

ISR 99

Strategic Intervention for the restoration
of the damages caused by the 1999 earthquake
at the Byzantine church of Aghios Petros
in Eastern Attica, Greece

Subproject's Progress

Athens, 15 & 16 March 2007

Contents

- Part I: Subproject's Management
- Part II: The Objective
 - A. Architectural & Structural study
 - B. Wall Paintings Conservation Study
- Part III: Subsequent Actions

Part I

Subproject's Management

The progress of the subproject lies on the elaboration of the studies concerning the restoration of the monument.

- Architectural & Structural study was commissioned to external expertise and is now completed.
- Conservation study, including material's characterisation, was conducted by the TEI of Athens in collaboration with NSCR Demokritos and is completed.
- Both studies have been submitted to the 1st Ephorate of Byzantine Antiquities (EBA) of the Ministry of Culture.

- According to Greek legislation, the 1st EBA are the supervising authority overlooking and supporting the elaboration of studies and the execution of restoration works.
- Following the submission of the studies, the 1st EBA has examined the quality and integrity of the studies and has subsequently forwarded them to the relevant services of the Ministry of Culture in order to acquire permission to initiate restoration works.

Part II – A

Architectural & Structural Study

The main objective for the small church was mainly to reassure the necessary structural behaviour on static and dynamic forces. In addition to that the restoration of the morphology and the integrity of the church was absolutely essential.

The numerous inappropriate interventions made in the 1980's, including the demolition of the west wall, were the main reasons to proceed to an architectural restoration.

The necessity for a structural reinforcement derives out of the strike by the earthquake of September 1999.

The features of the church



- General view from Northeast, illustrating some of the additions.
- The scaffolding supports the niche due to extensive cracks.



- General view of the interior with the inappropriate additions and the gap at the place of the demolished west wall

The large hall westwards has been constructed in two phases

Decay, Pathology and Interventions

Pathology

- Extensive cracks all over the niche at the eastern part. The severe condition was the reason for the supporting scaffolding at the east part, erected by the 1st Ephorate for Byzantine Antiquities.
- Serious cracks at the side long walls, especially near the demolished part near the SE corner.
- The west wall was totally and illegally demolished in early 1980's to expand the interior westwards.
- A door was opened near the SE corner by demolishing part of the south wall.



Decay, Pathology and Interventions

Interventions

- Many non sympathetic interventions in the interior destroyed the original morphology. Most areas with wall paintings have been covered with a newer plasterwork.
- An icon screen wall was erected in the middle of the nave with inappropriate morphology.
- Extensive additions around the historic building eliminated its integrity and appearance.
- The poor quality materials used on the additions deteriorated the effect.



Structural Problems

The problems already mentioned in the pathology, are attributed to the following reasons:

- Rather weak, shallow foundation on an inhomogeneous ground (partly due to the close proximity to the nearby creek)
- Poor and mixed quality of the building material
- Later interventions to the building (opening of a door near the corner, removal of one of the western transverse wall) that affected the symmetry and conservative character on which such modest structures rely
- The fairly local, recent (September 1999) earthquake in the region of Mt. Parnitha



Requirements of the intervention

- Restoration of the structural integrity
- Refurbishment of the shape and the forms of the building.
- Protection of the rain and ground water
- Improvement of the near environment of the building.

Suggested restoration works

The church

- Removal of all the newer and inappropriate additions
- Reconstruction of the demolished west wall.
- Improvement of the integrity of the walls and the vault, by sealing the cracks and reinforcing the masonry.
- Reinstating and improvement of the structural integrity (see further bellow)
- Replacement-Reconstruction of the tiled roof and application of water proofing layers with breathing capabilities.
- Reduce of the rising humidity at the foundation, by acceptable (for a monument) admixtures in the cement and pointing mortars.

Suggested restoration works

The church

Elevations- Restored

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ΕΠΙΧΡΩΜΑΤΑ

ΑΝΟΙΓΜΑΤΑ

ΘΟΛΟΣ-ΕΠΕΘΗ

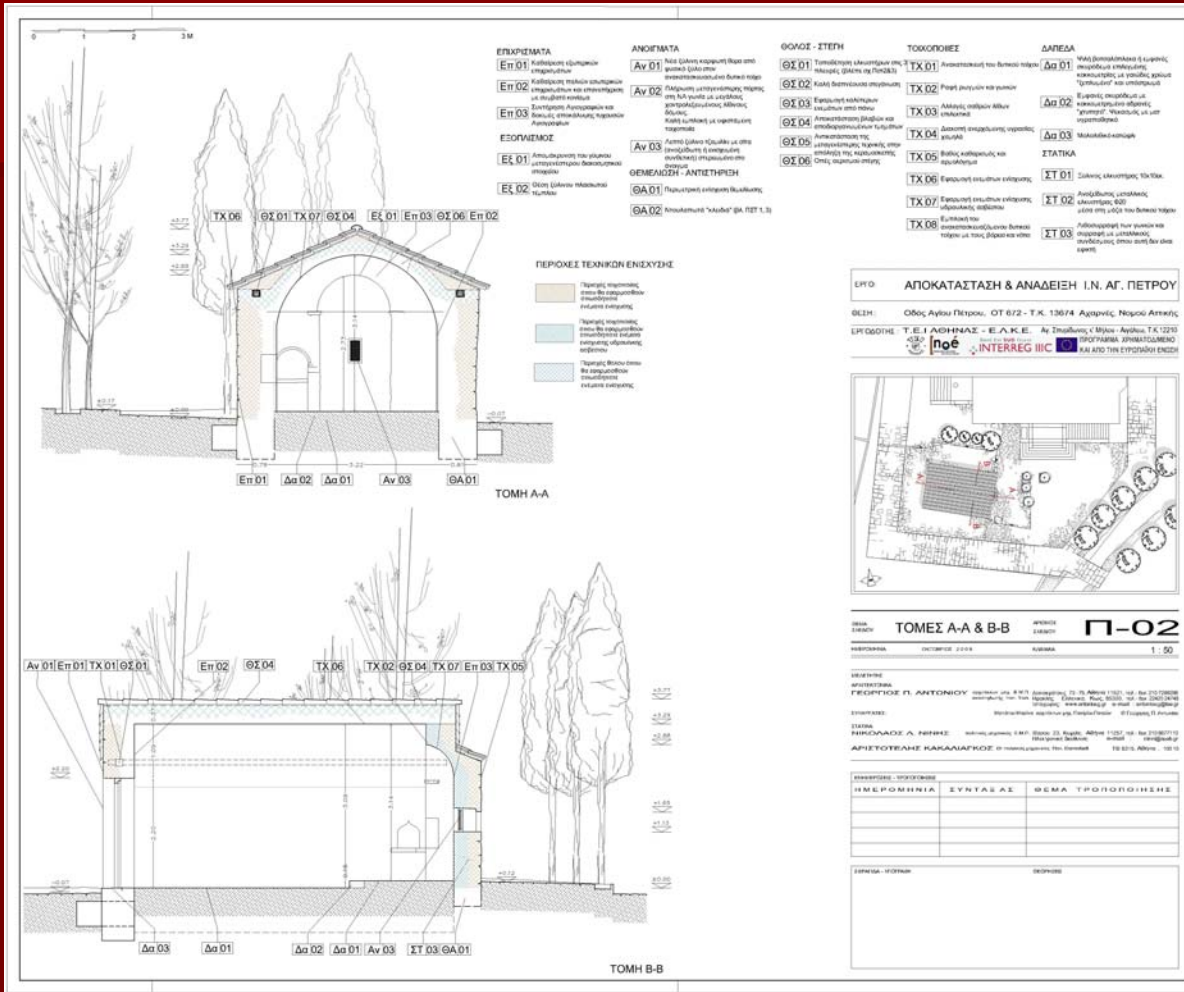
ΛΑΓΕΛΑ

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Suggested restoration works

The church

Sections- Restored



Suggested restoration works

The surrounding area

- Implementation of the approved town plan with a sympathetic to the monument way, using natural stone paving and formations.
- Separation features between the monument and the much larger, under construction church. (plantation, paving, steps)
- Designation of the additions on the paving by alternations on the type of the slabs.

Suggested restoration works

Structural Interventions

- Reversal all later modifications in the structure of the church.
 - Rebuilding the west wall
 - Securing its connection to the lateral walls
 - Closing the side door at the south east corner
- Increase of the stiffness of the church in the transverse direction
 - Inserting a stainless steel tie-rod in the western wall
- Grout injection in all stone masonry in order to increase the cohesion and strength of all load bearing elements
- Repointing of all exterior masonry after removing the existing plaster
- Placement of two wooden beams atop the lateral walls, and fixing them with metal connections to the walls
- Strengthening of the church foundation by constructing a reinforced concrete beam along the perimeter

Part II – B

Wall Paintings Conservation Study

The conservation study objective was to propose remedial treatments of the wall paintings and their substrates based on their construction technology and their pathology.

The first step was to characterise the materials used for their construction. This task was undertaken by NCSMR Demokritos. It was found that the paintings were constructed using low quality materials which can be justified by the size and location of the building.

Wall plaster and mortar samples were obtained inside and outside the church as well as samples from paint layer.

The analytical techniques used in sample characterisation were:

Optical Microscopy (OM)

Scanning Electron Microscopy coupled with Energy Dispersive X-Ray analysis (SEM/EDX)

X-Ray Diffraction (XRD)

The study concluded that the walls are constructed by irregular stones of different sizes

Mortars and plasters are constructed of lime and natural aggregates. Mortars contain a great percentage of large natural aggregates (<2 cm) while interior wall plasters contain a great amount of straw as reinforcement.

The paintings are of moderate quality in terms of materials and aesthetic values. There is no preparation layer and the paint layer is directly attached to the wall plaster.

The pigments used were: Ferrous red and yellow pigments (ochres), bone and carbon black, green earth, blue (amphibole, calcite, ferroglaucophane, quartz) and limewash.

The second step of the conservation study was undertaken by the TEI of Athens and its objective was to study the wall painting's pathology, to execute trial conservation treatments and by taking into account the construction material's characterisation, to produce conservation proposals that would be consistent with the international and national guidelines.

The monument's pathology focuses mainly on the structural damages caused by the 1999 earthquake.

As far as the wall paintings is concerned, they suffered detachment from the supporting wall, losses and structural cracks. Furthermore a great percentage of their surface is covered by a layer of wall plaster of about 2-4 cm thick which is based on cement and lime. The rest of the paintings are covered by a layer of soot produced by burning candles.

Trial treatments were applied in order to produce the wall paintings conservation plan. These included consolidation of the substrate, consolidation of the flaking paint layer, cleaning, and removal of the covering plaster.

- Covering wall plaster
- Substrate cracks
- Flaking paint layer
- Losses





Soot



Detachment from
the supporting wall

Wall paintings conservation proposals include:

- Removal of the covering plaster using hand tools
- Consolidation of the wall paintings supporting plaster
- Consolidation of the flaking paint layer
- Reinstatement of the cohesion of the wall paintings with the supporting wall by the use of injected consolidating material
- Perimetric stabilisation of the wall paintings by the use of lime plaster
- Reinforcement of the mortars using injected material
- Application of wall plaster on the losses
- Cleaning

Part III

Subsequent Actions

- Allocation of the restoration and conservation works to the lowest bidder of external expertise.
- Restoration and conservation works initiation.
- Completion deadline 31 July 2007

- Organisation of a one-day scientific meeting held in Athens in June 2007. The subject will be focused on the damages caused to historic buildings by seismic activity as well as on restoration and conservation interventions.

The scope is to bring together scientists from the field of preservation of cultural heritage and discuss recent advances on the topic.

Partners and external expertise of the subproject will also be invited to participate with presentations transferring their experience from similar case studies.

It will also be an opportunity for authorities who are involved in cultural heritage risk assessment and management, to be informed of the measures that are usually taken in such cases.