

quaderni di assorestauro



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MONZA
BOLOGNA
PISA
LAGO MAGGIORE
MILANO
TORINO
ABBIATEGRASSO

ACTA OF THE INTERNATIONAL WORKSHOP

**MED ART FOLLOW-UP
RESTORATION OF
THE SHEIKH SÜLEYMAN MOSQUE
TRAINING IN ITALY - SECTION 1-2**



Project financed by the Italian Institute for Foreign Commerce & Assorestauro

ITALIA 
Italian Trade Promotion Agency

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Quaderni di Assorestauro



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ITALIA

Italian Trade Promotion Agency

The Italian Trade Promotion Agency-ICE is the Government agency that supports the globalization of Italian firms, under the strategies of the Ministry of Economic Development. ICE helps to develop, facilitate and promote Italian economic and trade relations with foreign countries, focusing on the needs of SME, their associations and partnerships. ICE sustains Italian firms in their internationalization processes and promotes worldwide the marketing of Italian goods and services, Italian investments, as well as the image of “Made in Italy” products around the world.

ICE provides information, support and consultancy to Italian companies on foreign markets, promoting and fostering export and cooperation in all areas - industry, agricultural and agri-food, services, etc. - with the target of increasing and make more effective their presence on international markets. ICE works closely with the Italian Regions, the network of the Italian Chambers of Commerce, business organizations and other public and private entities.

ICE headquarters are in Rome, with a large network of offices around the world and acts as “Trade Promotion Sections” of the Italian Embassies or Consulates.



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

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
 President of Assorestauro

This issue of QA has been edited with the clear intent of providing a further support and an operative tool within the boundaries of the Med Art Project and the restoration of the Sheikh Süleyman Mosque.

The primary aim, Assorestauro links to the Med Art project, particularly emphasized in the official protocol signed with the T.R. Prime Ministry Directorate General of Foundations, is to offer to the Turkish restoration experts the widest panorama of the Italian restoration Industry and technical culture.

The Transfer of Technologies and the reciprocal exchange of qualified experiences are surely one of the widest areas for an open-minded dialog between two different Cultures, but ultimately not the most important. The organic and utter approach to the Conservation Project is the real factor which characterizes and qualifies Italy among other Countries. Without a deep knowledge of the materials which constitute the Cultural Heritage, the historical and scientific aspects concerning its evolution in time, it is clearly impossible to plan a conscious and correct intervention for its conservation. This process comprehend, among the main topics, the re-use or use of the building according to its nature and the modification carried by History as an open dialogue between past and present. In many cases, the quality of the compromise and the feeble equilibrium between the respect to the past and the smart attribution of the actual or planned use are the topics which states and qualifies a good project of restoration. In the specific case of the Sheikh Süleyman Mosque, considering that its function has been stated by History, that fine compromise has been found in the delicate restoration of the surfaces and the dialog with modern languages, the adequate design of the adjacent areas, the seismic reinforcement and the energy saving management. Work on the context in which the monument has been set up, trying to think at the surroundings as a part of the monument itself, characterize the Italian approach to the conservation of Cultural Heritages. After that... technologies, advanced materials, expertise, innovative and minimal invasive solutions can be involved in the process.

Since 2006, starting from the Renovation & Restoration Fair and the B2B meetings organized by the Italian ICE, going through the restoration of the Clock Tower of the Dolmabahçe Palace and the collaboration in the lighting systems of the Fountain of Ahmet III, The Fashion Academy and the Clock Tower itself, Assorestauro has been conveying this values with its Turkish partner and colleagues, well aware that Turkey represents one of the prime Countries in the Mediterranean area due to its history, tradition and due to the quantity, complexity and value of its Cultural Heritage.

This is the approach to be used reading this issue of QA and the furthers, related to the Med Art Project. All the collaboration and future project, the meetings and training session already held and to be planned in Italy and Turkey, will be based on those values and meanings. On those bases, we will be able to write and share a common language which will be used by the experts and companies of both Countries for a long term cooperation on the basic and strategic field of the Restoration of Cultural Heritage.





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■ General philosophy of restoration

The approach to the structural restoration of Villa Reale in Monza was marked by utmost care and respect of the existing structure, pursuing the policy of minimum intervention and reversibility. Specific analyses were carried out both locally (on elements such as slabs, structural vaults, stairs, etc.) as well as globally, considering the building as a whole (analysis and verification of comparison, both static and seismic, between ante-operam and post-operam).

The engineering design process followed the procedure recommended by international conventions on Cultural Heritage (Venice Charter, Guidelines for Cultural Heritage, ICCROM, ICOMOS, etc.), some of which are prepared with the contribution of the writer.

A thorough anamnesis was carried out to accurately evaluate the soundness of the building, as it has been handed down from the past, focusing both on the historical events that have characterized it, including the change of use and the technological adjustments associated with modern comfort in some parts of the building (electricity, heating, hot water etc.), and on the marks left by time, as for every historic building, that are detectable by an accurate analysis of the crack patterns. The following step was the diagnosis: all information, the one already available as well as the one determined during the project phase, have allowed us to shed light on the actual soundness of the building, from the point of view of its specific elements (vaults, slabs, stairs) and for the entire building behavior (load-bearing walls, the overall response to stress such as earthquakes or temperature variations). It is very important to consider the different levels of need for restoration works between all the different elements.

The specific elements, as mentioned before, substantially represented by slabs, stairs and vaults, must necessarily be evaluated individually, since each floor has unique features being characterized by different spans, different finishes, different dimension of the bearing elements, maybe even from a different essence or from a different state of conservation of the wood, etc.. Therefore, it was necessary to extend the knowledge of all the factors mentioned above as far as possible, in order to propose an analytical verification true to the actual state of the structure, indicating, where necessary, the most appropriate manner of restoration to solve these shortcomings. Regarding the whole of the building, in terms of masonries and foundations, the only possible investigation performed was carried out in limited areas of the building, extending later the results to the rest of the construction.



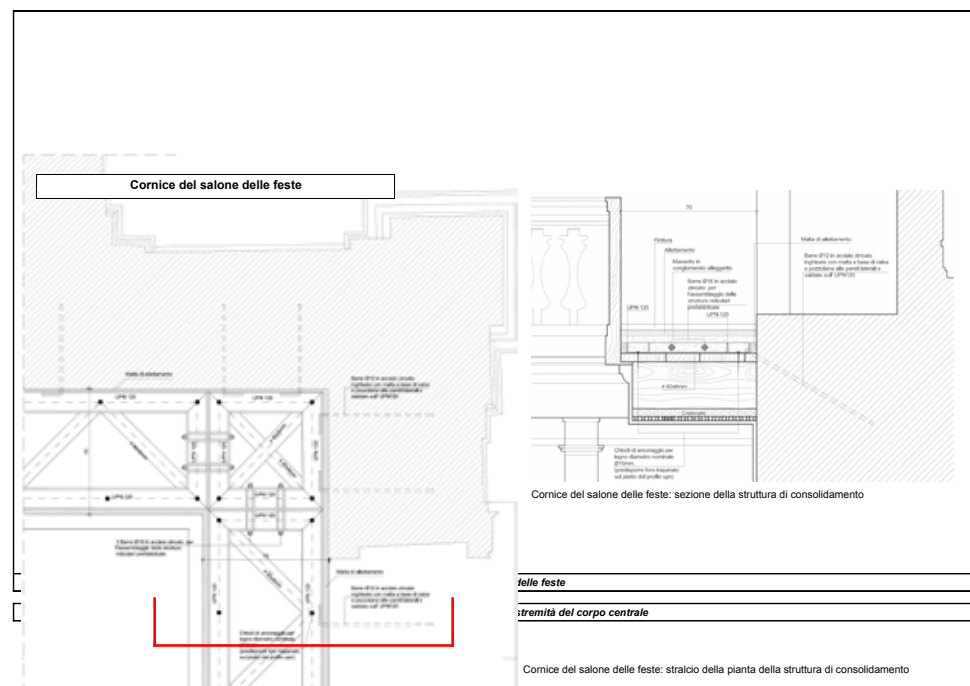


RESTORATION WORKS ON MASONRIES

The analysis of geometric survey showed that masonries were built in substantial accordance with a structural system of modern concepts, characterized by load-bearing walls of the facade and transversal masonries linked by numerous cross direction walls, able to give the construction the necessary guarantees in terms of static stability and a “natural” ability of earthquake resistance. What remains is the need to reinforce and improve the static strength of the existing walls.

It is necessary to highlight that:

- The masonry, relative to type of material, layout and state of consistency, is not generally injectable and hence it was necessary to provide a more structured system of differentiation and reinforcement in order to assure the necessary static safety;
- The masonry (investigated with single and double flat jacks) has revealed a very high stress state, characterized by safety factors to rupture well below the minimum established by law;
- The real state of decay (as checked on site) of the interface (connection) between the external granite facade and the adjacent masonry led to a further differentiation of the activity (need for filling injections and particular temporary safety structures).



OTHER WORKS. Slabs, vaults and vertical connections have been carefully evaluated on the base of historical researches integrated with inspections and survey campaigns. These structures must necessarily guarantee security and stability in relation both to permanent loads and to accidental overloads compliant to current legislations; in other words, it is not sufficient to rely on the adequacy of the construction technology and the good condition of the structural elements but must furthermore assure the same safety requirements of new buildings.

This because it has not been possible to reach the accidental overload on all floors or the seismic stress required by current legislations (which involves the global checks on the building). In such cases it was necessary to impose restrictions of the loads to avoid that the operation was too invasive. After completion of this step the therapy was defined: the causes of the structural deficiencies were identified and studied as well as the necessary works to remedy the relevant diseases (problems).

STRUCTURAL WORKS

Works on masonries ante-operam

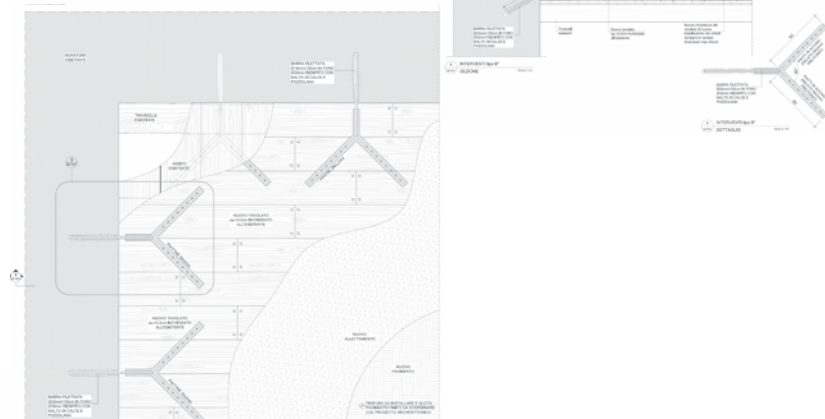
In accordance with the analysis, in respect of the Villa and the historical and artistic heritage it represents, the reinforcement of the walls was limited and minimized to achieve of the objectives established by the verification, and it was differentiated according to type, location, value, finish and stress characterizing every bearing structures, pillars or walls. The choice of materials was made in full accordance with the guidelines : no mortars reagents and bandage high modulus aramid fiber; materials (including composite) that give assurances in terms of performance and durability. In order to achieve the objective, in terms of the required bearing capacity to vertical loads, the reinforcement system chosen, verified and implemented, was the restraint by means of galvanized steel bars put into the load through the use of steel plates which made it possible to limit the contact pressure on the masonry itself to acceptable values. This action was also implemented through the pressure of the structural plaster mortar of lime and fiber-reinforced pozzolana by the associated network of alkali resistant fiberglass. Where required, the works were characterized by the simultaneous use of a bandage of discontinuous multi-layer fabric of aramid fiber high modulus. A similar approach can be applied to the inner pillars of the central



area of the ground floor. On the other hand, for the external wall of the ground floor, a possible alternative was studied, abandoning the idea of dismantling and subsequent setting of the facade of granite and implementing the use of one-side no-expulsion prestressed bars. The project furthermore demanded (where required) the simultaneous reinforcement and filling by injection of the interface granite-masonry. For the masonry walls to be strengthened on the first floor and for those considered to be of great value at the ground floor, a different process was prepared that took into account, as mentioned initially, the specific characteristics of the individual walls, to verify and implement the strengthening by bars post-tensioned without the need to completely remove the existing plaster (valuable). In this respect, the preliminary examination and study of walls to be reinforced was of paramount importance in order to define the exact location and limits of works to be implemented.

OTHER WORKS. The vault coverage of the ground floor of the Main Building was able to withstand permanent loads and accidental ones required by law. They are, in fact, well-sized and able to hold up loads in excess of those required during operations. The areas of the first floor of the villa, dedicated to representative events, had to withstand large crowds during official ceremonies, so the size of the structures has been generous. In contrast, the horizontal elements of the upper floors of both the Central Body that North and South Wing (which actually occupies only a marginal part of the first lot) show, in the analytical tests, a lower load-bearing capacity, an indication of an original sizing to more modest loads exercise: in fact, they were private areas unsuitable for large crowds. The analytical tests conducted for types of construction have allowed to calibrate the necessary works on the slabs, also considering the unnecessary ones. In particular, it is not required to intervene heavily on the vaulted roof of the ground floor, limiting the works to crack fissure repair and reconnections targeting visible lesions of the intrados. In contrast and with regards to the wooden floors of the upper floors, the need to provide higher performance than originally required has led to the need to carry out works to increase the lift of the structures as explained in the following. The steel slabs and vaults were appropriate and do not require reinforcements. The existing ground floor slab was replaced with a more functional igloo-type slab using suitable plastic domes.

8° CONSOLIDAMENTO DELL'ESTRADOSSO DI TRAVICELLI IN LEGNO MEDIANTE POSA IN OPERA DI UN ULTERIORE TAVOLATO INCROCIATO SP.3,56V E CONNESSIONI ALLE PARETI PERIMETRALI





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■ “Rocchetta Mattei” Castle Grizzana Morandi - BO: intervention on a masterpiece of the XIX Century Eclecticism

An interesting work is what you are performing on Rocchetta Mattei, a castle built in 1850 and placed on the hills between Bologna and Florence.

After the purchase by the Fondazione Cassa di Risparmio Bologna in 2005, was defined a restoration project that provided not only the interventions on the architectural heritage, but a greater development of that, with the aim to realize a multifunctional center, at national and international level, and make it the scene of a new artistic and cultural excitement.

The first phase of work had the objective to describe and **analyze the materials composing the decoration of the building**. This aspects was useful to **define the state of conservation** and thus obtaining essential information for the editing of a correct and effective restoration project.





Rocchetta is the result of a series of interventions made between the second half of the XIX and early XX century, all characterized by the use of heterogeneous material, with the intention to obtain a decorative and special scenic impact. So were used various types of materials also made ad hoc with specific productions, that characterize the building in a way that differentiate it considerably if compared to other contemporary.

The analysis was specifically studied to be able to define in detail the materials and techniques used in the various place of the building, identifying the existing decorations in order to characterize the state of conservation of the complex.

The surveys carried out in situ to classify the seemingly chaotic decoration of the building supported by **autoptic analysis of decorated rooms, stratigraphic analysis of the coatings, laboratory analysis of samples** were fundamental phases in order to make a correct diagnostic project.

The historical information of the building made possible to define some macroscopic phases of the Rocchetta development that were useful for the interpretation of the surface coatings and those that emerged in the stratigraphic samples.

The restoration of the external surfaces of the Rocchetta Mattei was divided into different phase of work. It was a complicate intervention because of critic state of degradation due to exposure to pollutants that has accelerated the natural process of decay, all amplified by the context in which the whole building is located.

The elevations were very deteriorated, the stone parts made of sandstone or concrete blocks, and cotto elements seemed without anchoring, very damaged and worn out by the placer mining of rainwater.

On the surface there were present consisting biodeteriogens formations with organisms like algae, lichens and fungi and in addition it was found the presence of shrubs and weeds. These plants have determined the cracking and the crumbling of the substrates on which they were placed producing aesthetic problem in the site. The **restoration** was carried out with the intention to operate an intervention that was partly **conservative** and partly **reconstructive**, taking into account the strongly degradation due to exposure to the climatic conditions under which the building was subjected to.

The reconstructive procedures have become functional when it was necessary to permanently eliminate the problems due to degradation factors identified.

Essentially, it was used during the restoration works **materials** procured in situ at **0 km** while at the same time prefer **materials** that are **compatible** and **respectful** of personal choices made in the past by Count Mattei.

All the operations were made with a methodological approach for an **eco-friendly** and **eco-compatible restoration** of cultural heritage. The definition of particular technical solutions make possible to define more effective procedures for saving energy in a way of **decrease environmental impact** that is functional to the achievement of the best result of restoration work on which you operate.





■ The restoration of San Petronio Basilica: four year project between innovation and eco-sustainability

One of our most important example of restoration work is the intervention on **San Petronio Basilica**.

San Petronio Basilica is one of the most elaborate and significant Emilia Romagna's monument, **Felsinae Thesaurus** is the name of the **project** correlated with his restoration that is defined in six functional phases divided in a time interval of four years.

Is possible to illustrate expectancy on the results thanks to the work in progress on the Basilica chapels and façade.

Resolution of static and structural collapse, through disassembly and reassembly stone elements, were made on the polifora (window) of the Santa Brigida Chapel where different methodologies have made possible to develop a prototype system for execution of similar works on the monument itself or in other similar monuments.

Another type of problem has been observed on the St. Vincenzo Ferrer Chapel where our professionals have worked on concretions and deposits never removed until recent interventions (unique example on surfaces with a high degree of conservation). This first restoration of the marble after the war, made possible to carry out a study of the original patina that was useful as





a case guide for future work on other areas presenting the same deposits as well as the tests of cleaning with **sulphate-reducing bacteria**.

In this chapel was also realized a restoration of the original “cotto sacramato”: the work on this particular medieval finish, typical in the buildings of Bologna’s architecture, are significant for its characteristics and conservative specificity.

The main tests were carried out on the Basilica facade. The conservation problems found in the brick facade resulted in the adoption of different solutions during the work. The restoration of the marble in the lower part collided with the problem of performing a “**restoration of restora-**





tion” related to the removal of resins and other chemical compounds used for past consolidation (resin and plaster).

The experimental intervention for the monumental portals with methods and technologies defined by Opificio delle Pietre Dure of Florence, according to the DL (work managers), was a guideline for the remaining areas (1500 square meters). Among the main methodologies used: test for the cleanings with **agar gel**, cleanings pack of the marble plates (Arbocel with demineralized water) and of the decorative elements and cornice (Carbogel with demineralized water), finish cleaning with **laser systems**, use of natural materials for the reintegration and accurate assessment of the future interventions with continuous analysis.

The Basilica restoration was conducted according to the **Green Restoration®** project a methodological approach for an eco-sustainable and eco-friendly restoration of cultural heritage and historical building created by the Leonardo Srl. Thanks to Green Restoration system, procedures are activated in the specific choice of materials and natural products and handicraft, in energy saving policies, in the management and disposal of waste and in reducing waste in all business operation. This reduced environmental impact to achieve the best result in restoration work on which you operate and to a limitation in terms of risks for the operator and for those who benefit (property, visitors, etc.).

Felsinae Thesaurus now involves a synergy of professionals committed to bring back to light the San Petronio Basilica, including: first of all Arch. Roberto Terra and Arch. Guido Cavina (work managers of Felsinae Thesaurus project) officials of the Ministry of Culture (general supervision in the work and responsible of the restoration of the monumental portals of the facade), Dr. Rossana Gabrielli and Dr. Michela Boni (Leonardo Srl, company who make a part of the restoration work).





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■ The Baptistery of St. John. An integrated monitoring project of the building

In consequence of the increasing cracking conditions of the arcades of the women's gallery intrados of the Baptistery, in the month of September 2013, the Opera decided to undertake an integrated monitoring project through the analysis of the entire structures of the building.

The project has two basic purposes:

- To monitor the existing general movement,
- To work out the causes and origins of the existing movements,

to supply the adequate fact-finding knowledge for providing the correct actions for the safe and the reinforcement of the Baptistery structure, as targeted, successful and durable as possible.

INTEGRATED MONITORING WORKING PHASES:

1. **VAULTS AND ARCHES CONSTRUCTIONAL CHARACTERIZATION:** performed by means of non-invasive 3D georadar survey and video-fiber-endoscopic investigation with few targeted direct samples.
2. **"WIRELESS SENSING" SYSTEM FOR PERMANENT (REAL TIME) MONITORING OF THE CRACKING MOVEMENTS:** this issue is regarding the real time assessment (if any) and the





extent of the existing movements along the present cracking pattern. The monitoring wireless measurement system will run on 8 fractures spots for the first 12 months, with a further extension up to 24 months. For those points, the Celsius temperature informations are provided for each single measurement of the movements. The wireless monitoring system joins the general low-impact approach aimed to preserve the esthetical availability of the heritage, with the very low impact effect on the elements of the structure itself. Moreover the so-called “wireless sensing” technology allows the creation of a real time monitoring network of sensors which combines the measurement, registration and the data digitalization direct nearby the sensors (which means extremely high quality and safe data acquisition and a very safe short, medium and long term data transfer) with a non-invasive impact due to the removal of wires and cables.

3. **MONITORING OF THE VERTICAL DIFFERENTIAL MOVEMENTS OF THE BAPTISTERY BASE STRUCTURE BY MEANS OF A VERY HIGH PRECISION GEOMETRIC LEVELLING.** For this very high precision levelling a network of 30 very high precision topographic miniature rod are used, combined with an automatic high precision levelling device. The resolution of the measurement is of one hundredth of a millimeter and the accuracy is of a tenth of a millimeter.

4. **MONITORING OF THE HORIZONTAL AND VERTICAL MOVEMENTS OF THE WHOLE BAPTISTERY USING AN ELECTRONIC AUTOMATIC TACHEOMETRY:** the survey is implemented to investigate the horizontal and vertical movements of the vaults and faces of the Baptistery and is performed using an electronic automatic very high precision tacheometry (very high precision total station). Fifty optical prism for automatic survey are employed, placed on the most relevant internal structural point of the building.



5. ASSESSMENT OF THE GEOMETRIC SETUP OF THE SOIL-FOUNDATIONS COMPLEX AND THEIR RESPECTIVE INTERACTION: the qualitative assessment of the tridimensional geometric setup of the soil-foundations complex to evaluate the possible interaction between soil and structure and characterize the foundations (from a geometrical point of view) and the depth of the seabed floor (of course along and below the entire footprint of the building) are the principal focus of this item. It will be performed using geophysical 3D electrical tomography survey (3D ERT). Through the subsurface tridimensional electrical resistivity distribution, the qualitative 3D foundations geometry will be characterized, together with the continuity and depth of foundations.

The presence of interference between foundations and groundwater, if any, will be identified;

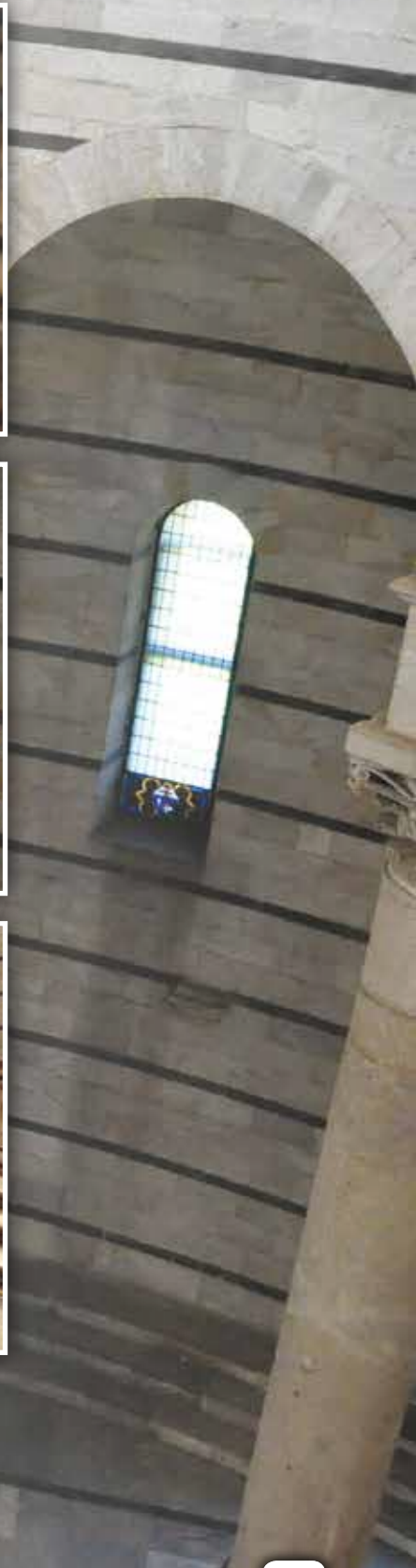


the vertical and lateral variations of the electrical resistivity 3D distribution will allow, as well, to address the subsurface heterogeneity at the foundation level and / or lack of homogeneity of the structures (from a geometric point of view).

All those informations will contribute to trace the fact-finding scene in which the differential settlements, if any, will be identifiable.

- 6. AMBIENT VIBRATION TESTING TECHNIQUE FOR GROUND AND BUILDING DYNAMIC RESPONSE:** a particular ambient vibration testing (AVT) technique to study the dynamic behavior of the building and the statistical site amplification response (in terms of vibrations and seismic events) will be performed. Through the statistic differences or drift assessment of the spectral signatures, measured for both the internal and external faces, will allow to assess the correlation between the building existing movement and the differential dynamic behaviour (if any). More, it will possible to verify the influence between the general existing movement and the site amplification differential response, if any, and to match the informations on the soil-foundations setup coming from the tridimensional electrical tomography. Recent novel scientific research has demonstrated how the correlation between existing movement and differential dynamic behaviour of the building in occurrence with the ground, sometimes may be useful to evaluate possible future damage thresholds.
- 7. INTEGRATED MONITORING COORDINATION, SURVEY MANAGEMENT AND QA/QC ACTIVITIES:** the management of the survey and monitoring activities, the data quality control and assurance, month by month, together with the coordination and complete sharing of informations with the Scientific Committee and the Technical Team of the Opera, are care attended, together with the final dissemination of the results.





LAINO
CORENNO

18
DECEMBER



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Palazzo Scotti, Laino (Co)

The Palace, one of the most important architectural monuments of Val d'Intelvi, can be considered as the union of several buildings, on existing structures.

It may have been subsequently added other rooms, the central staircase and the rooms of the building lower (eastern portion). The testimony of this fusion is visible on the south elevation where an offset identifies the body separates from the service (which includes the hallways of passage on the ground floor and the kitchen on the first floor).

In the nineteenth century, as evidenced by the maps, the building took the form of an irregular polygon that characterizes it today

The major structural and decorative changes were between 1722 and 1751 when the Scotti' family painters, known family of Magisters and Comacini, transformed the houses in a own prestigious residence.





The big fresco, in the main hall, has recently been attributed to Giovanni Pietro Scotti (1695-1761) and his collaborators.

THE RESTORATION

In 2012 began the restoration of the building that will be the most important cultural landmark for the all area, becoming the Valle d'Intelvi museum.

The project involves the safety of the wall structure, as well as the enhancement of the decoration of the halls of greater importance.

During the excavation of the ground floor, the company has found remains of ancient walls in several rooms : one with a circular section, that recalls the plan of a medieval tower, and presumably tanks, probably used for the production of lime.

The works include the paintings restoration, in their original colors.

The vault of the main hall has been made safe with anchors and chains inserted along the entire perimeter of the base of the same. Then it will proceed with consolidation of the numerous deep cracks.

The works are concluding in 2014.





■ Arche degli Andreani, Corenno Plinio (Lc)

The three tombs located in the little square where the Church of St. Thomas of Canterbury is built, in the small village of Corenno Plinio on the Como lake, are the latest testimony of the custom of burying the dead near the church before the Napoleonic laws forbade it.

The three "Arche", as these monuments are called, represent well the transition from the simple to the most delicate Romanesque Gothic and can be placed in a time period from the beginning of the fourteenth century to the second half of the same.

The tombs, all characterized by the presence of a stone canopy, huddled at the front of the church and the walls of the adjacent castle.

The oldest of the three, is located to the right of the door of the church and its construction should probably be by Jacopo Andreani, or his father, lord of the place around 1271, who died in 1326.

The Romanesque building, is made by the alternation of white marble from Musso and black serpentine marble, both frequent in the Como area since the thirteenth century. Similar is the next arch, presents in the opposite side of the door.

The third, on the castle walls, originally was inside the church, but in 1870 was placed outside the church.

THE RESTORATION

The problems of deterioration of the monuments have been determined mainly by infiltration of rainwater from roofs: due to the displacement of some pieces of stone of the roof. The percolation of rainwater falling on the marble walls, however, resulted in the formation of black crusts together with sedimentation of spores mushrooms with algae. Again a old restoration work covered all the three monuments of a bad glue, now very difficult to remove.

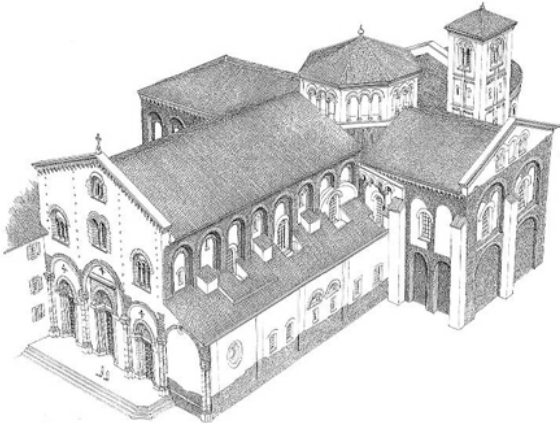
In fact one of the more difficult work is cleaning the yellowing white marbles and the blackening grey stones.

Many and different cleaning methods are using: solutions to die microorganisms and different cleaner for black crusts. Sometimes it's using laser method for hard crusts.

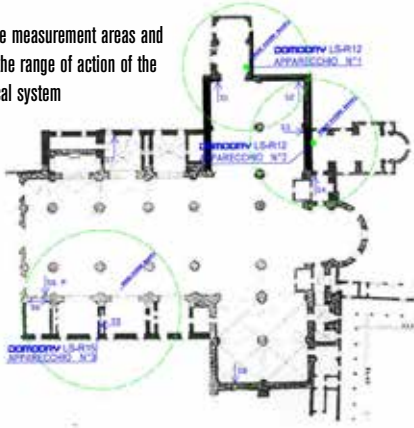
Interesting it will be studies for consolidation and protective marbles using nanotechnology.



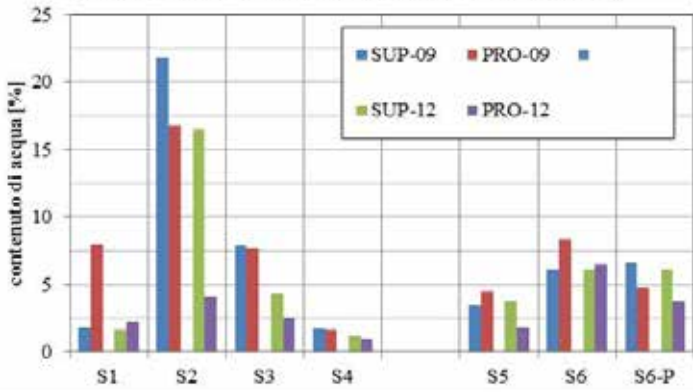
the Basilica of San Simpliciano



Location of the measurement areas and indication of the range of action of the electro-physical system



CONFRONTO SUPERFICIE-PROFONDITA' (BASSO)



Values of water content measured at the surface (SUP) and depth (PRO) at each measurement point located at the height of 30 cm from the internal floor (comparison between the measurements of May 2009 and those of April 2012)



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■ Effectiveness of the electrophysical “charge neutralisation” technology system against water from rising damp in the masonry of the San Simpliciano Basilica in Milan

INTRODUCTION

This report presents the results of a study carried out in the San Simpliciano Basilica in Milan in order to analyse the results obtained following the installation of the Domodry “charge neutralisation technology” (T.N.C) for the restoration of the masonry; this is an innovative technique based on the active principle of “charge neutralisation”.

The study, which was carried out over the period of three years, objectively demonstrated the positive dehumidification action performed by the system on the masonry. The high level of detail of the investigations carried out, as well as the quality and quantity of the data collected, seem to support the reliability of the results obtained.

The study has been carried out in cooperation with **Massimo Valentini, Engineer, Environmental and Technical Physics for Cultural Assets Laboratory (Fi.T.Be.C.) - Energy Department - Milan Polytechnic.**

This laboratory has a long tradition of monitoring technologies for intervention on humid masonry, and has adopted the various methodologies that have succeeded each other over time in its laboratory and field research (“CATTANEO M., ZECCA S. (1995/1996 academic year) - TINININI L. (1997-1998 academic year) - MANCINELLI E. (1999-2000 academic year) - CAVALLARO S. (2000-2001 academic year) - DE NICOLA E. (2006-2007 academic year)”), in the firm belief that a university laboratory must put itself at the service of the scientific community and of operators in the sector to further knowledge and to provide useful information about the limits and real effectiveness of any intervention carried out on cultural assets, above all with a view to their safekeeping and preservation over time.

THE CASE STUDY

After the initial session, during which the water content of the masonry was measured before the installation of the electrophysical “charge neutralisation” system (these measures confirmed that rising damp was the main way in which water was penetrating the masonry), two more followed, at respective intervals of one and three years – this duration is considered sufficient to allow us to express a judgement on the results obtained, since it seems comparable to the slow drying processes of masonry that is very rich in water and very thick, as is the case with the masonry in question here.

The measurement of the water content was carried out using a weight method; while most of the measurement points were selected within the area of the building that was subject to the effects of the reconditioning system, two of these were however placed in areas that were not affected by the system itself, so that the values measured at these points could be used as reference samples of the masonry “as it was”.

At the same time, a check was carried out using the results of nearby samples, but analysed using the calcium carbide method.

In addition, some of the samples taken from the masonry and other samples from efflorescences were analysed using ion chromatography in order to evaluate their soluble salt content.

All three measurement sessions that followed one another in time were preceded by a mapping of the surfaces using thermographic equipment in order to have an additional tool to evaluate the effectiveness of the intervention being examined, using a non-invasive method, albeit a qualitative one.

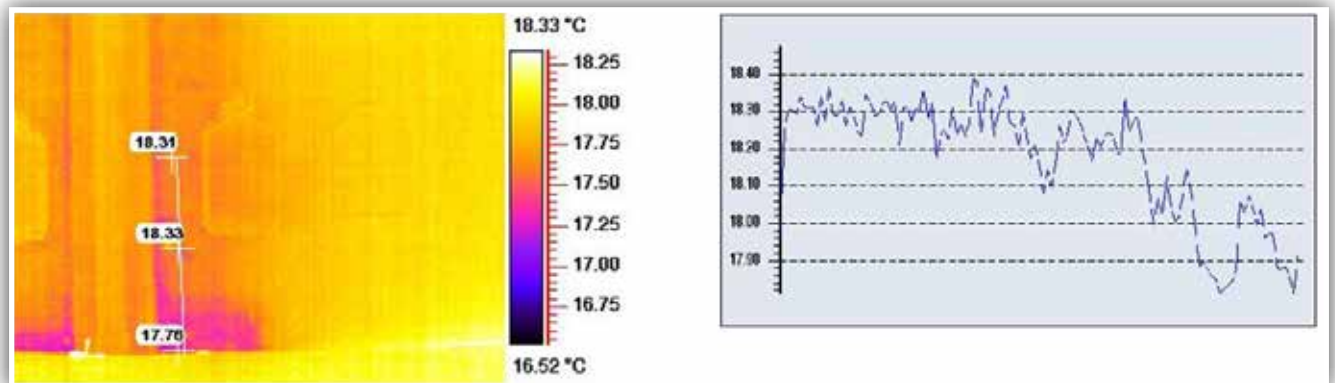
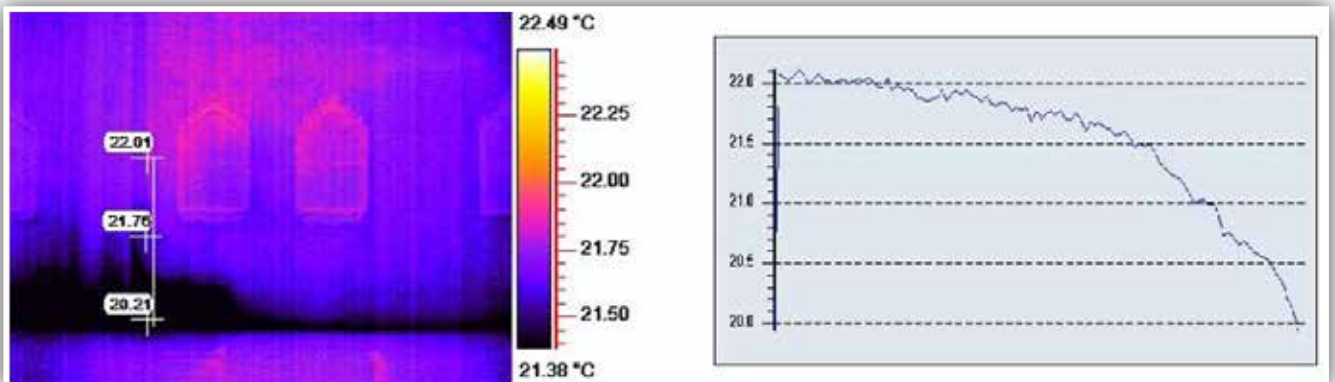
The results show a general and clear reduction of the water contents in the masonry over time, with this reduction being more pronounced in the samples taken from the deeper layers of the masonry, or in those that are less sensitive to microclimatic environmental variations and to the hygroscopic effects of superficial salts.

This is the demonstration of the effectiveness of the drying process: the water has to pass through the inside of the wall up to the surface where it evaporates. It follows that the surface part of the wall is the last to get dry as the water that abandoned the interior must transit through the superficial part of the masonry to finally leave the wall through evaporation.

The full report on the case history of the Basilica of St. Simpliciano is available in the book: “Scientific Method and technological innovation to the protection and recovery of historical heritage. Case studies and examples of success in the diagnosis, prevention and resolution of rising damp in UNESCO sites and other prestigious sites in Italy.” You can request a free copy to Domodry srl - info@domodry.it



"Visible Image" in the area of the measuring point S3 (a) and infrared images and graphics surface temperatures along the vertical recorded in May 2009 (b) and April 2012 (c)





studio
Berlucchi
 società di ingegneria
 dal 1920

■ The restoration project of Sheyk Suleyman Mescide

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Eng. Arch. Nicola Berlucchi

Prof. Alessandro Zanini
 report

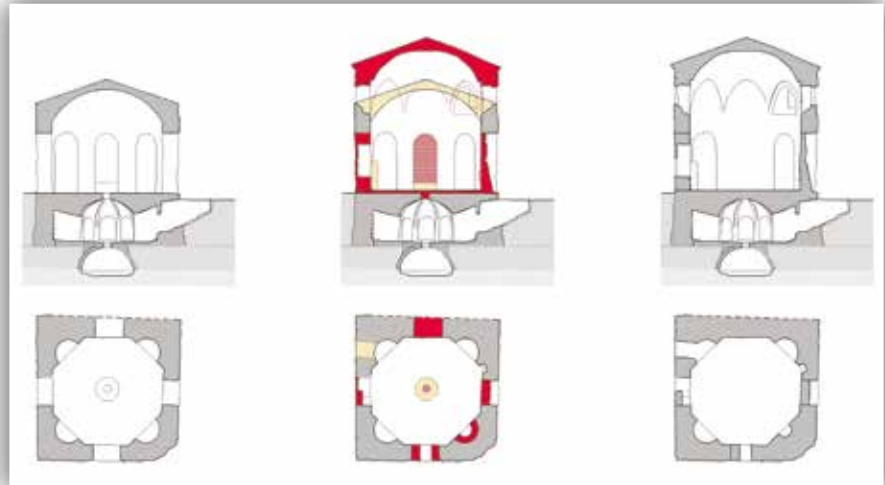
For a correct restoration and rehabilitation design it is fundamental to achieve a deep knowledge of the building: the dimensions, the materials, the decay, the way it has been built and the list of all interventions and modifications made during its life are some of the main aspects to be studied.

All these data are extremely important to get to a good, respectful and reliable restoration design project.

The structural behavior and eventual lacks, the state of art of all heating and electrical supplies and security devices are even important aspects to be considered during implementation design and need to be understood and take into account.

Assorestauro's companies have followed a complete and virtuous path to get to the right result: a complete architectural and restoration study and design that descends from a deep knowledge of the monument through many different technical approaches listed in the image above.

The Sheik Suleyman restoration design has seen a preliminary phase that have taken advantage from the previous studies made by Turkish partners improving and increasing these data with some techniques that are not frequent in Turkey and that has given to this important Italian-Turkish joint venture a special and unique character.





The principal aim has been the definition of any possible intervention on the buildings, in a way to get a trustable DETAILED DESIGN PROJECT that would not change during the restoration works, without surprises, stops and any unexpected discovery.

Berlucchi srl company has had the task to coordinate and merge the results of single experts putting them together into a complete design and to make some proposals about the surroundings and annexes (toilets, fence, courtyard, entrance and light design).

The diagnostic plan has been shared and defined with every single specialized Assorestauro Company and has guaranteed a full coverage to all questions and doubts and has allowed the Scientific Turkish Board to evaluate and give preliminary permission about all requested analysis and on site tests.

At the end of survey and diagnostic campaign, we could call it “the knowledge phase”, Berlucchi srl company has prepared the plans and a final report where most significant results and reports and works descriptions were matched, compared and summarized, to let the Scientific Board get the maximum comprehension and benefits from this important phase with a simple visualization of main results.

TOPICS DEALT DURING THE PRELIMINARY STUDY

The first destination of the building was probably an Octagonal byzantine Baptisterium that was modified and super elevated to add arches and windows and light inside, as results from Leonardo srl Stratigraphic analysis and endoscopic analysis.

Masonry is completely different in the two phases: the byzantine one is made with stone, brick and external mortar with crushed brick and lime, but internal nucleus made with irregular stones and earthy mortar or even only earth with very little consistence; the upper part is made by brick masonry with better consistence and homogeneity.



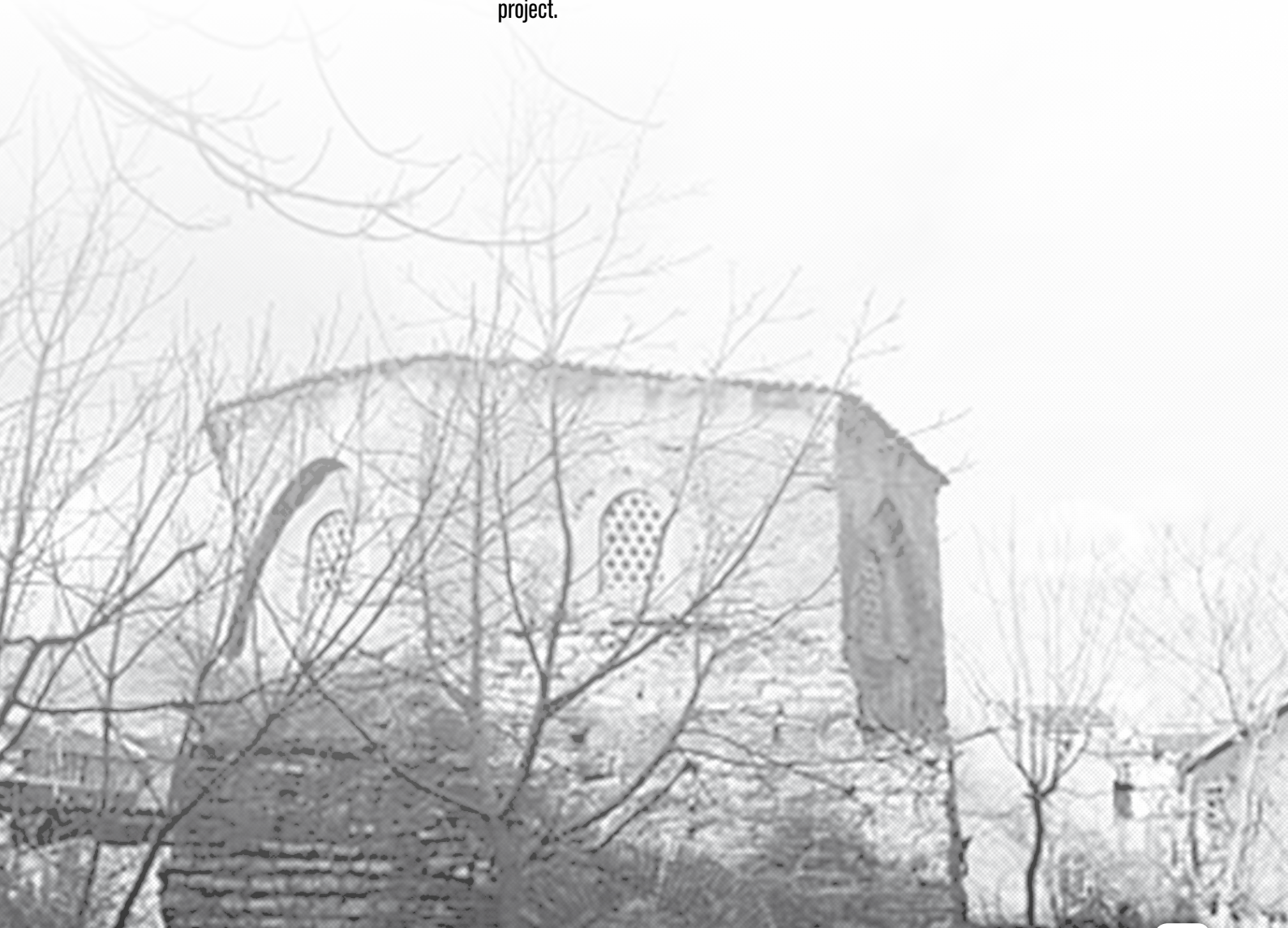


The plan has changed in the old time as reported in the Restitution design made by Turkish experts, starting from an octagonal plan with four arches and four lateral niches of similar sizes and changing the entrance in a lateral niche (maybe for religious reasons to be opposite to mihrab), reducing the dimensions of two other niches to host the Mihrab and the Minbar and closing two arches.

Under the recent concrete floor it still exists the original byzantine floor in very bad state of conservation, but still clear and comprehensible in its octagonal shape and design.

Very useful is the archeological report of Assorestauo President and Archeologist prof. Alessandro Zanini. It would be interesting to re-open exclusively the old eastern arch, only if the careful analysis of the surface would show no Ottoman decoration in this specific area. The first results have been summarized in a detailed section and plan (1/20 scale) that is a sort of medical TAC (computerized axial tomography) with complete reconstruction of roof, masonry and floors.

This work will be the starting point for the next restoration and architectural project.





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Architectural survey and operate with 3D models for promotion and protection of Cultural Heritage: Methodologies and Issues

The laser scanner survey is considered especially suitable for parts of a building with geometrically complex details and in the event that the survey, other than the geometries, has the objective of the acquisition of the colorimetry of any deterioration or frescoes found on the surfaces surveyed. The survey consists in acquisition of a high-resolution point cloud; resolution defined as a function of the complexity of the object to be detected. A point mesh starting from 2mm x 2mm may be adopted suitable, for example, for the survey of parts with complex decorations such as capitals, cornices, bas reliefs, etc., to move on to less dense meshes, for the survey of flat walls and floors, etc. Simultaneously with the point acquisition, photographs will be made with suitably calibrated high resolution photographic cameras. As a function of the distance from the object being surveyed from 10.5, 14, 20, 50 or 80 mm calibrated lenses will be used.

The overall point cloud is realized by the union of the individual georeferenced scans by way of the acquisition of specific targets. The alignment will then be optimized with the reduction of the point deviations to a minimum among those in the point cloud. The deviations due to the joining of the clouds will, in this manner, be contained in just a few millimeters.

The point cloud generated in this manner will contain all of the information about the object surveyed. From later processing the coloured point clouds, the three dimensional model with the images developed from the three dimensional surfaces, from which sections and plans may be

2D drawing table with CAD section and planar point cloud image



First external station of 3D laser scanner survey

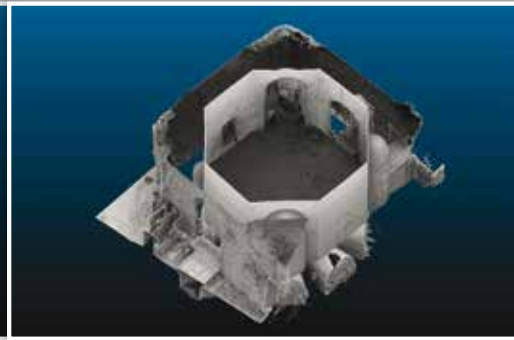




Isometric view of colour point cloud



Isometric view of point cloud complete model



Isometric view of 3D section

extracted, will be generated. From this model original orthophotos may be obtained at any level. Whatever the survey method used for data acquisition, the final graphic restitution remains a stable point on which much attention is paid. In the two dimensional drawings of plans, elevations and sections of historically significant buildings, special care is given to the proportions of the building's architectural orders and the geometries of the decorative elements and sub-elements, capitals, shafts, mouldings, etc. When possible, these are compared, for the purpose of proper restitution of the drawings and the geometries are surveyed with the conventional geometries found in manuals or historic treatises. Special attention is also given to the drawings of figurative elements such as statues, bas-reliefs, festoons etc., or frescoes. Graphic restitution, in these cases, requires appropriate and different stylistic research, on each occasion, aimed at coherently interpreting the aesthetic expression of the object to be restored. It is possible to attach at CAD sections a bigger amount of images at high resolution of the point cloud obtaining orthogonal maps of walls. With the same attention for proportions and geometries, faithful three-dimensional models are restored for historical research or for prototyping, such as, for example, the 3D model of Palazzo Madama made for the reproduction of a 1:30 scale model. Geomar. it and Geogrà provide survey service for architecture and topography supported by the latest technology laser scanners and GPS equipment for the restitution of two and three dimensional vector printouts and photographs for study.

Sheik Suleyman Mosque view of the entrance



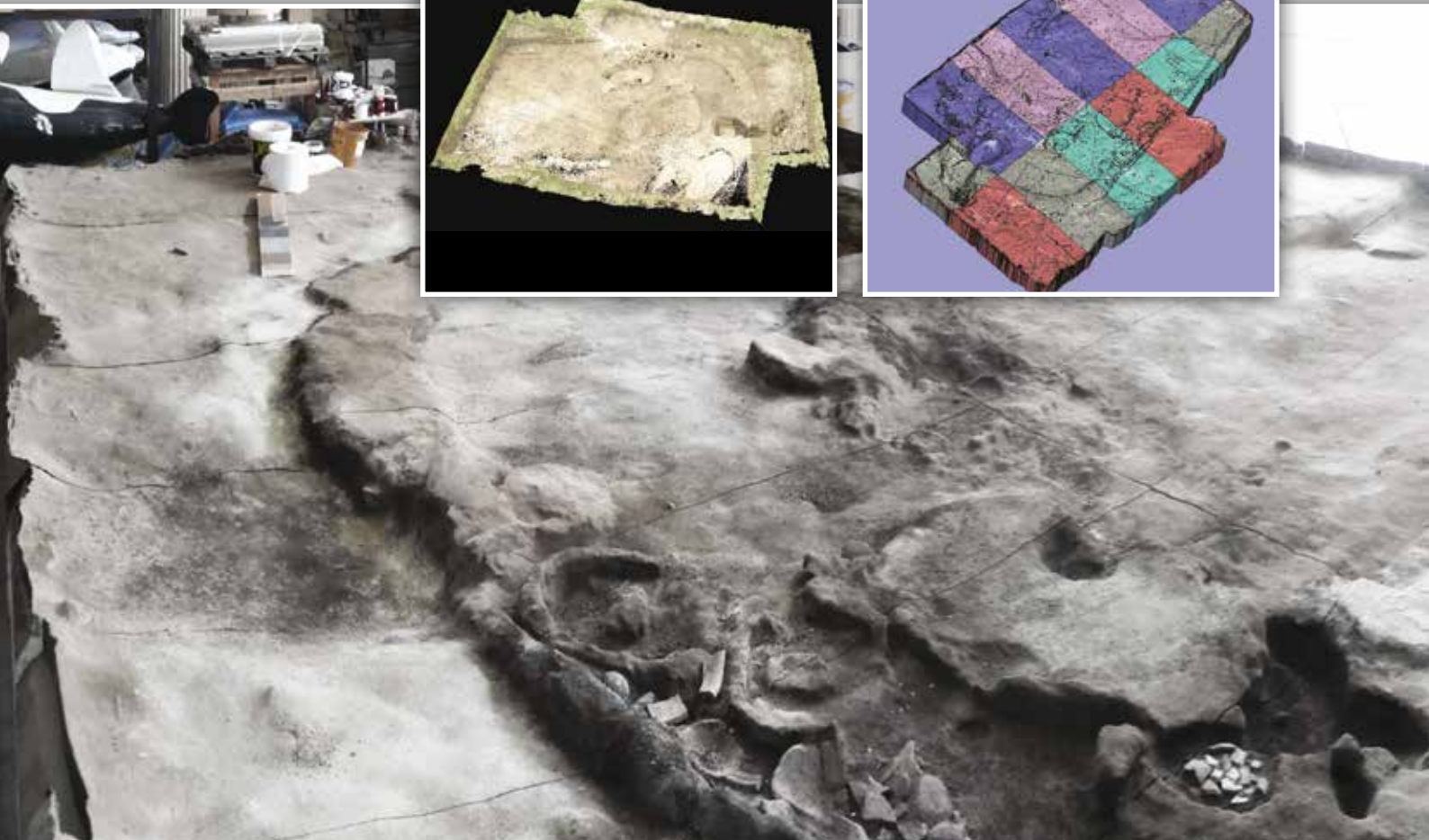
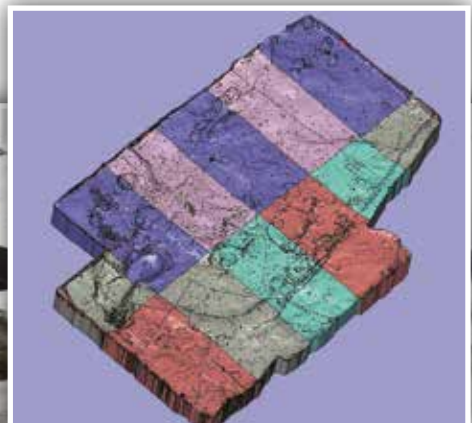
THE SHEIK SULEYMAN MOSQUE SURVEY, TECHNICAL DATA

A Z+F IMAGER® 5010C scanner was used and a total of 35 scans were carried out. At the same time of the laser-scans, photographs were also taken for the composition of an equal number of spherical images. From scanner in HDR mode and from professional camera a total of 1,500 photograms were made. A coloured 3D-point cloud model was made from the survey data from which graphic restitutions of plans elevations and sections were developed.

Working with 3D data it is possible to develop new systems for the promotion and protection of cultural heritage, TryeCo 2.0 performs CAD two-dimensional models and photorealistic rendering, as well as specific three-dimensional solid printing for architectural models on scale plan and sculptural copies for museum staging. Tryeco is specialized in processing data high definition laser scanning, both on architectural and sculptural detail scale, using the most advanced techniques and instrumentations now available. An interesting case study is a copy in 1:1 scale of Scalo di Furno's archeological excavation. Excavation's survey was made with 3D laser scanning process, used on the 100sq.m wide surface of archaeological site. After the survey, a "mesh model" is processed by using specific software solutions. Due to complex morphology of certain areas, laser data were integrated to photogrammetric ones. Site's data bank is now available, together with photographic relief that can be consulted now and certainly in future. To create scale model's base, techniques and materials from nautical field were applied, while for the models "render to real" those techniques used to create characterizations in amusement parks.

Point cloud of Scalo di Furno's archeological excavation

3D mesh model of archeological site divided for CNC engraving



A digital model was elaborated to make it ready for realization. This prototype occupies an area of 90 sq.m and it has been divided in 18 base “blocks” (4x1 m) and 6 border “blocks” with same width, but variable length. Site’s morphology was recreated with CNC engraving system from blocks full of polystyrene, then covered with fibreglass coating. Fibreglass is model’s supporting structure. Its union with polystyrene ensures that maintenance can step on the copy. It also protects it from weather conditions effects and it does not affect blocks weight, which can be easily transported. Thanks to a series of simulations realized on digital model, we detected disposition and number of drainings for meteoric water. Prototype for factual rendering was created in a shed, where we colored model’s surface using photograph documentation previously collected. We used acrylic water colors and various sands of different kind of grain and shade to perfectly reproduce soil we collected “in loco”. The whole surface was then covered with transparent matt polyurethane protection. This innovative representing and valorization system of an archaeological site opens the way for other similar sites safeguard with held down costs both for realization and maintenance, considering that for this kind of models a low level of maintenance is required.

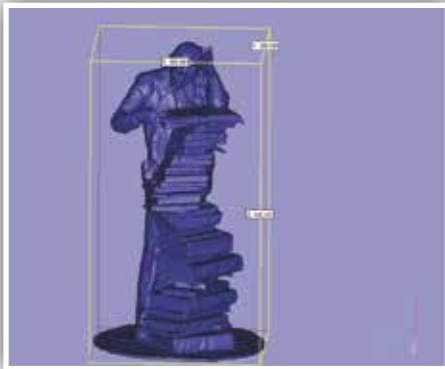
The copy assembled inside a shed for color processing of surface



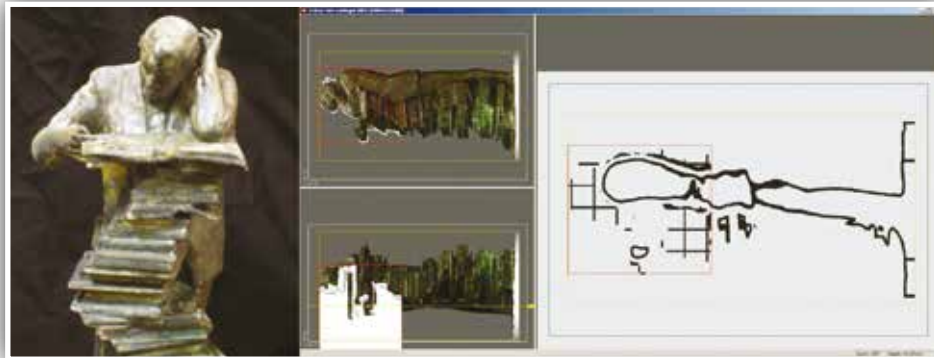
Archeological site copy under construction



The digital polygon model



Exposition of the mono color printout with Near Field Communication (NFC) tags



The 3D printout in full color during processing. Right one single layer of the model profile



Augmented multimedia content and impact on the public

In recent time there has been a massive invasion of new Information and Communication Technology ICT in the use for exploitation of exhibits. Enhanced fruition and a highly emotive relation between artifact and visitor are among the attested benefits. An example of this is the “App of The Reader” provided for Zoller + Fröhlich GmbH, in this case we combine 3D laser scanner survey and augmented reality. The beautiful and locally well known statue The Reader is situated in front of the city library in Wangen, South Germany. A high density documentation survey was carried out using nine scans at high resolution and color implementation using Z+F’s M-Cam solution. The 3D solid mesh was created subsequently and the results produced a high level detail model. The metric digital model can be used for various functions: as a base for measurements and which are used for conservation and preservation the original artifact, or as a medium to communicate the artifact and its history. The versatility of the digital model resulting from High Density Documentation HDD shown by the possibility to perform under so different requests is a central advantage of the methodology. The true-scale digital model allows processing physical copies at any scale, through rapid prototyping technology. This extends the usability of the artwork, e.g. haptic visit to museums for visually disabled. In the case of “The Reader a sculpture of human scale located in the exterior has been reproduced in two downscaled copies that allowed divulgation to a larger audience. The prototyping technology by plaster layers was adapted with the print system ZCORP 650, currently unique to reproduce 390k colors at 600 x 540 dpi resolution. At Salone del Restauro 2012 (Italy) and “SPAR International 2012” (USA) have been exposed the mono color and

the multicolor copies of the artwork which originally is located in Wangen, Germany. The haptic property of the prototype extended the emotional experience in addition to the integrated Augmented Reality (AR) and Near Field Communication (NFC) technologies which allowed further interactivity on personal tablet and / or Smartphone. The cultural heritage sector is considered a pioneer in using augmented reality, which today sometimes is named the eighth mass media. Thanks to AR technology it is possible to illustrate multimedia contents which adapt themselves to the user's language and level of interest. Starting from an existing image - like an exhibition panel, a catalogue or a poster - it is possible to visualize enriched and augmented contents. An application may initially behave as a traditional audio guide within an exhibition area and then guide the user directly out to further events in the neighborhood. By keeping this idea in mind, in the collaboration with the Z+F GmbH has been developed the Z+F The Reader AR application. The intention is the interactive viewing of a 3D model of a statue which has been documented by means of laser scanner technology. The application is adapted to the need of using the 3D model independently wherever and whenever. The application Z+F The Reader for Smartphone and iPad allows interactivity to the scene with the digital 3D model of the statue. On the other hand the physical model has been produced with the 3D printing technology. The mobile application is extremely easy to use and does not require expertise: once freely downloaded at Apple App Store or Google Play Store you need just to point the Smartphone's/tablet's camera on the prior distributed postcard. Right away the user can show the 3D digital model is and access to a video clip with background information about the rapid prototyping process of the object (from registration of the single scans, the advanced modeling for the hardcopy of the statue used for exhibitions). This kind of exploitation of an artwork is extremely emotional. The user holds a virtual copy of the artwork in his own hands, independently from any geographic location. The emotional and surprising experience which links the user directly with the exploitation of the artwork by using his personal mobile device is a new way of earning loyalty and customization of a user. Wherever in the world, the user or visitor can touch with his personal emotions his favorite pieces of art, by the AR filtered vision. Just a postcard, a journal or a paper are sufficient to act as a marker. If the AR app is combined with Near Field Communication NFC sensors it is possible to access to the additional contents simply by passing the Smartphone (with NFC support) close by a dedicated tag. Finally, users may socialize their personal experience of the visit by publishing their comments and snapshots on social network sites as Twitter or Facebook. In this way a contagious network promoting the event or product will spread out. In a near future technological standard in the cultural heritage valorization will offer the possibility to enjoy downloadable cultural tours on mobile devices which are adapted to personal profiles (passionate, scholar, tourist, educational, childhood...), multilanguage and immediate availability. Museums, without distinction, are able to reach and inspire to visit millions of potential visitors all over the world through dedicated AR publications on their exhibits, due to over a billion smartphones and tablets out there. With the 3D laser scanner survey and this technology, in future it will be possible promote and communicate all the aspect of Sheik Suleyman Mosque restoration project.



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Palazzo Madama one of the most important museums of art in Italy

The history of the building, placed in Turin city center (Piazza Castello), begins in Roman times. Originally the central part of the building was part of the ancient gates of the city of Augusta Taurinorum. In the Middle Ages, the Roman gate suffers his first radical metamorphosis, becoming a fort. In the XVII century, the interiors were modified in order to transform the building in a luxurious palace, adequate to the needs of Maria Cristina d'Orléans, daughter of King Henry IV of France and Maria de Medici, widowed of the king Victor Amadeus I of Savoy. Carlo di Castelmonte built the Hall of the Swiss and the beautiful salt flats of gala. In the XVIII century, the famous architect Filippo Juvarra add to the Palace a new magnificent façade and the spectacular grand staircase. In 1832 Carlo Alberto transformed the palace and founded the "Royal Gallery" (later the Savoy Gallery) forming a collection for the public enjoyment. The restoration of the building was preceded by the survey and the documentation of all the finishes of the main floor. In the meantime, all the objects of art and the artefacts that could be affected by the next phases of intervention were catalogued and moved to a secure storehouse. These operations were carried out between 1993 and 2001. In 2001 began the second work phase, which consisted in the stratigraphic analysis of the main floor rooms and in the assessment of the state of conservation



of the various rooms that were altered by the transformations and interventions carried out over the centuries. The restoration works finally started in 2003 and were completed in 2006 for the main floor, while the top floor restoration lasted until 2008. The restoration involved all the rooms on the first floor, with the recovery of the original colours of the wall paintings preserved in the vaults and walls, and of the precious ancient historic woodwork flooring. Furthermore, the interventions led to the uncovering of fragments of frescoes paintings beneath the plaster, ascribable to the medieval age; in these areas, the residual frescoes were revealed and restored. The first floor rooms also showed sculptural decorations in stucco, which were altered and damaged by salt efflorescence, gaps, lacks of decoration and of gilding; the missing parts were completed and the superficial gilding was retouched. The intervention also entailed the restoration of the furnishings of the rooms (oil paintings, mirrors, consoles), of the stone artefacts and of glazed and wooden products such as frames, woodwork, windows and floors.

VAULTS. In some cases, the state of preservation of the decorations was compromised due to water damages that affected not only the plaster layer, but also the structural wooden elements of the vaults. In these cases, for the consolidation operations we choose to operate simultaneously on the top and on the bottom of the vaults, with localized solutions.

WALLS: The detachment of the plaster from the wall spread over the rooms of the building for many different causes. The intervention consisted in consolidating the inadherent plaster through injections of hydraulic mortar using selected sands mortar. The sand was adequately chosen on the basis of the colour and grain size, and then it was mixed with La Farge lime and marble dust.

STUCCO DECORATIONS: all the decorations of the building had been completely repainted during the numerous maintenances and transformation of the rooms, so that it was necessary to remove the more recent layers of painting. For the fragile stucco-modelled decorations, the cleaning was conducted in three different phases: first of all mechanically proceeding with bamboo utensils of various forms, better than the scalpel, which tended to scratch the surface. Then, in order to minimize the risk of damaging the decorations, the layers were softened with poultices of sepiolite and ammonium carbonate, and finally the restoration was completed with bristle brushes and fiberglass pencils.





WINDOWS AND DOORS: The restoration work also concerned the historic windows and doors painted and/or gilded. These objects were repainted during multiple and extended maintenances over time. The interventions followed a standard procedure: verification, consolidation and, if necessary, substitution of the structural parts and uncovering of the original ancient finishes. The cleaning of the surfaces was performed with a scalpel, after the softening of the recent repaints with solvent. The portions of the windows that were not original were scoured and rebalanced in the tone of the original. For the reintegration of gilding, a layer of golden leaf was applied with mission glue, than it was consumed with agate stone.

FLOORING: The general state of preservation of wooden flooring was the result of the intensive use, of the attack by wood-eating insects, of the deposit of dust, smog, general dirt, also included in the protective wax applied in the past. In order to restore the original flooring, first of all we made a survey of the existent pavement to have a scheme for the assemblage; than the the flooring was disassembled and moved to the cabinet maker department in our laboratory. We proceeded there with the cleaning of the surface with solvents and steam; then, after a mechanical removal of the wax inside the worm galleries, the wood was treated with woodworm and consolidated. The lacks of material were compensated with a compatible filler. The elements, packed and taken back to the palace, were refitted with the support of our cabinet makers, who restored the joints and assemblies, creating new elements where new connections were required. The wooden surface was then treated with a protective coating and finally a micro-crystalline wax was applied.

HISTORICAL EXHIBITION DISPLAY. The work carried out on the exhibition boxes of the top floor rooms was conducted both on site (inside the museum) and in our department cabinet-making. The main problems were related to the state of conservation of the structures of the boxes, and to the new safety restrictions required for the exhibitions rooms. All the exhibition boxes were cleaned with solvents, integrated and varnished. The wooden lacking parts were integrated using the same essence and vein of the original wood. The glasses of the exhibition boxes were reinforced adding an UV and safety film to the external surface. A new lighting ceiling was created using special lamps that don't affect the artwork contained in the exhibition boxes.



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Palazzo Reale, Torino

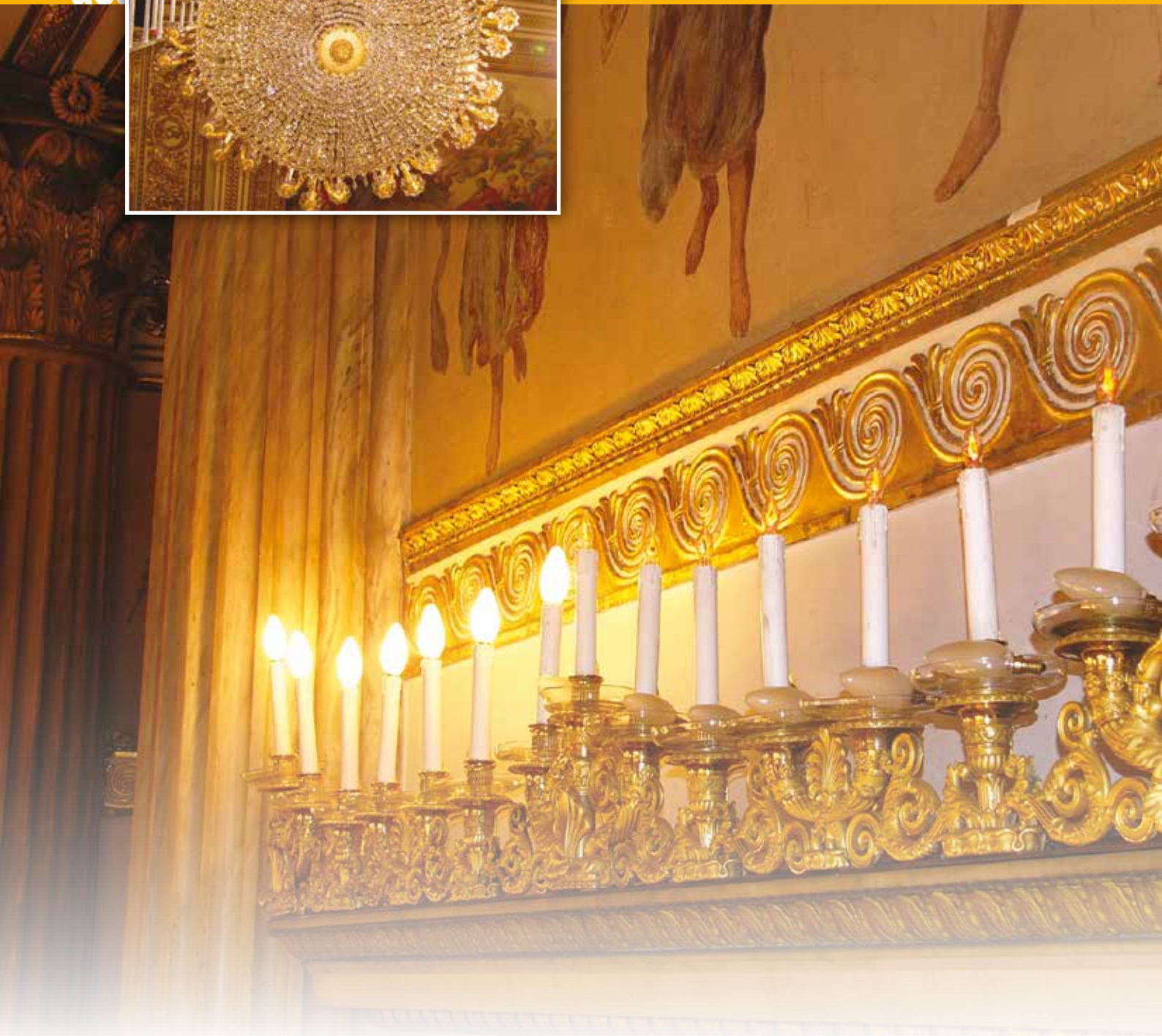
In September 2005, we are given the assignment to the restoration of the eight lamps that illuminate the ballroom of the Palazzo Reale in Turin. This task there is provided in a set of major renovations that have long interested in the building.

The ballroom was built between 1835 and 1842 by sacrificing two environments of 1600 at the behest of King Carlo Alberto. At the completion of this great work was attended by numerous craftsmen of the highest level (remember Carlo Bellosio and Francesco Gonin).

The chandeliers of which we are speaking were made to the drawings of Pelagius Pelagi (Bologna 1775 - Turin 1860), a classic style that nonetheless often find ourselves inside the building, such as the throne room. The whole process took about three months to work with the employment of four full-time people. The first stage was the lowering of each individual artifact at floor height with the use of special hoists. Subsequently, the chandeliers were dismantled in every detail in order to be able to proceed to work on the metal part. The parts were washed with deionized water and Rochelle salts by immersion in water releases that could vary from 45 minutes to an hour and a half depending on the state of degradation of the pieces. Where the above washing had not produced the desired result it was decided to finish the job with the help of a scalpel or small mechanical brushes. The hundreds of chains that adorn these chandeliers were removed and washed with deionized water solution of quaternary ammonia at 33%, the same were subsequently recalibrated in order to make it as harmonics.

Regarding the electrical system has been completely replaced with cables CE using bipolar cable sheathed 1.5 mm section for the central line and the bipolar cable sheathed 0.75 mm section for the arms of the chandelier. The ballroom has been inaugurated in December 2005 in the presence of the highest offices in the city.





the company

The company Reale Restauri di Forconi Cristina located in Turin in the almost central area of San Salvario, an area once known for housing a large part of the craft of Turin, mainly deals with restoration of chandeliers and restoration of various types of metals. Founded in 2000 by Francesco strong desire to continue learning the craft from his great master Giovambattista Truffa, in the last thirteen years he has had the

honor of working with the most important mastery of Turin, Florence and Rome.

Among the most important work that can be found in the curriculum of the Reale Restauri can find the Palazzo Reale of Turin, Palazzo Madama, the Reggia di Venaria, the Palazzo Venezia in Venice, the Cassa di Risparmio di Firenze.



sustainable.energy&facility.services

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■ Parish of Santa Maria Nuova in Abbiategrasso (Mi)

Realization of the heating plant for the Parish complex Santa Maria Nuova in Abbiategrasso (Mi): church, parish house, recreational centre and movie theatre

The Parish of Santa Maria Nuova, with its magnificent Renaissance portico, is one of the most significant historical and artistic treasures of the entire Milan province.

Yes.co has designed and installed the thermal power plant of 840 Kw of power for the winter heating of the Parish complex. The combustion system is composed of 4 methane burners at the service of 2 steel boilers.





The thermal energy produced is piped into 1 balancing collector before being sent to the different departments.

2 control units vary the water temperature, in accordance to the variations of the outside temperature.

The church is heated with floor panels with circulating water at low temperature (max 38°C), that is going to adapt to the external temperature thanks to an electronic control unit, that maintains the desired internal temperature.

The thermal power plant also supplies water at medium / high temperature to the parish house, recreational centre and movie theatre.

Every room can be heated on different timings, following the needs of use.

The electrical system supplies power to the heating system and the automation system.

Everything has been inserted in dedicated electrical control and power units.

■ Kindergarten in Boffalora Ticino (Mi) Heating and air conditioning system with heat pump technology and geothermal probes

The heating and air conditioning system of the Kindergarten in Boffalora is made up of 2 heat pumps of 90Kw of power of water-water type. They are supplied with water from wells, and are equipped with temperature control units.

The wells are 3, 2 for the withdrawal of groundwater and 1 for the release to the water back to the subsoil. The groundwater temperature in the wells is steady at 16°C throughout the year. This means warmer than the outside temperature in winter, while it is cooler in the summer. This leads to a maximum level of efficiency of the heat pumps and to high energy savings.

The system is controlled by a processor that controls the parameters of temperature, frost protection, compressor timing, sequence of their start, reset and alarm management in case of abnormal functioning. The water supplied to the floor panels is regulated by a mixing system that ensures winter temperatures of 36/38 ° C and summer temperatures below the limit of the humidity condensation in the air. Moreover, the plant is equipped with an air dehumidification system that guarantees an optimal relative humidity value. The domestic hot water is pre-treated with water softening systems and strictly regulated at temperatures that ensure the safety of the young users of the kindergarten. The electrical system supplies power to the heating system and the automation system. Everything has been inserted in dedicated electrical control and power units. This system is technologically advanced and provides the maximum safety. It fully respects the environment in which it was built and ensures a very high level of energy efficiency.

Geothermal energy, that is currently less than 1% of world energy production, is indeed a clean and renewable energy with great potential. According to an MIT research, it could fulfil the global energy needs for the next 4000 years, thus making unnecessary any other non-renewable sources currently used.





PILOSIO spa
 www.pilosio.com

■ Pilosio mp scaffoldings for art: a very italian story

Basilicas, art exhibitions and period buildings:
 the MP multidirectional system conquers the art world



PILOSIO IS NOT ONLY SYNONYMOUS WITH MAJOR BUILDING PROJECTS. THANKS TO ITS INCREDIBLE FLEXIBILITY AND THE AESTHETIC APPEAL OF ITS TEMPORARY STRUCTURES, TOGETHER WITH MORE THAN 50 YEARS' EXPERIENCE IN THE FIELD, THE COMPANY IS PLAYING AN EVER GREATER ROLE IN PROTECTING AND RECOVERING THE ARTISTIC HERITAGE OF ITALY

The perfect partner for any project of restoration and recovery of the urban and architectural heritage, following the Made in Italy tradition, Pilosio is a company that, for more than fifty years, has excelled in the sector of temporary equipment for the building and restoration world. The experience acquired by the company in this specific sector has led to the development of solutions that make it possible, for example, to create access routes and leave windows and doors clear when the subject of a restoration project is in a historic city centre. Pilosio never neglects the aesthetic aspect: the scaffolding used for restoration projects is always selected carefully in order not to disfigure the facade of the structure in question, given that these buildings are often located in the historic centres of cities. The jewel in the crown of the Pilosio range for this field is the MP multidirectional scaffolding system, a modern solution that reproduces at an industrial level all the flexibility of tube and joint scaffolding. The special washer welded to the uprights has 4 openings for the orthogonal mounting of the cross-pieces and diagonals and another 4 openings that enable mounting at variable angles in order to cover almost 360°. In addition to the enormous flexibility, the wedge and washer type of coupling is easy to mount and assembly and dismantling are very quick. Featuring quick assembly, great modularity, extreme adaptability and great capacity, the MP multidirectional scaffolding is the most flexible of Pilosio's systems, offering the greatest possibility for use in the most complex situations. Pilosio's varied projects bear witness to this, ranging from the restoration of the Basilica di San Croce in Lecce to the restoration of the façade of Palazzo Papadopoli in Venice, from the restructuring of the Basilica di San Bernardino in L'Aquila – seriously damaged by the 2009 earthquake – to the staging of the Keith Haring exhibition in the Chiesa di San Francesco in Udine. In addition, Pilosio equipment enables the creation of loading platforms, with very high capacity, located in front of floors so they can be used to deposit both the material removed from the building and the materials required for the works. Pilosio scaffolding, moreover, ensures the option of adding a cover, fixed or removable, to protect the site and the staff from adverse weather conditions. Pilosio is also adept at the creation of special, custom-built projects and structural items designed by our technical office to the specific requirements of the customer.

PILOSIO FOR: BASILICA DI SAN BERNARDINO IN L'AQUILA

The Ministry of Cultural Assets and Activities used Pilosio's MP multidirectional scaffolding for the restoration of the very beautiful Renaissance Basilica di San Bernardino in L'Aquila, seriously damaged during the 2009 earthquake. Pilosio's technical office was able to brilliantly solve the difficulties that the widespread and heavily damaged site presented. The requirement was to make the Basilica safe through the creation of a temporary structure that would allow the workers to proceed in complete safety with the delicate operation of restoring the cupola of the marvellous Renaissance Basilica and, at a later stage, the bell tower. The difficulties were that the scaffolding could not be supported by the roofs or the existing structures due to their precarious situation. In the design phase, Pilosio had to provide an overhanging scaffolding "bridge" to allow the unstable parts of the building to be surmounted. The first operation involved making the Basilica's interior safe. Pilosio designed and supply a safety portal inside the Basilica's central nave, and the chapels of the side naves, in order to protect the workers from any material falling from the ceiling and roof. The portal was 17 metres high and around 50 metres long and ran the entire length of the nave up to the presbytery, with overhanging access to the base of the internal cupola. Later, complex scaffolding was provided to enable the external restoration of the cupola and tambour to proceed. The option chosen was an overhanging portal in which the scaffolding left the ground at Piazza del Teatro and, passing over the Basilica and completely encompassing the outer surfaces of the cupola, returned to the ground in the internal Cloister. From the outside, the Basilica seemed to be inside a cage of sturdy scaffolding. A large team of restorers worked in complete safety on Pilosio's MP scaffolding and a site lift, manufactured by Electroelsa (a company belonging to the Pilosio group), allowed easy access to the service floors with the material required for the restoration works. In total, the volume of the scaffolding was around 35,000 square metres in a layout of 50x28 metres to a height of 44 metres.

The works then continued with the restoration of the interior part of the cupola, which was in a precarious condition. Pilosio designed and constructed a walkway at the height of the join of the cupola, with a loft that followed the cupola's inner line, and the creation of a work area to support the hydraulic jacks that were used to push the collapsed parts of the cupola outwards and put them back in their original positions.





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■ The restoration of Juliet's House in Verona

ABSTRACT

Juliet's house, the legendary house of the Shakespeare's heroine, dates back to the 13th and it is part of a medieval building that has always attracted crowds of tourists. Over the centuries, the building underwent important modifications, especially in the 40s when Antonio Avena transformed the style in neo-Gothic. For example, the addition of the famous balcony, a sarcophagus from the Castelvecchio museum, was done in that period. This article presents the restoration of the brick façade in front of via Cappello, carried out in 2013 by Tisato Massimo company and performed with restoration products mainly supplied by AN.T.A.RES srl.

INTRODUCTION

The front of Juliet's house still presents readable elements of the original medieval style and of its long history, such as the marble shelves of an ancient balcony (Figure 1). The wall is made of bricks with the exception of the eaves that were realized in a rough plaster with lime mortar. Traces of an ancient plaster and natural stones are also present on the façade. In particular, the plaster lies on the bricks following their relief and it is reddish in some parts: this suggests that the façade originally looked covered by a "three-dimensional" plaster imitation bricks.

The façade is composed of five floors; at the ground floor there is a wide entrance arch to the courtyard, Lessinia limestones hold up an arch of brick. The upper floors, excluding the mezzanine, are characterized by a row of four vaulted-arch windows with different types of frame (made of brick, white stone, with pilasters and Corinthian capitals, white and red brick arches).





Figure 1. Verona, Via Cappello, 23, Juliet's house, facade



Figure 2. Juliet's house, decay of brick facade



Figure 3. Juliet's house, facade, fragments of ancient plaster, made of a grout of lime and sand

THE STATE OF CONSERVATION OF THE FAÇADE

The façade bricks were interested by dark patinas and pollutant deposits even in the form of black crusts; phenomena of erosion and flaking were also present and the problem of soluble salts was limited. The lime mortar joints were superficially chalked or without any binder. In general, several cracks, especially in the central portion of the façade, were evident (figure 2).

At the first and third floor, the fragments of ancient plaster, made of a grout of lime and sand, were in poor condition (figure 3). The compact limestone of the architectural elements was in an advanced state of decay with the exception of the entrance arch, better conserved. The main stone degradation was black crusts in areas without runoff of the rain such (figure 4) as flaking, cracking and little lacune. Finally, the lower part of the façade was heavily smeared by graffiti paint and chewing gum (figure 5).

INTERVENTION

After a pre-consolidation with ethyl silicate (at 80% in white spirit, AN.T.A.RES), the superficially disaggregated bricks were cleaned by using mechanical tools, low pressure water spray and gradual hydro-sandblasting for removing the black crusts and dirt deposits. The disaggregated bricks were then deeply consolidated with ethyl silicate (AN.T.A.RES) by brush and by injection. The re-adhesion of bricks fragments was carried out with epoxy resin, in combination with bars in plastic reinforced by fiber glass for large fragments (figure 6).

The wide and deep cracks were treated as follow: after practicing holes in the walls, the bars were inserted and the epoxy resin was injected. The rotten bricks were instead replaced with similar ones (figure 7).

The grouting of micro and macro cracks was made with two different mixtures: with lime, powder of terra-cotta brick powder and pigments, for brick cracking, and with lime and sand for joint mortar.

The integration of the grouting was carried out with thin paint layer and lime.

It was finally applied a water-repellent based on siloxanes (Water repellent H224 at 7% in white spirit - AN.T.A.RES) in order to prevent, or at least slow down, the degradation due to the action of air pollution and the rainwater. The product is colorless, resistant to weather and UV radiation, does not alter the natural color of the support material allowing, at the same time, the permeability.

After a delicate dry cleaning, the ancient plaster fragments were consolidated with a water-based acrylic in micro-emulsion (Calchera San Giorgio), the re-adhesion of plaster layers were performed with grout based of natural limes at low specific weight, free from salts (Ledan C30 - AN.T.A.RES), injected through existing cracks. The cleaning of surfaces plastered was carried



Figure 4. Juliet's house, particular of the decay of the stone frame: black crust



Figure 5 Juliet's house, particular of the entrance arch to the courtyard before restoration

out with nonionic detergent in aqueous solution (Tween 20 at 2%) and in some areas poultices of ammonium carbonate at 5% were used. The cracks and micro-cracks were grouted with a mortar of seasoned lime with inert fillers physically and chemically similar to the plaster to ensure homogeneous elasticity between the old and new mortars.

The grouting and the new plaster were slightly paint coated and covered with thin layer of lime to match the surrounding color of the original material. Finally, the protective siloxanes-based (Water repellent H224 at 7% in white spirit - AN.T.A.RES) was applied on the surface.

During the cleaning of the plaster, medieval frescoes were discovered under the window frames of the first floor: drawings made with red, green and ochre spirals on a black background. The removal of all later overlays and the cleaning by poultices of deionized water and ammonium carbonate were then performed and the adhesion of detached layers were done with injections of natural hydraulic mortar free from salts (Lafarge, AN.T.A.RES) (figure 8). The gap of plaster, micro and macro cracks were filled with a mortar of seasoned lime with similar inert filler to the original plaster. The lacune of the paint layer were layered with watercolors using the "lowering the tone" technique without false reconstructions. Siloxanes-based protective (Water repellent H224 at 7% in white spirit - AN.T.A.RES) was finally applied to the painted surfaces.

The flakes of stone material were firstly fixed with mixtures of stone powder and natural hydraulic lime NHL 5 in order to avoid detachment in the subsequent cleaning, performed by using brush, water at low pressure, poultice of ammonium carbonate (figure 9). The disaggregated elements were consolidated with ethyl silicate (AN.T.A.RES) by brush, injection or by percolation. The block of stones was performed as above described for the bricks and the grouting was made with natural hydraulic lime-free salts with different color mixture depending on the color of the stone in different parts of the façade. The final protection was performed with water-repellent siloxane (Water repellent H224 at 7% in white spirit - AN.T.A.RES) spraying the surfaces in a uniform manner from the top downwards.

The removal of graffiti and chewing gum was finally performed on the courtyard entrance, by graffiti remover and mechanical tools (scalpels, brushes and spatulas), respectively. The treatment was completed with a final protective anti-graffiti to avoid the absorption of ink and spray paints that can thus be removed in the future with greater ease.

CONCLUSION

The present work, through the use of appropriate products and methodologies, has allowed to slow down and stop the decay of different substrates such as bricks, ancient and modern plasters and natural stones of the front of Juliet's house in order to preserve them in the future (figure 10). At the same time it has been possible to improve the reading of the many traces of the past that have marked this building. Last but not least in importance, the restoration has uncovered medieval frescoes under ancient plasters.



Figure 6. Juliet's house, block phase of bricks



Figure 7. Juliet's house, "cuci-scuci" phase



Figure 8. Juliet's house, the consolidation of medieval frescoes



Figure 9. Juliet's house, the cleaning of the stones of the window frames



Figure 10. Juliet's house, facade after the cleaning and consolidation



Juliet's house, frame with Corinthian capitals after the restoration





composite engineering

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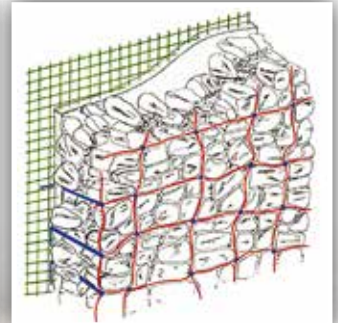
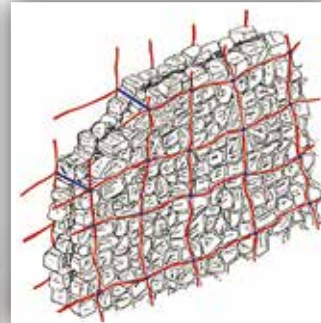
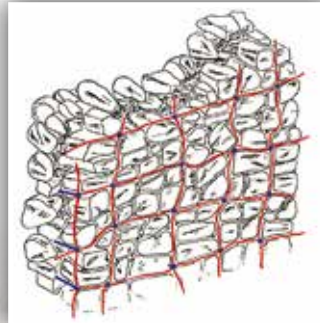
■ Fibre Net Fibrebuild Reticola[®]

An innovative technique to reinforce and consolidate stone or brick walls, preserving original aesthetic

When consolidation of masonry, whether of stone, brick or mixed materials is concerned, FibreNET is by now acknowledged as leading worldwide company, mainly thanks to FIBREBUILD reinforced plastering systems developed along last decade. Nevertheless, the reinforcement of exposed stones or bricks walls, preserving the original aesthetic, was still a question unanswered. Until FibreBUILD RETICOLA: the innovative reinforcement system developed by Fibrenet on this specific purpose.

FibreBUILD RETICOLA system consists in embedding a high tensile strength steel strand into mortar joints (previously skived to a depth of 5-6cm only), to create a sort of reticular net approximately 300-500mm wide. Steel strands are anchored through the wall by mean of steel special rods. Once joints have been repointed by mean of suitable mortar, the reinforcement system is completely hidden, with the impressive result to increase compression, shear and flexural strength, maintaining historical appearance untouched.

The small size of the reinforcement strands, their flexibility and easy installation, makes possible and cost effective to apply this technique on an extensive surface, which has the further benefit to spread forces acting on build reducing dangerous concentrations of stress.





FibreBUILD RETICOLA system efficacy has been investigated and well proved through an extensive and meticulous tests either at Fibre Net laboratory and on site. Through a double flat jack, vertical compression and diagonal compression tests (shear tests) have been performed on dozens of walls, built with different techniques and materials, either not reinforced, and reinforced by mean of different RETICOLA configurations, creating an extraordinary precise and reliable database of information on masonry mechanical behavior. Based on these results, it was possible to report an impressive mechanical resistance improvement of the masonry thanks to this systems. It was also noted that deep repointing of joints with metal fibers can increase compressive strength significantly, even doubling it as compared to unreinforced masonry.

Other recently performed tests regarding four-point bending tests of stone masonry panels, showed that the panels can support greater loads than those evaluated by means of calculations. FibreBUILD RETICOLA system can be effectively used from smallest local reinforcements (for example individual wall panels of existing buildings) to the most extensive applications (such as city walls boundary consolidation), and more in general, wherever exposed brick or stones masonries overall behavior has to be improved.

When historical building restoration is concerned, further essential, intrinsic features of FibreBUILD RETICOLA system have to be considered: its very low invasiveness, and total, easy reversibility.

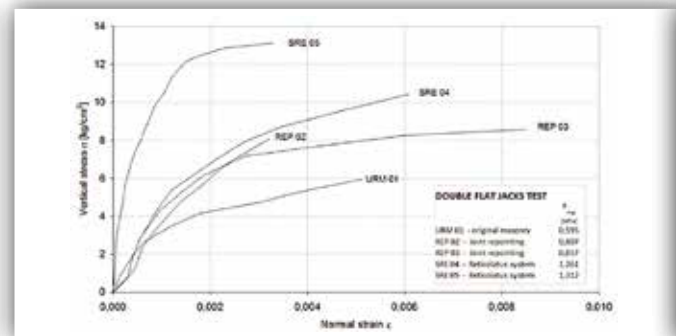
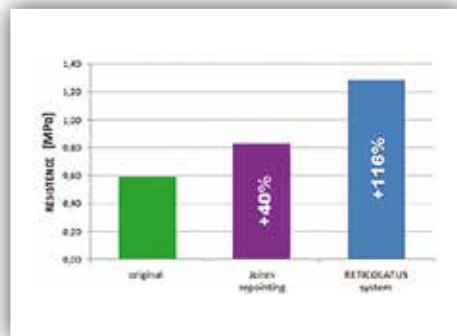
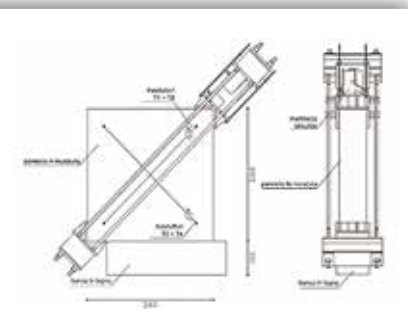
A typical application is limited to skiving some of joints only (according to the project developed by the designers), therefore stones or bricks remain totally untouched. Furthermore, in case of need, the whole system can be completely removed easily, without any leftover or damage to the original structure.





INSTALLATION STEPS (RETICOLA TWIN SYSTEM)

1. Masonry study in order to determinate steel strands layout, and to ensure the correct knit dimensions and shape.
2. Joints skiving, approx 6 cm deep, and waterjet cleaning;
3. Connectors holes drilling (according to designer's layout) and cleaning. Injection with controlled shrink mortar or suitable resin. Connectors insertion.
4. Light joints repointing to create a regular laying bed for steels strands. Placement of steel strands placement according to designer's layout, and connection to the connector's hook.
5. Steel strands tightening, by mean of connectot's bolts.
6. Final joint repointing to cover either steel strands and connectors.

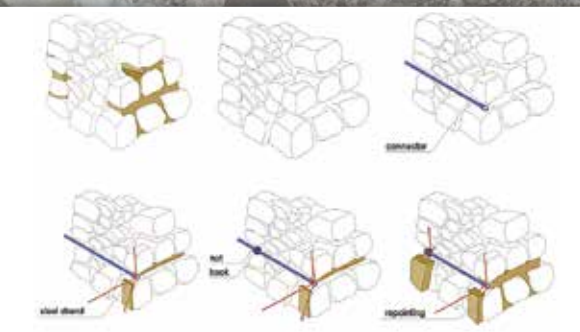


CONCLUSIONS

The data arisen from diagonal compression tests confirmed a significant peak resistance improvement compared to not reinforced masonry. Moreover, masonry behavior after peak resistance is even more interesting: while unreinforced samples post-peak resistance drops vertically to very low values, in reinforced samples compression resistance remains very good even at high deformation values. In other words, unlike unreinforced masonries, the ones improved by FibreBUILD RETICOLA system are able to provide a significant energy dissipation capacity even after peak point, and this is extremely important in case of seismic events, since building is able to withstand aftershocks, even if seriously damaged. Furthermore, experimental test confirmed that overall rigidity is not affected by the application of FibreBUILD RETICOLA system: this is important to avoid dangerous concentration of stresses, enabling the whole building to deform uniformly and spreading energies on wider surface with consequently lower values. In case of seismic event, the excellent out-of-plane behavior of reinforced masonry prevent wall collapse, improving in-plane resistance too, end ensuring a high energy dissipation.

MAIN BENEFITS

- mechanical characteristics of masonry with both in-plane and orthogonal actions get homogeneously upgraded.
- vertical walls can be connected diffusely one to another and to horizontal structures.
- tensile strength gets improved, also with irregular walls or with aligned vertical joints.
- stainless materials.
- monolithic walls are obtained thanks to transversal connections.
- stone and brick walls can be kept exposed.
- compatible with lime mortars.
- low invasiveness.
- reversible intervention.



notes

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quaderni di assorestauro



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