over the arena is supported by exterior slender columns not affecting the walls. The cover made of sheets takes inspiration from the ancient canopies.
Photo: Comune di Verona/3Arc Studio

CONSERVATION AND MULTITASKING

Another way that technology threatens our ability to pay attention is by forcing us to be constantly multitasking: we chat on WhatsApp as we attend a meeting, browse Facebook while we prepare a meal, check the mail every 5 minutes while writing a paper. It has been noted as this is an induced and unwanted condition that increases our level of stress. It has also been observed that our brain is not naturally suited for dealing with multiple items at the same time. For this reason, instead of increasing our productivity, multitasking reduces our efficiency:

We can't multitask well, no one can. (...) What we're actually doing when we think we're multitasking is just switching back and forth between tasks (...) We overestimate our ability to focus – so when you're concentrating do one thing and close down multiple screens and windows to avoid distractions. It also symbolically signals to your brain you need to focus. (CHATZKY 2016)

On the one hand, the historic heritage can be damaged by this constant urge to multitasking, since it is likely to be reduced to one of the many fleeting items our mind is called to cope with. On the other hand, heritage can also be a refuge from this constant threat. In fact, when we experience a piece of heritage while studying, restoring or simply visiting an archaeological site, a historic building, a collection in a museum, we are subject to a demand for a high-quality attention. This naturally supports our spontaneous weakness to linger in the dozens of distractions that would lead us to squander our attention into irrelevant fragments. It does not mean that enjoying a monument, a historic building or any other piece of heritage is necessarily a boring experience or a strain on our mind so much as it can not be counted among the pleasures and leisure to which free time is reserved. On the contrary, the real experience of historical heritage is an oasis where we finally put in stand-by all the items looking for short and immediate answers and where we can instead continue to exercise our ability to think deeply.

Instead of reducing the richness of our historical heritage to the contingent needs of multitasking, we should focus on its naturally polysemous content. In fact, every monument / document embodies a number of different meanings and messages that can be decoded and interpreted at different levels and to the benefit of different users. This is a specific task for museums, where specific paths are conceived for each kind of user. Galleria Nazionale delle Marche – Palazzo Ducale di Urbino, is a good example. Along with the traditional diversified routes for children, boys, experts, etc., a path for low vision users has been developed. Digital technology has been helpful, for example by facilitating the creation of 3D models that allow blind people to “see” some of the major Renaissance masterpieces through the touch and other senses (CLINI et al. 2017).



CONSERVATION AND AUGMENTED REALITY

The Ara Pacis is one of the major legacies of the Roman Empire as it is an altar dedicated by Emperor Augustus to the “Pax Romana” in 9 BC. The Ara Pacis was overwhelmed during the Middle Ages and was recovered from the 16th century. In the 1930s it was placed in a large display-case-shaped building along the Tiber River. Since last year, the “Ara com’era” (Ara as it was) exhibition allows you to visit the monument with the aid of a pair of glasses for augmented-reality. The visit consists in a walk around the monument along 9 points of interest (POI). Each point provides 3D multimedia contents telling the characteristics and history of the Ara Pacis (ARCHEOMATICA 2016). (Fig. 4)



Fig 4. Since 2016, the “Ara com’era” (Ara as it was) exhibition allows you to visit the monument with a device for augmented-reality providing 3D multimedia contents and suggesting how the monument has changed during centuries. Photo: arapacis.it

Beyond the playful aspect and audience appeal, it is interesting to use the augmented-reality devices as a tool to show a hypothetical, though philologically well-supported, reconstruction of the aspect the monument had when it was built. Sophisticated digital images effectively enrich the storytelling, without affecting the material authenticity of the monument. For example, looking at the Ara Pacis through the viewer, you may see a simulation of its surfaces as they were colored in antiquity, though colors are naturally virtual. It is then interesting to observe as the use of such portable device allows a visitor to enjoy additional content just as he / she is visiting the monument and physically interacting with it, for example walking around. As a visitor enjoys the real and virtual content at once, he / she spontaneously appreciates the difference between the authentic value of the real monument and the contemporary and experimental value of the image representing a research hypothesis (BACCA et al. 2014).

CONSERVATION AND MEMORY

Memory is perhaps the brain ability most seriously affected by digital technology. The so-called “Google effect” represents a fundamental shift in how we remember by using the internet to outsource our memory storage like a remote hard disk. In 2011 a seminal study by Columbia University explored the way we use our memory since we have internet. Results show how the internet has become a primary form of external or transactive memory, meaning that we use it like spare storage for our brains, filing many information like memories, things we have done or studied. As a matter of fact, before the internet allowed so many data to be immediately available to users, to do a research, you did need to consult an expert or go to the library and find the right book. Being aware of this process, we were stimulated to store the hard-earned information. Now we know we will be able to access it again when we need it, and we thus choose not to remember because we do not have to. This may have relevant consequences, e.g. reducing or changing our ability to focus onto details, as when we encode information we tend to do it more superficially.

The “Google effect” affects our most basic functions also, like our navigational ability. Researchers have recently studied as the instinctive ability to keep the orientation by figuring the right route from a place to another, takes place in a specific part of our brain, which stops working when we use a satnav for long time (JAVADI et al. 2017). Using a satnav puts in a sort of stand-by some parts of the brain that would otherwise be used to simulate different routes. The “Google effect” does not make us less intelligent, but our brain (particularly some parts) is just less engaged. It is thus vital we keep memory fit, not to lose mental agility. Our mind, in the end, is able to adapt quickly and react to the environment and its stimuli. Therefore, it is not surprising that our concentration and memory capacity is changing in an environment dominated by digital technology and the internet. We may guess that if we devote less resources to storing information, this can free up space and mental energies for other activities, hopefully creative or inventive.

Historical heritage can play an important role in this process, because its enjoyment requires these faculties in use. When visiting an archaeological site for instance, we are called to mentally rebuild the image of the lost city on the basis of the view of its remains.

This exercise keeps our attention, memory and orientation skills fit. In addition, when visiting a historical site, we are stimulated to remember and process the memory of what we have previously studied only on the basis on its image, on a book or video (e.g. its history and shape). This instinctively happens in front of the real thing, as if memory was there looking for a confirmation. Moreover, the onsite experience of a historic, architectural and archaeological heritage is a source of powerful images and other multisensory stimuli largely non-replaceable by virtual reproduction. These images and stimuli do create intense emotional reactions that are indispensable to fix a memory in our brain, as well known since the antiquity, particularly the technique of “architectural mnemonic” already described by Giordano Bruno’s “Art of memory”. For this reason, the real experience of archaeological monuments and sites remains necessary both for mental health and education, particularly for young people.

REFERENCES:

- ARCHEOMATICA (2016), *L'Ara com'era: Un racconto in realtà aumentata del Museo dell'Ara Pacis*. Archeomatica, October, 10th
- AVRAMI, E., & MASON, R. (eds.) (2000), *Values and Heritage Conservation, Research Report*. The Getty Conservation Institute, Los Angeles
- BACCA, J.; BALDIRIS, S.; FABREGAT, R.; GRAF, S.; KINSHUK (2014), *Augmented reality trends in education: a systematic review of research and applications*. *Journal of Educational Technology & Society*; Palmerston North 17.4, pp. 133-149
- CASTIGLIONI, G., & COFANI, M. (2017), Verona, solo bufale nell'Arena. *Il Giornale dell'Architettura*, May, 10th
- CHATZKY, J. (2016), *3 Reasons Multitasking is a huge waste of time (and how to stop doing it)*. *Forbes*, May, 6th
- CLAVIR, M. (2002), *Preserving what is valued: Museums, Conservation and First Nations*. UBC Press
- CLINI, P.; NESPECA, R.; RUGGERI, L. (2017). *Virtual in real. Interactive solutions for learning and communication in the National Archaeological Museum of Marche*. *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLII-5/W1, pp. 647-654
- DEZZI BARDESCHI M. (2005), *Geomatica per la conservazione, ovvero: l'ombra e la cosa*. *'Ananke*, 46, pp. 126-133
- JAVADI, A-H.; EMO, B.; HOWARD, L.R.; ZISCH, F. E.; YU, Y.; KNIGHT, R.; SILVA, P.J.; SPIERS, H.J. (2017), *Hippocampal and prefrontal processing of network topology to simulate the future*. *Nature Communications* Vol. 8, No. 14652 (21 March 2011)
- LOWENTHAL, D. (1985), *The past is a foreign country*. Cambridge University Press
- MUÑOZ VIÑAS, S. (2012). *Contemporary Theory of Conservation*. London & New York, Routledge
- PANE, A. (2017), *Per un'etica del restauro*. FIORANI, D., (editor in chief) *RICerca/REStauRo* / MUSSO, S., (editor) *Questioni teoriche: inquadramento generale*. Roma, Società Scientifica Italiana per il Restauro dell'Architettura / Edizioni Quasar, 2017, pp. 120-133
- SIMON, H. A. (1971), *Designing Organizations for an Information-Rich World*. GREENBERGER, M., *Computers, Communication, and the Public Interest*. Baltimore, MD, The Johns Hopkins Press
- SMITH, L. (2006), *Uses of Heritage*. Routledge, Oxford
- SPARROW, B.; LIU J.; WEGNER D.M. (2011), *Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips*, *Science, New Series*, Vol. 333, 6043 (5 August 2011), pp. 776-778
- STORM, B. C., & STONE, S. M. (2015), *Saving-enhanced memory: The benefits of saving on the learning and remembering of new information*. *Psychological Science*, 26, pp. 182-188

Roberta Bianchini
Renzo Bozzi
Andrea Cali
Stefano Coccia
Giuseppe Sammartino

RESTORE IN LEBANON: A JOINT VENTURE COOPERATIVA ARCHEOLOGIA - ITALIANA COSTRUZIONI



cooperativa archeologia

info@archeologia.it
www.archeologia.it



italianacostruzioni

info@italianacostruzionispa.it
www.italianacostruzionispa.it

The JV between Cooperativa Archeologia and Italiana Costruzioni is in charge on the restoration and valorization project in Baalbek and Tyre. Baalbek was enlisted in UNESCO heritage sites in 1984, because of the greatest importance of its history through the ages and its archaeological remains. It is located in the Beqaa valley, in the North-East side of Lebanon. Signs of almost continual habitation are testified over the last 8–9000 years. The monumental complex still existing belongs mostly to Hellenistic and Roman Period, with some remodeling occurred during the Middle Age by Arab populations, who fortified the ruins they found in order to control the territory nearby. The two temples of Jupiter (Fig. 1) (for its huge proportions: it is the greatest temple all over the Roman Empire) and of Bacchus (for its good state of conservation) are some of the iconic symbols of Lebanon, but represents some of the most impressive heritage of ancient times throughout the Middle East as well. On the other end, Tyre itself is a UNESCO site. Divided in two main areas of City Site (Al Mina) and Al Bass, the old Phoenician town shows nowadays relevant Roman and Byzantine monuments, such as a triumphal arch, a hippodrome, colonnade roads, public and private baths (Fig. 2), funerary complex with sarcophagi. The great extension of the archaeological sites, the importance of the town and its influence through the ages and the Mediterranean area (many colonies were founded abroad by its inhabitants, i.e. Carthage) mark Tyre as one of the most important old settlement of the Middle East.

Tyre, Al Bass
The Blue Team Complex
from a drone survey



01



02

Baalbek
Jupiter Temple



Fig 3. Baalbek.
Structural investigation on
Jupiter Temple

Fig 4. Baalbek.
Scaffolding assembled around
Jupiter Temple

Fig 5. Tyre, City Site.
Meeting in site with contractor,
CDR, DGA, Consultant,
and a representative
of UNESCO

Especially in this last city, the work is on an advanced stage: most of the restoration is already executed, the civil works are in progress. Concerning Baalbek, the first steps were moved with the cleaning of some archaeological stone blocks and with the installation of some pedestrian paths around the site. The core of our project here, the structural intervention and restoration of Jupiter Temple's six columns, is in the preliminary phase of the all necessary investigations (Fig. 3), in order to assess a more detailed and accurate work, after acquired all the data requested. Meanwhile a huge scaffolding has been assembled around the monument (Fig. 4), and through it we acquired many additional information related to the nature and progressive decay of the monument, including the previous restoration carried out in the 30s of last century.

All our activity, with our Italian expertise and with the help also of local subcontractors, is spread in continuous coordination with the client CDR (Council for development and Reconstruction), the DGA (Directorate General of Antiquities) and the Consultant (Fig. 5).

BAALBEK

By now the JV is moving steps in many sites of the archaeological complex. All around the main walls, and in the area of Venus Temple and the new Visitor Center, the presentation works for the visitors are in progress. Meanwhile a group of restorers is focused on the restoration of limestone blocks (Fig. 6), that are going to be exhibited in the Cryptoporticus, and of fifteen sarcophagi, that will be displayed at the new entrance. In the general view of the project, concerning tourists' circulation, many areas are involved, with different solutions. At the Propylea we are executing a new green settlement, reshaping the original roman staircase; in Bustan Zein, Bustan Nassif and Arab Gate a long system of footpaths and new toilets; in the Hexagonal Court and Great Court we are going to relocate many stone blocks, in order to give more sense to them, and we will grant also safety to everybody, settling some archaeological trenches, still open; in the east and west fronts of Jupiter Temple, new staircases will allow an easier access and way out.

Without any doubt, the greatest task in Baalbek concerns the six columns of Jupiter Temple. After assembled a scaffolding, imported from Italy, around it, 85 years later the past restoration carried out by a French team, we are able to have a wonderful close up on all the details of this incredible monument. While appreciating its decorative system, we also took advantage to evaluate all the aspects necessary to re-assess, with a major definition, both the structural and restoration intervention. Indeed there are many elements, related to the monument itself and the past intervention also, that occurred and affected considerably the temple. Its particular condition (six columns preserved in only one side), the limestone constituting all the elevation (naturally presenting micro-cracks), oscillations due to the wind and earthquakes, all the iron inserted 85 years ago and now oxidizing, the relevant weight added over the lintel with the reinforced concrete beam, many fragments

Fig 6. Baalbek.
Restoration
of limestone blocks

Fig 7. Baalbek.
Pre-consolidation and
cleaning samples on a
capital of jupiter Temple



06



07

Fig 8. Tyre, Al Bass.
Consolidation of
an unearthed grave at
the entrance of the site



of different sizes detached from all the parts (bases, drums, capitals and lintel), the climatic excursion with the winter component of frost and thaw, the decay of the surfaces, combined all together are the most important issues. A campaign of structural investigations (including magnetometry, endoscopy and corings) has been executed in order to acquire other information. With the evaluation of the outcomes, our duty will be the assessment of the most useful structural work, in order to ensure the stability of the monument, and of the restoration. This will be, with awareness and pride, our task in the next months (Fig. 7).

Fig 9.
Tyre, Al Bass.
Apollo Shire before
and after cleaning

Fig 10.
Tyre, Al Bass.
Opus sectile in
Blue Team Complex

TYRE

The JV is active in the two different sites of All Bass and City Site. As in Baalbek, also here the work follows the two lines of restoration for some ancient structures, and presentation of the sites with new paths, balustrades and explicatory panels. A particular case is the finishing of the Museum building, with the relevant showcase of some archaeological finds.

At the entrance of Al Bass, since during an archaeological investigation a grave was un-



earthed, we already consolidated the artifact (Fig. 8) and are going to partially modify the path, installing a metal bridge. The three main buildings, object of our work here, are: the Apollo Shrine (Fig. 9), an ancient religious building, affected by a huge decay; the Blue Team Complex, next to the Hippodrome, displaying an interesting mix of structures (floorings, basins, furnaces); and the Crusader Church, built in early XIII AD, overlapping the previous Hippodrome. The activity here is almost completed. It was focused on cleaning and consolidation of all the surfaces, vertical and horizontal, with special care to mosaics and opus sectile (Fig. 10). All the buildings will be open to the visitors, by means of a new circulation's route, and the installation of the necessary requirements.

In City Site, following the same concept, the monuments we are restoring will be integrated in a new system of pedestrian footpaths, that will allow audience to enjoy the visit. Therefore, in locations such as the Commercial Building and Arena, the work is oriented entirely on the presentation. In Coordination with CDR and DGA, only some urgent measures will be undertaken in order to stop the advanced decay of some delicate pavements. Moreover, in Palestra, where an excessive excavation affected the colonnade, leaving on light even its foundations, a considerable backfilling and gabionade were put, sustaining the archaeological structure and allowing installation of the path. But in other areas, an intense work of cleaning and consolidation has been already carried out and almost completed. In Latrinae, along with the reinstatement of walls, the mosaics were the most delicate task, because of their advanced decay. A small part of them, as a sample, has been detached, consolidated on an aluminum panel, and eventually replaced in its position. In Thermae, the current poor stage of conservation required a deep action, especially on the exposed foundations and the marble slabs of the floorings.

In both Baalbek and Tyre, part of our challenge is already accomplished, in the next months we will complete the rest of our mission.



10



Francesca Brancaccio
Architect, Ph. History,
Specialized in Restoration
of Monuments

Ugo Brancaccio, engineer
Specialized in Restoration
of Monuments



info@b5srl.it
www.b5srl.eu

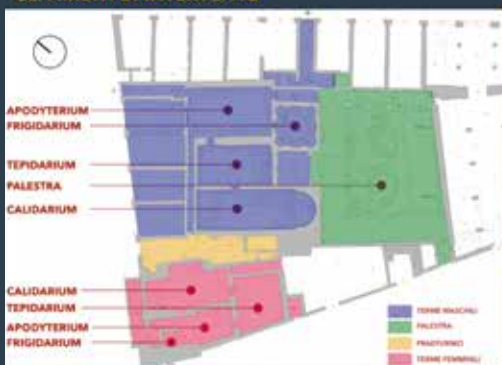
PRESERVING, KEEPING AND TRANSFERRING CULTURAL HERITAGE TO THE FUTURE: A FOCUS ON RESTORATION AND ARCHAEOLOGY

We will focus on 3 case studies of restoration and archaeology, as examples of how to preserve, keep and transfer cultural heritage to the future: the restoration of Forum Baths and Gymnasium, the restoration of the insula of Chaste Lovers, both in Pompeii and the restoration of the façades of the Coliseum in Rome. The Italian highly specialized company B5 S.r.l. was charged of the coordination and realization of these three projects.

FORUM BATHS AND GYMNASIUM IN POMPEII

This project is in the context of the Major Project Pompeii, great collective commitment and example of good practices and high executive skills. Pompeii - the largest archaeological site in the world - has been a UNESCO site since 1996 (it provides a complete and vivid picture of society and daily life during the Vesuvius eruption of 79 a.C., without parallel anywhere in the world). It possesses a rich and varied artistic heritage: mosaics, decorated surfaces, frescoes and stuccoes, decorative architectural elements. The project aims to arrest degradation, secure, removing the causes that threaten the preservation of items and that make some areas impossible to use of the so-called 'Gymnasium' (insula n. 5 on

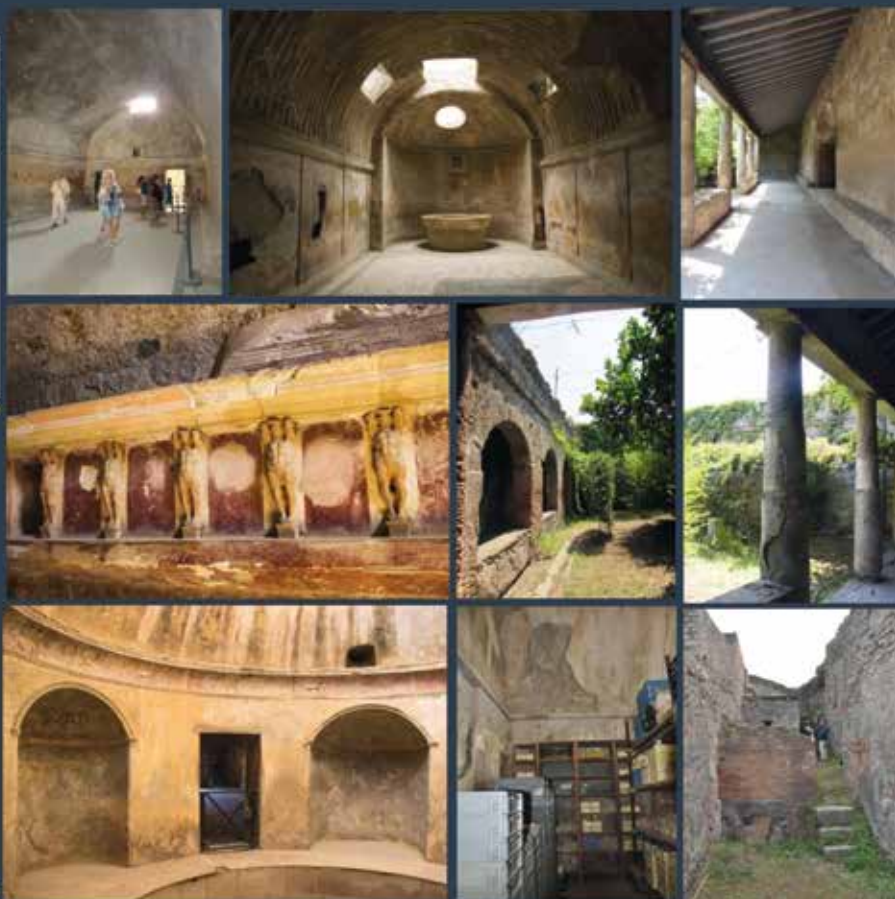
GLI AMBITI DI INTERVENTO



Terme del Foro : Planimetria



Terme del Foro : Aerofotogrammetria



the north side of the Forum in the Regio n. VII). It forecasts some demolitions of concrete structures, as well, together with the project of new structures. The site has been object of scientific studies from all historical, archaeological, geological, material, architectural, botanical and structural points of views, with attention to the use for touristic visits and to planned maintenance for the future. The in-depth and wide-ranging investigations allowed to lead to a conscious design, based on the initial “recognition” of the values, and aiming at preservation and transmission of these values. The discovery of glass frames demonstrates the use of glass for windows in roman age, found almost intact, and described by architects and visitors in the past. Windows play a key aspect for Thermal baths, documenting an ingenious hygrothermal control system. The analysis of the internal microclimate tells that temperature and humidity conditions nowadays are not compatible with the preservation of existing stuccoes and frescoes. Big groups of tourists entering in a few minutes, make a big hygro-thermal load in the rooms, that drops dramatically at the end of the visit, until the incoming of the next group. This make the archaeological artifacts not able to achieve and maintain the conservative balance necessary to the preservation of materials. The regulation of the group entrances with suitable devices has been evaluated within a flow planning, in order to control humidity and temperature, controlled by instruments, in order to monitor and create a history of the inner microclimatic conditions. In order to prevent the entry of rainwater and poultry, the project introduces then new solar control window frames with laminated magnetronic glasses. A complete survey has been done, keeping analytical accounts, stone by stone, and identifying all tracks and materials, as ar-

COMPLESSITÀ DI UN PALINSESTO: ANALISI DELLE MURATURE



Grafici di rilievo dello stato di fatto e conservazione

LEGENDA MATERIALE					
TECNICHE DI RICOVERO					
PUNTO A			PUNTO B		
PUNTO C			PUNTO D		
PUNTO E			PUNTO F		
PUNTO G			PUNTO H		
PUNTO I			PUNTO J		
PUNTO K			PUNTO L		
PUNTO M			PUNTO N		
PUNTO O			PUNTO P		
PUNTO Q			PUNTO R		
PUNTO S			PUNTO T		
PUNTO U			PUNTO V		
PUNTO W			PUNTO X		
PUNTO Y			PUNTO Z		
PUNTO AA			PUNTO AB		
PUNTO AC			PUNTO AD		
PUNTO AE			PUNTO AF		
PUNTO AG			PUNTO AH		
PUNTO AI			PUNTO AJ		
PUNTO AK			PUNTO AL		
PUNTO AM			PUNTO AN		
PUNTO AO			PUNTO AP		
PUNTO AQ			PUNTO AR		
PUNTO AS			PUNTO AT		
PUNTO AU			PUNTO AV		
PUNTO AW			PUNTO AX		
PUNTO AY			PUNTO AZ		
PUNTO BA			PUNTO BB		
PUNTO BC			PUNTO BD		
PUNTO BE			PUNTO BF		
PUNTO BG			PUNTO BH		
PUNTO BI			PUNTO BJ		
PUNTO BK			PUNTO BL		
PUNTO BM			PUNTO BN		
PUNTO BO			PUNTO BP		
PUNTO BQ			PUNTO BR		
PUNTO BS			PUNTO BT		
PUNTO BU			PUNTO BV		
PUNTO BW			PUNTO BX		
PUNTO BY			PUNTO BZ		
PUNTO CA			PUNTO CB		
PUNTO CC			PUNTO CD		
PUNTO CE			PUNTO CF		
PUNTO CG			PUNTO CH		
PUNTO CI			PUNTO CJ		
PUNTO CK			PUNTO CL		
PUNTO CM			PUNTO CN		
PUNTO CO			PUNTO CP		
PUNTO CQ			PUNTO CR		
PUNTO CS			PUNTO CT		
PUNTO CU			PUNTO CV		
PUNTO CW			PUNTO CX		
PUNTO CY			PUNTO CZ		
PUNTO DA			PUNTO DB		
PUNTO DC			PUNTO DD		
PUNTO DE			PUNTO DF		
PUNTO DG			PUNTO DH		
PUNTO DI			PUNTO DJ		
PUNTO DK			PUNTO DL		
PUNTO DM			PUNTO DN		
PUNTO DO			PUNTO DP		
PUNTO DQ			PUNTO DR		
PUNTO DS			PUNTO DT		
PUNTO DU			PUNTO DV		
PUNTO DW			PUNTO DX		
PUNTO DY			PUNTO DZ		
PUNTO EA			PUNTO EB		
PUNTO EC			PUNTO ED		
PUNTO EE			PUNTO EF		
PUNTO EG			PUNTO EH		
PUNTO EI			PUNTO EJ		
PUNTO EK			PUNTO EL		
PUNTO EM			PUNTO EN		
PUNTO EO			PUNTO EP		
PUNTO EQ			PUNTO ER		
PUNTO ES			PUNTO ET		
PUNTO EU			PUNTO EV		
PUNTO EW			PUNTO EX		
PUNTO EY			PUNTO EZ		
PUNTO FA			PUNTO FB		
PUNTO FC			PUNTO FD		
PUNTO FE			PUNTO FF		
PUNTO FG			PUNTO FH		
PUNTO FI			PUNTO FJ		
PUNTO FK			PUNTO FL		
PUNTO FM			PUNTO FN		
PUNTO FO			PUNTO FP		
PUNTO FQ			PUNTO FR		
PUNTO FS			PUNTO FT		
PUNTO FU			PUNTO FV		
PUNTO FW			PUNTO FX		
PUNTO FY			PUNTO FZ		
PUNTO GA			PUNTO GB		
PUNTO GC			PUNTO GD		
PUNTO GE			PUNTO GF		
PUNTO GG			PUNTO GH		
PUNTO GI			PUNTO GJ		
PUNTO GK			PUNTO GL		
PUNTO GM			PUNTO GN		
PUNTO GO			PUNTO GP		
PUNTO GQ			PUNTO GR		
PUNTO GS			PUNTO GT		
PUNTO GU			PUNTO GV		
PUNTO GW			PUNTO GX		
PUNTO GY			PUNTO GZ		
PUNTO HA			PUNTO HB		
PUNTO HC			PUNTO HD		
PUNTO HE			PUNTO HF		
PUNTO HG			PUNTO HH		
PUNTO HI			PUNTO HJ		
PUNTO HK			PUNTO HL		
PUNTO HM			PUNTO HN		
PUNTO HO			PUNTO HP		
PUNTO HQ			PUNTO HR		
PUNTO HS			PUNTO HT		
PUNTO HU			PUNTO HV		
PUNTO HW			PUNTO HX		
PUNTO HY			PUNTO HZ		
PUNTO IA			PUNTO IB		
PUNTO IC			PUNTO ID		
PUNTO IE			PUNTO IF		
PUNTO IG			PUNTO IH		
PUNTO II			PUNTO IJ		
PUNTO IK			PUNTO IL		
PUNTO IM			PUNTO IN		
PUNTO IO			PUNTO IP		
PUNTO IQ			PUNTO IR		
PUNTO IS			PUNTO IT		
PUNTO IU			PUNTO IV		
PUNTO IW			PUNTO IX		
PUNTO IY			PUNTO IZ		
PUNTO JA			PUNTO JB		
PUNTO JC			PUNTO JD		
PUNTO JE			PUNTO JF		
PUNTO JG			PUNTO JH		
PUNTO JI			PUNTO JJ		
PUNTO JK			PUNTO JL		
PUNTO JM			PUNTO JN		
PUNTO JO			PUNTO JP		
PUNTO JQ			PUNTO JR		
PUNTO JS			PUNTO JT		
PUNTO JU			PUNTO JV		
PUNTO JW			PUNTO JX		
PUNTO JY			PUNTO JZ		
PUNTO KA			PUNTO KB		
PUNTO KC			PUNTO KD		
PUNTO KE			PUNTO KF		
PUNTO KG			PUNTO KH		
PUNTO KI			PUNTO KJ		
PUNTO KK			PUNTO KL		
PUNTO KM			PUNTO KN		
PUNTO KO			PUNTO KP		
PUNTO KQ			PUNTO KR		
PUNTO KS			PUNTO KT		
PUNTO KU			PUNTO KV		
PUNTO KW			PUNTO KX		
PUNTO KY			PUNTO KZ		
PUNTO LA			PUNTO LB		
PUNTO LC			PUNTO LD		
PUNTO LE			PUNTO LF		
PUNTO LG			PUNTO LH		
PUNTO LI			PUNTO LJ		
PUNTO LK			PUNTO LL		
PUNTO LM			PUNTO LN		
PUNTO LO			PUNTO LP		
PUNTO LQ			PUNTO LR		
PUNTO LS			PUNTO LT		
PUNTO LU			PUNTO LV		
PUNTO LW			PUNTO LX		
PUNTO LY			PUNTO LZ		
PUNTO MA			PUNTO MB		
PUNTO MC			PUNTO MD		
PUNTO ME			PUNTO MF		
PUNTO MG			PUNTO MH		
PUNTO MI			PUNTO MJ		
PUNTO MK			PUNTO ML		
PUNTO MM			PUNTO MN		
PUNTO MO			PUNTO MP		
PUNTO MQ			PUNTO MR		
PUNTO MS			PUNTO MT		
PUNTO MU			PUNTO MV		
PUNTO MW			PUNTO MX		
PUNTO MY			PUNTO MZ		
PUNTO NA			PUNTO NB		
PUNTO NC			PUNTO ND		
PUNTO NE			PUNTO NF		
PUNTO NG			PUNTO NH		
PUNTO NI			PUNTO NJ		
PUNTO NK			PUNTO NL		
PUNTO NM			PUNTO NN		
PUNTO NO			PUNTO NP		
PUNTO NQ			PUNTO NR		
PUNTO NS			PUNTO NT		
PUNTO NU			PUNTO NV		
PUNTO NW			PUNTO NX		
PUNTO NY			PUNTO NZ		
PUNTO OA			PUNTO OB		
PUNTO OC			PUNTO OD		
PUNTO OE			PUNTO OF		
PUNTO OG			PUNTO OH		
PUNTO OI			PUNTO OJ		
PUNTO OK			PUNTO OL		
PUNTO OM			PUNTO ON		
PUNTO OO			PUNTO OP		
PUNTO OQ			PUNTO OR		
PUNTO OS			PUNTO OT		
PUNTO OU			PUNTO OV		
PUNTO OW			PUNTO OX		
PUNTO OY			PUNTO OZ		
PUNTO PA			PUNTO PB		
PUNTO PC			PUNTO PD		
PUNTO PE			PUNTO PF		
PUNTO PG			PUNTO PH		
PUNTO PI			PUNTO PJ		
PUNTO PK			PUNTO PL		
PUNTO PM			PUNTO PN		
PUNTO PO			PUNTO PP		
PUNTO PQ			PUNTO PR		
PUNTO PS			PUNTO PT		
PUNTO PU			PUNTO PV		
PUNTO PW			PUNTO PX		
PUNTO PY			PUNTO PZ		
PUNTO QA			PUNTO QB		
PUNTO QC			PUNTO QD		
PUNTO QE			PUNTO QF		
PUNTO QG			PUNTO QH		
PUNTO QI			PUNTO QJ		
PUNTO QK			PUNTO QL		
PUNTO QM			PUNTO QN		
PUNTO QO			PUNTO QP		
PUNTO QQ			PUNTO QR		
PUNTO QS			PUNTO QT		
PUNTO QU			PUNTO QV		
PUNTO QW			PUNTO QX		
PUNTO QY			PUNTO QZ		
PUNTO RA			PUNTO RB		
PUNTO RC			PUNTO RD		
PUNTO RE			PUNTO RF		
PUNTO RG			PUNTO RH		
PUNTO RI			PUNTO RJ		
PUNTO RK			PUNTO RL		
PUNTO RM			PUNTO RN		
PUNTO RO			PUNTO RP		
PUNTO RQ			PUNTO RR		
PUNTO RS			PUNTO RT		
PUNTO RU			PUNTO RV		
PUNTO RW			PUNTO RX		
PUNTO RY			PUNTO RZ		
PUNTO SA			PUNTO SB		
PUNTO SC			PUNTO SD		
PUNTO SE			PUNTO SF		
PUNTO SG			PUNTO SH		
PUNTO SI			PUNTO SJ		
PUNTO SK			PUNTO SL		
PUNTO SM			PUNTO SN		
PUNTO SO			PUNTO SP		
PUNTO SQ			PUNTO SR		
PUNTO SS			PUNTO ST		
PUNTO SU			PUNTO SV		
PUNTO SW			PUNTO SX		
PUNTO SY			PUNTO SZ		
PUNTO TA			PUNTO TB		
PUNTO TC			PUNTO TD		
PUNTO TE			PUNTO TF		
PUNTO TG			PUNTO TH		
PUNTO TI			PUNTO TJ		
PUNTO TK			PUNTO TL		
PUNTO TM			PUNTO TN		
PUNTO TO			PUNTO TP		
PUNTO TQ			PUNTO TR		
PUNTO TS			PUNTO TT		
PUNTO TU			PUNTO TV		
PUNTO TW			PUNTO TX		
PUNTO TY			PUNTO TZ		
PUNTO UA			PUNTO UB		
PUNTO UC			PUNTO UD		
PUNTO UE			PUNTO UF		
PUNTO UG			PUNTO UH		
PUNTO UI			PUNTO UJ		
PUNTO UK			PUNTO UL		
PUNTO UM			PUNTO UN		
PUNTO UO			PUNTO UP		
PUNTO UQ			PUNTO UR		
PUNTO US			PUNTO UT		
PUNTO UU			PUNTO UV		
PUNTO UW			PUNTO UX		
PUNTO UY			PUNTO UZ		
PUNTO VA			PUNTO VB		
PUNTO VC			PUNTO VD		
PUNTO VE			PUNTO VF		
PUNTO VG			PUNTO VH		
PUNTO VI			PUNTO VJ		
PUNTO VK			PUNTO VL		
PUNTO VM			PUNTO VN		
PUNTO VO			PUNTO VP		
PUNTO VQ			PUNTO VR		
PUNTO VS			PUNTO VT		
PUNTO VU			PUNTO VV		
PUNTO VW			PUNTO VX		
PUNTO VY			PUNTO VZ		
PUNTO WA			PUNTO WB		
PUNTO WC			PUNTO WD		
PUNTO WE			PUNTO WF		
PUNTO WG			PUNTO WH		
PUNTO WI			PUNTO WJ		
PUNTO WK			PUNTO WL		
PUNTO WM			PUNTO WN		
PUNTO WO			PUNTO WP		
PUNTO WQ			PUNTO WR		
PUNTO WS			PUNTO WT		
PUNTO WU			PUNTO WV		
PUNTO WW			PUNTO WX		
PUNTO WY			PUNTO WZ		
PUNTO XA			PUNTO XB		
PUNTO XC			PUNTO XD		
PUNTO XE			PUNTO XF		
PUNTO XG			PUNTO XH		
PUNTO XI			PUNTO XJ		
PUNTO XK			PUNTO XL		
PUNTO XM			PUNTO XN		
PUNTO XO			PUNTO XP		
PUNTO XQ			PUNTO XR		
PUNTO XS			PUNTO XT		
PUNTO XU			PUNTO XV		
PUNTO XW			PUNTO XX		
PUNTO XY			PUNTO XZ		
PUNTO YA			PUNTO YB		
PUNTO YC			PUNTO YD		
PUNTO YE			PUNTO YF		
PUNTO YG			PUNTO YH		
PUNTO YI			PUNTO YJ		
PUNTO YK			PUNTO YL		
PUNTO YM			PUNTO YN		
PUNTO YO			PUNTO YP		
PUNTO YQ			PUNTO YR		
PUNTO YS			PUNTO YT		
PUNTO YU			PUNTO YV		
PUNTO YW			PUNTO YX		
PUNTO YZ			PUNTO ZA		
PUNTO ZB			PUNTO ZC		
PUNTO ZD			PUNTO ZE		
PUNTO ZF			PUNTO ZG		
PUNTO ZH			PUNTO ZI		
PUNTO ZJ			PUNTO ZK		
PUNTO ZL			PUNTO ZM		
PUNTO ZN			PUNTO ZO		
PUNTO ZP			PUNTO ZQ		
PUNTO ZR			PUNTO ZS		
PUNTO ZT			PUNTO ZU		
PUNTO ZV			PUNTO ZW		
PUNTO ZX			PUNTO ZY		
PUNTO ZZ			PUNTO AA		
PUNTO AB			PUNTO AC		
PUNTO AD			PUNTO AE		
PUNTO AF			PUNTO AG		
PUNTO AH			PUNTO AI		
PUNTO AJ			PUNTO AK		
PUNTO AL			PUNTO AM		
PUNTO AN			PUNTO AO		
PUNTO AP			PUNTO AQ		
PUNTO AR			PUNTO AS		
PUNTO AT			PUNTO AU		
PUNTO AV			PUNTO AW		
PUNTO AX			PUNTO AY		
PUNTO AZ			PUNTO BA		
PUNTO BB			PUNTO BC		
PUNTO BD			PUNTO BE		
PUNTO BF			PUNTO BG		
PUNTO BH			PUNTO BI		
PUNTO BJ			PUNTO BK		
PUNTO BL			PUNTO BM		
PUNTO BN			PUNTO BO		
PUNTO BP			PUNTO BQ		
PUNTO BR			PUNTO BS		
PUNTO BT			PUNTO BU		
PUNTO BV			PUNTO BW		
PUNTO BX			PUNTO BY		
PUNTO BZ			PUNTO CA		
PUNTO CB			PUNTO CC		
PUNTO CD			PUNTO CE		
PUNTO CF			PUNTO CG		
PUNTO CH			PUNTO CI		
PUNTO CJ			PUNTO CK		
PUNTO CL			PUNTO CM		
PUNTO CN			PUNTO CO		
PUNTO CP			PUNTO CQ		
PUNTO CR			PUNTO CS		
PUNTO CT			PUNTO CU		
PUNTO CV			PUNTO CW		
PUNTO CX			PUNTO CY		
PUNTO CZ			PUNTO DA		
PUNTO DB			PUNTO DC		
PUNTO DE			PUNTO DF		
PUNTO DG			PUNTO DH		
PUNTO DI			PUNTO DJ		
PUNTO DK			PUNTO DL		
PUNTO DM			PUNTO DN		
PUNTO DO			PUNTO DP		
PUNTO DQ			PUNTO DR		
PUNTO DS			PUNTO DT		
PUNTO DU			PUNTO DV		
PUNTO DW			PUNTO DX		
PUNTO DY			PUNTO DZ		
PUNTO EA			PUNTO EB		
PUNTO EC			PUNTO ED		
PUNTO EE			PUNTO EF		
PUNTO EG			PUNTO EH		
PUNTO EI			PUNTO EJ		
PUNTO EK			PUNTO EL		
PUNTO EM			PUNTO EN		
PUNTO EO			PUNTO EP		
PUNTO EQ			PUNTO ER		
PUNTO ES			PUNTO ET		
PUNTO EU			PUNTO EV		
PUNTO EW			PUNTO EX		
PUNTO EY			PUNTO EZ		
PUNTO FA			PUNTO FB		
PUNTO FC			PUNTO FD		
PUNTO FE			PUNTO FF		
PUNTO FG			PUNTO FH		
PUNTO FI			PUNTO FJ		
PUNTO FK			PUNTO FL		
PUNTO FM			PUNTO FN		
PUNTO FO			PUNTO FP		
PUNTO FQ			PUNTO FR		
PUNTO FS			PUNTO FT		
PUNTO FU			PUNTO FV		
PUNTO FW			PUNTO FX		
PUNTO FY			PUNTO FZ		
PUNTO GA			PUNTO GB		
PUNTO GC			PUNTO GD		
PUNTO GE			PUNTO GF		
PUNTO GG			PUNTO GH		
PUNTO GI			PUNTO GJ		
PUNTO GK			PUNTO GL		
PUNTO GM			PUNTO GN		
PUNTO GO			PUNTO		

chitectural and archaeological units, by distinguishing them in relation to the building history. The project wants to maintain documentation of all phases of history. Analysis items are then associated with interventions in the drawings. Graphics and computer documentation base will also be used for locating the tasks performed on worksite.

This will allow, once restoration will be finished, to have a complete database with detailed graphic references, for monitoring and scheduling of maintenance activities.

The new structure for the roof confirms the same “shape”, putting new beams in the walls within the existing holes, only by changing the structure. Three different solutions were proposed: wood (no glue-lam but true chestnut timber), steel or Pultruded FRP Structural material. The wooden solution was finally chosen by the Superintendence of Pompeii because considered as more similar to other cases already performed in Pompeii.

Some devices were adopted to improve the accessibility and the quality of the touristic visit, with new structures, in steel elements, multimedia space, where tourists can acquire information, in different foreign languages and explained in Braille on a tactile map.

INSULA OF CHASTE LOVERS

The second case study is linked to the restoration project of the insula of Chaste Lovers, located in the central district of Pompeii, the Regio IX (nine), with access from via dell'Abbondanza, one of the principal street in ancient Pompeii. The block extends over an area of approximately 4.000 square meters: a bakery and a shop connected to it, together with some houses (“Primo and Secondo Cenacolo Colonnato). Some rooms probably belong to a single real estate unit, the House of the Painters at Work. Another residential unit is the house of the Chast Lovers, with its frescoes and mosaics.

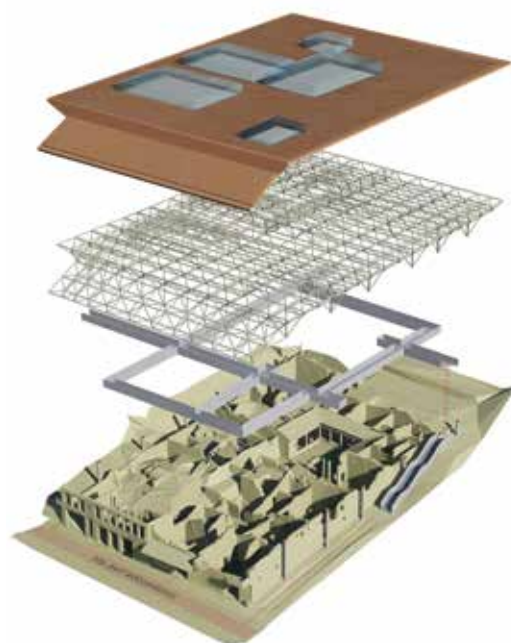
The insula has come to light for the first time in the early twentieth century. In 1943 it has been partially bombed and destroyed by Allied Forces, and it has been then restored through wide reconstructions. The last excavation and study activities date back to 1980: at this time the area was protected with provisional roofing systems, that nowadays still cover the entire surface of the insula, which is closed to public from many years.

Five different fields of actions were defined in the project:

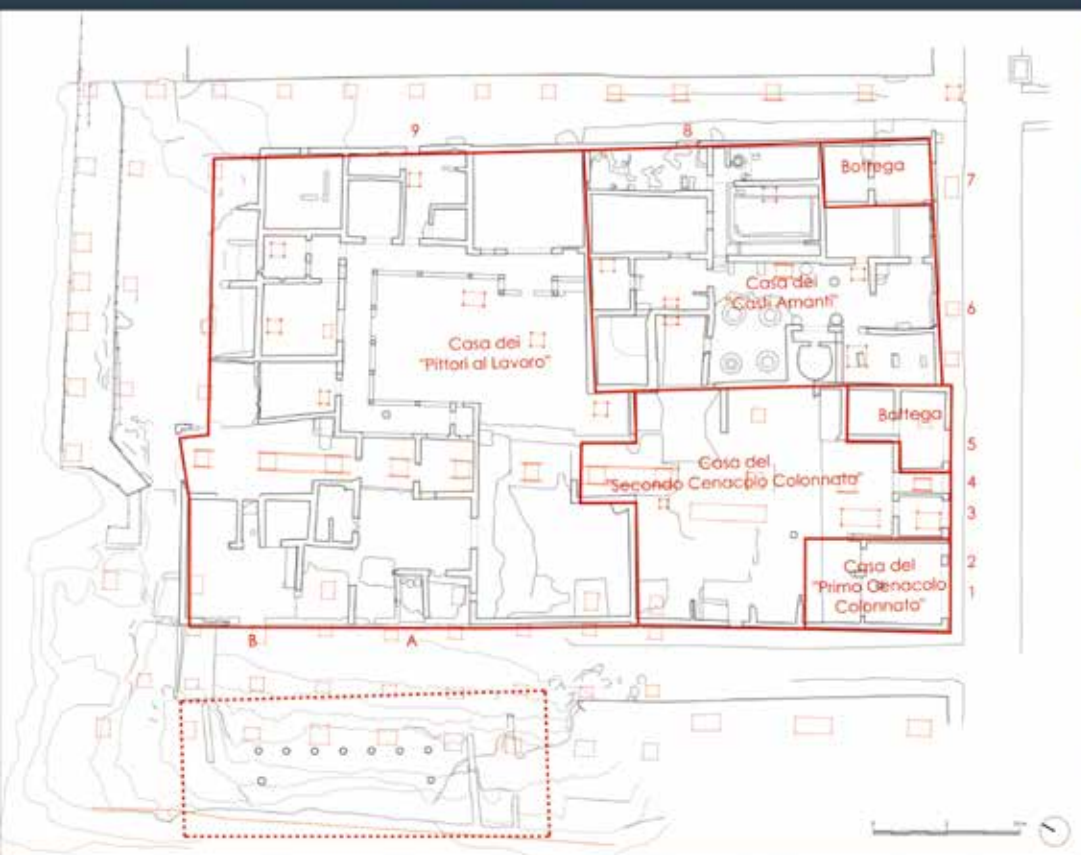
- _ coverage;
- _ consolidation of fronts of excavation;
- _ archaeological excavations;
- _ restoration and walls securing;
- _ accessibility and valorization of the site.

All aspects of the project are closely connected to each other, not only in terms of restoration choices, but also of operational steps.

The project is based on the principles of minimal intervention, reversibility, impact control, compatibility with the context and among materials, and “polite” possibility of distinguishing the intervention.



DESCRIZIONE DELL'AREA



Planimetria dell'Insula dei Casti Amanti con individuazione delle unità edilizie



The existing provisional cover today is a patchwork of different sheets (top view) and, from the inside is a disordered dense forest of metallic pillars, having in many cases also the function to hold collapsing walls.

Structural investigations were made on the existing elements of the cover, revealing that they can't assure safety conditions anymore.

The roof has to be replaced by a studied and designed new cover.

The new designed roof will be a definitive one, and it will help to keep the conservative balance of the archaeological structures and decorations.

It also meets the needs of preservation and improving of the accessibility at the insula.

The new roof has a reduced covered surface, conceived as a studied articulation of layers in relationship with the rhythms, the geometry and the spatiality of the ancient walls and the rooms below, even considering the relationship between covered and open parts. The relation with the existing red clay roofing on neighbor domus is evoked through the polite suggestion of aluminum coating in a red color, similar to the color of tiles covered areas. The archeological open spaces, which correspond to the atrium or the courtyards, are covered by glass panels, that suggest the idea of "open sky" while providing protection to the underlying elements. The coverage is based on a metallic reticular spatial structure, with tubular rods and spherical nodes. The supports and foundations were designed and calculated in order to minimize the number and the dimension of the columns, reduced to the overall

number of 12 (6 per side), placing them outside the insula, along the sidewalks of the western and eastern streets. The punctual foundations were positioned in already existing cavities. Refined calculation permitted to limit their maximum dimensions. The positioning of seismic isolator on the head of pillars has contributed to a significant reduction of the size of the supports and foundations. Some further archaeological excavations were forecasted in order to secure the areas and the structures. Excavations will also achieve scientific goals, as research activities aimed at knowledge, study and documentation of archaeological layers and structures. The insula is in a rather good state of conservation, even if abandoned for years. This demonstrates the conservative efficiency and conservation benefits of the cover, which has protected walls and decorations from water action, direct solar irradiation, and extreme heating and cooling phenomena.

The archaeological walls - since they have no longer horizontal elements - do not have structural function, they must only fulfil their own stability standards. In the verifications, walls have then been considered as elements to be protected only under static conditions, without considering the action of the earthquake on them.

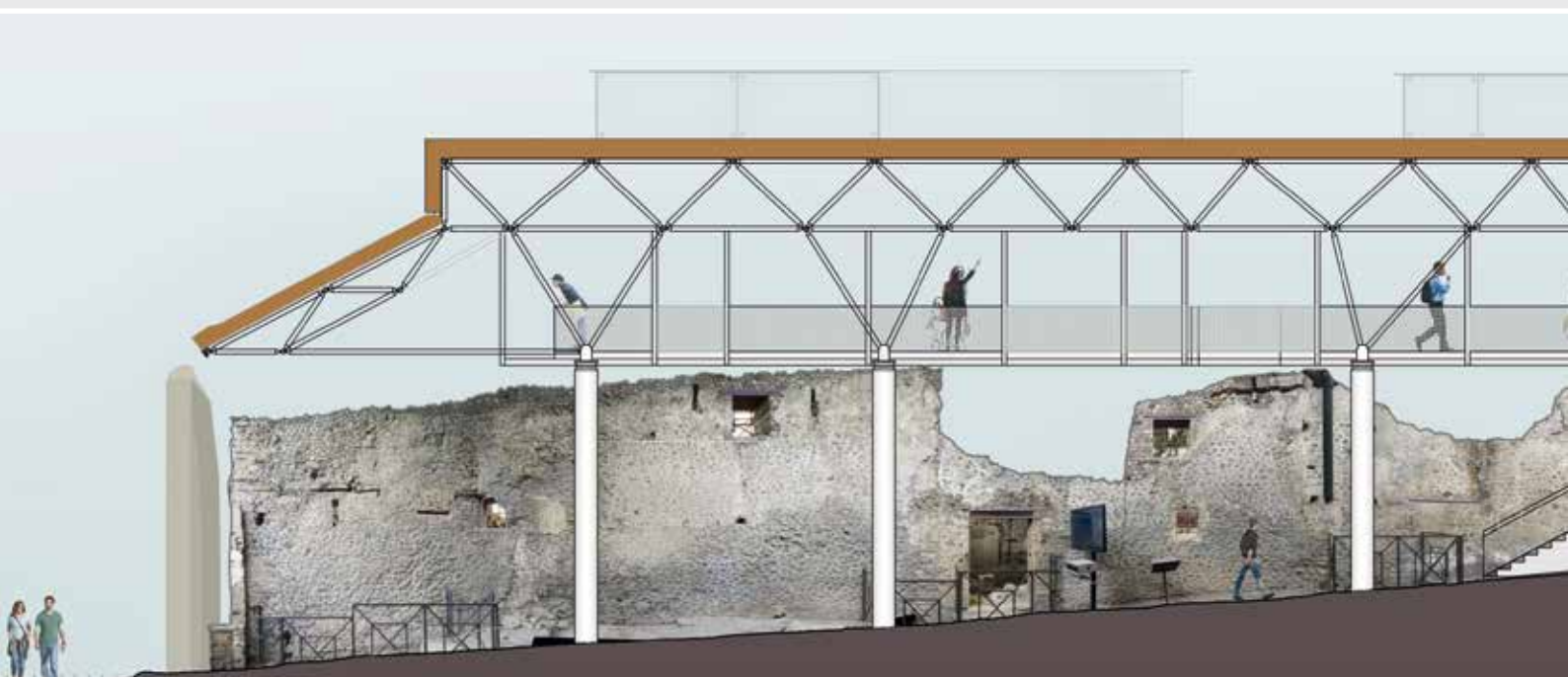
An accurate diagnostic campaign on archaeological structures has allowed to find out the quality of the structures and the mechanisms of ongoing disasters and their causes.

Walls with critical "static" problems will be assured with new external support structures in stainless steel, according to:

- _ low visual impact;
- _ limited extension within the room;
- _ high durability of elements.

Fruition and valorization

The project of the Chaste Lovers insula also focuses on the fruition and valorization of archaeological cultural heritage. In Pompeii touristic paths follow a "domestic" approach, dropping the visitor into a daily life dimension. This type of visit might sometimes contrast with



the conservative nature of archaeological artifacts, which remain a priority. In the Chaste Lovers insula some rooms might not be visited by tourists in order to prevent their destruction. The project forecasts therefore a suspended pathway, in order to allow the visit of these spaces without interfering with them. This approach enables to develop the visit of the archaeological heritage into a “museographic” way, and allow visitors to understand more, implementing their awareness of historical-aesthetic values. The two ways are complementary. The insula of Chaste Lovers can be approached using the original path, by entering from Via dell’Abbondanza which is integrated by the footbridge, suspended from the roof, proposing a different view from the top. Both paths are opened to people with disabilities.

COLISEUM

The Coliseum is a project and a 3 years lasting worksite and it can be the occasion to pointing out and quickly “open” to some conclusions.

The restoration project of the Northern and Southern façades of Coliseum, which means on the whole exterior stone and bricks walls of the Flavian Amphitheatre, aims to clean, consolidate, protect and present the world famous monument.

Restoration has been done in the most appropriate, both traditional and innovative way, by paying special attention - anything but usual - to the preservation, beneath the layers of dust, dirt and crusts, to all the colors that the travertine stone has taken over time, including amber patinas of oxalates. We were not just supposed to clean carefully the two façades by some water nebulization, which is anyway a very difficult and highly specialized operation. The question of this intervention deals with the relationship between surfaces and architecture, because the project was first considered in its previous scope of action, on a two-dimensional direction. The idea was to clean surfaces as working on frescoes or plasters, forgetting that the Coliseum is an archaeological building.

The intervention that we made was therefore able to make a significant shift from the ‘two-dimensional’ to a ‘three-dimensional’ - both volumetric and spatial - intervention of



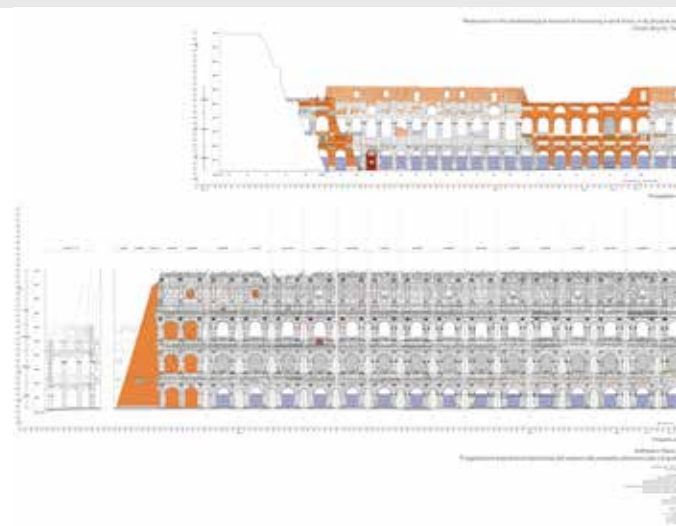
restoration and protection. And even – I dare say – it was able to include a fourth dimension, linked to the social perception of the whole operation in term of accessibility, visibility and dissemination during the worksite and to the transmission to the future not only of the restored surfaces of the monument, but also of its implemented knowledge.

The Roman Amphitheatre itself was considered and analyzed as an architectural, as well as an archaeological, theme of interposition. Restoration of architectural monuments must consider vertical surfaces together with horizontal ones, including all the protruding, angled and curved planes and volumes into a unified vision. The archaeological monument has been therefore studied as a complex “building system”: elements such as frames, jetties and horizontal planes are not only “decoration” elements, but they play an important role in protection and preservation. The whole system, starting from its constructive geometry represents a composite reality transformed during the times, under human and natural actions. Knowledge and recognition of values are the basis in order to lighten and localize the causes of the action of external agents, such as rainwater, smog, weeds, micro-organisms. The intention of the project of restoration is to facilitate the reading and not to erase the traces of time, according to the dictates of the Charters of restoration. The project method clearly defines the direction of “conservative” and “revealing” proposals of intervention, claimed from 1964 by the Charter of Venice, on an ancient monument but as much archaeological and perhaps - to a greater extent - architectural. The project of restoration answers also to the needs of implementing the monument with iron gates, in order to open or close the arches of the first order, according to a more flexible use of the monument and to security demands and standards. The solution took in account all the specific needs and controls using already existing holes for the mechanical fixing of the gates.

The guiding principles of this project aiming to PRESERVING, KEEPING AND TRANSFERRING CULTURAL HERITAGE TO THE FUTURE are screened and calibrated, through all the restoration process:

- _ “potential reversibility”;
- _ “compatibility”;
- _ “minimum intervention” or, at least a “non-invasive” one;

The principle of “minimum intervention” and the vision of maintenance lead to delicate operations and recovery of deteriorated stones and bricks, carefully studied case by case.



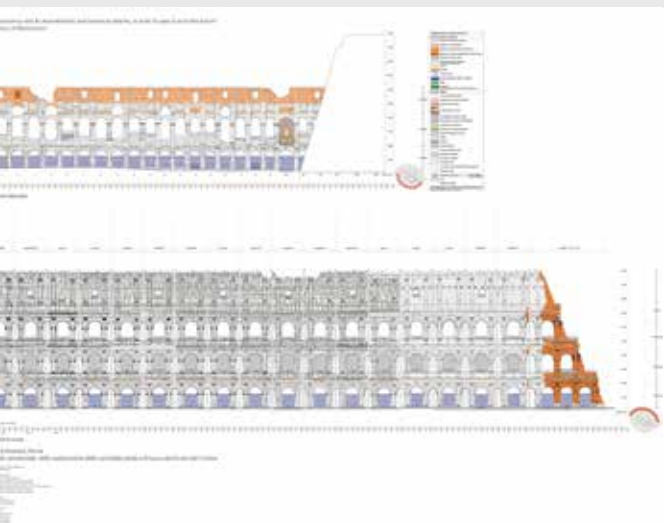
The project develops a dual synergistic action. It provides the most effective presentation of the monument and, over time, it gives a complete 'maintenance' or 'conservation planning'. This corresponds to the current state of theoretical and methodological reflection on restoration, which considers prevention and maintenance as the most effective way to transmit heritage to the future.

CONCLUSIONS

The Coliseum worksite is already finished in Rome, the first restoration worksite is starting in Pompei. Tangible results can be shared among international scientific communities. Among the actions to be taken:

- _ HIGHER SPECIALISED ACTORS AND LARGE COORDINATION EFFORTS
(interdisciplinary dialogue - private and public actions)
- _ TAKE INTO ACCOUNT THE ORGANISM IN ITS COMPLEXITY
(different scales and different point of views)
- _ RECOGNITION OF VALUES - HISTORICAL, AESTHETICAL, SOCIAL
(from the story of restoration to the traces of time)
- _ PRESERVATION BY ARRESTING DEGRADATION / REMOVING CAUSES
(cleaning, consolidation, reintegration, protection)
- _ GIVE SAFETY AND SECURITY TO BOTH STRUCTURES AND VISITORS
- _ IMPLEMENT AND IMPROVE ACCESSIBILITY
- _ RECORD ALL FINDINGS AND ACTIONS (graphic and database) PLAN MAINTENANCE
(what, when, who)

In conclusion a restoration project, in an archeological context, maintain its effectiveness references and principles as critically and scientifically shared. We preserve and keep in order to transfer the cultural contents, the layers of history, the structure and the materials themselves of the ancient monument, in the serene consciousness of being able to just slow down the relentless degradation, but not to grant an impossible - but anyway always pursued - immortality.





Daniele Fanciullacci
Patrizia Barucco
Antonio Tripodi

 **A.R.S. Progetti S.P.A.**
Ambiente Risorse Sviluppo
www.arsprogetti.com

DESIGN AND SUPERVISION OF RESTORATION OF KHAN EL ECHLE (SAIDA) AND BAALBEK SERAIL (BAALBEK) AND TECHNICAL ASSISTANCE TO DGU (DIRECTORATE GENERAL OF URBAN PLANNING)

The assignment of ARS Progetti is part of the Cultural Heritage and Urban Development (CHUD) Project.

ARS Progetti assignment consisted in consultancy services for the restoration and the rehabilitation works for Khan el Echle in Saida and for Baalbek Serail and in Technical Assistance to DGU in establishing a macro-level national safeguard for historic urban areas preservation.

Khan el-Echle or Khan el Hommos was built at the beginning of the 18th century (around 1712) by the Hammoud family. It was located near the harbour of the city, which gave it many benefits to its trade activity. The khan was originally used by merchants to house commercial and trading activities.

Presently, the Khan is located in a privileged site, along the street connecting the Sea Castle and the Land Castle, attractive and frequented tourist route as well as one of the entrances to the Saida Souk. (Fig. 1)

The khan is a three-storey building and it has the traditional architectural plan of a caravan-serai with a central courtyard surrounded by rooms of different dimensions used for goods and animals of caravans and merchants. Among the most considerable issue relevant to

building construction phases is the addition of the upper floor implemented during the French occupation.

Khan El-Echle is undoubtedly an historic building of outstanding historic, architectural, aesthetic and social, values.

Therefore, the restoration and adaptation was approached considering the essential issues the followings:

- 1 Preserve historic building integrity and authenticity;
- 2 Reuse the Khan to guarantee its maintenance and inclusion in the social and economic life of the city of Saida.
- 3 Rehabilitate the building by adapting it into as the Saida Centre for Artistic Handicrafts Production and Promotion Center;

The consultancy services for Khan el Echle included the following project activities:

- _ Historical and bibliographic research and studies on construction techniques aimed at the identification of building construction phases;
- _ Architectural heritage impact assessment;
- _ Proposals for sustainable solutions for the re-use of the Khan i.e. as Centre for Artistic Handicrafts Production and Promotion Center;
- _ Concept, Preliminary Design and Economic Feasibility Studies on Conservation and Adaptation;
- _ Final design and Cost Estimate for structural strengthening, conservation of surfaces and adaptation works.
- _ Landscaping arrangement of the Courtyard and of the public area in front of the Khan with ad hoc designed furniture.
- _ Execution Drawings, detailed cost estimate, technical specifications and preparation of Tender Dossier;
- _ Work Supervision, presently ongoing.

The whole process was developed in close coordination with all involved stakeholders.

The first task was the 3D laser scan, the structural diagnostic tests on the masonry consisted in single and double flat jack tests; chemical tests on mortars, compressive tests on

Fig. 1 - The red rectangles underline the location of the most important monuments in Saida that have a clear relationship with the Khan. The blue dashed line represents the edge of old town of Saida and the link between the Sea Castle and the Land Castle (or Castle of Saint Louis). The triangles highlight the position of the three gates to the Old Town.





Fig 2. Tri-dimensional cloud of points and graphic rendering of North Elevation

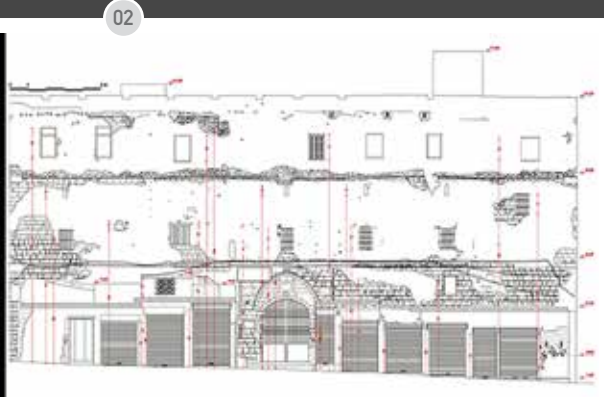
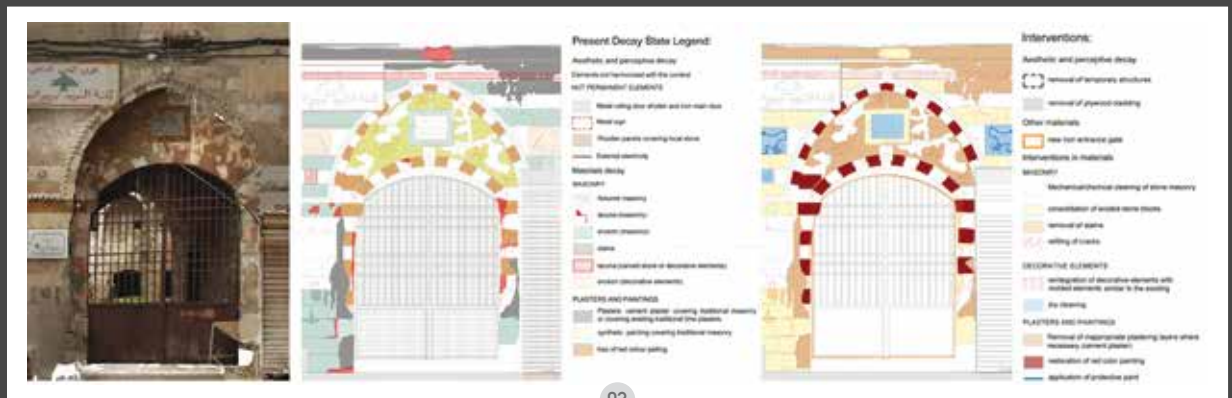


Fig 3. Decay mapping and intervention proposed for surfaces conservation

Fig 4. Structural consolidation measures on stone arches and lintels, reconstruction of wooden floors



stone specimens; sonic tests/video-endoscopic tests (Fig. 2).

The information collected allowed for developing thematic drawings illustrating structural and materials decay and the identification of structural and surfaces conservation measures. The conservation design was focussed on structural consolidation, seismic improvement, and surface conservation.

Surface conservation measures are based on the valorisation of historic and traditional materials, of decorative features such as inscriptions and bas relief (Fig. 3).

Structural strengthening measures have been carefully designed to minimize the addition of new structural features. Main interventions are:

- Masonry consolidation by scarification of mortar joints and repointing, reinforced plaster (GFRP net and connectors), “scuci-cuci”;
- Stone arches consolidation by inserting reinforced connections made of stainless steel bars at the arches springer;
- Wooden floor demolition and reconstruction;
- Concrete floor demolition and reconstruction by using wooden elements;
- Connection of horizontal structures by inserting steel tie bars combined with CFRP strips. (Fig. 4)

The adaptation design consisted in improving staircase and elevator, arrangement of the courtyard, providing exhibition rooms, workshops, and accommodations for Centre temporary guests, panoramic roof garden (Fig. 5).

Fig 5.
Arrangement of
the Courtyard
and of the
Exhibition Area

05





Nicola Berlucchi
Civil Engineer,
Architect and Restorer

RESTORATION OF THE TEATRO SOCIALE IN CAMOGLI, GENOVA

studio
Berlucchi
società di ingegneria
dal 1920

restauro@studioberlucchi.it
www.studioberlucchi.it

The "Teatro Sociale" of Camogli was completed in 1876 following the design of Eng. Salvatore Bruno Sampierdarena. The theater, inspired by the "Massimo Teatro" in Genova designed by Carlo Barabino, was realized following the tradition of "Teatro all'italiana", with a main hall shaped as an horseshoe with four levels of stalls and an upper gallery.

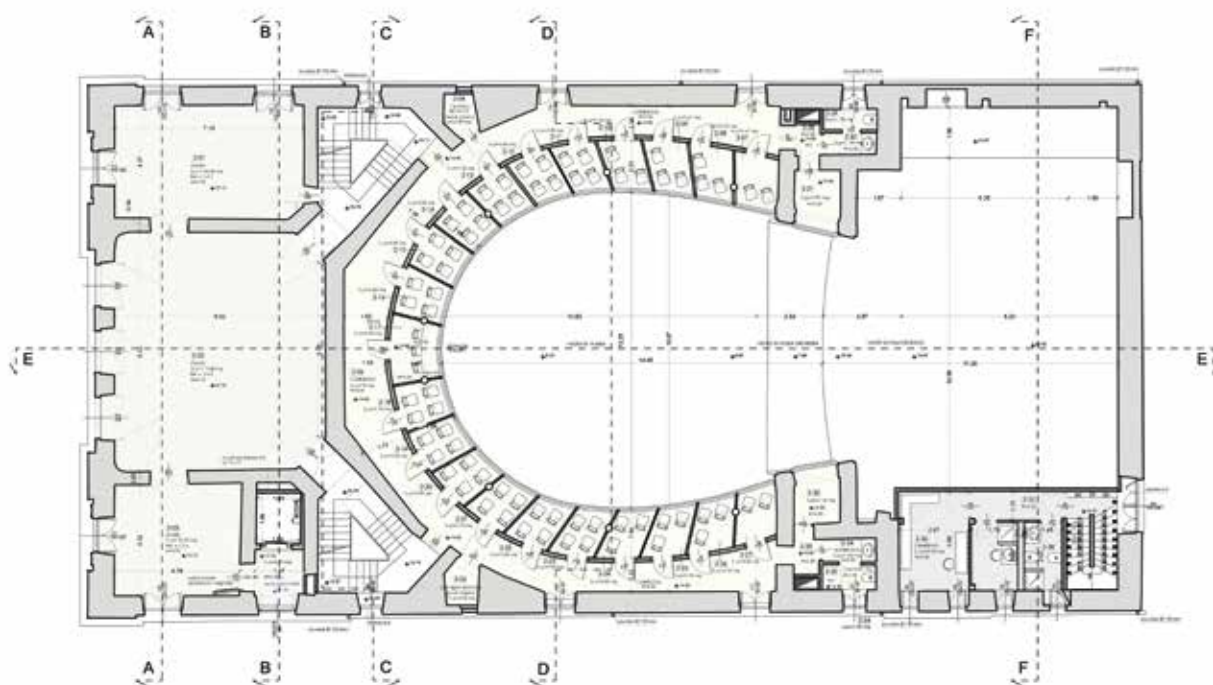
The town of Camogli lays by the northern part of the western Mediterranean sea, not too far from Genova; The construction of the building coincided with the brightest period of its commercial navy, soon unavoidably failing due to the evolution of the steam sailing. Such decay caused the simultaneous abandon of the theatrical activities. Since then, the Theater was restored in 1933 with the reconstruction of the stalls with a new concrete structure, and was definitively abandoned in 1980. The building was listed by the Ministry of Cultural Heritage, since the quality of its external proportions and the beauty of the interior decorations.

Detail of the façade
before the restoration



The hall and the main façade of the building during the Sixties

The Theater in 2005 before the restoration. The external facades are peeling, the ceiling of the hall is collapsed and the interiors are almost ruining



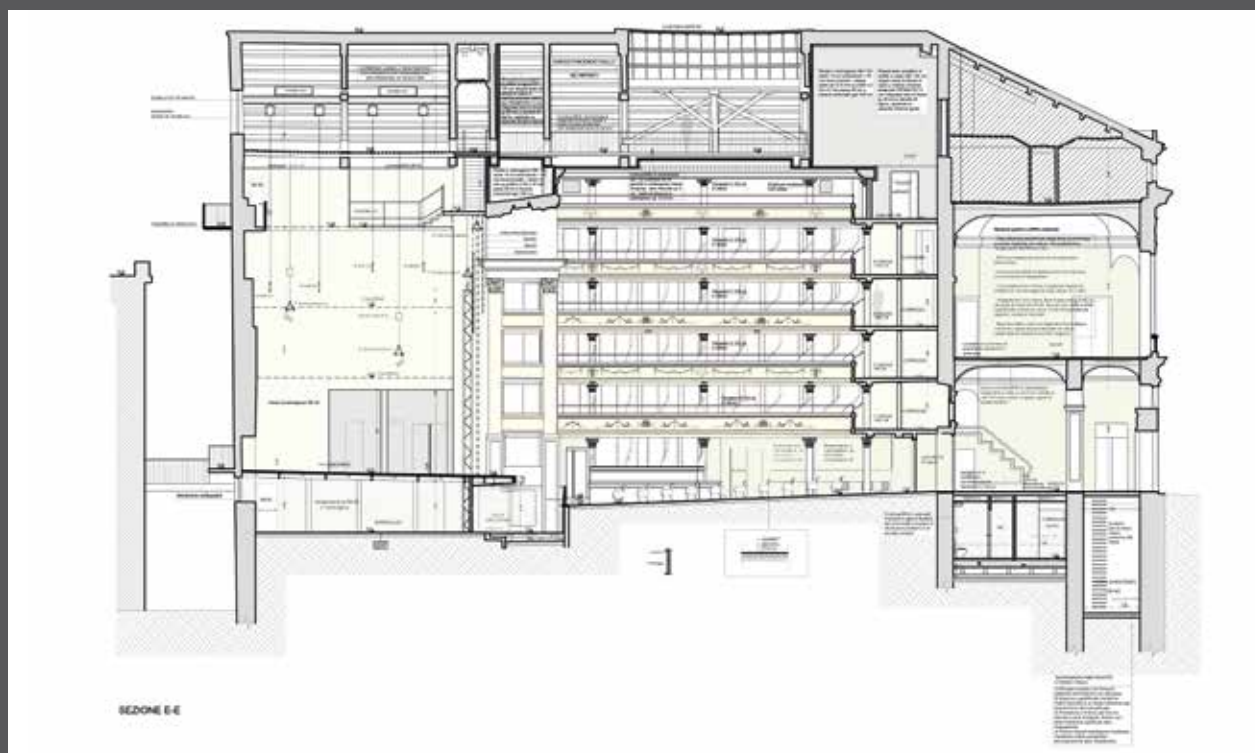
PIANO SECONDO ORDINE

Detailed project. General plan of the second floor

In the early 2000, the “Fondazione Teatro Camogli” (the private company of the owners of the Theater), has decided to restore the building, asking Eng. Nicola Berlucchi and his team to rise to the challenge. The design phase started in 2006 with an overall preliminary project including the complete restoration of the theater. In order to define and verify the preliminary project, the design team, in accordance with the client, has designed and realized a detailed survey campaign, including a geometrical laserscanner survey, chemical and physical analysis on concrete structures, wooden elements, internal and external plasters. The team paid particular attention to the analysis of internal decoration and external facades in order to understand the original aspect and colors of the building. All data collected during the survey campaign were cross-studied with the historical data found in the local archives.

The following detailed design phase lasted approximately from 2009 to 2014; Such a long period of time was necessary to obtain a complete and precise perspective over the setting of the building and over all the aspects of the restoration. During this phase, the project obtained the necessary authorizations by the Ministry of Cultural Heritage and by the fire brigade. Such result was based on the close cooperation of all experts covering every different specializations involved in the work and coordinated by Eng. Nicola Berlucchi.

In 2014, the building yard was finally opened, and Eng. Nicola Berlucchi was the site coordinator in charge for all interventions.



Detailed project. Vertical cross section

The reinforcement of the columns and of the existing concrete structure



The boxes and their corridor after the restoration

Examples of the stratigraphic researches lead on the decorated internal surfaces of the theater and chromatic study of the color palette

The new ceiling realized over the hall



Thanks to the detailed structural model realized in the design phase, the entire structure of the building has been reinforced using a conservative approach; the existing concrete structure was supported with new foundations. Existing concrete walls and columns have been reinforced with carbon fiber and specially designed mortars. The masonries have been strengthened with new steel structures hidden beneath the plasters. A new lift has been fit inside the historical structure in order to allow wheel-chair user to reach all levels of the building. The wooden roof has been reinforced with new steel structures that connected existing elements and added more stiffness. After the completion of the reinforcement, the theater can be considered fully anti-seismic.

Electrical and mechanical systems were completely renewed in accordance with the standards of a contemporary theater: In addition to the new electric system, all public spaces have been equipped with air-conditioning systems that allow the use of the building both in winter and summertime. These interventions were accurately designed in order to minimize the impact on existing structure and preserve the original aspect. The heavy machineries that allow the systems to work have been placed outside the historical building, creating a new external volume well inserted in the surroundings.

The restoration has improved the usability of the scene, in order to allow the representation of complex shows and operas.



Stratigraphic research lead on the external façade; the original colors were white and grey instead of the yellow-brown palette



The original design of a wall light was re-discovered beneath the existing paint, allowing the reconstruction

After the restoration, all the elements of the building is fireproof and the audience has appropriate emergency escape routes. The building is now equipped by an automated fire detection and fire extinguishing system, connected with a 100 cubic meter water tank (arranged in an underground existing room). The restored theater is now able to accommodate safely almost 500 people.

All original decorations were verified, restored and preserved thanks to an accurate work lead by highly specialized restorers. The choices made in term of colors and finishing of the materials were driven by the respect of the original aspect reconstructed thanks to the preliminary researches, without inserting prevaricating elements. The hall has been finished with wooden floor while the original material of the surrounding corridors was restored.

The entire restoration of the building has affected approximately 3.200 square meters, cost almost 6.000.000 € in total and absorbed approximately 9.000 hours of work for Eng. Nicola Berlucchi and the design team.

The interventions were able to restore the original destination of the Theater in full accordance with the original aesthetic and with all contemporary safety and comfort standards. The restoration has returned a fully reliable theater to the citizenship with great satisfaction of the client and of the public opinion.

The main entrance at the ground floor



Details of the interiors after the end of the restoration





The hall of the Theater after the restoration



Luca Zappettini

THE RESTORATION OF THE PINNACLES OF CERTOSA DI PAVIA

KAIROS
RESTAURI S.n.c.
di Luca Zappettini & C.

info@kairosrestauri.it
www.kairosrestauri.it

A number of urgent and non-deferrable works aimed at securing various portions of the Certosa di Pavia monument made the object of our intervention. The targeted areas were the sacristy, the library, the clock wing looking onto the grand cloister, the small cloister, the transepts and presbytery of the church, in addition to the conservation of roofs, chimney stacks, pinnacles, walls and mortars subject to deterioration and damage owed to both weathering and poor maintenance (Fig. 1).

The pinnacles showed severe biological decay in stone, plastered finish and masonry of cones. Attack by biological deteriorating agents, including algae, mosses, lichens and weeds, resulted in colour change, lesions and mechanical pressure on the surface and in depth (Fig. 2-3-4).

Fig 2-3-4.
Details, biological
degradation, Pinnacle
of Southern Transept



Regular exposition to weather agents over time triggered an irreversible natural process of slow and continual erosion, resulting in the loss of considerable portions of stone. The remarkable extent of the gaps contributed to affecting the physical properties of the stone and to altering the static conditions of the work (Fig. 5-6).

Concerning the sculpted elements, and namely the coat of arms, the columns of the arcades, the side elements of the rose window and some of the frames – most of which are made of Angera stone with granite and Ceppo gentile stone inserts – featured some alterations of the surface layer, with prominent differences in shape and colour as compared to the original substrate, i.e. black crusts, coherent deposits of dirt, patchy joints, cracks and biological deterioration (Fig. 7-8-9).

Fig 5-6.
Details, erosion,
Pinnacle
of the Southern Transept



THE RESTORATION

After estimating the conditions of the work as a whole and of its individual ornaments, the restoration was started with the aim of protecting the materials, healing the finishes and at the same time recovering the original appearance of the ornaments and of their history. The main objective was to strike a balance between the removal of coherent deposits and black crusts and the conservation of the patina of age that has built up during the life of the work, which makes an integral part of it (Fig. 10).



Fig 7-8-9.
Details, state
of conservation,
Southern Transept

Fig 10.
Pinnacles of
Southern Transept

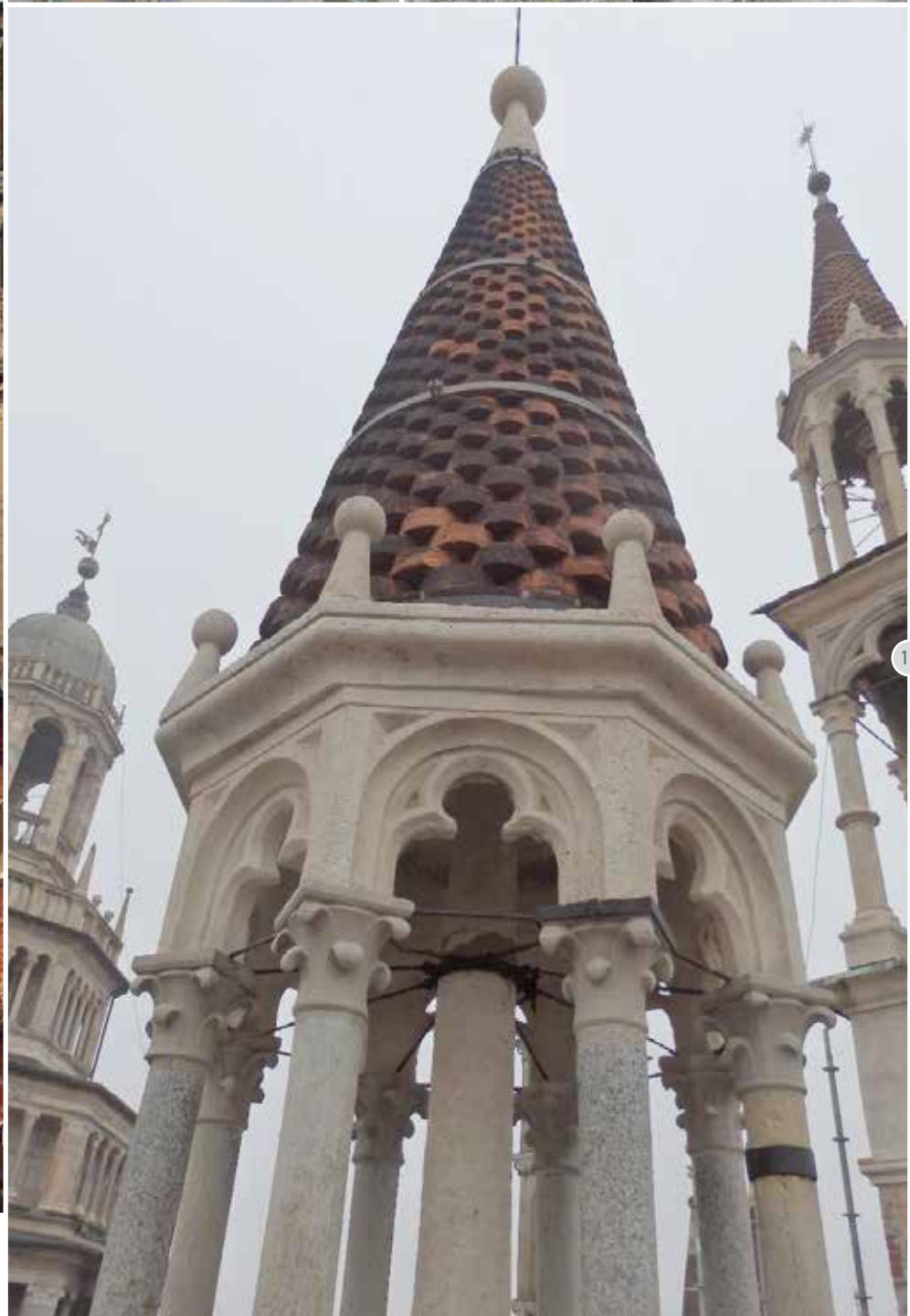




Fig 11. Detail, Biocide treatment, Pinnacle of Southern Transept

Fig 12-13-14. Details, results after biocide treatment and cleaning, Pinnacle of Southern Transept

Fig 15. Detail of structural reinforcing fabric

Fig 16-17. Detail, Interior of dome, before and after consolidation

PEST CONTROL AND DISINFECTION AGAINST BIOLOGICAL DETERIORATING AGENTS

The areas hit by autotrophic and/or heterotrophic bacteria were sprayed with a wide-range biocide, diluted in compliance with the manufacturer's specifications. At a later step of the cleaning process, the chemical was rinsed off with low-pressure deionized water (Fig. 11).

CLEANING

After all the surfaces were cleaned with ionized water, coherent dirt deposits were treated with chemical compresses and the spots featuring the hardest black crusts were micro-sanded with the help of precision tools (Fig. 12-13-14).

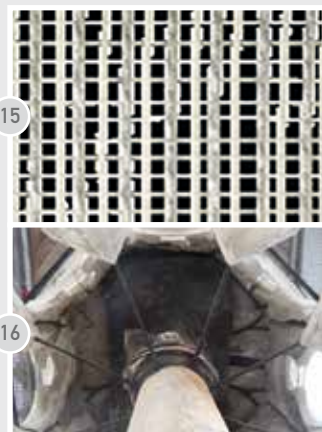


Fig 18-19-20.
Details, Consolidation,
Pinnacle of Southern
Transept

CONSOLIDATION

Consolidation and structural reinforcement were carried out as follows.

Ethyl silicate was repeatedly applied until rejected by the substrate, with special care to the areas where the original thickness had been heavily reduced, with the aim of making them more compact and sturdy. Subsequently, the original thickness was rebuilt with the help of structural mortars and special steel fabrics, by using different materials for columns and for arches.

A thixotropic mortar was used to repair portions of the columns, by sinking in it a structural reinforcing fabric, whose one-directional mesh is composed of high resistance galvanized steel micro-strands fixed to a fibreglass micro-mesh (Fig. 15-16-17-18-19-20).



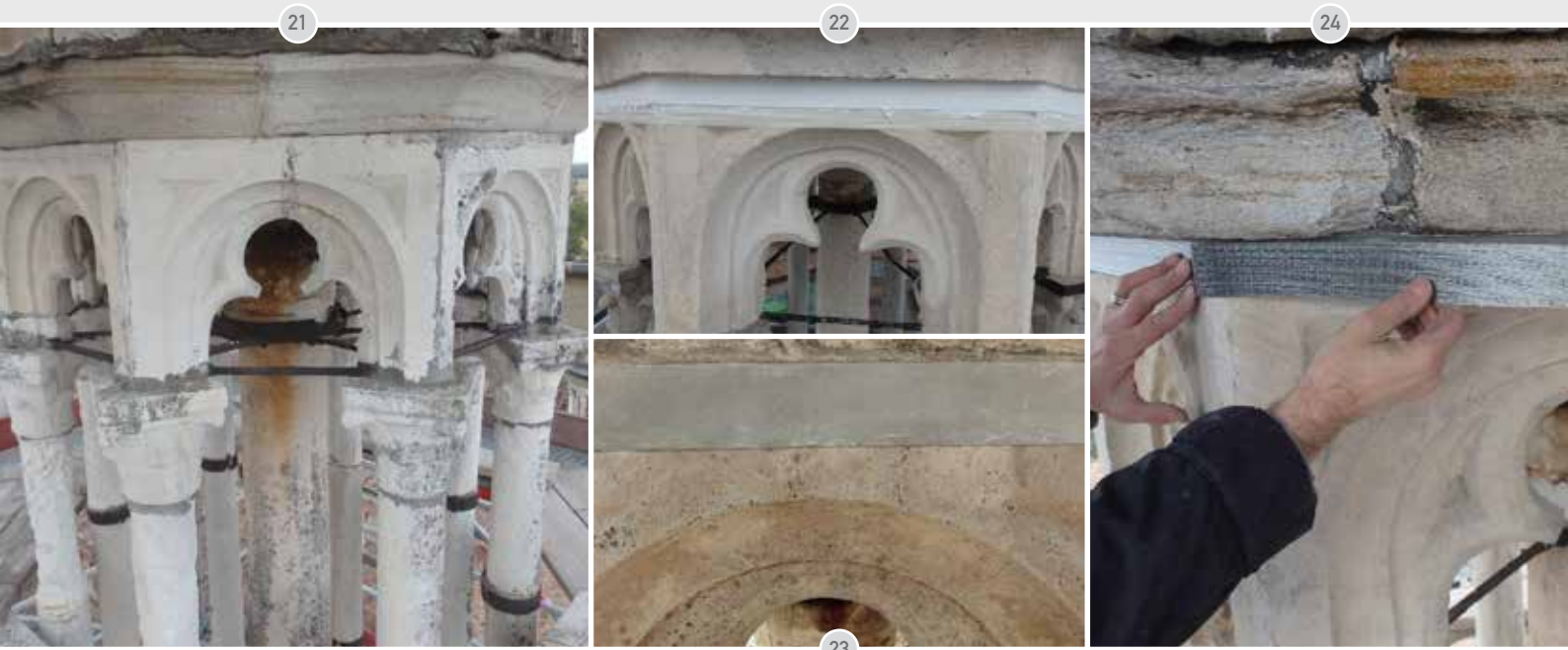


Fig 21.
Details, erosion,
Central Pinnacle of
Southern Transept

Fig 22-23.
Detail, Preparation
of the surface by levelling
the area where
the reinforcement patch
is to be applied, Pinnacle
of Southern Transept

Fig 24.
Application of steel fibre
patch, Central Pinnacle of
Southern Transept

Fig 25.
Supporting anchors are
used to help correct
the position of the fibre
during the application
of the epoxy resin, which
will incorporate the whole
system. Central Pinnacle
of Southern Transept

STRUCTURAL REINFORCING BANDAGE

As planned at the engineering phase, the external portions of stone between the capitals and the earthen cones of the pinnacles required to be reinforced by means of a special restraint system. After preparing the surfaces, the bandage was executed with the help of high resistance galvanized steel fibres fixed on a fibreglass microlattice and mineral epoxy adhesive (height of patches varies from about 60mm to 100mm). To reduce the visual impact of the added elements, the fresh resin was powdered with a silica sand and finished with a convenient silicate paint of the same colour as the neighbouring stone (Fig. 21-22-23-24-25-26-27).

POINTING

After carefully and cautiously removing all mortars, plasters and residues of any previous works with the help of a hand hammer, all gaps and joints were pointed with special mortars aimed at preventing water infiltration and at integrating all stone elements. Any cracks and fissures were filled with epoxy resin and/or hinged with stainless steel or fibreglass rods (Fig. 28).





Fig 26.
Final application
of adhesive resin on top
of the reinforcement fibre.
Central Pinnacle
of Southern Transept.

Fig 27.
Detail, Colour of
the surface is corrected
after introducing
the retention patch.
Central Pinnacle of
Southern Transept

Fig 28.
Detail, Integration,
pointing, Central Pinnacle
of Southern Transept

Fig 29.
Pinnacles of Southern
Transept, after
restoration works



Vittorio Bresciani



BRESCIANI

Material and Equipments for

Restoration and Conservation

info@brescianisrl.it

www.bresciani.eu

THE SPANISH WALLS OF MILAN: MICROINJECTION AND GROUTING SYSTEM

The use of instrument grouting system (Fig. 1) has been in place for years, both in Italy and abroad, in many yards, giving an important aid in the joints of the masonry brick of natural stone.

The analysis of the use and usefulness of the instrument was verified on a very large and important shipyard, having as object the improvement of the Spanish Walls of Milan (Fig. 2), with thousands of metres of mortar joints.

The joint system was designed to facilitate and speed up the long process of sealing of joints (Fig. 3-4-5) that lie between the bricks or stones and that, over the years, have lost much of the bedding mortar which constituted the link between the rows of stacked bricks. These gaps should be restored to prevent further degradation leads to a possible collapse of the walls.

Until now the joints were restored by manually inserting the mortars, creating problems precisely from the system by which the operator inserted the new mortar into the joint itself using a small spatula: the joints have a size of about one centimeter and pushing the same mortar from outside to inside, it was not certain that it had completely filled the joint.

using the grouting machinery, this does not happen because its nozzle allows it to enter the joint and fill it from inside to outside.

Another problem in the manual joining was the cleaning of the bricks or stones from the grouting mortar because, with a small spatula and a liquid mortar, inevitably the mortar was dripping and getting dirty.

The mortar system is equipped with pipes that allow it to work up to 5 m high without moving the machine.

Fig 1. Grouting System

Fig 2. Spanish Walls of Milan

01



02





03

If it is necessary to move the machine, it is equipped with a structure with wheels and handles that facilitate handling.

The instrument is also equipped with a remote control that the operator will easily hold with his left hand, as with the right he will have to hold the injection nozzle, which allows him to start and stop the machine, electronically adjust the speed of the machine, which can vary from 0 to 180 l/h, and to use the counter-pumping device, which allows suction of excessive groove mortar that could spill from the nozzle.

Fig 3-4-5.
Sealing of joints



04



05

In the top part, the machinery has a 9 liter conical hopper in which the grouting mortar is supplied, which can also have a 3 to 4 mm granulometry.

The 12 Vdc motor, which moves the peristaltic pump, can be powered by batteries, with a battery charger, or 230 V electricity.

By replacing the flat nozzle with the round bushing, the machine can be used as an injector pump (Fig. 6).

Fig 6.
Injection probe

Fig 7-8.
Microinjection version

There is also a version for microinjection (Fig. 7-8), with micrometric flow regulation, equipped with a needle nozzle and pressure gauge for pressure control. Of course the mortars will have to be much more fluid and have a proper granulometry.



06



07



08

CASE HISTORY



Spanish Walls - Milan - Italy



Kınık Höyük Archaeological Site - Southern Cappadocia - Turkey



Asinelli Towers - Bologna - Italy



Basilica of Sant'Antonio - Padova - Italy



Duomo of Pisa - Pisa - Italy



Grotto of the Annunciation - Nazareth - Israel



01

Alessandro Zanini
Laura Bartoli

LASER CLEANING OF CULTURAL HERITAGE



conservazione@elen.it
www.elengroup.com

Laser ablation is one of the most important irradiation effect which can be induced on optically absorbing materials. Laser cleaning is a particular case of laser ablation where a specific substrate is uncovered through the removal of undesired layers. Laser cleaning gained in the last years a prominent position among the cleaning techniques for the conservation of Cultural Heritage. The use of laser for the restoration of artworks started in the 70s but the technique actually began its rise at the end of the 90s when scientific studies validated the efficacy of the use of a laser beam to clean masterpieces. The emission parameters of the lasers have been also optimized in order to guarantee a safe and efficient cleaning of different substrates. Laser cleaning was initially applied only for the removal of black crusts from white marbles but, thanks to the technological innovation and to the background of scientific studies, its use has been extended to other materials such as metals, gilded bronzes, wood, ceramics and wall paintings. Laser ablation provides indeed many advantages with respect to mechanical and chemical methods in terms of gradualness, self-termination, selectivity, environmental impact and safeguard of the so-called “age patina”.

Laser cleaning has been widely applied for the cleaning of frescoes and wall paintings also in very particular and extreme environments such as catacombs. One beautiful case study regarding underground locations is the Catacomb of Domitilla (Fig. 1), in Rome, in particular the “bakers’ niche” which is located on the first floor of the catacombs. Its walls are mainly frescoed, often with dry overpainting. The microclimate inside the hypogean structures of



02

Fig 1.
The vault of the
Domitilla's catacombs
before the cleaning

Fig 2.
The vault after the
laser cleaning

Fig 3.
A detail of a wall
painting during the
cleaning

the catacombs is usually quite stable, featuring high relative humidity between 96% and 100%, and temperatures around 14-17°C all through the year. One of the most common decay problems concerns the precipitation and crystallization of calcium carbonate that covers the frescoes almost entirely. An instance of such decay is the typical dark film covering the vaults and the upper walls of the rooms that may range from thin films to very thick layers.

Nevertheless, the results obtained with traditional conservation methods were unsatisfactory as they did not result in the complete cleaning of the surface. Therefore, after preliminary tests, two laser systems with optimized pulse duration have been used for the removal of the black film. The cleaning has been extremely satisfactory and brought back to light the beautiful colors of the original paintings. (Fig. 2 - 3).



03



04



05

06

07

Fig 4.
The removal of the thick carbonatic layer from the walls of the Hypogean Basilica of Porta Maggiore in Rome

A similar conservation problem was faced in the first century A.D. Roman complex of the Underground Basilica of St. Maria Maggiore in Rome. This is a beautiful and fascinating hypogean temple decorated with fine stuccos and a fresco. Here, too, the laser had to intervene for removing thick layers of mineralized carbonation that obscured and covered the precious depictions. (Fig. 4)

Fig 5.
A restorer at the Opificio delle Pietre Dure in Florence during the cleaning of the frieze of the Gates of Paradise by Lorenzo Ghiberti

The application of laser cleaning on metals concretely started with the case study of the gilded bronze panels of the “Gates of Paradise” by Lorenzo Ghiberti of the Baptistery in Florence (Fig. 5): a careful optimization of laser parameters was performed and led to the introduction a Long Q-switching laser system with pulse duration of 100 ns. The effectiveness and safety of the laser for the cleaning of amalgam gilding, gold laminas, silver and bronze were proved during the years thanks to interesting conservation treatments such as the restoration of the bronzes statues of David by Verrocchio, David and Attys by Donatello, the Etruscan statue “Arringatore (Fig.6) and the cleaning of the other two doors of the Baptistery: the North door by Lorenzo Ghiberti (Fig. 7) whose cleaning ended up in 2015 and the South door, the oldest of the three, by Andrea Pisano that is currently under restoration at the Laboratories of the Opificio delle Pietre Dure in Florence.

Fig 6.
The laser in action on the Etruscan statue named “Arringatore”

Fig 7.
The laser cleaning of a detail of the North Door of the Baptistery of Florence

In the last years the laser cleaning technology overcame the boundaries of Europe to land also in Asia. Two stone portals of the Royal Palace of Patan in Nepal (Fig. 8), built in local sandstone, were covered with a thick bituminous layer difficult to be removed with traditional cleaning techniques. During a previous intervention the use of solvents (acetone and white spirit) followed by mechanical action by scalpel had been able to remove this thick black layer only partially. The use of the sandblaster has been discarded due to the fragility of the stone and the consequent possible loss of material as well as for reasons related to the humid climate in Nepal that would have affected the emission of sand from the nozzles. After some preliminary laser cleaning tests it was decided to perform the conservation of the portals only using the laser which has proven the most effective in the removal of the bitumen from the stone of the portals.

Fig 8.
The portal of the Royal Palace in Patan, Nepal during the laser cleaning operation for the removal of a thick black layer of bitumen



Marco Volpi
Sara Gabriele

THE USE OF COMPOSITE MATERIALS IN STRUCTURAL CONSOLIDATION



composite engineering

info@fibrenet.info
www.fibrenet.info

The structural consolidation world has been revolutionised in the last few years by the introduction of innovative materials, the so called FRP-Fiber Reinforced Polymer composite materials, composed of a matrix and a reinforcement fibre.

The matrix is usually of organic nature, composed of thermosetting resins of various types, whilst the reinforcement is composed of long fibres: carbon (CFRP - Carbon Fibre Reinforced Polymer), glass (GFRP - Glass Fibre Reinforced Polymer) and aramids (AFRP - Aramid Fibre Reinforced Polymer).

In addition to these fibres, recognised and covered by Italian norms through dedicated guidelines, other types of reinforcement with different performances are currently being studied, especially as far as the mechanical resistance and characteristics of durability with time are concerned.

The development in Italy of these alternative materials was encouraged by the presence of a vast, existing historical heritage, on which interventions were carried out with traditional



techniques utilising materials which were often heavy, invasive, with low compatibility and little coherence with the structures, resulting in vetoes by the institutions responsible for their protection.

The Italian norm identifies the different levels of controls on the existing buildings, dictated by their characteristics and age, but the principals, with which one approaches an historical building or a building/artefact appertaining to an archaeological area, are commonly shared.

There are four principals which must be referred to during the design and execution of a restoration project: compatibility, reversibility, durability and limited invasiveness.

Faced with the necessity of a consolidation intervention, which traditional building methods carry out with steel mesh and cement mortar, innovative materials like FRP composites are the best solution, as they fully satisfy such interventions.

A steel mesh installed with cement mortar does not satisfy compatibility requests when used on historical walls - traditionally in stone and brick - due to the intrinsically rigid characteristics of the mortar's composition. Such consolidation is hardly reversible: an intervention involving the removal of high performance materials, like the cementitious ones, characterised by an elevated capacity of grip, inevitably lends itself to an invasiveness which damages the existing structure.

REINFORCED PLASTER (RI-STRUTTURA system)

Villa Adriana, Tivoli

Utilising mesh, connectors and accessories in GFRP (fibre glass composites) together with lime mortars, the technique of "reinforced plaster" provides for the carrying out of compatible and reversible reinforced plastering, which significantly improve the shear, flex-

ural and compression resistance of masonry walls, keeping the weights and thicknesses as low as possible. This system was used on the infamous Roman villa called Villa Adriana in Tivoli, for the consolidation intervention on the vaults.



A composite FRP material generally unites its capacity to increase the performance of the structural elements relative to the static or seismic nature of the solicitations, with the characteristics of light weight, compatibility, reversibility (the contact/adhesion surface remains unchanged) and limited invasiveness.

The need to confront consolidation issues for the historical/architectural heritage emerged strongly in Italy, starting from 2009 after the earthquake in L'Aquila and subsequent seismic events which involved the centre of Italy, probably being the territory with the highest concentration of artistic and architectural heritage of elevated value.

Since then, the need arose to repair damages and intervene urgently, involving interventions for ensuring immediate safety, over and above the need for compatible and safe repairs and partial reconstruction. In parallel and simultaneously, the need also arose for ample and complex type interventions, in terms of solutions for risk situations, namely: seismic resistance improvement, adaptation, the reconstruction with adequate criteria and new building with seismic resistance characteristics.

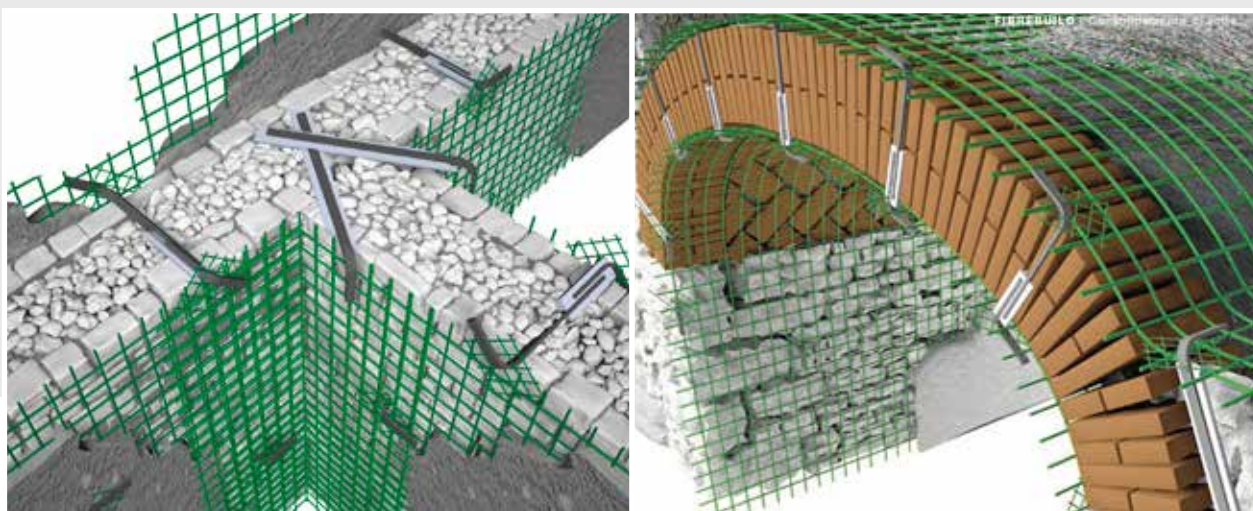
The intrinsic seismic characteristics of the Lebanese earthquake, in a manner similar to Italy's, induced certain reflections relative to the opportunity to evaluate adequate preventative actions.

To intervene in terms of consolidation signifies operating in an efficient manner with materials and systems which are capable of reinforcing the existing structures, after having considered the fragilities caused from different mechanical issues, which cause a multitude of repercussions in relation to the type of masonry structure on which they act (stone, brick, etc.) and in relation to the way they have been built.

In an historical wall, the absence of structural integrity, the inadequate distribution of the reinforcement elements, the scarce resistance of the materials, the inadequate anchorage or an insufficient foundation system, are stresses which promote damages.

Once the appropriate characteristics have been defined in context, utilising composite materials for vertical walls or intervening on domed surfaces, there is the preventative need to identify the most adequate method considering the specific characteristics of the structure.

The reinforced plaster with GFRP reinforcement and lime mortars for the reinforcement of masonry walls, the reinforced re-pointing for the consolidation of face brick wall joints, the localised, fibre-reinforced plate for local structural reinforcement and composite pultruded profiles for the construction of light structures, are all consolidation techniques which utilise composite materials with the scope of confronting the specific problems in proportion to the different types of masonry structures, intrinsic fragilities and damage causing mechanisms.





REINFORCED POINTING (RETICOLA system) - Sheik Süleyman Mosque - Istanbul

Utilizing stainless steel cables and connectors, the technique of “reinforced pointing” of the mortar joints was identified in Istanbul as the most appropriate for a consolidation intervention carried out at the Sheik Süleyman Mosque, a religious building of Byzantine origins of elevated historical and symbolic significance. The system was developed for consolidation interventions on masonry walls where the “face brick” feature needed to remain, and which consents the carrying out of an efficient and

diffused reinforcement and confinement, maintaining the original aesthetic aspect.

Specifically, the project foresaw an intervention which was capable of guaranteeing, as much as possible, a boxed behaviour to the masonry structure of the building, extending the reinforcement in two directions, one in a central position and the other close to the top of the building’s apex, whilst a particular consolidation solution was studied for the dome.





FIBRE-REINFORCED PLATE (BETONTEX-EPOXY system)

Duomo di Carpi and Basilica di San Petronio in Bologna

This technique utilises glass fibre or carbon fibre fabrics, which need to be glued with polymeric, thermosetting resins which increases the shear force resistance in masonry walls and the compression resistance in beams and columns, as well as the use of local reinforcement and enveloping of irregular geometric shapes and in the areas which are solicited the most, like curbs and apexes.

Bandaging in carbon fibre was also used on the Duomo di Carpi, damaged by earthquake on 2012, damage which was located close to the

dome and the lateral aisles, both zones having suffered a series of cracks and detachments.

A localised intervention with CFRP materials was carried out on the Basilica di San Petronio in Bologna for the consolidation of a breakage found on the architrave of the left door, which in turn caused the rotation of the one part with respect to the other, probably imputable to the original installation or due to material defect. The intervention was carried out using CFRP bars, cords, laminates and fabrics.





COMPOSITE PULTRUDED PROFILES IN GFRP Catacombe of San Callisto - Rome

Characterised by an elevated level of resistance, reliability and safety, profiles and light structures in GFRP possess particular peculiarities such as low weight, compatibility, reversibility and are scarcely invasive relative to the structures they will act on.

Such profiles have been used on an intervention in Rome in the San Callisto Catacombs in the form of light infrastructure for the construction of pedestrian handrails and the consolidation of some protections on crypts.

The particular ambient conditions and the specific

context, primarily in consideration of the geological characteristics of the location, were a determining factor for the definition of the materials to be used: the elevated versatility of the composite materials, combined with the possibility of controlling and calibrating in advance the performance offered, together with the durability against the aggressive external agents combined with the benefit of reduced weight, as well as the optimal weight/performance ratio and the ease of workability on site with normal cutting and drilling tools.



Diego Aisa
Chiara Frate
Federico Picuti

ALTERNATIVE APPLICATIONS OF INNOVATIVE FRP-ANTI DELAMINATION AND ANCHORING DEVICES: THE PIETA' RONDANINI CASE STUDY



info@kimia.it
www.kimia.it

During the workshop, a special focus will be given to innovative techniques to be used to avoid the delamination of FRPs from the substrate. Kimia developed a full range of anchoring solutions, among which a special mechanical locking system, Kimitech FRP LOCK, is used to better exploit the resistances theoretically ensured by the composites preventing the delamination of the fibers from the substrate. That feature is particularly useful when reinforcements are applied:

- _ On poor quality substrates, where a cohesive failure on the cortical layer of the strengthened element is usually attained for stress-stains values lower than the ones the fibers could withstand;
- _ For the reinforcement of elements undergoing dynamic stress conditions: without end connections and by following the movements of the structure, the composite is likely to be disconnected from the support when subjected to compression, being, therefore, unable to exert its resistance in the subsequent phase in which would have worked in traction.

A special version of Kimitech FRP-LOCK®, called Kimitech FRP-LOCK PR (Fig. 1), was used to anchor Michelangelo's Pietà Rondanini statue to a new anti-seismic basement during its relocation inside Palazzo Sforzesco in Milan.

The seismic assessment project of the "Pietà Rondanini" coordinated for the structural aspects linked to the repositioning of the statue by Eng. Devis Sonda (Miyamoto International), won the "Global Best Project 2016" prize. The award is also a recognition of the work done by Kimia, which developed the anchoring system of the sculpture to the anti-seismic basement.

Fig 1.
Kimitech FRP-LOCK PR

Fig 2.
The new location of
Michelangelo's Pietà
Rondanini



01



02



Fig 3.
The new anti-seismic
basement

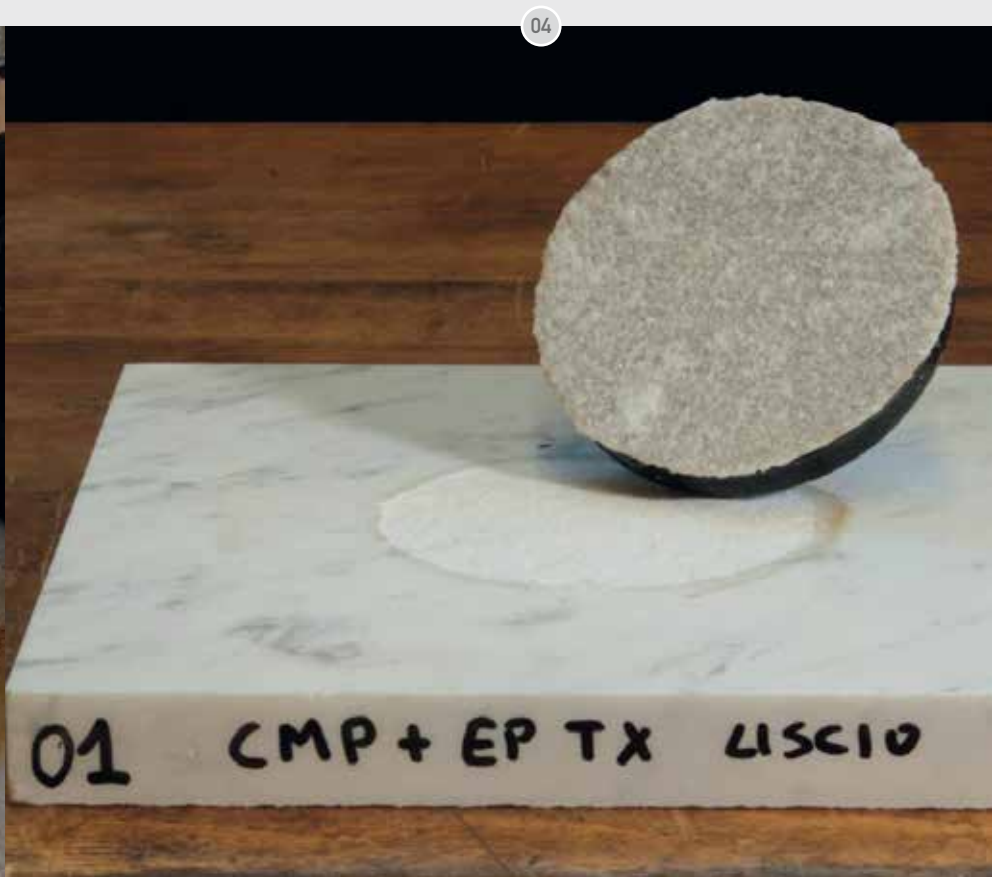


Fig 4.
Reversibility tests

The famous Michelangelo's sculpture, dating back to the XVI century, for the opening of EXPO 2015 was located in a new location of Palazzo Sforzesco in Milan (Fig. 2).

In fact, after 60 years spent in the Hall of the Scarlioni, it has been housed in one of the lovely rooms recently recovered from the ancient Spanish Hospital. For the occasion, the statue has been placed on an advanced anti-seismic basement able to make it immune from both seismic actions and frequent vibrations generated by the visitors and by the passage of the underground trains nearby (Fig. 3).

Because of the priceless artistic value of the statue, the exceptional work of relocation of the sculpture represented an opportunity for more competent companies to show their skills and technologies. Kimia was called to cope with the locking system to be applied under the basement of the sculpture.

The idea of realizing a locking system with composites is born from the thirty-years-experience of Kimia in the field of structural reinforcements with these materials.

Kimitech FRP-LOCK® PR is realized through a lamination process of the carbon fiber fabrics around a metallic core. It looks like a disk made of composite material in which the base forms the bonding surface, the core is used to fasten a metal cylinder incorporated and blocked into the basement.

The steps prior to the placement of the reinforcement, have been in-depth studied to develop and test - in the laboratories of Politecnico in Milan - the best solution taking into account the necessity to make the intervention both highly strong and reversible (Fig. 4).

Fig 5.
Preliminary operations



Fig 6.
Casting of Betonfix CR
pourable mortar



OPERATIVE STEPS:

1. The anti-seismic and anti-vibrating platform realized by a team of companies, including Eng. Devis Sonda (Miyamoto International), the THK multinational mechanics and the Italians Goppion and Reglass, has been positioned inside the room of the Spanish Hospital. The surface was prepared by a casting of the pourable fiber-reinforced cement mortar Betonfix CR, reinforced with welded steel mesh (Fig. 5-6).
2. The Statue, properly protected and secured, was brought into the Spanish hospital room. In order to proceed with the bonding of the Kimitech FRP LOCK® PR on the lower surface (Fig. 7), the statue was raised and maintained in safety for all the necessary processing time. Finally, once screwed the metal cylinder to Kimitech FRP-LOCK PR (Fig. 8-9), the final positioning has been done by inserting the cylinder into the basement (Fig. 10).

Fig 7.
Bonding of Kimitech
FRP-LOCK PR



Fig 8.
Lifting of the statue



Fig 9.
Fastening of the metallic cylinder

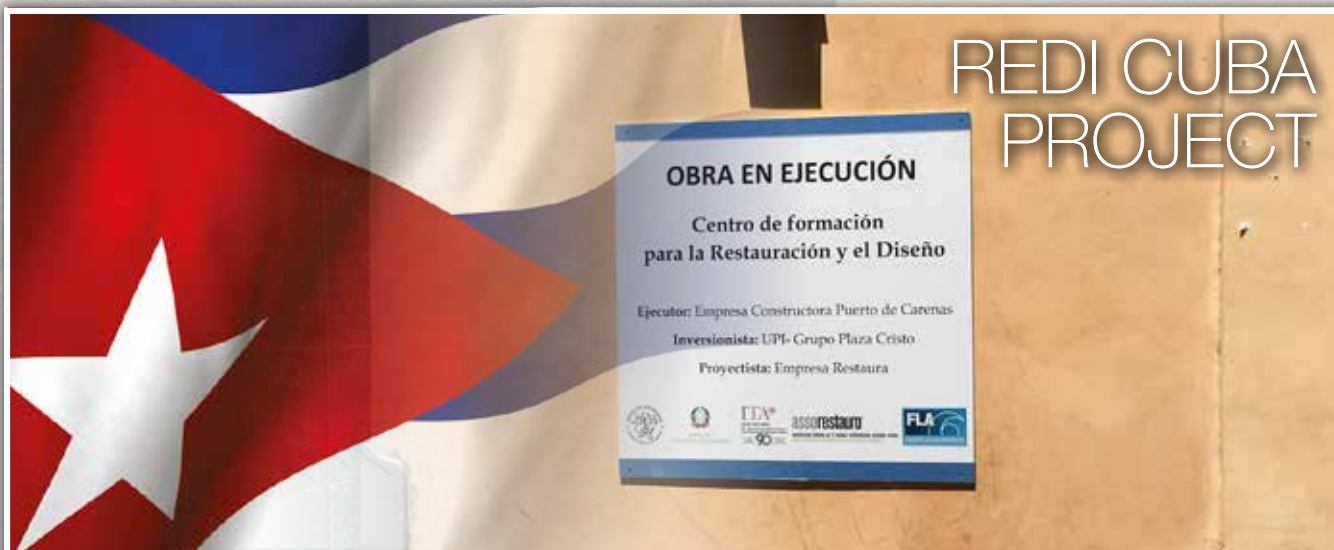


Fig 10.
Positioning of the statue



INTERNATIONAL PROJECTS

IN PROGRESS...



REDI CUBA PROJECT

CUBA

TECHNOLOGY CENTRE FOR RESTORATION AND DESIGN, IN CALLE SAN IGNACIO, LA HABANA
WORKSITE INAUGURATION WITH ITALIAN SUPPLY IN SEPTEMBER 2017
TRAINING – CONFERENCES-COOPERATION



COLLECTIVE EXHIBITION OF ITALIAN RESTORATION

CANADA/USA

NATIONAL TRUST FOR CANADA JOINT CONFERENCE OF ATPI,
OTTAWA, 11-14 OCTOBER 2017
PRESENTATION CONFERENCE ON REDI CUBA PROJECT

PROMOTIONAL PROJECTS 2017/2018

COLLECTIVE EXHIBITION OF ITALIAN RESTORATION



RUSSIA

DENKMAL MOSCOW 8-10 NOVEMBER 2017
**THE THIRD INTERNATIONAL TRADE SHOW FOR PRESERVATION,
RESTORATION AND MUSEUM TECHNOLOGY**



IRAN

PROMOTIONAL PROGRAM
WORKSITE SCHOOL IN TABRIZ AND TEHERAN



quaderni di assorestauro



YEAR06NR02