Restoration problems of historical stone buildings in Central Greece

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Abstract

There are approximately registered 3000 historical stone buildings in Central Greece (in villages as well as in monasteries). All of them are of considerable age (i.e. their age is over hundred years) and many are masterpieces of the Greek architecture in past centuries. Their common structure is a two storey building with stone masonry walls and wooden floors, balconies, roofs as well as frames of windows and doors.

Unfortunately most of these buildings suffer from lack of maintenance. The abandoning of most of them, particularly in the last fifty years, together with the influence of the climate conditions (windstorms, strong rainfalls, frequent snowfalls during winter) contributed to the aggravation of the state of these buildings, although many of them still remain in good condition as far as it concerns several architectural elements of their original structure.

Research and studies which are to be discussed in this paper refer to the common damages and structural analysis of these stone buildings which will be illustrated by means of series of examples as well as a photographic documentation. The paper also includes the proposals for their strengthening as well as the appropriate interventions for a reuse of these structures.

1 Introduction

The mountainous region of Central Greece, dominated by the mountain range of Pindus, is comprised of many villages and small towns whose inhabitants have
moved to large urban areas in the past fifty years. This population transfer has resulted in many villages being left completely uninhabited, some of them with very few inhabitants and a certain number of these villages inhabited only during the summer months. As a result, there are churches, schools, clusters of monasteries (Fig. 1), small factory buildings, mansions and a large number of bridges in mountainous region of Central Thessaly which nowadays are out of use left without any preservation by the owners or the state (Lekkou [1]).

These old structures, practically all of which are excellent examples of the Greek architecture in the past century or perhaps further back, were built by local artisans renowned for their skill. They created organised groups of workers, who moved from place to place in the previous centuries, constructing buildings or bridges not only in Greece but also in regions of the Balkans and Asia Minor (Manta [2]).

Figure 1: Doussiko monastery in the 19th century

2 Typology of buildings

A common feature of these buildings is the outer rough stone masonry with horizontal wooden lintels (Ph. 1).

The width of the stone masonry is about 70cm and it is often plastered on the inner side and not rarely on the outer side too. The internal walls are made of
stone or full brick masonry. The mortar in bed-joints is a lime one, with a maximum grain of aggregates up to 6mm.

The floors and the roofs are wooden while the roof covering is made with slabs of stone or tiles.

The buildings usually have two stories as well as a basement partly below ground level. The floors are connected by internal staircases which are made of wood.

Openings can not be found on all the external surfaces of the stone buildings. For example Zigras’ mansion in Ellinopyrgos village (year of erection 1894) on its east side with a length of 17.0m has only one window 0.70m by 1.0m and the 400 year old hostel of Doussiko monastery, built in the wooded eastern slope of mount Koziakas, has no openings on the west side (Ph. 2, Ph. 3) although this one has a length of 30.0m (Karaveziroglou et al. [3]).

The timber ribs forming the ceiling are covered with lath and plaster. The window frames and the doors are also wooden.

The balconies, where they exist, are supported by wooden beams which were often an extension of the beams used for the floors. There was usually a roof for the protection of the balconies, while the railings were either wooden or made of wrought iron.

All the main rooms of these buildings have fireplaces and decorations painted on the walls and the wooden roofs.
Photo 2: The west side of the hostel of Doussiko monastery

Photo 3: The east side of the hostel of Doussiko monastery
3 Common damages

The up-to-date state of the historical buildings in Central Greece can be characterised as light damaged up to very damaged or ruined (Ph. 3).

Many buildings are damaged mainly due to environmental factors, lack of preservation or users’ clumsy and provisional effects to modernise them.

The abandoning of the buildings together with the weather conditions—regular rainfall and snow—has caused damages to the roofs. This has allowed water to penetrate the interior of these buildings, consequently destroying the wooden roofs, ceilings and floors as well as eroding the walls and of course the decorative elements found on the surface of the interior walls (Ph. 4, Ph. 5).

Photo 4: Painting decoration in the interior of the Zigras’ mansion

In certain houses there are also cracks in the walls which have been caused by earthquakes or landslides as the most of the buildings are situated on mountain slopes. However, the earthquakes which have been noted up until now in Central Thessaly are of low intensity and have not caused substantial damages to the buildings.

The natural ageing of the historical buildings, which is revealed by the erosion of the stone surfaces, the deterioration of the joints and the growth of moss
plants in the stonework, is greatly aggravated with the passing of time due to the absence of any provision for the restoration of damages. This occurs because the owners-heirs of the buildings are not at all interested in inhabiting or using them, while buildings which have been turned over to the state are not being preserved, mainly for economic reasons, as the different governments have not made any appropriations for this.

Photo 5: Damages in the interior of the Tazes’ mansion

4 Structural analysis

The evaluation process of each building is based on the geometrical data of the structure (bearing and non-bearing elements), its pathology and its use after repairing. The geographical location of the structure must be also taken into account.

For the analysis the finite element method is commonly used (Wilson [4]). The 3D structural, in most cases asymmetric, system is subjected to the combination of gravitational and seismic actions (consideration of longitudinal and transverse axes of each building).

The seismic effects are computed according to the current Greek code on seismic actions. As it is already mentioned above, the mountainous Thessaly is a region with very low seismic hazard and the historical structures, all of which are of considerable age, survived earthquakes in the past with no or little damages. Of
course nowadays the same structures suffer under ageing, abandoning and absence of any restoration. As a result the safety factor is reduced but the analyses of the historical fabric show in most cases that under the effects of dead, live and seismic loads after repair of the damaged bearing elements the stresses in the stone masonry are low and the safety margins are satisfactory.

5 Repairing and strengthening works

To restore the stone historical buildings in their original state the works that must be undertaken are mainly the following:

- Repairing of the masonry, which sometimes includes local rebuilding of some parts, grouting of the cracks and refilling of the joints with mortar after the removal of existing weeds or plants and damaged materials.
- Replacement of the damaged wooden elements of floors, ceilings and opening frames.
- Repairing of the plaster on the wall surfaces, which were once plastered.
- Reconstruction of damaged balconies and roofs, using the same geometry of the original bearing system.

The materials for repairing proposed in the study have to be similar to those of the existing historical structure (Karaveziroglou [5]). The only exception in this principle is the use of reinforced concrete on the top and the floor level of the external masonry walls, where the floor and roof timbers are supported. This intervention satisfies seismic safety with minimal impact on the historical fabric.

The interventions mentioned above are concerned with the restoration of the buildings to their first use without consideration of changes which leads to a different loading of the original structure. The additional works necessary for a reuse as culture or conference buildings, hostels or town halls equipped with modern outfits has not be taken into account too. Such a kind of intervention is not considered in this work, which is referring to the “static” restoration of the structure.

6 Restoration proposals

In recent years an attempt has been made by the state, the church authorities and the locals to preserve the ”traditional” buildings and to make them known.

For example, it has been reported that the mountaineering club of Thessaly in a once large village, which today is inhabited only during the summer, has repaired the magnificent school which was closed down since forty years and nowadays is using it as a hut where mountain climbers can stay overnight.

The Zigras’ mansion in Ellinopyrgos village in the recent years has been made over to the village council for the foundation of a folklore centre, while the Tazes’ mansion, built in the past century in a village behind Mount Olympus, has been made over to the University of Thessaloniki for the purpose of holding seminars for students of Architecture.
The Dousiko monastery is collecting money in order to repair and restore its 400 year old guest house, which was used as storage for a long period of time after Greece’s liberation from the Turks, was largely damaged by fire, and has been abandoned for more than forty years. The monastery authorities aim to use the building as a guest house once more for visitors to the monastery. Let it be noted that just like the monasteries of Mount Athos, women are not permitted to visit this monastery either.

The fact that many repairs to historical buildings and traditional structures have been taking place in the past few years with the intention of reusing them is very gratifying for Greece. Simply by preserving and reusing these buildings the architectural heritage of the region is maintained and the erection of modern reinforced concrete buildings is also avoided. As a result, the local character of the mountain regions of Central Greece is preserved.

References