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THE ATTITUDE OF THE MODERN SOCIETY TO THE CULTURAL HERITAGE DAMAGED BY EARTHQUAKES

Abstract

The report deals with the difficulties encountered in conservation and restoration of cultural monuments exposed to a seismic activity or located in seismic regions. The complications involved in their restoration or strengthening, such as poor foundations, wearing out or exhausting their load carrying capacity, non-coinciding mass centres with solid parts centres, non-homogeneous materials, presence of unique and original architectural and artistic details, paintings, stonework ornaments, etc., are enumerated. Some antiseismic measures, such as improvement of the environment and foundation conditions, reinforcement of elements or groups of elements to obtain solid parts, construction of new structures within the existing architectural dimensions, etc., are pointed out. The religious monuments such as churches, bell towers, etc., are described in a separate group. The methods of restoration or repairs to protect such monuments from seismic activity are considered in four cases of this group, beginning with mortar replacement in walls and vaults and ending with their complete pulling down and building anew. The importance of the problem from technical, social and educative points of view is emphasized. The text contains many examples and is illustrated with 11 slides.

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In accordance with the legal documents in force in the People's Republic of Bulgaria in the sphere of designing, the monuments and buildings of particular architectural and historical importance should be designed woth one degree higher earthquake protection than in the case of other buildings. The higher seismic activity during the recent years and the new regional division of our country have increased the number of monuments of culture granted protection against natural disasters.

The difficulties to be overcome by the designer in finding the dynamic parameters required for the structures and equipment of the buildings are well known. Typical building systems and methods and their interconnection have led to standard solutions, supported by model investigations. The use of computers has produced more complicated mathematical methods and models bringing the theory closer to each specific case. Suitable locations and foundations of the equipment or the building also are of particular importance.

The conditions for establishing an antiseismic protection of the monuments of culture — archaeological, medieval or rennaissance ones — are peculiar. The difficulties may be summarized as follows:

1. Existing foundations — poor or unsuitable, modified during posterior levelling in weak soils, insufficient depth.

2. Rich architecture in harmonious sections and sizes, dislocated floors without reinforcement in structures or insufficiently secure.

3. Stress limit values reached in overloaded elements built from experience, not calculations.

4. Use of non-homogeneous materials and systems of building, such as thick stone and brick masonry, easily deformable floors of joists and Prussian vaults, abundantly filled up for insulating purposes, thus causing a great constant overloading.

5. Lack of interaction between the structural elements made of different materials and located in different places, this being the reason for rigidity against horizontal forces.

6. Existence of original and unique architectural details, artistic ornaments, frescoes, stonework ornaments, etc.

7. Classification of the monuments of culture: timeancient, medieval, renaissance, of the end of the 19th century and the beginning fo the 20th century; importance — monument in an ensemble of local, national or world (under UNESCO protection) importance; such classification accumulating the above-mentioned difficulties in a geometrical progression.

The analysis made shows the additional difficulties encountered in finding a solution of antiseismic protection of the monuments of culture located at present on about 60% of the territory of the People's Republic of Bulgaria. Therefore, a differentiated approach in dealing with each separate case is imposed.

Measures to be taken for antiseismic protection of the monuments of culture may be grouped as follows:

A. Improvement of land and conditions of foundations by silica treatment, pouring concrete (where there is no danger of salt extraction) or epoxy solutions. When modifying the ground — by exposing authentical levels, mosaics, several levels, using clay and concrete mortars in the relevant sub-structure to mark clearly the original joint. (Example: equipment at the third gate of Tzarevetz in Veliko Tirnovo). This involves ancient or medieval monuments of national importance. The problem of the general and antiseismic strengthening of the rock churches in the village of Ivanovo in the district of Rousse, being a monument of world importance is very interesting. To reinforce the monolithic rocks in which they are excavated, pre-stressed anchors are used for general reinforcement and passive anchors — for local reinforcement of the separate rock fragments with frescoes. The same measures have been undertaken for the Madara rider near the village of Madara in the district of Shoumen. In the case of monuments with polychromic ornaments, passive mortars are used. (Example: the Boyana Church near Sofia). Silica treatment of foundations laid in loess has been carried out in Svistov: the Commercial School and the St. Trinity Church built by the Master Kolio Ficheto.

B. Reinforcement of different structural elements to obtain parts with increased strength against horizontal loads. Thes protection is selected with a view to maximally preserving the original as a whole and in its details. It has been adopted in the case of monuments of national importance such as the Kordopoulos House in the town of Melnik, district of Blagoevgrad, the house at No. 4, A. Kanchev St. in Sofia, the Boyana Church, etc. In this case steel elements are generally used to obtain relatively less deformable floors and walls.

C. Building a new structure of pillars, beams and blocks of monolithic reinforced concrete in the existing architectural sizes. Sometimes, the framework is made of steel. At the same time flooring is made lighter and, if necessary, after working out a detailed documentation, the artistic ornaments are removed. Examples: the Economic School in Svistov, district of Veliko Tirnovo, the Library in Rousse, the Lamartine House in Plovdiv (with a steel framework), the medieval fortress in Cherven, district of Rousse, the Rojen monastery, etc. The restoration of the ancient amphitheatre of Philippopolis in Plovdiv can be described as an achievement. The excavated materials such as pillars,

architraves, capitals, etc., have been included in the design by the authors of the restoration, arch. V. Kolarova and eng. Peyko Manov of NIPK in Plovdiv, for antiseismic protection by reinforcing them with plastic reinforced and plain concrete, and steel anchors. A reinforced concrete structure made of beams and walls and ensuring the stability in the case of earthquakes has been artfully concealed in both floors of the stage. The different elements of the original amphitheatre, such as capitals, pillars, architraves have been perfectly arranged and marked.

Another interesting solution guarnateeing a clear limit between the old original and the new structure and allowing to dismantle the latter in case the problem is reconsidered in future is the reconstruction of the Southern wall of the fortress in Pliska, a national monument on the district of Shoumen. For the composition, aesthetic and other reasons, it has been necessary to build a new wall over it as per the original in plane and section. This has been done by using longitudinal and transversal frames erected on the treated original wall of the fortress. A square revetment was fixed on the transversal and longitudinal supports. Panels with hidden grooves for electric cables and water piping are installed on the top. Thus, it has been possible to partially reconstruct a medieval monument of national importance by applying mechanized metdohs of manufacture and installation and saving thousands of cubic metres of brickwork.

At the end, we would like to say a few words about the antiseismic protection of another large monument of national importance, the Rojen monastery, district of Blagoevgrad. The 2-storey South-Eastern wing, the first floor of stone masonry and the second floor representing an adobe masonry (with mural paintings in the refectory), with wooden floor joists covered with ceramics, did not allow the use of traditional reinforced concrete framework. It was decided to make several closed frames with gantry beams under the roof and the cave to support the whole architectural structure. Fastenings were replaced by plastic concrete ones. The Pillars were fixed in suitable places in the walls. The North-Western wing was also reinforced in an original way by using a strong L-shaped girder in the roof supported by reinforced concrete blocks that could be used for sanitary purposes. The transversal walls represent mixed type blocks.

Here, the religious buildings form a separate group. They represent churches or medieval buildings of national importance in most of the cases, because of their architecture, mural paintings, wooden iconostases, etc. While the vaulted buildings have sufficient resistance to horizontal forces, (favourable location of masses and transversal walls) the problems related to the rennaissance and medieval buildings (of one or many naves, with stone or brick vaults with wooden roofs are complicated and complex.

Here are some solutions realized in practice:

a. redestribution of load from the roof by means of a steel truss carrying horizontal and vertical forces e.g. the church in the village Mala Tzarkva, district of Sofia, the St. George Church in the village Kremikovtzi near Sofia, etc.;

b. reinforcement of the vault by means of an additional coating of epoxy solutions, lightening of the filling in inclinations, on a suitable steel structure, for the vault e.g. St. Petka Church and St. Elia Church in Sofia, St. Petka Church and St. Panteleymon Church in Vidin, etc.;

c. installation of a complete reinforced concrete structure on walls and vaults, e. g. the church in the village Krassen, district of Rousse, etc.;

d. strengthening the carrying walls by replacing the fastening system with a steel one, e. g. St. George Church in Kremikovtzi, St. Mary Shroud Church in the Rila monastery; homogenizing the walls with epoxy solutions.

D. When the architecture does not allow a partial or a complete re-building by a reinforced concrete structure, the monument is completely dismantled, after establishing a detailed documentation for the same, and then the support structure is built to meet the most strict antiseismic requirements. The most modern stereo-photogrammetric methods are used to preserve all data related to the original. Sometimes the model of the antiseismic structure of the dismantled monument is checked by on a computer, when all conditions required for working out its model again are observed, e.g. St. Trinity Church in Svistov (computer — based), the Lamartine House in Plovdiv, etc.

Finally, it is possible to summarize that the strict theory should often yield to the sound feeling and the correct estimate of the old master of the existing carrying system in order to preserve the original, since this is a vocation deserving respect and having a great importance at present and in future.

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ОТНОШЕНИЕТО НА СЪВРЕМЕННОТО ОБЩЕСТВО КЪМ КУЛТУРНОТО НАСЛЕДСТВО ПОСТРАДАЛО ОТ ЗЕМЕТРЕСЕНИЯ

Резюме

В доклада са засегнати трудностите, които възникват при опазване и възстановяване ламетниците на културата, подложени на сеизмични въздействия, или намиращи се в райони със земетръсна активност. Изброени

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са утежненията, съществуващи при тяхното възстановяване или укрепва не, като лошо фундиране, износване или изчерпване на носещата способност на сеченията, несъвпадение на центровете на масите с центровете на коравините, прилагане на нехомогенни материали, наличието на уникални и оригинални архитектурни и художествени детайли, изписване и пластична каменна украса и др. Изложени са някои мерки за антисеизмична защита на тези обекти като подобряване средата и условията на фундиране, подсилване отдели или групи елементи за получавани ядра с висока коравина, осъществяване на нови конструкции в съществуващите архитектурни габарити и др. В отделни група са отделени сакралните обект-църкви, камбанарии и др., където в четири случая — от подмяна разтвора в стени и сводове до пълен демонтаж на църквата и повторното й изграждане, е даден подхода за възстановяване или саниране на тези обекти срещу сеизмични въздействия. Посочена с важноста на проблема от техническа и обществена — възпитателна гледна точка.

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ODNOS SAVREMENOG DRUŠTVA PREMA KULTURNOM NASLEĐU POSTRADALOM OD ZEMLJOTRESA

Rezime

U referatu su dodirnute teškoće koje se javljaju u vezi sa zaštitom i obnovom spomenika kulture u seizmičkim uslovima.

Nabrojene su neke teškoće koje se javljaju prilikom njihove restauracije ili učvršćivanja, to su: problemi fundiranja, neodgovarajući profili nosećih elemenata, neusklađenosti smjerova dejstava sila i masa, upotreba nehomogenih materijala, prisustvo unikalnih i originalnih arhitektonskih i umjetničkih detalja, zapisa i reljefnih kamenih ukrasa i dr., koje treba sačuvati. Izložene su neke mjere antiseizmičke zaštite takvih objekata, kao: poboljšanje konstrukcija i uslova za fundiranje, ojačavanje elemenata za dobijanje jezgra visoke izdržljivosti, ostvarivanje novih konstruktivnih rješenja kod postojećih arhitekturnih gabarita i dr.

U posebnu grupu su izdvojeni sakralni objekti — crkve, zvonici i dr., gdje je — u etapama, od saniranja otvora u zidovima i svodova do potpunog demontiranja i ponovne izgradnje — data metodologija obnavljanja ili saniranja tih objekata u seizmičkim uslovima.

Naglašena je i važnost ove problematike s tehničkog i društveno-vaspitnog stanovišta.