

HISTORICAL BUILDINGS

















PADENGHE CASTLE, PADENGHE SUL GARDA, BRESCIA (CASTELLO DI PADENGHE) ROYAL VENARIA PALACE, TURIN (VENARIA REALE) CA' FOSCARI UNIVERSITY, VENICE (UNIVERSITA' CA' FOSCARI) "LA SCALA" THEATRE, MILAN (TEATRO LA SCALA, MILANO) VILLA PISANI, STRA', VENICE PAVIA CASTLE, PAVIA HOTEL ESEDRA, ROME VILLA ARVEDI, GREZZANA, VERONA PODESTA' PALACE, RIMINI



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CHURCHES AND BELL TOWERS



(BASILICA DI SAN PETRONIO) (BASILICA DI SAN PE I RONIO) THE CATHEDRAL OF ORBETELLO, ORBETELLO, GROSSETO (DUOMO DI ORBETELLO) THE SANCTUARY OF OUR LADY OF GRACES, PIOVE DI SACCO, PADOVA (SANTUARIO MADONNA DELLE GRAZIE) THE CHURCH OF SAINT SOFIA, PADOVA (CHIESA DI SANTA SOFIA) (CHIESA DI SANTA SOFIA) THE CHURCH OF SAINT AUGUSTIN, COLLE VAL D'ELSA, SIENA (CHIESA DI SANT'AGOSTINO) THE BELL TOWER OF SAINT ZENO, VERONA (CAMPMAILE DI DAN ZENO) CHURCH OF THE HOLY SOULS, L'AQUILA (CHIESA DELLE ANIME SANTE) Resin Proget S.r.l has its main offices in Costa di Rovigo, Veneto and its Technical Management Offices in Modena, Emilia-Romagna.

Since 1986 it has dealt with restoration and structural consolidation of historical buildings and monuments such as theatres, castles, churches, bell towers and villas. Resin Proget always uses innovative technology and materials and guarantees that work is carried out perfectly with the use of electronic, mechanical and manual equipment. It works together with some of the best-known planners and designers in Italy and often uses methods that it has fine tuned itself.

The following are examples of some very important and prestigious buildings where Resin Proget has had the honour of carrying out structural consolidation, achieving positive results:

- The "Fenice" Theatre, Venice / Teatro "La Fenice", Venezia
- Royal Venaria Palace, Turin /Reggia di Venaria Reale, Torino
- The Holy Convent of Saint Francis, Assisi / Sacro Convento di San Francesco, Assisi
- Saint Chiara's Basilica, Assisi / La Basilica di Santa Chiara, Assisi
- Saint Mary of the Angels' Basilica, Assisi / Basilica di Santa Maria degli Angeli, Assisi
- Saint Anthony's Basilica, Padua / Basilica di Sant'Antonio, Padova
- Saint Petronius' Basilica, Bologna / Basilica di San Petrronio, Bologna
- The Bell Tower of Saint Zeno's Basilica, Verona / Campanile della Basilica di San Zeno, Verona
- Visconteo Castle, Pavia / Castello Visconteo, Pavia
- The Great Guards' Palace, Verona / Palazzo della Gran Guardia, Verona
- Ca' Foscari University, Venice / Università Ca' Foscari, Venezia
- The Alpini's Bridge (designed by Palladio), Bassano del Gappa / Ponte degli Alpini, (Opera del Palladio), Bassano del Grappa
- Villa Badoer, (Palladian Villa), Fratta Polesine, Rovigo / Villa Badoer (Villa del Palladio) Fratta Polesine (RO)
- The Academy of Literature, Athens /Accademia della Letteratura, Atene
- "La Scala" Theatre, Milan / Teatro la Scala, Milano
- The Palace of Reason, Verona / Palazzo della Ragione, Verona

- The Civic Library, Verona / Biblioteca Civica, Verona
- The Royal Villa, Monza, Milan / Villa Reale, Monza (MI)
- The Parish Church of Saint Mary, Our Lady of the Assumption, Cavalese, Trento / Pieve di Santa Maria Assunta, Cavalese (TN)
- "La Quiete" Municipal Villa, Paese, Treviso / Villa "La Quiete" sede Municipale, Paese (TV)
- The Church of Saint Julian the Martyr of Puglia, San Giuliano di Puglia, Campobasso / Chiesa di San Giuliano Martire di Puglia, San Giuliano di Puglia (CB)
- The Church of Saint Peter in Vincoli, Roè Volciano, Brescia / Chiesa di DSan Pietro in VIncoli, Roè Volciano (BS)

The main kind of work carried out by the company includes:

- Vibration-free perforations of brickwork, stonework and mixed material walls. Its record perforation was 50ml in 60cm thick frescoed brickwork walls.
- Consolidation of dilapidated walls with injections
- Consolidation of vaults and ceilings with techniques that are specifically designed to suit the type of structure requiring attention
- Application of composite materials
- Structural consolidation of deteriorated wooden parts
- Increasing the load-bearing capacity of wooden beams and floors
- Micro-sandblasting, cleaning, parasiticidal treatment and healing of wooden parts
- Non-destructive diagnostic investigations for walls and wood

Resin Proget has been trusted by several Italian Public Works Department and has many specialized technicians and expert craftsmen on its staff.

In 2001 the company obtained the **Quality System Certificate** in conformity with the **UNI EN ISO 9001:2008** regulation, following collaboration with a leading Consultancy company and one of the most important Certifying bodies.

It also achieved the SOA award for the OG2 category (4th place), OS21 (2nd place) and OS2 (1nd place)

THE CHURCH OF ST. JULIAN THE MARTYR OF PUGLIA (CAMPOBASSO)



Structural consolidation of the walls and vaults of the Parish Church of Saint Julian the Martyr of Puglia, damaged by the earthquake of October 31st 2002

External scaffolding to underpin the façade





Endoscopic

the walls

investigations on

Preliminary sonic investigations The structural consolidation project consisted of:

- 1. **Investigations of the perimeter and internal walls** and of the pillars in the nave using sonic and endoscopic instruments;
- 2. **Injection** of natural lime and remediation of the perimeter walls
- 3. **Inner tensions bars** placed in the walls and pillars by using coring perforations, the insertion of high resistence longitudinal and vertical steel wire ropes fixed and tautened with plates, cylinders and wedges
- 4. **Reinforcement of major vaults** and minor vaults on the extrados and underside with carbon composites



Injections into the walls



Reinforcement of the vaults with carbon material

Tautening operations for the ropes





Positioning the core drill

Fixing the ropes with steel plates



THE HOLY CONVENT OF THE BASILICA OF ST. FRANCIS – ASSISI (PERUGIA)



The consolidation of the vaults was carried out by connecting metal chains to the stonework pillars by using core holes made with totally vibration-free perforating machines.



Details of consolidation of the vaults with metal chains

Work performed:

- Consolidation of the walls of the Hoy Convent with natural lime injections
 - **Consolidation** of the vaults with tension bars inserted with core drilling



In the Holy Convent there was the problem of decaying mechanical characteristics of the joining mortar in the ballast walls and at the same time, the problem of cavities inside them. Consolidation was carried out by low pressure injections of resistant salt-free lime, which filled all the cavities inside the wall itself, restoring the load-bearing capacity to the mortar.



Detail of the wall injections phase

Detail of the perforating machine







Safety scaffolding for the façade



Work performed:

- Consolidation of the stonework vaults and increase of their resistance to earthquakes
- **Tensioning** of the façade with highly resistant steel cables
- Injections in the walls and core drilling to insert concealed tension bars





Following the earthquake which struck on September 26th 1997, it was necessary to build a safety frame to ensure that the Basilica's façade didn't collapse.

The consolidation work on the façade was carried out using high resistance cables inserted into the inside of the walls.

Detail of consolidation work on the internal ribs of the apse vault

ASSISI (PERUGIA)



Details of different phases of the work to create the ribbing grid for the vaults







General view of the ribbing grid on the vaults **Consolidation of the vaults** in the nave and apse was performed by creating a reinforced concrete ribbing grid capable of increasing the resistance of the vaults themselves to an earthquake

General view of the ribbing grid on the vaults







ST. ANTHONY'S BASILICA



Work performed:

- Reinforcement of the curtain wall base of the domes by injecting salt-free lime;
- Consolidation of all the wooden structures of the load-bearing frame of the eight domes, using various technologies;
- **Consolidation** and reinforcement of the covering wooden trusses of the confessional;
- **Internal hooping** of the domes with plates and stainless steel cables regulated by tensioning elements;
- Consolidation of the vertical walls of the library with reinforced staples;
- Reinforcement of the library spandrel wall with composite materials (carbon- aramid);
- **Treatment** of all the wooden structures with parasiticides products and consolidation work made to measure;
- **Consolidation** of the vaults in stone work of the Library with bands (Aramidic carbon fibre).

Consolidation and reinforcement of the wooden covering trusses of the confessional

Reinforcement of the library spandrel wall with composite materials (carbon-aramid





PADUA



Reinforcement of the curtain wall base of the domes with injections of salt-free lime

The work was carried out for the 2000 Jubilee and involved the Basilica's eight wooden domes, the confessional and the library.

Resin Proget was successful in consolidating this handcraft by using, as always, avant-garde technology and mastery.



Consolidation and reinforcement of the wooden covering trusses of the confessional



Consolidation of the wooden structures inside the eight domes of the Basilica



Consolidation of stone work vaults of the Basilica

The eight domes, built in the XIII century with wood from Venetian ships, have the shape of the upturned hull of a ship. The techniques used to consolidate them were innovative but integrated with traditional and typical technologies. In particular, it was necessary to perform internal hooping on several levels using pretensioned cables.

The consolidation of the library spandrel wall was important, inasmuch as mixed carbon-aramid composite materials were used. They gave an excellent response in terms of workability and resistance.



Work performed:

- **Reinforcement** of the walls in the Apolline Rooms (Sale Apolline), the theatre Cavea (seating area) and the Stage with controlled injections of consolidating mixtures
- Reinforcement of the wall arches, architraves and lintels by positioning spatially shaped metal bars
- **Pretensioning** the walls with high resistance steel
- **Reinforcement** of the stairs and steps with carbon-fibre composites
- **Suspension** of the wooden lintels in the Apolline Rooms to the stronger walls of the upper floors by means of tension bars positioned in holes produced through core drilling
- **Consolidation** and restoration of the cement structures that remained on the site

THE "FENICE" THEATRE





The internal ""Cavea" before work

The strong exposure of the walls to fire in the "Fenice" Theatre in Venice had produced superficial degradation of the bricks and quite severe crumbling of the mortar bedding. This, together with fractures, holes and inner cavities, made the walls that had survived the fire particularly fragile, especially the walls in the stalls which had suffered the greatest thermal shock. Suitable methods were studied and employed in order to restore the strength of the walls and return their original bearing capacity to them.

Resin Proget monitored the effectiveness of this consolidation work by means of innumerable sonic tests performed before and after consolidation had been achieved.

These tests made it possible to identify cracks and cavities and therefore to confirm the effectiveness of the consolidation work. The fire had also attacked the reinforced concrete structures inserted into the stage walls. This cement was restored following a thorough examination of the materials to be used.



Consolidation of walls by injecting saltfree lime mixtures in the Apolline Rooms, the theatre "Cavea" and the Stage



VENICE



Consolidation of walls by injecting saltfree lime mixtures in the Apolline Rooms, the theatre "Cavea" and the Stage

The fire had also attacked the wall dividing the stalls from the stage which consisted of a central arch discharging onto two side pillars. **These pillars were reinforced not only using injection techniques, but also by reinforcing the walls with a spatial grid of stainless steel bars inserted into the body of the wall through non-vibrating perforations performed with special synthetic diamond blade equipment.** Special attention was paid to reinforcing the wooden lintels in the Apolline Rooms: this was performed by hanging the load of the beams onto the stronger walls of the upper floors, using perforations that were particularly difficult to make because of the presence of the only frescoes and stucco that had survived the fire and because it was impossible to trace the perforation line.



All the stone steps of the main staircase of the Apolline Rooms and of other stairs were reinforced with carbon-fibre. **The same** carbon was also used to hoop (as with the hoops of a barrel), the cylindrical walls of the lantern tower on the south side which proved to be severely fractured.

The tower terminates with four marble columns which were also fractured: they were reinforced by inserting stainless steel pipes into their cores. Other work, such as pretensioning the wall panels, connecting the summers to the walls and placing tension bars in the bodies of walls allowed all the other companies to complete the complex mosaic of reconstructing and to make use of the "Fenice" Theatre in total safety.



Injecting the walls behind the stage



Core hole perforations in the stone columns of the lantern

Reinforced perforations to consolidate the lintels, arches, beams, pillars and floor slabs



COLONNATO BASILICA THE COLONNADE -





Consolidation work was done on the statues of the colonnade using titanium and/or aramid reinforcements.

To insert the reinforcements, perforations were made using drills with pressure valves and nebulizers with cooling water



A coat of arms and statues



S. PIETRO – ROMA ST. PETER'S BASILICA - ROME



Reinforcement of damaged parts with aramid fibres



Core boring perforations into the walls of the coats of arms, to insert post tensioned titanium reinforcements



Insertion of titanium reinforcements



Glueing of broken parts



Fixture of broken parts using titanium reinforcement



View of the completed work

THE PARISH CHURCH OF SAINT MARY



The vaults after the first phase of cleaning





Consolidation of the great dome with carbon fibre composite

General view of the consolidated vaults



On the 29th April 2003, a raging fire devastated the magnificent parish church of Cavalese; this calamitous event completely destroyed the ancient wood shingle gabled roof.

The covering structure had consisted of antique wooden elements, positioned to form trusses which bore the load of the roof covering.

The fire totally destroyed the structure and it collapsed onto the vaulted structures below, immediately causing justifiable concern about the static capacity of the entire building, also because the high temperatures of the fire had weakened the resistance of the binding materials.



The fire that damaged the covering and the walls

General description of the work carried out:

The base of the internal columns was reinforced by consolidating the foundations with fluid, lime-based grout.

The vault over the central nave, which showed the most worrying examples of damage, was reinforced by placing metal tension bars in correspondence to the three pairs of central pillars and by creating a structural lime coping stone. As the coping stone was 8 cm. thick, it was reinforced with 6 mm. diameter steel netting and 10 x 10 square mesh, and reinforcing rods were placed at 10 cm. centre-to-centre on all the intersections of the side groins, and connected to the original vault below with stainless steel pins inserted into several stones and stone elements positioned on the underside of the intersections between the vaults.

OUR LADY OF ASSUMPTION - CAVALESE (TRENTO)



Pull-off and sonic investigations



The consolidated side vaults



The structure bearing the new roof

Reinforcement of the internal columns and the welded thick reinforced concrete slab



Stainless steel reinforcement of the vaults

the damage in the vaults





The new roof of the building was made with a load-bearing structure of double-sided larch-wood, traced over the geometry of the original structure.

The inner flooring was consolidated by forming a 13 cm. thick structural lime slab, reinforced with 8 mm. double metal netting and 20 x 20 mesh, and with 40 x 40 cm size spandrel beams in correspondence to the walls and pillar bases, attached with stainless steel connectors injected with resin.

The entire church spandrel wall was injected with natural lime grout and the many cracks in correspondence to the side walls were stapled with stainless steel bars inserted into 4 m long core holes.

In the bell tower, all of the internal flooring was reinforced by creating double wooden floor boarding and perimeter connectors on the walls and the existing beams. The load-bearing wooden structure in the cusp was thoroughly checked and consolidated with reinforced staples to improve coupling between the wooden parts. The 4 pinnacles at the base of the belfry were consolidated with vertical perforations and the insertion of steel bars injected with epoxy resin



Stainless steel reinforcement of the vaults



The aim of the work was consolidation, to increase the load-bearing capacity of all the existing wooden floors by inserting metal T-shaped elements on the underside of secondary beams, attaching them with epoxy resin.





Restoration and structural consolidation project for the Civic Library of Verona



Special work to consolidate the floor beams







Reinforcement of the main beams



LIBRARY

The roof of the building consisted of wooden beams that were badly degraded at their resting points, and these parts were consolidated by reconstructing all the deteriorated portions of wood with large-size gravel resin and steel bars and by plating them with metal plates.

The inner dividing walls, which were noticeably cracked, were reinforced by positioning metal elements in an "arch" or "bridge", thereby plating the discharging arch in stonework or the wooden elements.





To conform to the regulations regarding seismic protection of the "Nervi" building, all 24 of the concrete pillars on the first floor were reinforced with several layers of wrapping in carbon fibre material.



Consolidation of the concrete pillars with carbon material

Plating the inside walls and reinforcement of portals





THE CHURCH OF SAINT PETER



On November 24th 2004, a strong earthquake badly damaged the Church of Saint Peter in Vincoli and many other buildings in the various boroughs of the Brescia side of Lake Garda.

The church underwent serious damage to the vaulted brick structure of the nave, the first bay completely collapsed and second bay partially.

Taking into consideration the risky position of the area, seismic protection was made necessary for the whole building.



The inner vaults that collapsed after the earthquake

The damaged vaults were reconstructed with materials similar to the original; the new bricks were placed on a wooden centre built on the geometry of the original vault.

The underside of the vault was entirely plastered using natural lime based materials reinforced with fiberglass netting.

Base centre for the reconstruction of the vault of the first b**ay**



Detail of the extrados of the reconstructed vault of the second bay



Detail of the underside of the vault of the first bay



IN VINCOLI – ROE' VOLCIANO (BRESCIA)



Detail of the extrados of the reconstructed vault of the second bay



Consolidation of the vaults and the creation of reinforced spandrel

All the existing vaults were consolidated with ribs on the extrados: reinforcing ribs in reinforced plaster with fibreglass netting were created on modelled polystyrene formworks following the shape of the vaults.

The church roof was completely redone with the creation of an anti-seismic covering made up of multi-layer panels fixed to a new wooden structure resting on big arches in ballast. The jointing between the panels was constrained by positioning a bored steel band, fixed with nails to the multilayer. To complete the spandrel beam of the covering, hoops of metal plates were positioned and connected to the walls and the big arches with steel plugs.

The main façade, which was showing signs of listing, was anchored to the side walls and metal chains were positioned above the church's inner cornice.

Creation of the new covering structure in the apse



View of the new anti-seismic covering with multi-layer panels in the apse



View of the new anti-seismic covering with multi-layer panels in the nave



THE ALPINIS' BRIDGE or THE OLD BRIDGE BASSANO DEL GRAPPA (VICENZA)



Consolidation of the four wooden columns of the Old Bridge, also called THE ALPINI'S BRIDGE (by ANDREA PALLADIO).

All the towers showed signs of considerable deterioration (rotting and erosion), both the vertical structures which were out of the water (columns and cut-waters), and the structures in the water ("soglia" and "cavazzali"). Consolidation work was performed by reducing damages with fiberglass reinforced epoxy bars and by introducing epoxy concrete in the worst affected areas.

The "soglia", an element that unites the foundation piles fixed in the river bed and is made of particularly hard wood, showed widespread damage. It was consolidated by inserting fiberglass reinforced epoxy bars into the main body of the beam across the damaged parts, and fixing them with injections of special epoxy resins that harden in water.



Work carried out:

- **Consolidation** of the four wooden supporting piers of the old bridge
- Consolidation of the wooden "soglia" between the foundation piles
- Consolidation of the wooden columns and reconstruction of the rotting sections of wood

Detail of the reinforcement of the wooden cut-waters





Consolidation of the wooden columns

The columns, made of round trunks with a remarkable diameter, showed notable cracks and rotting in the median section. Their crumbling state had been caused by rain water attacks, initially entering through holes made in the columns to insert tightening bolts in the planks.

QUADRIPORTICO ARCIVESCOVADO – NOVARA THE FOUR SIDED PORTICO IN THE ARCHBISHOP'S PALACE - NOVARA



The rectory complex of the Cathedral first underwent restoration work as far back as the 15th century.

This work was significant both for the perspective in the four-sided portico, where enlarging and raising was done, and for structural elements such as pillars and vaults, following work at the end of the 1960s, when the current brick facing was done.

Consolidation of the masonry pillars consists of creating structural plaster reinforced with stainless steel netting and connectors to support the application of carbon fibre bands. Prior to the reinforcement work, all the hollows in the walls were filled with injections of lime.

The inner walls and the intrados surface of the vaults had lost their plaster over the years during previous restoration work, and the bricks themselves showed evident signs of degradation due to external factors. For this reason all the surfaces were covered with a new layer of lime plaster which restored the original aesthetic effect of the four-sided portico.

Work carried out:

- **Consolidation** of the masonry pillars, using injections and composite materials;

- **Consolidation** of the vaults and vertical walls with new lime plaster.

Details of propping arches and injections in the pillars



Reinforcement of the pillars with structural plaster and carbon fabric



Views of the work carried out





THE BASILICA OF SAN BERNARDINO – L'AQUILA (AQ)



The dome in masonry was damaged in the earthquake of April 6th 2009 and its vaulted structure put seriously at risk. Work was carried out to restore and ensure the safety of its load bearing capacity.





External reinforcement with carbon fabric

The structure of the masonry vault is reinforced and consolidated by applying several layers of bands in carbon fabric, both along the diagonals of the vault, and following the radius to the upper central oculus and down to the base of the dome. Intervention was external and internal and the bands were connected using looping bars, in order to create double anchorage, inside and out.





Details of internal reinforcement with carbon fabric

Details of internal reinforcement with carbon fabric



THE FERRARI WORKS – MARANELLO (MODENA)



Restoration of the load-bearing capacity of the pre-compressed beams in the "experience shed" following the fire, by glueing carbon fibre sheets to the underside





Detail of the shed affected by the fire

The work planned was to apply High Module carbon fibre sheets to the underside of the main beams with suitable epoxy resins.

Restoration of the deteriorated concrete and consolidation of the jointings by wrapping them with carbon material.

Detail of the pre-compressed concrete armoured beams during the phase of applying 24ml long carbon sheets



Detail of the reinforced beams





CERTIFICATO

Nr 50 100 1832 - Rev. 05

Si attesta che / This is to certify that

IL SISTEMA QUALITÀ DI THE QUALITY SYSTEM OF

RESIN PROGET S.r.I



SEDE LEGALE E OPERATIVA: **VIALE DELLE INDUSTRIE 190** I-45023 COSTA DI ROVIGO (RO)

È CONFORME AI REQUISITI DELLA NORMA HAS BEEN FOUND TO COMPLY WITH THE REQUIREMENTS OF

UNI EN ISO 9001:2008

Riferirsi al manuale della qualità per eventuali dettagli delle esclusioni ai requisiti della norma ISO 9001:2008 Refer to quality manual for possible details of exclusions of requirements of the norm ISO 9001:2008

Questo certificato è valido per il seguente campo di applicazione This certificate is valid for the following product or service range

Esecuzione di interventi di restauro e consolidamento di strutture murarie, lignee ed in calcestruzzo e di intonaci dipinti, in accordo alle specifiche del cliente (EA 28a)

Execution of restoration and consolidation works of wall, wooden and concrete structures and painted plasters, according to customer specification (EA 28a)

Sistema di gestione per la gualità conforme alla Norma ISO 9001:2008 valutato secondo le prescrizioni del documento SINCERT RT-05

La presente certificazione si intende riferita agli aspetti gestionali dell'impresa nel suo complesso ed è utilizzabile ai fini della qualificazione delle imprese di costruzione ai sensi dell'articolo 8 della legge 11 febbraio 1994 N. 109 e successive modificazioni e del D.P.R. 25 gennaio 2000 N. 34. Per informazioni puntuali e aggiornate circa eventuali variazioni intervenute nello stato della certificazione di cui al presente certificato, si prega di contattare il nº telefonico 02 241301 o indirizzo e-mail tuv.ms@tuv.it



SGQ Nº 049A SSI Nº 005G PRD Nº 081B SGANº 018D ITX Nº 001L **ISP Nº 057E** SCR Nº 009F

Membro degli Ad

EA. IAF e ILAC Signatory of EA, IAF and ILAC Mut Agreements

Per l'Organismo di Certificazione For the Certification Body TÜV Italia S.r.l.

Andrea Vivi istratore Delegato - CEO

Data di emissione / Issue date

2011-05-20

Data di scadenza / Expiry date

2014-05-14

"La validità del presente certificato è subordinata a sorveglianza periodica a 12 mesi e al riesame completo del sistema di gestione aziendale con periodicità triennale"

"The validity of the present certificate depends on the annual surveillance every 12 months and on the complete review of company's management system after three-years'

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