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REHABILITATION OF LOCAL ARCHITECTURAL AND STRUCTURAL TECHNOLOGIES FROM THE CENTRAL BALKAN MOUNTAINS REGION AND THEIR APPLICATION IN THE PRESENT-DAY CONDITIONS

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ABSTRACT

The scientific study encompasses the typology and construction specificity of traditional residential and commercial buildings during the Bulgarian National Revival period in the Central Balkan Mountains region in particular on the territory of the Troyan region. Measured survey, architectural, structural and energy efficiency assessment of typical examples of the Bulgarian revival architecture are carried out. The typology of buildings is analysed, as well as their structural and technological characteristics and the specific features of their materials.

This study presents ten-day practical workshops during which the students had hands-on experience with natural materials and learnt various methods of recording of the cultural heritage related to its protection and posterity.

1. Introduction

The renovation and restoration of some of the old houses in recent years has not been done with the necessary skill and respect for the work of the old masters. The unsuccessful use of modern building materials and technologies (concrete, expanded polystyrene, etc.) leads to a total change in the behaviour of the building's structure, a change of the microclimate in the premises and not less important – it leads to the destruction of the most valuable in the old

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house – its spirit. The possibility of applying sustainable design and construction practices to these buildings should also be enshrined in architecture training in the form of workshops and classes.

The purpose of such initiatives is to get students acquainted with the characteristics of the building materials and technologies, to acquire basic skills in working with them. These practices are very important because they allow students to focus on certain skills and knowledge that are not taught in the core curriculum of the University. They concentrate on the practical skills to understand this type of architecture and the knowledge of the building materials.

2. Core of the Study

The practical training includes the acquisition of skills for the assembly of architectural survey, the analysis of data from structural and thermal engineering, and the examination and systematisation of typical examples of Revival architecture in the region, determining the typology of buildings, their structural and technological features and the characteristics of the materials. The chosen methodology includes the following two main steps:

2.1. Preliminary Work, including:

- defining criteria for selecting specific examples from the region;
- architectural survey of selected examples;
- analysis of the constructive examination – visual and instrumental;
- description and analysis of the materials and construction technologies;
- comparison of the obtained results with modern principles of sustainable architecture;
- developing a methodology for designing and implementing local construction technologies.

2.2. On-Site Work, including:

- dismantling of non-original construction materials.
- restoration of individual elements of the building – walls and floor, which have been partially destroyed and compromised – through materials similar in characteristics to the original ones. Whenever possible, recycled materials from other existing buildings from the same period that will be demolished will also be sought.

The second stage is especially important for the practical training of the students.

2.3. Case Studies

According to the defined criteria the students have analysed several buildings in the town of Troyan.

There are not a small number of landmark buildings that are in very poor condition and/or are unusable. When provided with the necessary funding, they could be adapted in the way that has already happened with several buildings in the city. “Changes in the functions of buildings are interventions that in some cases may offer strategies for how a particular object can be saved from physical destruction.” [1]. For them, applying a holistic scientific approach and adhering to a clearly defined methodology in architectural intervention is the basis of a sustainable concept for the conservation, exposure and socialization of the tangible property [2].

2.3.1. Markov Bridge House Complex

This complex of several old houses is a group cultural heritage that has preserved the look and feel of the old craft town. The buildings are interconnected, two-storeyed with artisan workshops and shops located on the ground floor, oriented to the former “craft street”, while the second level with large bay windows above the river is designated for residential purposes. The buildings are in very poor condition. Apart from the first one, closest to the bridge, which functions as a shop, the rest of the buildings are unusable and have partially destroyed roofs. The complex is private property and the access to the buildings was denied.



Figure 1. Markov Bridge House Complex, view from the bridge

2.3.2. Vlasi Vlaskovski House

The building is declared local cultural heritage. It is a typical example of a Revival house in the Central Balkan Mountains region. It was built at the end of the 18th century as a residential building with the characteristics for its time functional scheme – the first floor for commercial purposes and the second – for residential.

The building is currently unusable. The authentic timber frame structure is preserved, with brick filling (partially replaced by hollow bricks) and a joist floor structure. The facade is plastered with lime plaster and the windows are timber with preserved timber covers. The roof is multilayered with timber structure and the covering is preserved with stone roof tiles. Due to serious structural problems, several broken timber beams and the risk of collapse, the building was not selected for the student`s intervention.



Figure 2. Vlasi Vlaskovski house

2.3.3. The Voivodi tavern

The building is a declared local cultural heritage. It is a typical example of a Revival house in the Central Balkan Mountains region, built in the mid 19c, located in the centre of Troyan.

This building has been chosen as an object of intervention and restoration activities by the students, because of its characteristics and good condition. The building has been used in recent years as a restaurant. Over the years, several repairs have been made in which part of the original materials have been replaced and materials inappropriate and uncharacteristic for the Revival construction technology – expanded polystyrene and cement plasters on the facades, have been used.



Figure 3. The current state of the main facade

The building has a well-preserved timber frame structure, adobe brick walls, partly replaced with new bricks and partly stone masonry in the ground floor. The roof structure is timber, with a covering of stone roof tiles that are well preserved. In the courtyard, there is a timber staircase, leading to the vestibule, but the old railings have been replaced by new ones, alien to the original interpretation.

The premises have also undergone several changes and many of the interior doors, replaced with plastic or aluminium, have been irretrievably lost. The preserved original timber doors have been thoroughly measured and described.



Figure 4. The current state of the doors

During the first visit to the site, students, under the guidance of their tutors, made a complete architectural survey of the selected building, putting into practice their theoretical knowledge. They measured all the walls, the openings (windows and doors), the levels and the other characteristic elements of the rooms, with their height and refinement of materials. All diagonal dimensions were measured to acquire correct geometry of the premises.

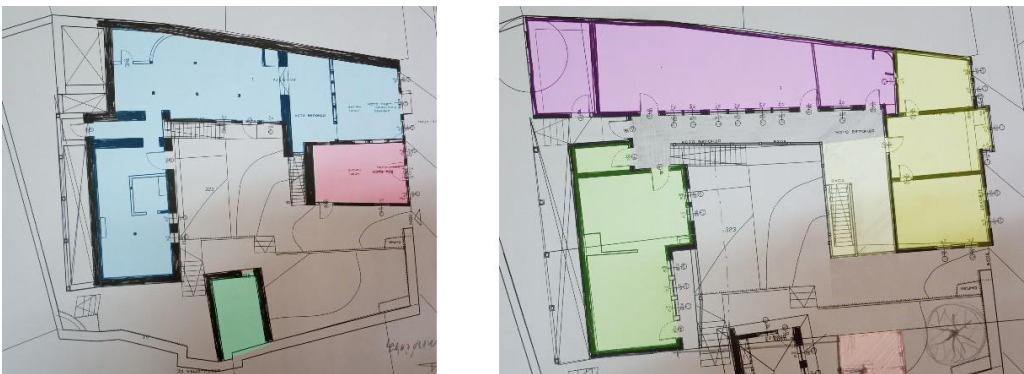


Figure 5. Plans of the first (left) and second (right) floor

During the stage of analysis of the collected information, based on the architectural survey and the structural survey, the students determined the typological characteristics of the building and the structural characteristics. They compared with other buildings typical for the period and made conclusions about which elements of the building are original and which are the consequence of inappropriate repairs. The participants worked on the design solution, which sets the parameters of the intervention in the building, determines the necessary dismantling and installation works described in the Bill of Quantities.

After analysing the architectural survey, it was found that the building was made of a timber frame structure with a brick filling and partly with stone supporting walls. The structure consists of horizontal, vertical and diagonal elements, interconnected by means of characteristic joints (for further strengthening and stabilising the work of the structure), and they all together carry both vertical and horizontal loads. Horizontal wooden belts (santrachi)

are arranged longitudinally and transversely to the wall and interconnected. A skeleton is created, which imparts plasticity to the stone masonry and at the same time divides it into parts, which prevents the propagation of cracks throughout the height of the wall. The condition of the timber structure and its elements, including previous works, was carefully recorded and measurements of its physical conditions using non-destructive testing were made.

The floors are mostly of clay. The upper floor structure consists of timber joists with planks.

The building has undergone restoration work and some timber elements have been replaced with new ones, perfectly treated. The adobe bricks were replaced with new bricks and the lime plaster with cement. All these changes impact the behaviour of the structure of the restored building and its enclosing walls, giving straightness to all the elements, but changing its character.

According to the IIRC's theoretical framework – Principles for the Conservation of Wooden Built Heritage, 1999 and the prevailing opinion of heritage experts, the basic principle is of “minimal intervention” according to the specific cultural context [3].

Moreover, the different behaviour of alien materials and techniques might result in pathologies. Their use should be the result of a thoroughgoing research about the adequacy of those techniques and materials to the specific case.

Therefore, the compromised elements of the timber frame must be replaced by aged building parts from other structures. Timber joints in this type of structure have limited or no moment-resistance capacity, and as a result, they are statically indeterminate. One of the characteristics of these timber structures is that each element is independent of the others. In this way, an element belonging to a frame can be repaired or replaced without altering the structural integrity of the system.

One of the most characteristic details in traditional revival house structure is the beam-column joint.

This connection between the columns and the main beams is made with an auxiliary element (pillow in Bulgarian), a short support, located below the main beam. The elements are joined by a wooden dowel assembly for greater horizontal stability.



Figure 6. The current state of the beam-column joints

The second stage was especially important for the practical training of the students, in order to connect the real work with the knowledge obtained at the University, thus the participants tested the theoretical principles and applied them in a specific practical situation. The possibility of physical contact with the material, as well as the direct observation of the way the materials were laid, contributed to the students' awareness of the actual practice.



Figure 7. The current state of the timber columns

During the hands-on workshop, students, under the guidance of specialists from Röffix, rebuilt the structure of the enclosing walls and performed stone masonry restoration work on the ground level. Under the direction of a master carpenter, they repaired the compromised elements of the timber ladder and several timber horizontal beams (santrachi) in the structure of the stone masonry.

The joints of the stone masonry were also repointed with hydraulic lime mortar.

All timber facade elements – windows, doors and covers were cleaned, grinded, sanded and protected with natural impregnating solutions.

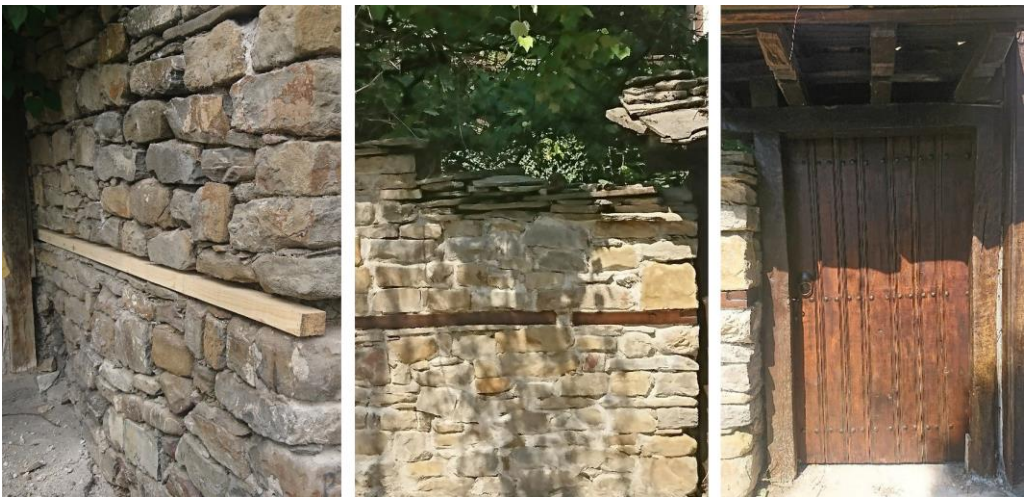


Figure 8. Work on the timber elements

The time dedicated to practical training is not sufficient to achieve complete restoration of the building, even if only externally. In order to fully complete the process, it is envisaged to subsequently remove the vertical planed elements of the railing and to find and recycle aged boards and mats from other houses to restore its original appearance. As there is not severe pathology in the structural material despite the heavy stone roof, partial material deterioration and the cumulative effect of past earthquakes, only a few components should be replaced.

During this relatively brief exposure of the participants to the ancient materials and tools, they realised the importance of preserving and restoring valuable examples of the Revival architecture.

The restoration and the rehabilitation of such buildings must meet modern requirements while still keeping its historical value. The change of purpose of the buildings, as written by Kliment Ivanov, is “an architectural intervention that is possible and actually applicable, and so that it does not restrict the architects in their work, but also provides an additional field for expression of their creative pursuits and opportunities” [4]. That is why it is very important such buildings not only to be restored but also socialised in the present-day conditions.



Figure 9. The main facade after the students' work

3. Conclusion

In conclusion, the implementation of practical training in architecture training will enhance and upgrade the skills of students acquired in the compulsory learning process. Working with students is a serious bet on changing the attitudes of future designers regarding

restoration practice. The avoidance or at least minimisation of design errors and the lack of respect for traditional construction technologies can be achieved by directing attention to the practical implementation of the restoration work and the adaptation of the design proposals to the real possibilities and real needs of the sites. There are many valuable examples of our architectural heritage, but not a few of them are not sufficiently socialised and no efforts have been made to restore, maintain and adapt them to the present conditions. The second reason for these serious problems is the lack of funding (public and private) for their research, restoration and adaptation. Those of them which are privately owned also suffer from the lack of interest of their owners and the lack of incentives and sanctions for mismanagement. Integrating them into the modern life of the town and the region, as well as improving the adjacent infrastructure would allow much better development of tourism and tourist activities, and hence the standard of living. This is the most appropriate proposal to update the topic of architectural design, applying the principle and criteria for sustainable development, which is recommended to support buildings using traditional construction techniques and materials [5].

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ВЪЗРАЖДАНЕ НА МЕСТНИ АРХИТЕКТУРНО-СТРОИТЕЛНИ ТЕХНОЛОГИИ ОТ РАЙОНА НА „ЦЕНТРАЛЕН БАЛКАН“ И ПРИЛОЖЕНИЕТО ИМ В СЪВРЕМЕННИТЕ УСЛОВИЯ

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Ключови думи: възраждане, исторически сгради, традиционни технологии, архитектурно наследство

РЕЗЮМЕ

В научното изследване се разглеждат типологията и конструктивните особености на традиционни жилищни и стопански сгради през Възраждането в района на Централен Балкан и по-специално на територията на община Троян. Направени са архитектурно заснемане, конструктивно обследване, оценка на енергийната ефективност на типични примери от Възроженската архитектура. Анализирана е типологията на сградите, също така техните конструктивни и технологични характеристики и спецификата на използваните материали.

Публикацията представя резултатите от десетдневна работилница, по време на която студентите имат практически занимания и работа с естествени материали. Усвояват умения за анализране и описване на примери, представляващи недвижимо културно наследство, които са свързани с тяхната защита и съхраняване за бъдещите поколения.

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