

Environmental Risk Assessment and Mitigation on Cultural Heritage assets in Central Asia

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Position papers in key focal areas

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1. Introduction

The invited specialists to the Workshop have been requested to answer to a list of questions on need analysis in Environmental Risk Assessment and Mitigation on Cultural Heritage Assets in Central Asia.

- In your humble opinion, what are the main reasons for the deterioration of the condition of cultural heritage sites?
- In order to reduce environmental impact on cultural heritage sites, what focal areas require the further development and in what areas are experts in a huge need?
- What new forms of knowledge and skills should young engineers and restorers possess?
- To what extent are these knowledge and skills currently taught?
- How would you evaluate the level of knowledge of the teachers who teach them?
- How many more credit hours should particular courses have and what additional courses should be included in the curriculum?
- What lab equipment should be procured in order to conduct practical and lab trainings at their higher quality?
- What modern devices and software applications should young engineers and restorers be able to work with?
- In addition to the above mentioned what more do you think should be done to improve the skills of students and teachers?
- How would you evaluate the level of knowledge of young professionals concerning the internationally accepted concepts of restoration and conservation of cultural heritage assets?
- What are the main reasons for this lack of knowledge and skills among local professionals and educators?
- Are these knowledge and skills taught at the university, and if so, to what extent?

The answers were collected and reported in the following paragraphs.

2. Rakhmanov Abdusafikhan

Member of ICOMOS, corresponding member of the International Academy of Architecture of the Countries of the East, member of the Union of Architects of Uzbekistan, laureate of the State Prize of the Republic of Uzbekistan.

In your humble opinion, what are the main reasons for the deterioration of the condition of cultural heritage sites?

Human activities; (economic activities, local and foreign tourism, etc.)

Anthropogenic actions; (environmental: pollution, climate change due to the development of life)

Natural, natural phenomena. (Earthquakes, floods, fires, etc.)

Over time, buildings are a major influencing factor. After a certain period of time, the environment and, of course, man and the things he creates affect the building. For example, in the 15th century, the car did not exist. The toxic fumes emitted from it did not affect the building. Neither building is designed to be resistant to car smoke poisoning. At that time, people used dung and firewood. This did not cause any damage to the buildings. It can be seen that the living conditions and lifestyle changes of the people had a great impact on the ancient buildings. There are also natural factors such as flooding, earthquakes, droughts, and river bed changes. Soil salinity, climate change, increasing humidity, and increasing salinity - these are. The participation of landscape specialists' and ecologists' work should also be taken into account.

In addition, I can say that the development of tourism, the fact that many people visit the buildings, also affects the technical condition of the building.

For example, one wall of the building tourists can cause some side-effects of future disasters.

In view of the above, it can be said that each monument has its own "disease". An individual approach to each of them is required.

In order to reduce environmental impact on cultural heritage sites, what focal areas require the further development and in what areas are experts in a huge need?

To restore a building, several specialists may be required, depending on its technical condition, for example: restorer, nakkosh (a painter is a specialist who draws manuscripts, ornaments (girikh/islamiy-geometrical shapes) and drawings on the building), ganchkor (a plasterer is a master who repairs the demolished walls of a building), key specialist for the opening holes of the walls for aeration, biologist-engineer, ecologist, technical-engineer, construction materials scientist, architectural-historian, architectural scientist, architect-constructor, archeological restorer, visualization, animator, BIM specialist etc. Restoring a single building in a professional condition requires a large number of professionals in a narrow range. However, the "director" of these specialists is always the architect-restorer.

You can reduce the impact of the environment:

- Objects of cultural heritage should be considered as part of nature;
- Raise the general culture: teach from childhood that the environment, our home and it must be kept clean;
- Strong shortage of specialists - ecologists, nature conservation and other specialties;
- Wide awareness of the population, through whose fault all this is happening.

An important role in the protection, research, restoration and promotion of cultural monuments was played by such scientists and craftsmen as I.I. Notkin, M.E. Masson, V.A. Shishkin, L. Yu. Mankovskaya, Sh. Muradov, A. Bakiev, Yu. Musaev, Sh. Gafurov, P. Sh. Zakhidov and many others in our history.

What new forms of knowledge and skills should young engineers and restorers possess?

Restoration of a building requires not only practical but also theoretical knowledge. Based on the activities of M.F. Mauer, B.N. Zasyplin, L. Yu. Mankovskaya and many others, a number of recommendations for the preservation and restoration of architectural monuments of Uzbekistan were developed, presented below:

To research the rich experience of restoration of famous architects-restorers who stood at the origins of the restoration business in Uzbekistan, as well as their followers, in particular, a number of their scientific and methodological developments, which should be introduced into the scientific use and practice of restoration.

Develop a comprehensive publication on the restoration works of Uzbekistan, which will summarize and analyze almost 100 years of experience in domestic restoration.

Revive the research and design institute for the conservation and restoration of cultural heritage sites as a separate state, private structure.

When restoring architectural monuments - cultural heritage objects, the following fundamental rules should be adhered to: (a) the restoration must be carried out with a preliminary selection of archival materials and an exhaustive iconography of the object to be restored; (b) every part of the building must be restored not only with the preservation of the style in its appearance, but in particular of its structure, i.e. constructions; (c) give an architectural characterization of the monument and determine its place in the historical and cultural context; (d) if it is a ruined monument, in order to choose the correct method of restoration, which is a very difficult task, the restorer must set a goal for himself what exactly is valued in the architectural monument and in what form he wants to preserve it; (e) mandatory documentary graphic reconstruction; (f) full- scale restoration with the use of natural building materials is a synthesis of all architectural research works.

It should be remembered what great help was provided by such masters as Abdukadyr Bakiev, Gafurov, Usto Shamsuddin from Samarkand, and in Bukhara - the architect Ibrahim Khafizov, who was at the court of the Emir, folk craftsmen Rakhim Khayatov, Shirin Muradov, Narzilo Yadgarov and others.

Nowadays, what the above specialists were engaged in, young specialists should own as they either.

A young restorer and engineer should know:

Legislation of the country and international conventions, treaties, facts, etc.;

Broad knowledge in the field of history of architecture, art and modern sciences; the most important thing is to have your own opinion on each issue. Book and literary is the opinion of the authors. In order to improve the thoughts of young architects, the quality of the study must be improved.

To what extent are these knowledge and skills currently taught?

If you do not take into account the restoration of monuments destroyed during the war, the attempts observed in the post-war years to return to the old methods of restoration, which allowed attempts at stylistic conjecture, represent, according to one of the restoration theorists Roberto Pané, "oblivion of cultural experience." Attalus Pane described the reconstruction of the monument as a manifestation of an approach to the monument not as a historical individuality, but as a commodity, the "use value" of which increases depending on the degree of its entertaining for an unprepared, "tired of the ruins" tourist. Likewise, throughout the Soviet Union in the 1960s the press has repeatedly expressed a call to move from the restoration of monuments to their conservation as a work of art, which the restorer is free to supplement, as soon as he is imbued with the pattern of its construction. In contrast to this, archaeological restoration proceeded from the assessment of the monument mainly as a historical source, which motivated the rigor of the scientific approach. According to the point of view of a number of modern theorists, a monument, being a historical source, should be considered as a work of art to the same extent. Without pretending to be able to substitute for an ancient architect, a modern restorer cannot, nevertheless, be distracted from artistic evaluation, and restoration is not only an area of scientific research, but also an area of creativity, albeit limited by rigid frameworks Conservation and restoration of monuments and historical buildings.

In a word, currently, taught knowledge and skills are unsatisfactory.

In general, an architect should be able to draw from life, whoever he will be later. Contemporary or restorer. Don't mess with computers.

But, it is necessary to educate personnel (teach in theory and practice).

Now, the level of teaching in universities is purely theoretical, moreover, it is outdated and backward.

The teachers themselves do not know what is in the circle. Universities have forgotten what practice at a facility is, especially in architecture.

How would you evaluate the level of knowledge of the teachers who teach them?

I do not support the knowledge and teaching style that higher education institutions provide today. First of all, the set class hours are less. Second, theoretical lessons are not well connected to practice. Students should first and foremost see the ancient building with their own eyes, spend time in it, have a deeper knowledge of it, and be interested in its history. Only in this way can the interest of students in reconstruction be aroused. It is also possible to receive quality course work. This is not currently being done. Students are either satisfied with just theoretical knowledge, or are just "painting". In the science of restoration, mainly in the restoration of Islamic structures, knowledge of Arabic writing and calligraphy is required. So what does a professor teach students if they don't have that kind of knowledge of their own? Just take a picture/photo?

What can be expected from teachers, if they are only from college or a former "C grade", they were not accepted to other places where knowledge is needed; universities (?) yes, because there are no other people/candidates.

There is no practice, they know, also if they read, theoretical.

How many more credit hours should particular courses have and what additional courses should be included in the curriculum?

This is a question for teachers, but it is definitely necessary to teach them first, teachers, and then students.

According to theory, the papers have everything: methodology and more.

You can guess what and how should be taught through the following methods. Methods of scientific restoration, in particular: (1) fixation of an architectural monument, namely: measurements, description, photographs; (2) research on structures, architecture and decoration; (3) clarification of the original architectural image (the time of early repairs, extensions with the involvement of primary sources, iconography and archeology); (4) defining the style, architectural characteristics of the monument and its place in the historical and cultural context; (5) mandatory documentary graphic reconstruction; (6) and, finally, full-scale restoration as a synthesis of all architectural research works (Zasytkin, 1949).

What lab equipment should be procured in order to conduct practical and lab trainings at their higher quality?

I have not seen laboratory equipment, which exists among contemporaries, in Tashkent, Samarkand. But I know that private traders have acquired modern equipment abroad, you just have to want to, and take your experiences there and do analyze. It leaves a part of mind and another in this laboratory. The University of Turin doesn't count, but it doesn't teach restorers yet.

Here is what I learned from my student times: tools for paintings; a room equipped with special tools for painting; modeling equipments, and tools for modeling. However, I also know that in today's era of advanced IT, more rooms will be needed. Including a room equipped with a PC; and the Original version of the modern program on every PC.

What modern devices and software applications should young engineers and restorers be able to work with?

A young restorer and engineer must know all modern devices and software applications, but do not forget that the object of cultural heritage is in a single copy, and an individual approach is needed to it.

See above point 7, as well.

There are so many programs out there today that all that is needed for restorers are graphics, spreadsheets, GIS, and BIM.

As far as I know - graphic programs use Illustrator and InDesign and AutoCAD, ArchiCAD, Revit in BIM are used more.



But in general, if a restorer loves his profession and is very interested in repairing buildings, he can do good and quality work even with old computer programs, such as Photoshop, CorelDraw, and even through Office programs.

In addition to the above mentioned what more do you think should be done to improve the skills of students and teachers?

Do not be afraid that we know little, lagged behind others. Everyone should study here, if there is an opportunity in another foreign university, but in India, China, Korea, Iran, Turkey, because their culture and art are closer to us. Not in Germany, France or other European countries. I saw a huge difference.

It is possible to expand the knowledge of both teachers and students by organizing foreign student exchange programs, short courses, additional classes and special courses. It is important to know how it is being restored all over the world today through the exchange of foreign knowledge.

However, it should also be borne in mind that the methods and rules of restoration of all states do not apply to us.

As I mentioned earlier, every historical monument has a unique and distinctive "patient". Therefore, it is necessary to "cure", to take knowledge and apply to the building individually.

I can highly recommend to make courses with the countries where has the Islamic architectural buildings, like Alhambra, Spain, Istanbul, Turkey, Lahore, Pakistan, Agra, India etc.

How would you evaluate the level of knowledge of young professionals concerning the internationally accepted concepts of restoration and conservation of cultural heritage assets?

Earlier, the UNESCO Convention on the Preservation and Restoration of Cultural Heritage stated: An ancient monument cannot be restored; it can only be left and preserved in its current state. Notwithstanding, to date, this article has been amended as follows: If you have all the necessary documents and reasons, it will be possible to restore the ancient monument from 0 stages.

And, again, there is the belief that UNESCO must allow our monuments to be restored and preserved. No, in fact this is not the case at all. Cultural heritage sites, which are on the UNESCO list - can be restored and preserved at any time. A letter of consent from UNESCO is not required. It's just that UNESCO knows what's going on and can warn if necessary (if any damage happens to the building). The object of cultural heritage is something that is unique in every region, in every country. Unfortunately, this information has not yet been understood not only by our local experts, but also by the authorities.

The issue of reconstruction is variety as well. To substantiate this, you need to be familiar with good knowledge and documentation.

The level of knowledge of local young specialists is still higher, but due to lack of knowledge of a foreign language, many cannot explain or prove.

According to the Law of the Republic of Uzbekistan "On the Protection and Use of Cultural Heritage Sites" (August 30, 2001, supplemented on April 2, 2009, approved by the Senate on August 28, 2009) cultural heritage sites are divided into the following categories:

- objects of cultural heritage of republican significance, representing historical, scientific, architectural, artistic and memorial value, which are of particular importance for the history and culture of the entire country;
- objects of cultural heritage of local importance, representing historical, scientific, architectural, artistic and memorial value, which are of particular importance for the history and culture of the region, district and city.

State protection of cultural heritage sites:

- state registration of objects of historical and cultural value, and maintenance of the State cadastre of objects of material cultural heritage and the List of objects of intangible cultural heritage;

- development of scientific and scientific-technical research of cultural heritage objects; carrying out a historical and cultural examination of cultural heritage objects; development of projects of protection zones for objects of material cultural heritage;
- issuance of permits for excavation, land management, construction, land reclamation, economic and other works in the locations of objects of material cultural heritage, works to preserve Objects of material cultural heritage, as well as for scientific and technical research at objects of material cultural heritage;
- establishing the boundaries of objects of urban planning activities subject to special regulation and related to the protection of objects of tangible cultural heritage;
- installation of security signs on the objects of tangible cultural heritage; Monitoring the status of the cultural heritage objects.
- State protection of cultural heritage objects can be ensured by other measures in accordance with the legislation;

A brief of history of organizing the protection and use of cultural heritage sites:

The practical foundations of scientific restoration were laid and applied in Samarkand in the 1920s by the architect M.F. Mauer, who later became the initiator and leader of the work to save the falling northeastern minaret of the Ulugbek madrasah. The straightening of this minaret in 1932 was an outstanding success of the Soviet restoration work and had no analogy in world practice at that time. Another falling southeastern minaret of the Ulugbek madrasah was straightened in 1965 by engineer E. M. Gandel, who successfully used the experience and the latest achievements in the methods of movement and lifting of ancient structures.

What are the main reasons for this lack of knowledge and skills among local professionals and educators?

The state structure has changed its name over the years: Turkomstaris, Sredazkomstaris, Uzkomstaris, later, in the 50s in Uzbekistan, the Committee for the Protection of Monuments of Material Culture was organized, which was abolished in 1961 and in its place the Main Directorate for the Protection of Monuments of Material Culture and Museums was created, in 1967 the GlavNPU of monuments of culture and history, in 2001 the GlavNPU heritage, since 2019 the Department for the protection and use of cultural heritage sites. In the middle of the XX century a detachment of architects and restorers of the Special Scientific and Restoration Design Workshop (SNRPM) was created, which in 1979 was reorganized into the Research and Design Institute for the Conservation and Restoration of Cultural Monuments (UzNIPIR), the period of privatization and, finally, the self-destruction of the research and design and survey institute.

The controversy of many restorations, the diversity of the individual approach of individual architects stimulated a revival of interest in issues of restoration theory. The most relevant question was the attitude towards the provisions of archaeological restoration. In this regard, the overwhelming majority of those who spoke out were quite in solidarity: the basic principles formulated in the first half of this century, despite the new shades that life brought in the post-war period, remain unshakable.

In addition to the reasons mentioned above, over time, due to the frustration of the architects and the lack of attention paid to restoration in the country, interest and hope faded.

That's why the category of "genius" teachers you know today was born. Because they have no interest in the field and no hope for the future, they are educating students like themselves.

However, it should be noted that in our country there were very talented local restorers. Even today, the traditional teacher-student (ustoz-shogird) schools they created can be rebuilt. Such types of schools are really necessary for us now.

Are these knowledge and skills taught at the university, and if so, to what extent?

I don't know yet.

Since I don't work at a higher education institution today, I can't say exactly where and what they teach, nor can I cite an example. What I have said above is clear because I am aware of the knowledge and skills of today's specialists and work in this field.



I would like to finish my input with this phrase of Alisher Navoi (1441 - 1501), who was a great connoisseur of architecture, poetry, patronized scientists, architects and artists. Various buildings were built according to his plans. That is why in his poetry he glorifies the Architect, his art; describes the process of building magnificent palaces, parks, canals:

The architect who built the Palace, He all provided and calculated in it.

3. Rustam Samatovich Mukimov

Professor at Technical University named after acad. M. Osimi, Tajikistan.

Note: before starting to answer the questions posed, we need to understand what is meant by objects of cultural heritage, since cultural heritage is an extremely extensive concept (in dictionaries, cultural heritage is interpreted as material and spiritual values created in the past). Therefore, as a basis for the concept of “cultural heritage” we took the definition given in the dictionary edited by A.I. Kravchenko¹: “Cultural heritage is a part of material and spiritual culture, created by past generations, withstood the test of time and passed on to future generations as something valuable and revered.” This definition definitely connects cultural heritage with the past. We accept the thesis about cultural heritage objects, excluding spiritual heritage (for example, songs, dances, poetry, drama, etc.), taken from the Law of the Republic of Tajikistan dated March 3, 2006 No. 178 “On the protection and use of objects of historical - cultural heritage” (with amendments and additions as of May 30, 2017). The objects of cultural heritage particularly, include the monuments of the historical and cultural heritage of the

Republic of Tajikistan. These are real estate objects (including objects of archaeological heritage) and other objects with territories historically associated with them, works of painting, sculpture, arts and crafts, objects of science and technology and other items of material culture, arising as a result of historical events that are of value from the viewpoint of history, archeology, architecture, urban planning, art, science and technology, aesthetics, ethnology or anthropology, social culture.

The followings belong to real estate monuments:

- historical monuments - buildings, structures, memorial sites, historical necropolises, monuments and memorials associated with the most important events in the life of the people, the development of society and the state and the way of life of the people, as well as with the life of prominent public, cultural and political figures and scientists;
- archaeological monuments - caves, parking lots, settlements, embankments, ruins of ancient settlements, fortifications, ancient mines, sewage and irrigation systems, roads and bridges, individual burial mounds and necropolises, rock paintings and inscriptions;
- monuments of town building and architecture, including architectural ensembles and complexes, historical centers, quarters, squares, streets, ruins of ancient planning and buildings, cities and other settlements, buildings of civil, military, industrial, religious architecture, folk architecture, as well as related works with them like fine arts, decorative arts and crafts, landscape gardening and other types of art and folk crafts;
- landscapes - joint creations of man and nature, as well as zones, including ancient inhabited places, which have value and great importance from the viewpoint of history, aesthetics, ethnology and anthropology.

The above mentioned ideas allow us to answer the questions given in the agreement from the standpoint of our understanding of “cultural heritage objects”

In your humble opinion, what are the main reasons for the deterioration of the condition of cultural heritage sites?

On the example of the Republic of Tajikistan, the main reasons for the deterioration of the state of cultural heritage objects are:

- absence of qualified restorers of cultural heritage objects. There is no system for training architect-restorers with higher education, as well as middle-level specialists in Tajikistan, for example, technicians-restorers of architectural monuments, painting, monumental sculpture, etc., although there are enough opportunities for this. For example, since 1962, an architectural specialty has been functioning at the Tajik Technical University, where specialists on architecture with a wide profile are prepared. Special Scientific and Production Restoration Workshops (SSPRW) were created on the basis of this university under the Ministry of Culture of Tajikistan in the 60s and 70s of the last century. The SSPRW team mainly consisted of graduate architects of a wide profile who studied the special discipline "Restoration of architectural monuments" and other related (indirect) subjects: Building materials, Construction of buildings and structures, Engineering geodesy, Vertical planning of territories, Economics and organization of construction production, etc. several restorations of monuments of monumental

architecture were carried out by SSPRW team. At present time the SSPRW does not exist due to the departure of specialists during the civil confrontation in Tajikistan in 1992-94. The Ministry of Culture has stopped applying for graduate architects of a wide profile to work in the field of protection and use of cultural heritage monuments. There are only 2-3 architects left from the former SNRPM, who are engaged in private design. TajikMDPRM (Main Department for the Protection and Restoration of Monuments), which functions under the Ministry of Culture, is mainly engaged in the manufacture of sculptures, busts, landscaping of areas around monuments. Most of the restorations are made by local folk craftsmen without preliminary research work and scientific restoration;

- not everywhere heads of districts, cities and towns understand the importance of preserving and protecting cultural heritage, therefore there is no proper control over the physical condition of cultural heritage objects. The chairmen of the districts and urban settlements do not object to the use of the area of the location of archaeological sites for private construction or arable land without the permission of the department for the protection and use of cultural heritage monuments of the Ministry of Culture of the Republic of Tajikistan;
- insufficient funding of restoration work at cultural heritage sites. The funds separated by the state are not enough even for preliminary research and development work in the place where the monument is situated.

In order to reduce environmental impact on cultural heritage sites, what focal areas require the further development and in what areas are experts in a huge need?

In order to reduce the influence of the environment on cultural heritage objects, further development is required in the field of scientific restoration, research in the field of building materials, organization and management in the production of restoration work, calculations of structures of antiquity and the Middle Ages, new composite materials for using in restoration, research of cultural heritage objects with the help of new geodetic instruments and computer technologies, 3D prototyping, etc. There are no specialized workshops in the Republic of Tajikistan (at least SSPRW) for these purposes, let alone the Institute of Restoration, which exists in neighboring Kyrgyzstan, Uzbekistan and Kazakhstan.

What new forms of knowledge and skills should young engineers and restorers possess?

Young engineers and restorers must have the following new forms of knowledge and skills:

- computer technology for making measurements and making drawings based on these measurements;
- to know the scientific foundations of restoration in developed countries of the near and far abroad;
- to have knowledge about the setting restoration in world cultural centers (Greece, Italy, Egypt, Iran, Uzbekistan, Kyrgyzstan, Kazakhstan, Turkmenistan, etc.);
- to have the skills of scientific analysis of architectural monuments, archeology, monumental painting and sculpture, etc. ;
- to have knowledge of the world and national history of historical and cultural heritage.

All this knowledge and skill cannot be provided by one discipline "Restoration of architectural monuments", which does not even include a course project on the restoration or reconstruction of architectural monuments (students completed coursework on the topic of restoration, took scientific restoration practice historical object in Soviet Tajikistan). During the survey practice in the 2nd year, students traveled to the historical cities of Tajikistan (Khujand, Ura-Tyube, Isfara, Kanibadam, etc.) and Uzbekistan (Samarkand, Bukhara, Khiva). Now all this is not possible.

To what extent are these knowledge and skills currently taught?

The knowledge and skills necessary for restorers are not taught due to the lack of a training system for restorers of real estate monuments in Tajikistan. The discipline for masters "Restoration of architectural monuments" has been introduced at the 5th year of the architectural and design direction at the Department of Architecture and Design only since 2020. However, there is no course work or project, corresponding practice with a trip to the location of monuments of archeology or architecture in the curriculum of the discipline.

How would you evaluate the level of knowledge of the teachers who teach them?

I positively consider the level of knowledge of the teachers teaching the courses on the restoration of cultural heritage. The entire intellectual potential of Tajikistan is concentrated at the Department of Architecture and Design where there are 3 doctors of architecture and 5 associate professors of architecture in the scientific specialty "Theory and history of architecture, restoration of historical-architectural heritage", who can teach disciplines of the restoration direction, supervise course projects and practice. However, there is no relation between TTU named after M.S. Osimi and the Ministry of Culture of Tajikistan, and the ministry is not interested in architects-restorers. Despite this all, about 3 thousand objects of cultural heritage are registered in the Republic of Tajikistan today, of which more than half are land monuments.

How many more credit hours should particular courses have and what additional courses should be included in the curriculum?

Only one discipline "Restoration of architectural monuments" is taught at the Department of Architecture and Design. There is one more discipline related to restoration which is the History of Architecture, Urban Planning, Monumental Art and Design, and a number of disciplines indirectly related to restoration: "Construction of Buildings and Structures", "Economics and Management in Construction", "Engineering Geodesy", "Vertical planning of territories", "Architectural materials science", etc. All the named indirect disciplines should be reoriented to restoration, and they require additional hours and syllabus.

What lab equipment should be procured in order to conduct practical and lab trainings at their higher quality?

It is necessary to create a new special department for the restoration of cultural heritage objects, where it is necessary to create a complex or separate laboratory for testing ancient and medieval building materials of cultural heritage objects with computer technologies for restoration, a model workshop with the necessary equipment, where it will be possible to conduct practical and laboratory classes at high quality level

What modern devices and software applications should young engineers and restorers be able to work with?

Young engineers and restorers should be able to work with computer technology and 3D modeling programs, modern digital geodetic instruments.

In addition to the above mentioned what more do you think should be done to improve the skills of students and teachers?

In addition to what has been mentioned above, in order to improve the skills of students and teachers the followings will be required:

- to send teachers to improve their qualifications in the field of restoration and engineering, as well as to improve their skills to work with new computer technologies and modern geodetic instruments in the field of restoration in countries where the training of restorers is set at the proper level. So, for example, in 2002 3 people, including one representative from the Institute of History, one from the Ministry of Culture and one from the TTU named after academician M.S. Osimi were sent to a 2-week practical training seminar on the preservation and study of objects of archaeological preservation in Turkestan city, Kazakh Republic. R.S. Mukimov passed the training seminar from the department of the Technical University with receiving a corresponding certificate. It was then, in 2004, when the President of the International Council for Monuments and Sites ICOMOS from France came to Turkestan and participated in the creation of national committees of two republics: Kyrgyz Republic and the Republic of Tajikistan. R.S. Mukimov was elected as the President of the ICOMOS National Committee in Tajikistan;
- to organize annual scholarships for the most capable students to sightseeing trips to historical cultural centers (Uzbekistan, Turkmenistan, Iran, Italy, Greece, Cyprus, France, etc.);
- to invite experienced specialists and scientists on restoration from the countries of near and far abroad (from Uzbekistan, Italy, Greece, Iran) to deliver overview and introductory lectures.



How would you evaluate the level of knowledge of young professionals concerning the internationally accepted concepts of restoration and conservation of cultural heritage assets?

The level of knowledge of local young specialists regarding internationally recognized concepts on the preservation and restoration of cultural heritage can be assessed as satisfactory. There are specialists in the restoration of monuments of painting, sculpture and small forms in Tajikistan, in particular, at the Institute of History, Archeology and Ethnography of the National Academy of Sciences of the Republic of Tajikistan, but there are only 2-3 of them left, and the older generation are all engaged in scientific problems of history, archeology of spiritual culture (music, drama, scenography, etc.). They can be involved in teaching special disciplines in the preparation of restoration specialists at the TTU named after academician M.S. Osimi under appropriate conditions (salary, the presence of laboratories with equipment and instruments)

What are the main reasons for this lack of knowledge and skills among local professionals and educators?

Insufficient level of requirements for students' knowledge, absence of textbooks on special issues of restoration, lack of special laboratories, computers with software for new technologies, lack of creative and scientific ties with research and educational universities, both with neighboring countries (Uzbekistan, Kazakhstan, Kyrgyzstan) and far foreign countries (Iran, China, Egypt, Greece, Italy).

Are these knowledge and skills taught at the university, and if so, to what extent?

Knowledge of restoration, computer technology, structures, materials is taught only at the TTU named after academician M.S. Osimi with its branch in Khujand (Khujand Polytechnic Institute) in local universities. There are no conditions for high-quality teaching of disciplines due to the lack of appropriate laboratories and equipment.

4. Mavlyuda Yusupova

Professor, Dr of Science in Architecture, Head of Architecture Department at Fine Arts Institute of Academy of Science of Uzbekistan.

In your humble opinion, what are the main reasons for the deterioration of the condition of cultural heritage sites?

The main reasons for the deterioration of the state of cultural heritage sites, in my opinion, are the following reasons:

- *At the stage of heritage conservation*, there is no proper maintenance of monuments and there is no constant monitoring of the state of cultural heritage sites. Structures, having initially received small cracks or damage from atmospheric influences, seismic shocks and other reasons, without many years of supervision and timely restoration, begin to deteriorate rapidly year after year. As a result, a number of facilities have been brought to an emergency and acute emergency conditions. Examples of this are the Saroi Tash Caravanserai and the Khoja Porso Khanaka Madrasah in Bukhara, as well as hundreds of other objects in other historical cities of the Republic.
- *At the stage of heritage restoration*, this is a non-professional reconstruction of monuments at the level of amateurs, when work begins without a scientifically grounded and approved restoration project. In the practical implementation of the restoration, easy and quick methods are chosen, leading to a discrepancy between the work performed and international standards; instead of highly qualified *masters (usto)*, they attract cheaper labor - ordinary builders or hired workers – non-professionals (*mardikor*); sometimes restoration work is carried out in an emergency mode - by a certain holiday date. A difficult situation has arisen with the manufacture of traditional high-quality, similar to the medieval ones, bricks, architectural decor, sustainable traditional dyes and glazes, terracotta, etc., although back in the 1980s, local masters in state ceramic workshops produced quality glazed decorative tiles.
- As a result, such unprofessional measures lead to the renewal of the appearance of the architectural monument, the loss of its authenticity, to the feeling that a banal "European-style renovation" has been carried out at the heritage site, and not qualified work to maintain its antiquity and originality. For these reasons, tourists and local residents, instead of original or professionally restored unique monuments, sometimes see a "new building" replacing or disfiguring them with the use of modern building and decorative materials that do not correspond to ancient models in format, features, quality, artistic level, etc. Tourists sometimes refuse to visit such monuments distorted by incorrect restoration.

In order to reduce environmental impact on cultural heritage sites, what focal areas require the further development and in what areas are experts in a huge need?

- It is required to increase the number of inspectors or local volunteers from active social activists who must constantly monitor the condition of monuments, record changes or their destructions. They must report threats to the legacy in a timely manner to the head of the inspectorate and to higher officials in this area. It is also important to show changes in the preservation of the object through open public sites, informing the public about the state of the cultural heritage belonging to this society.
- To improve the quality of restoration, adherence to the artistic level and historical reliability of monuments, it is necessary to strengthen control over the scientific validity and competent application of methods and traditional technologies manufactured for the restoration of building and decoration materials, ensuring the durability and seismic resistance of constructions with a rational minimum use of metal and concrete.
- A shortage of qualified experienced specialists is observed in almost all areas of restoration, but especially there is lack of competent design engineers working in the field of restoration of ancient "tired" monument constructions, professional architects, designers, folk mason masters for the construction of complex vaults, arches and domes, ceramist masters of traditional architectural ceramics, rather than modern imitations. Therefore, it is necessary to train specialists in the field of protection, restoration, diverse traditional architectural decor, constructive strengthening and management of the

architectural heritage - architects-restorers, design engineers, decor specialists, specialists in all types of landscaping of the monument territory.

What new forms of knowledge and skills should young engineers and restorers possess?

- Architects-restorers, design engineers, specialists in decoration and management of monuments should possess, first of all, basic knowledge about the architectural heritage itself, which must be preserved and restored - these are subjects by specialty, including the history and theory of architecture of Uzbekistan and Central Asia, the typology of buildings according to their functions, etc.
- Engineers must also master the knowledge about the qualities and varieties of ancient building materials, traditional methods of erection and restoration of historical buildings structures, about traditional local methods of monument restorations. At the same time, new restoration methods and materials can be proposed for implementation in each special case which has separately been discussed by specialists, and only if the expediency of this proposal has been proven, combining them with traditional methods.
- All specialists in the field of restoration must learn well the subject "History and methods of restoration of architectural monuments of Uzbekistan." And this experience was rich. At first, UzSSRDW - Uzbek Special Scientific and Restoration Design Workshops worked in the Republic, which in 1979 grew into unique restoration institute in Central Asia - UzSRDI - the Uzbek Scientific Research Design Institute for the Restoration of Architectural Monuments. There were more than 300 highly professional specialists who developed projects for the restoration, conservation and adaptation of monuments and their protected zones, and in the chemical laboratory they revealed the compositions of ancient buildings and decorative materials. The closure of the Institute in the second half of the 1990s brought significant damage to this area. However, the experience of that "golden period" of restoration of Uzbekistan has been preserved. The monuments restored at that time are well preserved and have not lost their authenticity. Young professionals should learn thoroughly, research and apply this experience in their future practice.
- Teaching in groups of restorers should be not only eminent scientists and professionals, but also folk practicing masters (usto) and preferably hereditary masters, ready to share not only their experience, but also the craft subtleties of their ancestors. They can be invited to cooperate (with a decent payment), as part-time jobs, or with guest lectures or master classes. These should be experienced folk practitioners keepers of practical knowledge and techniques in the competent preservation of heritage with many years of practice.

To what extent are these knowledge and skills currently taught?

- There has not existed a special university or faculty in our country yet, although having about seven thousand objects of cultural heritage, one should have such a faculty or department in almost every historical city. In this case, young specialists will not strive to stay in the capital as it is now observed, but will live and work in their specialty in their city.
- Work on the restoration of monuments in the general course of diploma works and master's thesis are carried out in TACI at the Department of History and Theory of Architecture, as well as at the Institute of Arts and Design named after Kamaliddin Bekhzod at the Department of Restoration of Architectural Decor. However, there is still no special university or faculty for the restoration of cultural heritage objects.
- In the above departments, within the framework of their general directions, there are taught some basics on the history of architecture of Central Asia, but in an insufficient volume (few hours) superficially, giving not deep knowledge and skills of material analysis.
- Since Uzbekistan has not had special institutes and faculties for the training of restorers yet, a complete and competent curriculum has not been developed. After long efforts in 2019, there was opened a faculty within the framework of the Department of History and Theory of Architecture at TASI, for which a group of 28 people were taken at the bachelor's level. But even there, the teaching of Special subjects begins only from the second year, that is, September 2020. The training program developed for this direction is new, while it is still damp and we hope it will be improved in the process of training and exchange of experience with foreign restoration universities in the coming years.

How would you evaluate the level of knowledge of the teachers who teach them?

- Maybe this is my subjective opinion, but personally I am not satisfied with the level of teachers who teach courses in the history of architecture and restoration of monuments, since not all of them possess the material and sufficient experience to convey the necessary theoretical knowledge and practical skills in this area. In the process of training restorers, it is desirable to participate only those teachers who have practical experience in the restoration of objects, and who have long consolidated their theoretical knowledge with rich practical experience and the necessary skills.
- They should also be highly professional specialists who are well acquainted with research and scientific developments in this area or who themselves are researching the history and theory of architecture, restoration of monuments of historical and cultural heritage.

How many more credit hours should particular courses have and what additional courses should be included in the curriculum?

History of architecture of Uzbekistan – for 2 semesters 2 hours a week or for 1 semester 4 hours a week (18 classes of lectures and 18 practical classes = 72 hours).

History of architecture of Central Asia – for 2 semesters 2 hours a week or for 1 semester 4 hours a week (18 classes of lectures and 18 practical classes = 72 hours).

History and methods of restoration of architectural monuments of Uzbekistan – for 2 semesters 2 hours a week or for 1 semester 4 hours a week (18 classes of lectures and 18 practical classes).

Building materials and structures of architectural monuments of Central Asia (or only Uzbekistan) (18 lecture classes and 18 practical classes = 72 hours).

For engineers - *Restoration and maintenance of durability of ancient structures of architectural monuments* (18 lecture classes and 18 practical classes = 72 hours).

International organizations and vested requirements, documents, concepts in the field of preservation of cultural heritage sites.

Computer programs for use in the field of restoration (for drawing up dimensional drawings, restoration projects, mapping, etc.) (36 lecture classes and 36 practical classes = 72 hours) teaching for two years (72 hours in the first year and 72 hours for second year).

What lab equipment should be procured in order to conduct practical and lab trainings at their higher quality?

It is possible to purchase only the necessary modern laboratory equipment, reagents and chemicals, which make it possible to determine by the smallest samples: age, chemical spectrum - the composition of building material and architectural decor. For decoration, this is also a definition - the composition of glaze, paints, terracotta, embossment, wood and the degree of their preservation. For field research, it is necessary to purchase laser "tape measure" meters, a drone and other modern equipment.

What modern devices and software applications should young engineers and restorers be able to work with?

They must be familiar with such modern software applications as - AutoCAD, 3D MAX, ArchiCad, CorelDraw, etc. For example, for drafting drawing documentations: Autodesk products <https://www.autodesk.ru/products>, for 3D modeling Autodesk 3ds-max <https://www.autodesk.ru/products/3ds-max/overview?plc=3DSMAX&term=1-YEAR&support=ADVANCED&quantity=1>, for cartography (when developing a project for protected and buffer zones of the monument in the field) ArcGIS <https://www.esri.com/ru-ru/arcgis/about-arcgis/overview>

In addition to the above mentioned what more do you think should be done to improve the skills of students and teachers?

It is necessary:

- To invite highly qualified specialists, scientists and practicing masters (usto), architects-restorers to teach.

- To invite the best specialists and professors from the Restoration Centers of advanced foreign countries, familiar with local building traditions and materials as visiting professor. To send teachers and students in small groups to leading foreign restoration centers for advanced training and exchange of experience.

How would you evaluate the level of knowledge of young professionals concerning the internationally accepted concepts of restoration and conservation of cultural heritage assets?

Local young specialists, and sometimes the teachers themselves, are poorly guided in the restoration documents developed and adopted by such international organizations as UNESCO and ICOMOS, etc.

Four cities of Uzbekistan - Khiva, Bukhara, Samarkand and Shakhrisabz are included in the UNESCO World Heritage List. Currently, more than 30 monuments are being prepared along the Great Silk Road for the nomination of a UNESCO World Heritage Site. However, the lack of professionalism, ignorance and disregard by some specialists of international norms and rules in the preservation of heritage and pressure on them by ignorant officials have led to the destruction of the historical environment in the center of Shakhrisabz. As a result, in 2016, the city of Shakhrisabz was included in the UNESCO List of Heritage in Danger (Heritage in Danger). For the same reasons, other UNESCO World Heritage Sites - Bukhara, Samarkand and Khiva - may also be included in this list. In this regard, the issue of training specialists with knowledge of the competent preservation and documentation of World Heritage sites at the required international level, in accordance with recognized conventions, becomes especially relevant.

What are the main reasons for this lack of knowledge and skills among local professionals and educators?

The main reasons: first of all, it is the loss of the professional school of restoration and leaving the profession of its known masters; as a consequence of this - a drop in the level of restoration and the prestige of the profession of a restorer; the absence of a special Institute or Faculty for the training of professional restorers, where a competent and complete training program would be developed; there was no system of advanced training and practical training in leading foreign restoration universities and centers. Many teachers in restoration subjects are self-taught without special training and practice in this matter. In Uzbekistan, there is no worthy textbook on restoration based on the experience and traditional practice of restoration, the existing textbooks in this area are formal and leave much to be desired.

Are these knowledge and skills taught at the university, and if so, to what extent?

Good knowledge and skills were presented to undergraduate students of the Uzbek-German Center at the master's level at TASI. This Center was opened with the support of the German Volkswagen Foundation and the Ministry of Higher Education of the Republic of Uzbekistan in 2013. Two years later, 12 students of this Center defended their master's theses in Potsdam, Germany. They got a European Diploma from the Potsdam Institute of Restoration, which was later accepted in Uzbekistan. These masters studied restoration in Tashkent for two years by the best local specialists, as well as German professors who arrived in Tashkent every month from various universities in Germany. In addition, our students studied restoration for six months at several German Universities in Germany. It was a good experience and I think that only at this level our students received a decent knowledge of restoration. Unfortunately, this experience was interrupted.

But it is possible to continue training personnel at the international level with this or with other centers, involving in teaching the same masters with the European Potsdam and local TASI diploma in restoration, trained at the international level.

5. Jafar Niyazov

Head of Climatology and Glaciology Lab. Institute of Water Problems, Hydropower and Ecology, Academy of Sciences, Republic of Tajikistan.

In your humble opinion, what are the main reasons for the deterioration of the condition of cultural heritage sites?

There are a number of serious negative reasons that have a direct impact on the deterioration and gradual destruction of historical architectural monuments, primarily natural (1) and man-made / anthropogenic (2).

Geological/seismic (landslide exogenous processes), climatic/ meteorological/hydrological (flooding by flood waters, abrasion of river banks, lakes, reservoirs, wind and water erosion, meandering of rivers), weathering (physical, chemical, biological), biological damage of various species, solifluction, etc.)

Disturbances in the geological environment as a result of economic activities in the course of active development of the adjacent territory; air pollution by industrial emissions, vehicles and utilities; industrial and road construction; hydraulic engineering; flooding by ground and man-made waters; chemical pollution of soils and grounds; degradation of vegetation (due to deforestation, plowing of virgin lands, pasture and recreational digression, construction work, etc.);

Earthquakes are most dangerous for the normal development of the economy and society of Tajikistan and other states of the Central Asian region. The whole territory of Tajikistan is located in a highly dangerous seismic zone. Destructive earthquakes, which have occurred in the territory of Tajikistan in the XX century, demonstrate the high risk and vulnerability for the most populous areas and cities in the region. Natural disasters such as earthquakes, landslides, rock falls and other extreme situations bring potentially huge hazard for economy and society

An earthquake involving complex disaster, accordingly can distinguish between the primary and secondary consequences. The primary consequences involve soil motion, which can cause the collapse of structures, buildings and so on. The secondary consequences involve landslides, fires, floods, etc. The majority of strong and moderate magnitude earthquakes in Tajikistan will become the trigger mechanism for landslides, rock falls and avalanches. These secondary consequences of earthquakes carry out the heaviest human and material damage as compared to the main quakes. Clusters of housing often develop on marginal land such as steep

hillsides, which are the areas with high level of the above-listed and other disasters. Therefore strong earthquakes in Tajikistan are the cause of huge material damage and enormous human loss. Tajikistan has always been prone to earthquakes. The destructive earthquakes, which have occurred in the territory of Tajikistan in the XX century, demonstrate the high risk and vulnerability for the most populous areas and cities of Tajikistan. The most powerful seismic events of the past century were the Karatag (1907), Sarez or Pamir (1911), Khait (1949) and other earthquakes.

The level of transport vibration due to a decrease in the bearing capacity of soils; environmental pollution; air pollution by production facilities; intensive economic development of the regions; excessive development of tourist infrastructure in the territories of cultural heritage sites; excess growth in the attendance of cultural heritage sites; violent destruction of cultural heritage sites, vandalism, commercialization of cultural heritage, etc.

Also, non-observance of scientific and professional rules of restoration leads to the substitution of repair and restoration work, work on the radical reconstruction of cultural heritage sites. These and other factors directly or indirectly cause the deterioration of the state of cultural heritage sites.

Unfavorable natural and anthropogenic impact is complemented by destruction during unregulated development of historical cities, territories and protection zones of many valuable monuments.

In order to reduce environmental impact on cultural heritage sites, what focal areas require the further development and in what areas are experts in a huge need?

In order to reduce the impact of the environment on cultural heritage sites, it is necessary to develop the following areas: first of all development of the education area, because the cultured and educated people, they will take care about the cultural heritage preservation of their country and the world; The next area for further development is the area of tourism and management, as the organization of the right tourism business contributes to the preservation of the cultural heritage, both architectural and material in general.

In this context, it is necessary to educate and train specialists in the following important specialties: Engineers, architects, restorers, ecologists, architectural historians, managers (decision makers).

What new forms of knowledge and skills should young engineers and restorers possess?

In my opinion, modern young engineers and restorers should know: English, one of the programming languages (for example, Python, R program, etc), and be able to: work well on a computer, know Word and Excel programs well and easily understand the currents and details of work; in addition, it is very much to have knowledge of CAD, modeling of various natural and man-made processes, Geoinformatics, Geoecology, GIS, and etc.

To what extent are these knowledge and skills currently taught?

Currently, this knowledge skills are taught mainly at the Tajik Technical University, mainly at the Faculty of Construction and Architecture. Educational subjects such as Building Materials, Building Structures, CAD, Architecture and other related subjects are taught at a good and satisfactory level.

The Students receive a full amount of knowledge in these areas and have the knowledge and skills to perform various independent coursework and thesis. Cartography and GIS subjects are also taught at TTU, but it is necessary to more carefully focus the attention of students on obtaining knowledge and skills in various GIS programs, such as ArcGIS, ArcGIS Pro, QGIS, Google Earth Engine and others.

The development of this knowledge and skills will help students to further develop the ability to work with computers, the Internet and databases.

In the National Academy of Sciences of Tajikistan (NANT) range of the large scientific and research Institutes are engaged in research that is directly and indirectly related to the study, preservation and protection of historical monuments and that make a feasible contribution to the education and raising the level of knowledge of young specialists in Tajikistan, namely: Institute of History , Archeology and Ethnography, Institute of Written Heritage, Institute of Geology, Earthquake Resistant Construction and Seismology, Institute of Water Problems, Hydropower and Ecology, Institute of Chemistry.

Over the past five years, on the basis of these Scientific Research Institutes of the National Academy of Science, a Master's Department has been organized, where young specialists, after completing a bachelor's degree in various universities of the country, continue their education and after two years of study can obtain a Master's degree.

How would you evaluate the level of knowledge of the teachers who teach them?

Unfortunately, there is such a tendency that the general level of knowledge of preschool educators, general education teachers and teachers of secondary and higher educational institutions is constantly decreasing per year. It has become the norm that older teachers educated at the end of the 20th century have more knowledge and experience. The young teachers have less solid and deeper knowledge than older colleagues.

But young teachers, unlike the old generation, have broader computer skills and knowledge of foreign languages. In order for the knowledge and experience of young and adult professionals to average to a satisfactory and good level, it is necessary to constantly and stable its enrichment and exchange.

This is possible with constant participation in various international conferences, summer schools and trainings. To improve the level of modern professional knowledge and knowledge of foreign languages (English). In my opinion, I consider the level of knowledge of teachers to be satisfactory, but it is always necessary to raise its level through self-education and participation in various professional training courses.

How many more credit hours should particular courses have and what additional courses should be included in the curriculum?

In the sectoral research institutes of the National Academy of Sciences, within the framework of the Master's program, I would suggest conducting the following additional subjects: Assessment of the seismic resistance of buildings and structures (for historical and architectural buildings), at least 2 credits (72 academic hours); History of development of architectural styles of monuments and structures, at least 2 credits (72 academic hours); GIS and RS for assessing the state of architectural and archaeological monuments, at least 2 credits (72 academic hours).

What lab equipment should be procured in order to conduct practical and lab trainings at their higher quality?

Purchase of equipment for the geochemical analysis of building materials of architectural monuments and the composition of the soil around these buildings; geophysical equipment for determining the strength and intensity of seismic vibrations and various vibrations of a natural (earthquakes, etc.) and man-made (automobile traffic, etc.) origin; Engineering and geodetic equipment for leveling the objects under study; Modern licensed software for various calculations, analysis and processing of the obtained results.

What modern devices and software applications should young engineers and restorers be able to work with?

It is necessary to note that in universal informatization, computerization and robotics Age, it is necessary to have a wide knowledge of ICT, the Internet, forecasting and modeling of various objects and phenomena. In addition, young engineers and restorers must have skills in the following programs: AutoCAD, LIRA, ArcGIS, QGIS, Google Earth and others; and with devices: GPS, with various modern digital geodetic instruments.

In addition to the above mentioned what more do you think should be done to improve the skills of students and teachers?

In addition to the above, improving the skills of students and teachers requires:
Continuous improvement of the qualifications of teachers in various fields of architecture and construction, as well as in improving the skills of working in the Internet environment and modern programs based on GIS and CAD, to be able to use modern geodetic, geophysical instruments and tools;
to organize annual educational grants and scholarships for the most capable students;
invite experienced specialists and scientists of international level to read survey and introductory lectures

How would you evaluate the level of knowledge of young professionals concerning the internationally accepted concepts of restoration and conservation of cultural heritage assets?

The level of knowledge of local young professionals regarding internationally recognized concepts for the preservation and restoration of cultural heritage can be assessed as satisfactory.
Insufficient level of students' knowledge, lack of textbooks and modern literature on special issues of preservation, protection, restoration of historical heritage, lack or absence of specially equipped laboratories for scientific research, lack of powerful computers with modern software, insufficient organization of scientific, creative and cultural ties with scientific and educational institutions and centers of near and far abroad.

What are the main reasons for this lack of knowledge and skills among local professionals and educators?

In my opinion, the main reasons for the lack of knowledge and skills among local specialists and pedagogues are the following reasons: lack of international experience, lack of knowledge of a foreign language (English), lack of modern literature and software, expensive Internet communication, etc.

Are these knowledge and skills taught at the university, and if so, to what extent?

Currently, this knowledge skills are taught mainly at the Tajik Technical University, mainly at the Faculty of Construction and Architecture. Educational subjects such as Building Materials, Building Structures, CAD, Architecture and other related subjects are taught at a good and satisfactory level.

The Students receive a full amount of knowledge in these areas and have the knowledge and skills to perform various independent coursework and thesis. Cartography and GIS subjects are also taught at TTU, but it is necessary to more carefully focus the attention of students on obtaining knowledge and skills in various GIS programs, such as ArcGIS, ArcGIS Pro, QGIS, Google Earth Engine and others.

The development of this knowledge and skills will help students to further develop the ability to work with computers, the Internet and databases.

In the National Academy of Sciences of Tajikistan (NANT) range of the large scientific and research Institutes are engaged in research that is directly and indirectly related to the study, preservation and protection of historical monuments and that make a feasible contribution to the education and raising the level of knowledge of young specialists in Tajikistan, namely: Institute of History , Archeology and Ethnography, Institute of Written Heritage, Institute of Geology, Earthquake Resistant Construction and Seismology, Institute of Water Problems, Hydropower and Ecology, Institute of Chemistry.

Over the past five years, on the basis of these Scientific Research Institutes of the National Academy of Science, a Master's Department has been organized, where young specialists, after completing a bachelor's degree in various universities of the country, continue their education and after two years of study can obtain a Master's degree.

6. Tahir Mamatmusaev

Professor and head of Department of History and Theory of Architecture of Tashkent Architecture and Construction Institute (TACI).

Since the first years of independence, the preservation and protection of historical cities and cultural heritage sites has become an important part of the state policy of Uzbekistan. The number of cultural heritage sites in Uzbekistan is 7476, 4308 of which are archaeological, 2079 are architectural objects, 694 are considered objects of monumental art, and 395 are sights of urban planning.

In your humble opinion, what are the main reasons for the deterioration of the condition of cultural heritage sites?

Architectural monuments are evidence of the level of development of technics and technology at the time in which they were built. During the existence of architectural monuments, they are exposed to various natural influences (temperature and humidity, wind, snow, seismicity, etc.), as well as man-made influences (transport, noise, etc.). These impacts are multiple cyclic impacts.

A number of natural and climatic factors act on architectural monuments - the sun, wind, atmospheric and ground waters, sometimes highly saline ground waters, which is typical for the Central Asian region.

The following main reasons affect the deterioration of the state of cultural heritage sites:

- lack of staffed specialists - architects-restorers, design engineers, artists, etc., which consequently leads to a lack of control over the physical-mechanical, constructive and functional state of cultural heritage objects. This control should be carried out every decade (once every 4 months) or monthly according to a previously drawn up schedule;
- raising the level of groundwater. It often occurs due to open irrigation of green plantations in areas adjacent to cultural heritage sites and due to the lack of drainage systems around these areas;
- improper organization of the roof covering of the building, as a result of which rain and snow waters penetrate into the structure of the monument, as well as improper drainage of surface wastewater from the territory of the monument;
- permission for the construction of other modern facilities in the protected zones of an architectural monument.

Moreover, the main reason for the deterioration of the state of cultural heritage objects is the liquidation of UzSRDI- Uzbekistan Scientific Research Design Institute, which was the unique institute of Central Asia, where prominent specialists in the field of scientific research of historical and cultural monuments worked during the years of independence of Uzbekistan, in 1994.

Some employees of the institute worked part-time at the Department of History and Theory of Architecture at TIACI, combining practice with teaching.

As it is known, since the beginning of the XXI century, there were enormous changes on the territory of Uzbekistan, which led to the loss of the image tantamount to the disappearance of the city. Ancient cemeteries, architectural and historical monuments were demolished without study, baths, pools and ditches were filled up, and trees were cut down. Those changes contributed to the loss of the silhouette, appearance and microclimate of ancient cities. In addition, transport routes have been built in the historical core and in shopping streets of ancient cities, which does not contribute to the protection of monuments from all kinds of deformations and destruction.

In order to reduce environmental impact on cultural heritage sites, what focal areas require the further development and in what areas are experts in a huge need?

Today there is a lack of specialists in the field of protection, adaptation and use of cultural heritage objects, restorers, as well as specialists in control of the constructive and functional condition of architectural monuments. Employed officials are not professionals. There are not enough specialists in urban planning with knowledge of restoration work, and also designers for the development of restoration projects.

There is also a shortage of specialists who know the legal aspects of protecting cultural heritage sites. In the department "Cultural Heritage" and in the police departments, it is obligatory to create strict control over the observance of the rules for the operation and protection of architectural monuments.

What new forms of knowledge and skills should young engineers and restorers possess?

Young engineers and restorers should have knowledge not only on the restoration of architectural monuments, but on their reconstruction, knowledge on the adaptation and use of cultural heritage objects in modern social conditions.

They should be able to prepare an expert report on the assessment of the structural condition of the facility and the development of proposals for the structural strength of the building. In one word, we need specialists who can combine the tasks of an architect and a designer-engineer.

Also, young engineers and restorers should have the following skills: studying the material basis of monuments, studying their structures, constructions, analyzing the stress-strain condition, strength and stability of the whole or individual parts, identifying the causes and patterns of the occurrence and development of certain deformations or damage (especially the influence of termites that damage wooden structures). Moreover, young specialists should know how to determine the engineering-geological and hydrogeological conditions under the foundations of architectural monuments, analyze and calculate the bearing capacity of the foundation and foundations of buildings.

To what extent are these knowledge and skills currently taught?

Currently, in the universities of the republic, this knowledge, that is, architecture and construction engineering, is taught separately at different faculties. Teachers are also different: construction engineers have poor architectural knowledge on cultural heritage protection, and architects have little knowledge on engineering and structural knowledge.

For a new field of knowledge, there are not enough teachers with the skills of restoration and reconstruction of architectural monuments (architects, designers and specialists in building materials), it is necessary to organize advanced qualification courses with the involvement of master restorers among local personnel, and also to attract students for practical trainings, to work together with master restorers located in the historical cities of Bukhara, Samarkand and Khiva.

How would you evaluate the level of knowledge of the teachers who teach them?

Cultural heritage restoration teachers are ordinary architects who might not have good knowledge of structural engineering issues, and those who know structures might not know the architectural styles, decor and architectural significance of cultural heritage sites. In addition, architects and construction engineers alike might not know the Arabic handwriting and the words of epigraphic ornaments of the monuments of Islamic architecture.

In addition, most of the professors and teachers who are currently conducting courses on the restoration of cultural heritage sites have not practically carried out restoration projects and have not directly participated in the process of monument restorations. These teachers, for the most part, teach based on the theoretical knowledge of the early 2000s. This creates many problems in reconciling theory and practice.

How many more credit hours should particular courses have and what additional courses should be included in the curriculum?

After a lot of effort, since 2019, applicants have been accepted for training specialists in the direction of "Reconstruction and restoration of architectural monuments". Finally, since last year Tashkent Institute of Architecture and Civil Engineering has started to admit in the direction of training personnel in the field of protection, preservation, restoration of historical and cultural monuments at the governmental level within the framework of the existing system of higher education. It is required to include training courses to the UNESCO National Training Program. 25 students were admitted to this direction of study, but before its opening 10-15

specialists were trained only in the specialty "Theory and history of architecture, restoration of architectural monuments" in Tashkent Institute of Architecture and Civil Engineering and Samarkand State Institute of Architecture and Design trained per year. This figure is much lower for nearly 8,000 cultural heritage sites.

At present, the direction of study "Reconstruction and restoration of architectural monuments" directly includes such subjects as: "History and theory of architecture", "Typology of architectural monuments of Central Asia", "Architectural design and restoration of monuments", "Modernization and reconstruction of architectural monuments", "Organization of the technological process restoration and reconstruction", as well as such items in the specialty "Normative documents of architectural monuments", "Theory and methods of restoration", "Restoration and reconstruction of decor of architectural monuments", "Project of reconstruction and modernization", "Restoration of historical centres" and etc.

It should be noted that many of these disciplines are very close to each other in meaning and content. For example, "Architectural design and restoration of monuments" and "Theory and methods of restoration", as well as "Reconstruction and modernization" and "Restoration of historic centres". Artificial multiplication of such items can lead to negative consequences. Disciplines need to be optimized.

The following additional courses should be included in the curriculum:

- Building constructions and materials of architectural monuments of Central Asia. Total 120 hours (60 hours of lectures, 30 hours of practical classes and 30 hours of laboratory);
- Engineering restoration and reconstruction of architectural monuments of Central Asia. Only 60 hours (30 hours of lectures and 30 hours of practical classes).
- Technology of restoration. Only 60 hours (30 hours of lectures, 30 hours of practical classes).
- Restoration of historic residential buildings. Only 60 hours (30 hours of lectures, 30 hours of practical classes).

What lab equipment should be procured in order to conduct practical and lab trainings at their higher quality?

We need a laboratory building with several departments for the preparation and production of restoration products (appropriate burnt bricks, terracotta tiles, ceramic slabs, forms of kashin, majolica, mosaics, forest and faience masses for ceramic products, engobe, etc.). In addition, we need geodetic instruments, instruments for determining the strength of structural parts of architectural monuments, etc.

What modern devices and software applications should young engineers and restorers be able to work with?

Architectural monuments have been repaired and restored several times, which took huge amounts of money. There are sometimes made mistakes during restoration and reconstruction, without scientific analysis and study. In order to solve these problems, it is necessary to carry out comprehensive scientific and experimental research by young engineers and restorers. As part of the research, they will study the issues of strength, stability and technologies for the construction of architectural monuments and analyze the reasons for the deterioration of their condition, as well as recommend modern methods of strengthening and restoration. In the process of restoration, it is necessary to pay more attention to the main stage of scientific research and to involve qualified specialists in this process.

Young engineers and restorers must be able to work with new computer technologies and modern programs. For example, Corel Draw, AutoCAD, 3DMax, Lumion, Lira, etc.

In addition to the above mentioned what more do you think should be done to improve the skills of students and teachers?

At present, in the practice of urban planning, a procedure is needed in which, before the development of master plans for cities with valuable historical and architectural heritage, a comprehensive study of its existing structure should be carried out in order to identify, assess and determine the nature of the historical and artistic merits inherent in it. Creative decisions in the draft master plan must be based on prior to research, assessments and recommendations.

The practical experience of upgrading the qualifications of teachers - architects needs to be radically changed and translated in the direction of the modern level of knowledge of architects, architects-restorers and engineers-restorers.

It is desirable to create a new platform for scientific cooperation between scientists and UNESCO specialists at the department History and Theory of Architecture, both in the development of National legislation in the field of culture, and in the exchange of practical experience on the conservation and management of cultural heritage.

It is necessary to create a UNESCO design and research section at the History and Theory of Architecture department in TIACE, where future specialists will be trained on the problems of restoration of monuments and reconstruction of the centers of historical cities of Uzbekistan.

At the same time, it is necessary to train students to develop a historical and urban planning reference plan for the reconstruction of the centers of historical cities of Uzbekistan. None of the current official design documents have been created by the research departments of the country's design institutes. It is difficult in the conditions of a huge variety of urban planning objects and the absence of special research and design institutes. All the more, today we can single out the main ideas and provisions of this methodology, applicable in most cases to the reconstruction of our historic cities for the future generation.

It is also required to conduct a systematic internship for young teachers in foreign countries to learn the secrets of restoration work, in cities such as Kiev, St. Petersburg, Moscow, Vilnius, Potsdam, etc.

Qualification practice of students should be organized directly in the places of restoration work.

How would you evaluate the level of knowledge of young professionals concerning the internationally accepted concepts of restoration and conservation of cultural heritage assets?

I assess the knowledge level of local young professionals in relation to internationally recognized concepts for the preservation and restoration of cultural heritage as unsatisfactory. Because all subjects in the curriculum are taught in the classroom. Students and teachers, in practice, do not participate at all in the direct restoration process. There are no restoration laboratories.

Today, young specialists in the field of restoration and reconstruction of architectural monuments must have the following knowledge:

- Must have the skills to conduct "engineering monitoring" of architectural monuments;
- When organizing monitoring, they must be able to determine the degree of deformation of aboveground and underground structures of architectural monuments.
- Should be able to analyze and summarize the results of monitoring of architectural monuments.
- Must be able to develop guidelines for strengthening, reconstruction and restoration of architectural monuments, ensuring their durability and reliability in operation.
- Possess knowledge of building materials used in historical monuments, their composition.

What are the main reasons for this lack of knowledge and skills among local professionals and educators?

The reason is that local specialists, teachers, architects, apart from folk masters (usto) restorers, are not involved in the practice of restoration and protection of cultural heritage objects.

And also, there are some important factors such as the absence of a research institute for the restoration and reconstruction of architectural monuments in the country, participation in the restoration process of specialists from completely different fields who have knowledge only in computer programming, lack of funds and time to carry out the restoration project, lack of necessary equipment, etc.

Are these knowledge and skills taught at the university, and if so, to what extent?

They are taught, but poorly. Because of:

practical classes are not held directly at the restoration places, and students are forced to approximately create restoration projects that they did not see directly;



lack of laboratories to check building materials used in the reconstruction;
the lack of involvement of experienced specialists working directly with architectural objects in the educational process;
a large number of academic subjects not related to the specialty.

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METHODS FOR ANALYSIS OF SEISMIC VULNERABILITY OF BUILDINGS AND FACILITIES OF HISTORICAL HERITAGE

As a physicist, geophysicist and seismologist by education and experience, I will present my vision on the topic of preserving the cultural heritage of historical monuments (HM) precisely as a specialist in these areas. The Questionnaire focuses on staff training: what staff should be trained, on what training base and how? Naturally, this is determined by scientific approaches to the analysis of the physical state of HM and the dynamics of changes in this state. As a result of such an analysis, a specialist should be able to draw a conclusion about the physical state of the HM, about the change in this state in time – how quickly and to what extent the HM is destroyed under the conditions of the environment and, in particular, earthquakes. Based on this conclusion, measures are to be planned for strengthening, reconstruction, conservation and use of HM. Hence the requirements for the training of specialists – seismologists, geophysicists, builders are as follows:

- Must be able to assess the seismic hazard of the HM location;
- Assess the consequences of seismic actions on HM;
- Know the methods of reinforcement building units and structures, recovering and restoration of damage to HM;
- Know the methods of creating engineering protective structures against environmental impacts and, in particular, earthquakes.
- Know the methods of creating shelters for HM from adverse environmental influences.

Examples of the preservation of HM in Bukhara, Samarkand, Khiva, which have repeatedly experienced strong earthquakes over a centuries-old history, many of which are in excellent condition, attracting tourists and historians, architects and others from all over the world, show that, in general, Uzbekistan has chosen the right strategy and tactics security measures on HM. A lot of this experience can be borrowed by specialists working on the conservation of HM in Tajikistan. However, the convocation of this seminar shows that not all issues of preserving HM have been resolved and there is a need for training modern specialists. Let's try to share our experience gained in the Republic of Tajikistan. Let us consider in more detail the formulated requirements for the training of specialists – seismologists, geophysicists, builders.

ASSESSMENT OF SEISMIC HAZARD OF THE LOCATION OF HM

It is necessary to know the causes and regularities of earthquakes, the processes that accompany the preparation of earthquakes, the main phase of shaking at the time of the earthquake, and post seismic effects [1-10]. At the same time, a specialist should know that earthquakes can be both natural and artificial, man-made. Natural, in turn, are tectonic, caused by tectonic movements in the Earth's interior, landslide ones turn up as a result of rock falls on mountain slopes, and volcanic ones rise up at the time of volcanic eruptions. Man-made are caused by the operation of machines, mechanisms, other industrial devices, or artificial explosions. For HM in the Central Asia region, the main danger is represented by tectonic earthquakes, which on average over 50 years are catastrophic. Sometimes destructive earthquakes do not occur for centuries, millennia. Then, when they happen, a catastrophe occurs (for example, the earthquake in the historic city of Bam, Iran in 2003). However, permanent weak vibrations of microearthquakes and microseisms of natural and artificial origin also pose a threat to the safety and stability of HM (there is an example of the negative impact of vibrations of trams and metro on historic buildings in Leningrad / St. Petersburg, RF).

For quantitative assessments of seismic effects on the territory of Central Asia, two scales are currently used – a scale of intensities in points according to a 12-point scale MSK-64 and a modified MSK, and a scale of soil acceleration in m/s^2 . The first scale is integer, discrete, the second is continuous. When using the first, discreteness and dependence on the types of structures (such as building materials, the presence of reinforcement, seismic joints and seismic belts, number of storeys and other parameters) lead to a scatter in the estimates of seismic effects. When using the second, the acceleration of soils during an earthquake does not remain constant, there is a peak acceleration (PGA - Peak Ground Acceleration), there is an average, there is a spectrum of oscillations and the law of their attenuation in time, which depend on the type of soil conditions, on the reaction of the building, on the

interaction seismic vibrations with the base of the structure, etc. – therefore, there is also some uncertainty in the estimates of seismic effects. There are recalculated dependencies between the intensity scales, however, because of the scatter in the intensity estimates, they also introduce some arbitrariness. Therefore, it is very important to know the detailed patterns of manifestation of seismic shaking for specific locations.

Seismic intensities are not the same across the territories. The greatest earthquakes occur in the vicinity of tectonic earthquake foci, which, as a rule, form clusters. Earthquake foci occur along the lines of large fault zones, but are grouped in the vicinity of clusters. Eight such clusters are known on the territory of Tajikistan. The averaging of earthquake intensities on a national scale characterizes the seismic hazard in the territory of a country as a whole, which is shown in the form of seismic hazard maps, seismic zoning maps. Within large settlements, the maximum earthquake strength is also unevenly distributed, such unevenness is indicated in the form of seismic microzoning maps. To clarify the possible strength of earthquakes at a specific site of the facility location, in particular the HM, special works on microzoning are also to be carried out.

Seismic waves acting on buildings and structures are characterized by amplitudes, periods, the law of decay of fluctuations in time, and duration of action. Each wave has its own spectrum, on which the effect of earthquakes depends. In some cases, it was the duration of the oscillations, and not so much the amplitude and period, that played a decisive role in the destruction of buildings and structures (for example, the Spitak earthquake in Armenia in 1989 – the earthquake lasted about 2 minutes). In the case of the earthquake in Skopje, Macedonia, in 1963, it was important that the oscillation period coincided with the natural frequencies of one-storey buildings, which led to the resonance and destruction of these buildings. At the same time, the minaret, which was several centuries old, survived, not getting into resonance with the high frequency vibrations of the earthquake.

The seismic hazard does not remain unchanged, for example, a rise in the ground level can lead to an increase in the score by 1 [11], or due to a change in the composition of the ground during the filtration of groundwater with the formation of karst, weakening of rocks can occur, as was the case in the Spitak earthquake [12]. In addition, there are temperature differences, especially large in Central Asia - sometimes up to 20⁰C between night and day, and this leads to wear of materials in the form of thermal destruction - destruction due to differences in thermal deformation coefficients [13]. The effect of environmental humidity and its changes also leads to the destruction of building materials and wear. Any HM building is under the influence of gravity, gravity forces. Therefore, in accordance with the concepts of the kinetic theory of strength, it gradually collapses due to plastic deformations and creep-creep. If the building and its individual elements are in an overstressed state, then the rate of destruction increases significantly. It was found that even seasonal variations in atmospheric pressures of about 20 mbar can affect the creep rates of extremely stressed samples [14,15].

As a rule, after the main shock of a strong earthquake, there are shocks of lesser strength, aftershocks, they reflect the stage of stress relaxation and the return of the geomedium to a regular state [16]. The intensity of aftershocks is less than that of the main shock. The stronger the main earthquake, the longer the aftershocks last. The number of aftershocks decreases over time according to the Omori Law (with amendments for specific geographic locations) [16]. For strong earthquakes, they start in the first hours and last for a year or more. Aftershocks can be no less dangerous than the main shock, which produces the main destruction, and aftershocks act on an already weakened building.

As a rule, the strongest earthquakes occur relatively rarely, once in centuries, millennia, so it is important to take into account the historical experience of this hazard's witnesses, which is reflected in ancient manuscripts and books. Some overview information about the consequences of past earthquakes on the territory of Tajikistan and anti-seismic activities is given in the books [10,17].

Summarizing, we note the following characteristics of seismic waves, which need to be known for assessing seismic hazard and risk:

- Oscillation amplitudes - spectrum
- Frequencies / periods - spectrum
- Wavelength of seismic vibrations
- Duration of the main stage of oscillations
- Polarization - horizontal and vertical vibration components
- Law of damping of oscillations in time
- The law of damping of oscillations as waves propagate in space
- Seismic waves from aftershocks can be no less dangerous than from the main shock of an earthquake.

The final assessment of seismic hazard and risk is to be displayed in the form of the distribution of earthquake intensities over the area using zoning and microzoning maps of seismic hazard and risk.

Accordingly, a specialist must be proficient in the methods of geophysical and seismological observations, work with modern equipment for monitoring the aforementioned seismological and geophysical characteristics.

ASSESSMENT OF THE CONSEQUENCES OF SEISMIC ACTIONS ON HM

Currently, there are computing programs that make it possible to calculate the degree of destruction of a building under a seismic impact, for example, 7, 8, 9 points, in advance, even before an earthquake had occurred [18]. For this, the type and quality of building materials, structures, assemblies, elements, frames, type of structure, etc. are taken into account. The experience of assessing the consequences of earthquakes of various magnitudes for social facilities in Dushanbe (schools, hospitals, preschool units) was accumulated in the course of work under the UNDP project [19]. However, the degree of accuracy in assessing these consequences also varies somewhat. Knowledge of the degree of possible damage makes it possible to take the necessary measures to strengthen the nodes, structures, frames and other building elements most vulnerable to earthquakes, as well as to choose the appropriate methods of engineering protection of the HM. In addition, knowledge of the consequences of seismic impacts makes it possible to assess the seismic risk, which is directly proportional to the seismic hazard and vulnerability of the structure and inversely proportional to the response potential to overcome the consequences [20] (for example, it is known that Japan took years to eliminate the consequences of the 1995 Kobe earthquake, compared with decades for Haiti after the 2011 earthquake). Knowledge of seismic risk provides a basis for assessing economic damage and planning a budget for overcoming the consequences of an earthquake and the cost of measures to preserve HM.

Accordingly, a specialist must be proficient in methods of assessing and predicting the consequences of earthquake actions on an HM, skills in working with engineering seismometric equipment, with software products, on the basis of which the state is monitored and the consequences of earthquakes are predicted.

METHODS OF REINFORCEMENT CONSTRUCTION UNITS AND STRUCTURES, RECOVERING AND RESTORATION OF DAMAGE TO HM

Currently, in connection with the significant progress in the field of creating new materials over the past decades, in particular, composite materials, completely new opportunities have arisen for reinforcing the elements and structures most vulnerable to earthquakes. At the disposal of builders, there are now light, strong, elastic, durable building materials. Therefore, the opportunities for strengthening the HM are currently unique. Knowledge of the most effective methods and ways of reinforcement is required. Of course, this requires basic knowledge of the strength of materials, the properties of various structures, in particular shells, special training is required in the field of determining and testing the action of seismic loads on building materials, elements and structures. Measures to strengthen the HM should be carried out permanently, both in a regular, preventive mode, and in emergency cases of damage detection.

Accordingly, a specialist must possess methods of reinforcement building units and structures, recovering and restoring damage to HM, possess construction skills for carrying out these works using devices, tools and 3-D modeling programs (before proceeding directly to work, it is sometimes advisable to calculate 3-D model of this or that structural element).

METHODS OF CREATION OF ENGINEERING PROTECTIVE FACILITIES AGAINST EARTHQUAKES

The action of both strong and weak earthquakes, including microseisms, is dangerous for HM structures: strong earthquakes are relatively rare, but weak earthquakes are frequent, and microseisms operate constantly. In recent decades, various engineering antiseismic protective devices have been developed: dampers of various designs, ditches around buildings with sand fillers inside etc. The activity of research in this area can be judged by 150 reports presented at the 16th scientific conference "World Conference on seismic isolation, energy dissipation and active vibration control of structures", 1-6 July 2019, St. Petersburg, RF (some of the reports [21-24]). The reports reflect the rich world experience accumulated in the field of protection of various engineering structures, but only one of them is devoted to the protection of HM: Kaya M. PO-048 Techniques for Seismic Strengthening of Historical Monuments [24]. Therefore, much remains to be done in the field of seismic protection of HM buildings.

Accordingly, a specialist must possess methods for creating engineering protective structures, possess construction skills for carrying out work using devices, tools and 3-D modeling programs (before proceeding directly to work, it is sometimes advisable to calculate a 3-D model of a protective structure).

METHODS OF CREATING SHELTERS FOR HM FROM ADVERSE ENVIRONMENTAL IMPACT

It is known that the action of the environment generally leads to the deterioration of building materials, structures, building frames, thereby reducing the seismic strength and stability of elements and buildings in general. Therefore, in appropriate cases, the creation of artificial shelters can significantly prevent the destruction of the HM. World experience in creating such shelters, including in Central Asia there is (for example, HM Sarazm in Tajikistan, included in the UNESCO World Heritage List, the 5500th anniversary of which is scheduled to be celebrated at the state level on September 12, 2020), but it is necessary to improve the methods of creating such shelters towards the lightness of structures, efficiency and low cost.

In recent decades, significant climate changes have been taking place, this is especially evident in Central Asia, where there is a large accumulation of glaciers, mountainous areas and deserts, which actively affect the weather and climate, and this will undoubtedly affect the physical condition of the HM.

Accordingly, the specialist must possess the methods of creating shelters, possess construction skills for carrying out work using devices, tools and 3-D modeling programs (before proceeding directly to the work, it is sometimes advisable to calculate a 3-D model of the shelter).

CONCLUSIONS

It is necessary to train specialists in the field of assessing seismic impacts on HM.

It is necessary to train specialists in the field of seismic risk assessments for HM, the creation of specialized groups to carry out anti-seismic measures in the field of HM conservation.

Each HM must have a seismic data sheet, which includes the characteristics of seismic vulnerability in case of impacts of earthquakes of varying intensity. In particular, such "seismic passports" for civil buildings are available in the USA and Japan. Within the framework of the UNESCO pilot Project in 2015, an assessment was made of the physical condition and seismic vulnerability of a number of HM construction sites on the territory of Tajikistan [25], and this experience can be applied to assess the seismic consequences for the HM.

There is a need for training of construction specialists capable of strengthening the elements and structures of the HM.

There is a need for training of construction specialists capable of restoring damaged HM.

It is necessary to train specialists capable of creating engineering protective structures for HM.

Continuous monitoring of the physical condition of the HM using automated control systems is required.

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INTRODUCTION

Uzbekistan attracts the attention of the whole world with its numerous ancient historical and architectural monuments, the nature and rapid modern development. Historically, Uzbekistan was located at the intersection of trade routes of the Great Silk Road. And no wonder why Uzbekistan up to these days has been an attractive tourist destination for researchers, entrepreneurs and anyone interested in culture, history, traditions, exotic destinations. The historical heritage of Uzbekistan is known for its architectural monuments that have come down to us from the time of our ancestors. Take as examples the Ichan-Kala complex in Khiva, the historical centers of Bukhara, Shakhrisabz and Samarkand. Taking into account their historical values, these heritage sites are on the World Heritage List. The unique monuments and architectural structures in these cities reflect the era that played a significant role in the history of the country. The country's rich history attracts about 7 million foreign tourists every year [1].

It is well-known that the main territory of the Republic of Uzbekistan is located in a zone subject to a high seismic threat. According to the seismic zoning data of the Institute of Seismology of the Academy of Sciences of the Republic of Uzbekistan, this indicator is 78% of the total territory. Moreover, according to the MSK seismic scale-64, the intensity of earthquakes in these territories is 6 and higher scales. This factor jeopardizes the technical condition of architectural monuments located in the seismically active regions of the republic. It is thus highly important to constantly monitor and study the technical condition as well as strengthen building structures as aggressive factors create a very urgent problem [2].

According to the UN specialized agency for education, science and culture (UNESCO), five object names are included on the list of World Heritage List in Uzbekistan. Four are included on the list according to cultural criteria—the historical centers of Khiva, Bukhara, Samarkand and Shakhrisabz; another, according to the natural criteria—Western Tien Shan (Chatkal reserve). There are 8208 immovable objects of material cultural heritage in the republic, of which 4748 are archeological monuments, 2250 are architecture, 678 are monumental art and 532 are places of interests [3].

Given the urgency of the problem, the Government adopted the following Resolutions and decrees to regulate and improve this branch of industry: Resolution of the President of the Republic of Uzbekistan dated July 30, 2020 PP-4794 "On measures to radically improve the security system for the population and the territory of the Republic of Uzbekistan"; PP-2666 of December 2, 2016 "On the organization of the activities of the State Committee of the Republic of Uzbekistan for Tourism Development"; Decree of the President of the Republic of Uzbekistan dated January 5, 2019 UP-5611 "On additional measures for the accelerated development of tourism in Uzbekistan"; UP-4861 of December 2, 2016 "On measures to ensure the accelerated development of the tourism industry of the Republic of Uzbekistan" and the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated October 4, 2019 PKM-846 "On approval of the list of real estate objects of material cultural heritage".

REVIEW AND ANALYSIS OF WORLD EXPERIENCE IN THE RECONSTRUCTION AND RESTORATION OF ARCHITECTURAL MONUMENTS

The current state of the problem on assessing the technical condition and strengthening the structures of architectural monuments in the Republic of Uzbekistan.

In advanced economies, a great deal of attention is paid to the restoration of historical architectural monuments. There are research institutions and organizations for the restoration and strengthening of structures of architectural monuments. Notably, restoration takes a lot of time and requires a lot of capital investment. For example, a site work may take at least 10 years. During the restoration, costly and durable special building materials are used so that after restoration this object will serve for many more years for future generations. Nevertheless, for the use of special materials and solutions for strengthening, it is necessary to have the conclusions of the institutions involved in the restoration and reconstruction of the country's cultural heritage. The work experience of countries like Japan and Germany is provided below with some photos of the restoration process on their historical sites.

The restoration of an object located in Japan called the Tomioka Silk Mill is given as an example. Tomioka City is located in Gunma Prefecture in Japan. The Tomioka Silk Mill was built in 1872 by the Meiji government as part of a

modernization project. This factory in the history of Japan has taken a special place in the development of the country. The silk processing factory is included on UNESCO's Cultural Heritage List. Currently, the facility is under restoration process that began in 2014. The structure of the object is a wooden frame with a brick filling made of wood. During the restoration, all damaged wooden structures are partially replaced with new materials and the numbered structures are restored to their original form. Wooden brick walls were reinforced with composite wires with a diameter of 4 mm with fixing of horizontal joints of the masonry with a special mortar. Workers say that the restoration time of this object may take at least 10 years. Below are photos of the objects and their restoration process (Fig. 1).



Fig. 1. Tomioka Silk Factory, Japan

In Germany, the restoration of historical objects is carried out strictly according to the requirements established by the appropriate organization and only licensed organizations are allowed to carry out the restoration work. During the restoration, special durable injection solutions and expensive materials are used. Below are photos of the restoration process of the base of the house of German historical buildings by specialists from the organization German half-timbered center Quedlinburg (Fig. 2-6). The building was erected from a timber frame. Filling is from brick clack. During the restoration, the wooden structures after cleaning were treated with special solutions to increase their durability. Notably, the restoration process also takes a long time to get the job done well. There are a number of laboratories that develop special solutions and materials, and research institutes for the restoration of historical monuments.

THE CURRENT STATE OF THE PROBLEM ON ASSESSING THE TECHNICAL CONDITION AND STRENGTHENING THE STRUCTURES OF ARCHITECTURAL MONUMENTS IN THE REPUBLIC OF UZBEKISTAN

The following are answers to the main questions kindly provided by experts and researchers participated in our recent survey:



Fig. 2. Surface cleaning of a wooden column and treatment with a special solution



Fig. 3. Restoration of brickwork



Fig. 4. Preparation of a special injection during restoration work



Fig. 5. Restoration work of a wooden frame and injection with a special solution

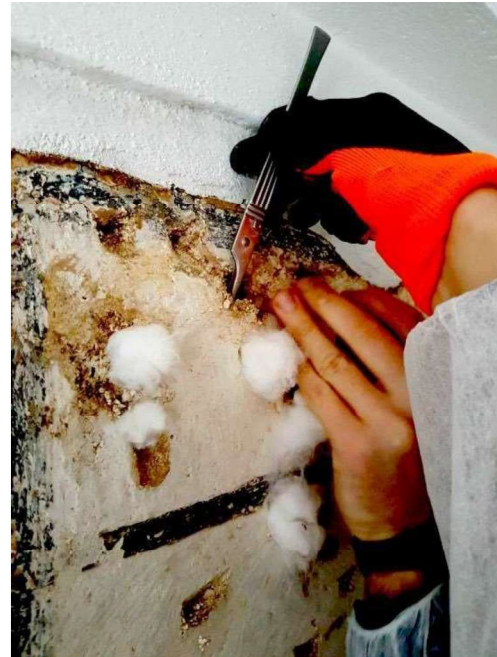


Fig. 6. Injection of a special solution into the filling attachment

In your humble opinion, what are the main reasons for the deterioration of the condition of cultural heritage sites?

Earthquakes, atmospheric pollution, wind and water erosion, the level of groundwater, chemical pollution of soils and grounds, noise, vibration and other distortions of the natural physical parameters of the environment, including various types of vehicle movements, the wrong decision and untimely restoration of architectural structures monuments, lack of scientific knowledge and experience in the restoration and reconstruction of architectural monuments, lack of special laboratories for the development of building materials for restoration, lack of design engineers for calculating the structures of architectural monuments, taking into account the existing technical condition, lack of a specially developed album of construction drawings for types of reinforcement of architectural structures monuments, the lack of a laboratory for model-based testing of structures of architectural monuments, little or no exchange of expertise with experts from advanced economies in the restoration and strengthening of architectural monuments, training in the restoration and strengthening of structures of architectural monuments at universities of construction technology based on expertise of advanced economies.

In order to reduce environmental impact on cultural heritage sites, what focal areas require the further development and in what areas are experts in a huge need?

It is necessary to organize a special organization and equip it with modern instruments and equipment for continuous monitoring of the technical condition of historical monuments; organize an association of construction engineers for problem discussions and give the right solution for the restoration and strengthening of architectural monuments; add additional hours at technical universities of the republic for technical observation and calculation of structures of architectural monuments; to equip universities for training specialists in the given field with special equipment and software, allowing to assess the technical condition based on the results of the stress-strain state, taking into account the seismic effects in the region; to equip with additional instruments and equipment for studying the influence of strengthening structures of architectural monuments, as well as for determining the physical and mechanical properties of materials of structures and base soils; to develop special regulatory documents for the calculation, restoration and strengthening of structures of architectural monuments; to develop well-grounded and approved album of structural drawings for strengthening structures

by types of architectural monuments; to develop a regulatory document for the use of special materials for the restoration of architectural monuments.

What new forms of knowledge and skills should young engineers and restorers possess?

Young engineers should have knowledge in drawing sketches, calculating structures based on stone and reinforced-masonry structures, reinforced concrete structures, steel structures of bases and foundations, soil mechanics, as well as skills in working with modern devices and computer software packages for calculating and evaluating technical the state of structures of architectural monuments. For example, in construction practice, there are software packages for the calculation of structures of buildings and structures, such as Lira, SAP, ETABs, Cosmosm and others. When using these software packages to create a three-dimensional model for calculating the structures of architectural monuments, taking into account cracks in load-bearing structures, is as laborious a process as in the full-scale state (Fig. 7) [4].

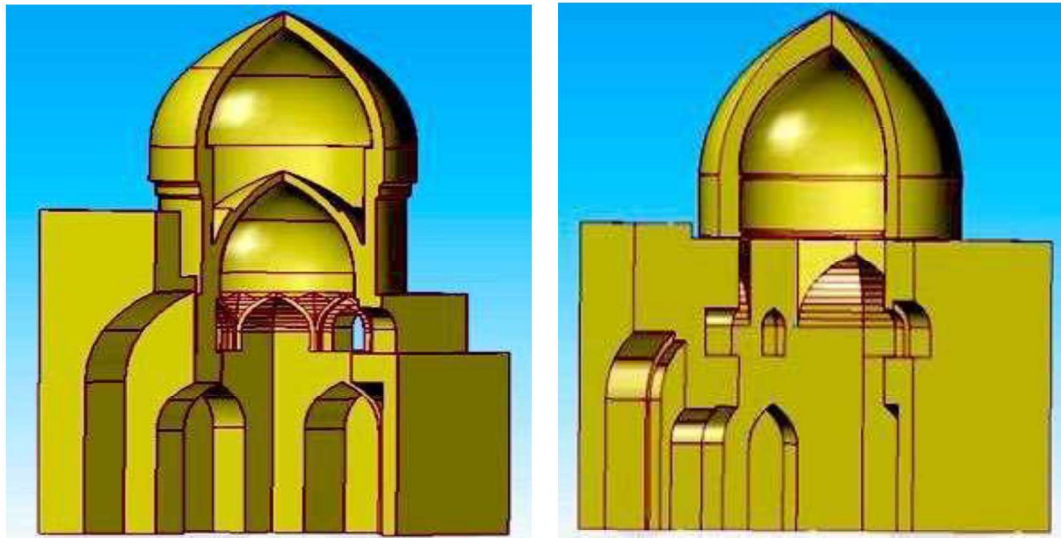


Fig. 7. These models of architectural monuments were produced in the Solid Edge software

Considering the above-mentioned prerequisites, the Leica RTC360 3D Laser Scanner device is used to create a computational model on the basis of foreign experience [5]. This device allows you to automatically build a design model of a structure based on measurements at various points of the object under examination and also takes into account all cracks and fractures in the structures of architectural monuments. As a result, this device will enable its user to correctly create a design model of the structure under examination, thereby increasing the accuracy of the calculation while strengthening and assessing their technical condition (Fig. 8).



Fig. 8. Leica RTC360 3D Laser Scanner

This device allows you to build a three-dimensional model of the object under examination, taking into account all cracks. Moreover, on the basis of the constructed model, it is possible to determine the stress-strain state of the structure, taking into account the seismic effects from the realrecords of the earthquakes that have occurred (Fig. 9), according to the studies in [6].

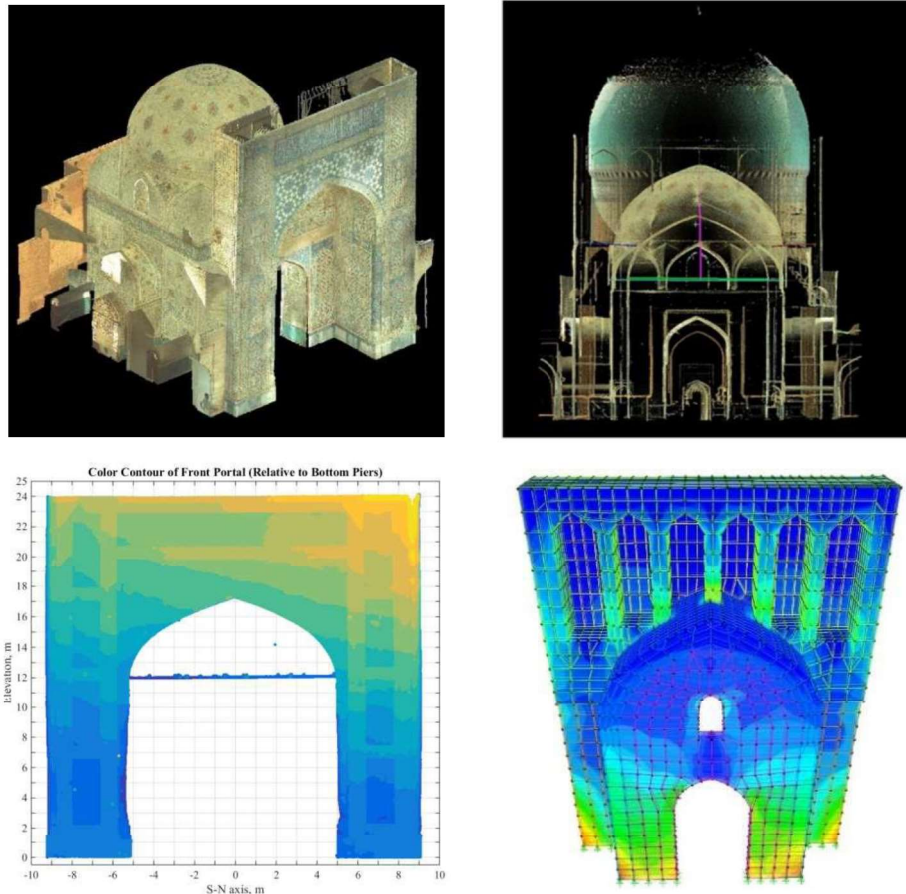


Fig. 9. View of the constructed model and the results of calculating the stress-strain state of the Kuk Gumbaz mosque in the city of Shakhrisabz

To sum up, young restorers should be skilled to develop durable building materials for the restoration of architectural monuments, the art of restoration and know the history of architectural monuments.

To what extent are these knowledge and skills currently taught?

Generally, different kind of courses on technical assessment and calculation of building structures are taught at construction universities today and their calculation is based on the country's regulatory documents. Nevertheless, when calculating and assessing architectural monuments, it is impossible to fully use the requirements of these regulatory documents as they are drafted for modern structures of buildings. Taking into account all the shortcomings, it becomes necessary to develop specific courses on the calculation, reinforcement, building materials and the method of restoration of structures of architectural monuments. Thus, I can wholeheartedly state that the current state of training for the restoration and strengthening of the structures of architectural monuments is unsatisfactory as there is a shortage of personnel in this branch of industry.

How would you evaluate the level of knowledge of the teachers who teach them?

There are indeed some teachers that meet all modern requirements for teaching the restoration and strengthening of structures of architectural monuments, but their numbers are insufficient. Therefore, in the

development of this branch of science and research, it is necessary to pay attention to the training of teachers, taking into account the advanced foreign experience in this field.

How many more credit hours should particular courses have and what additional courses should be included in the curriculum?

It is necessary to add at least 200 hours, taking into account lectures, practical exercises and laboratory work on the study of new durable building materials. The following courses can be added on the curriculum: "Dynamics and stability of structures of architectural monuments," "Building materials for the restoration of architectural monuments," "Assessment and strengthening of structures of architectural monuments," "Mathematical modeling of structures of architectural monuments" and "Assessment of the technical condition and strengthening of bases and foundations architectural monuments."

What lab equipment should be procured in order to conduct practical and lab trainings at their higher quality?

In the field of bases and foundations the following equipment should be procured: equipment for determining the mechanical properties and strength characteristics of the base soil, and equipment for determining the geometry of foundations.

In the field of structures the following equipment should be procured: equipment for determining the strength characteristics of material structures by a non-destructive method; equipment for assessing the amortization of structural materials; equipment for detecting internal cracks in load-bearing structures; Leica RTC360 3D Laser Scanner for creating a three- dimensional model of a structure, taking into account all structural cracks; software and compatible computers for calculating the stress-strain state of structures of architectural monuments.

What modern devices and software applications should young engineers and restorers be able to work with?

Young engineers should be able to work with equipment for determining the strength characteristics of structural materials by a non-destructive method, equipment for assessing the amortization of structural materials, equipment for determining internal cracks in load-bearing structures with use of the Leica RTC360 3D Laser Scanner to create a three-dimensional model of a structure taking into account all structural cracks, software such as Lira, SAP, ETABs, Cosmosm and others for calculating the stress-strain state of architectural monuments.

Last but not least, young restorers should be able to work with modern laboratory devices to develop durable building materials for the restoration of architectural monuments.

In addition to the above mentioned what more do you think should be done to improve the skills of students and teachers?

It is necessary to equip universities with modern devices, software and equipment for the restoration and strengthening structures of architectural monuments, conduct practical courses at the end of the training course at historical sites in order to assess their technical conditions. Besides students, trainers in this branch of industry should take advanced training courses at leading institutions in foreign countries.

How would you evaluate the level of knowledge of young professionals concerning the internationally accepted concepts of restoration and conservation of cultural heritage assets?

In my opinion, young specialists' level of training in the preservation and restoration of cultural heritage is mediocre.

What are the main reasons for this lack of knowledge and skills among local professionals and educators?

There is a lack of knowledge of the regulatory norms for calculating the structures of buildings, full-fledged use of the existing software product for calculating the structures of buildings, taking into account seismic effects, as well as their application in the calculations of structures of architectural monuments. Moreover, there is a lack of

regulatory documents for strengthening and assessing the technical condition of structures of architectural monuments, as well as skills in the use of modern durable materials for the restoration and strengthening of structures of architectural monuments.

Are these knowledge and skills taught at the university, and if so, to what extent?

These courses are taught at universities in relation to modern buildings and structures, but not completely at all institutions. In my opinion, it is necessary to introduce the following courses to the curriculum with a change in the topic of the course for architectural monuments. They are: "Bases and Foundations," "Soil Mechanics," "Resistance of Materials," "Structural Mechanics," "Earthquake Resistance of Buildings and Structures," "Wooden Structures," "Stone and Reinforced Masonry Structures," "Reinforced Concrete Structures," "Steel Structures," "Computer technologies in the design of building structures," "Technical inspection of buildings and structures," "Dynamics and stability of structures" etc.

PROPOSED SOLUTIONS TO THE PROBLEMS OF ASSESSING THE TECHNICAL CONDITION AND STRENGTHENING OF STRUCTURES FOR THE FUTURE PRESERVATION OF ARCHITECTURAL MONUMENTS

- To train personnel for the restoration and strengthening of architectural monuments at universities.
- To organize special laboratories for the development of special building materials for the restoration of architectural monuments.
- To organize a special scientific center for the calculation and development of projects for strengthening the structure of architectural monuments, as well as to equip its base with modern equipment and software packages for the assessment of their technical condition.
- To organize continuous monitoring of the assessment of the technical condition of architectural monuments.
- To organize the exchange programs for teachers and doctoral students in the field of restoration and calculation of structures of architectural monuments with leading foreign countries.
- To strengthen the responsibility and assistance of local authorities for the preservation of the cultural heritage of the Republic of Uzbekistan.

CONCLUSION

Architectural monuments are precious evidence of the way of life and culture of the Uzbek people. In the Republic of Uzbekistan, a special attention has always been paid to the careful preservation, study of our rich historical, cultural and spiritual heritage. Therefore, the country's constitution stipulates that citizens are obliged to protect the historical, spiritual and cultural heritage of the people and that cultural monuments are protected by the state.

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Main scientific and production department for the protection and use of cultural heritage objects under the Ministry of Culture of the Republic of Uzbekistan.

Khorezm Academy of Mamun.

Tashkent Institute of Architecture and Civil Engineering (Department of Construction Mechanics and Seismic Resistance of Structures).

Tashkent Institute of Architecture and Civil Engineering (Faculty of Architecture, specialty "Restoration of architectural monuments").

Samarkand State Institute of Architecture and Civil Engineering (department "Unesco") named after M.Ulugbek
LLC "Geofundamentproekt" at the Samarkand State Architectural and Construction Institute named after M. Ulugbek.

9. Askar Khasanov

Professor at Department of geotechnical engineering (Roads, floors and basements), SamSACII

In your humble opinion, what are the main reasons for the deterioration of the condition of cultural heritage sites?

The main reason for the destruction of cultural heritage sites, including architectural monuments, is a time factor. All factors contributing to the destruction of monuments can conditionally be attributed to the following categories:

- Natural and climatic factors;
- Geological, geomorphological and seismic-tectonic factors;
- Biological factors;
- Human factors;
- Urbanization factors.

Natural and Climatic Factors

The first category is related to the climatic conditions of the area and the most destructive factors are, first of all, the cyclical change in positive and negative temperatures, rains and, of course, wind erosion of the surface of roofs, domes, arches and other architectural elements.

Geological, Geomorphological and Seismic-tectonic Factors

The second category is related to the impact of the geological structure of the foundation of a building or a structure. During the geological period, there may be changes in factors such as level fluctuations, changes in the chemical composition of groundwater and changes in the level of the earth's surface around monuments. In addition to those factors, the process of the historical period and the development of the city are also possible. Erosion of the basement part of wall structures is related with the absence of a water-repellent screen. As a result, moisture and salts accumulate, thereby contributing to the destruction of stone structures. Seismic impacts have a significant impact on the strength and stability of monuments. Such impacts are the main reason for the destruction of such unique and monumental architectural monuments as the Bibi-Khanum Mosque, the Ishratkhan mausoleum in Samarkand and the Ok Saray in Shahri Sabz.

Biological Factors

To biological factors are related the destruction of the surface of stone, wooden structures and parts of the majolica by various biological formations and plants. The seeds of these plants are spread by birds. Sometimes the roots of these plants deepen to 5-10 m. They form cracks, which are subsequently destroyed by atmospheric waters and temperature due to climatic factors.

Human factors include wars, the loss of valuable building materials and the destruction of the majolica, the abandonment of cultural heritage sites, and others. Over the past 100 years, urbanization processes and urban development have had a significant impact on the state of architectural monuments. In particular, among them are the development of underground water-pressure and non-pressure water- carrying communications, and water leakage into the ground. Moreover, there have also been change in natural runoff of surface, ground drainage waters, changes in soil moisture and temperature on the surface in the aeration zone, the main reason for which is abundant irrigation and covering of the earth's surface with asphalt concrete and massive buildings around architectural monuments. Last but not least, micro dynamic effects of transport and stray currents, and emissions from vehicle gases have a significant impact on materials.

In order to reduce environmental impact on cultural heritage sites, what focal areas require the further development and in what areas are experts in a huge need?

First of all, it is necessary to correctly assess the global causes and factors contributing to the destruction of the entire building and structure or its parts based PP. Low level of organization of the entire restoration complex, starting from scientific research, design and production stages. The outcome of poor use of technology is the low level of restoration work, in particular, of cladding details. In our opinion, the most significant factors contributing



to the destruction of monuments are the factors presented in pp. Therefore, when studying the residual strength of the building frame and the surface of decorative architectural forms, it is necessary to comprehensively study it both from the point of view of the historical and architectural project, structures, decorative materials, geological structure and a measure of the chemical effect of the environment on the quality of building materials. A restorer should have the skills and ability to organize, and get various specialists involved in order to eliminate the main reasons contributing to the intensive destruction of the monument. Lack of specialists is observed in such areas as: preparation technology and composition of the majolica; specialists assessing the effect of chemical reagents (salt and other composition) and moisture on stone and other materials; architects with a fine comprehension of the basics of the monumental structures and the surrounding area with historical and traditional architecture.

What new forms of knowledge and skills should young engineers and restorers possess?

Young engineers and restorers should have knowledge in architecture, history of architecture, theoretical and practical basis of structures, building materials, basic concepts of engineering geology and geotechnics, modern monitoring methods, chemistry and the basics of organizing the safe operation of the monument. Architects must clearly understand not only the appearance of the monument itself, but also be able to link it with the surrounding urban planning techniques. It is in this very issue that gross mistakes have been made recently, when the surrounding territory turns into a super modern landscape architecture in replacement of its adaptation to the historically established old urban environment.

To what extent are these knowledge and skills currently taught?

In Uzbekistan, like in other countries of Central Asia, specialists with the architectural background, historians, engineers with a general construction background and sometimes specialists in chemistry and biology were involved in this problem. Unfortunately, the restoration schools have not survived to this day. The schools of restorers named "Usto" were shut down and their skills stopped passing down from generation to generation. Therefore, professional specialists of restorers with the above-mentioned skills are not trained in the existing universities and institutes. Moreover, there are no special middle-level schools for training "hunarmand" (craftsman) and restorers. These kinds of schools should be organized at institutes (universities) of the architectural and construction profile.

How would you evaluate the level of knowledge of the teachers who teach them?

There are no special training courses for specialists of restorers in the universities of Uzbekistan. Nevertheless, at Samarkand State Institute of Architecture and Construction (SSIAC) graduate students sometimes do scientific work on the restoration of monuments. Standard model and working, curricula designed to prepare architects or engineer restorers in architectural and construction institutes are nonexistent. The institutes do have teachers who deal with the problems of the history of architecture, the environment, including specialists, engineering-geological, and ecological heritage, but they are not united to solve the problems of preserving objects of cultural heritage. In order to produce highly specialized restorers, it is necessary to combine them into one training program. Notably, architects, without training at "Usto" (schools of restorers for old craftsmen) in the field of majolica, ceramics, in stone cutting, wood carving, metal forging, etc., cannot carry out a high-quality restoration project. Therefore, we believe we should develop both field of studies. We may assign restorers to develop a curriculum in one of the departments of the university.

As of today, there are no professional schools that train restorers with a narrow specialization in Uzbekistan. Therefore, the study and revival of ancient technologies is essential. Such specialties remain at the level of folk craftsmen whose experience is transmitted according to the principle of "Usto-shogird," that is, on the basis of apprenticeship. There are also several specialized private enterprises that deal with restoration issues on a contract basis at the request of the directorates of architectural monuments. I must admit that their level is poor. There are specialized planning organizations in the republic to carry out such science-intensive engineering work as monitoring, inspection of the condition of building materials, engineering calculations of parts of buildings, etc., but they are not involved in this problem.

**How many more credit hours should particular courses have and what additional courses should be included in the curriculum?**

First, we consider it expedient to train specialists in small groups in a graduate program on the basis of architectural faculties. However, admission should be based on a competition. Applicants must pass exams orally only by a specialized commission. Questions and requirements for applicants should include skills and knowledge of subjects such as: architecture, history of architecture, drawing, fluency in computer graphics. Have an understanding of engineering sciences, such as stone structures, building materials, design skills, engineering geology and geodesy, laboratory work, etc. It is possible to train specialists at the bachelor's level from the second year. To revive the training of restorers, it is necessary to take the European curriculum for training restorers as a basis.

What lab equipment should be procured in order to conduct practical and lab trainings at their higher quality?

Laboratories for studying the quality of building materials and binders; chemical laboratory for studying the composition of materials, soil and groundwater, mini production of ceramics and majolica; basic skills in monitoring and measuring instruments (sensors for measuring horizontal displacements and rolls of foundations, geodetic instruments, including special drones and laser total stations. We need a laboratory for assessing the influence of weather, climatic and environmental factors on the quality of the durability of building materials. For the past years, we have witnessed that during restoration work, materials that do not meet patterns of color, strength and durability have been applied from non-certified materials.

What modern devices and software applications should young engineers and restorers be able to work with?

Definitely all types of computer equipment, color printers, plotter, 3D printer, graphic software systems, programs for calculating engineering structures and geotechnics, a package of software systems developed for these purposes.

In addition to the above mentioned what more do you think should be done to improve the skills of students and teachers?

Unambiguously, these students, besides university courses, should undergo practical training at least 2-3 times a week in specialized restoration workshops and design groups dealing with these problems. Such a teaching method will give real results in the training of highly professional restorers. It is categorically impossible to practice the training program for specialists to be subordinated to a specific person or department. Young professionals should receive short-term training in specialized schools in developed European countries, as well as in India, Pakistan and Iran, along with their teachers. All the above-mentioned specialized laboratories, instruments and equipment should be available for the restoration of monuments and the training of specialists. It should be noted that access to these laboratories should be free for specialists dealing with these issues. In order to realize it, we need to create these laboratories and restore restoration science.

How would you evaluate the level of knowledge of young professionals concerning the internationally accepted concepts of restoration and conservation of cultural heritage assets?

They are poorly focused on the theory of restoration and restoration schools. It is difficult to compare the level of training of specialists trained in accordance with internationally recognized educational programs and local restorers and architects. Because, in the first case, they work according to well-coordinated and established European standards. Unfortunately, such strict standards for local specialists in Central Asian countries are vague. They are mainly based not on standards, but on historical experience or advice from "Usto." Therefore, studying the experience of European countries with their curricula and with their standards for the reconstruction and restoration of monuments is extremely important.

What are the main reasons for this lack of knowledge and skills among local professionals and educators?

First of all, there is no preparatory training curriculum meeting all the requirements. Secondly, there are no uniform standards, technologies, methods and laws in the approach and concept for the preservation and restoration of cultural heritage. The lack of uniform requirements for this problem leads to a decrease in the quality of restoration work. It is necessary to restore the production and technical base of the restoration workshops. For example, the composition and quality of majolica does not match either the patterns of color or its reliability to frost resistance. Often due to the lack of skills in the production of glaze, the requirement for both the color gamut and its durability against atmospheric precipitation is violated. Specialists do not have skills to strengthen the structures of arches, domes, and other complex architectural forms. Recently, it has become popular to completely venerate monuments with new stone structures from the outside. We take as examples the following monuments such as Ruhobod in Samarkand, the At-Termiziy and Nur- Ota mausoleums and many others. This leads to a violation of the historical appearance and its historical significance.

Are these knowledge and skills taught at the university, and if so, to what extent?

Basic sciences are taught for certain majors and specialties. But even across Central Asia, there is no narrow specialization that would prepare these specialists.

RECOMMENDATION:

For the development and revival of the graduation of restorers, it is necessary to take the existing training programs as a basis and adopt them to our conditions. It can be a specialized department or a group of university departments of architectural and construction major. These specialties can be prepared from the second year of the bachelor's degree or master's degree. Considering the availability of production and laboratory facilities, we consider it expedient to train craftsmen of restorers of various specialization at the middle level in special schools located at institutes. These schools can teach drawing, sculpture, folk crafts, ceramics, bricklayer restorers, decorators, woodcarving, metal forging, and more, etc. The term of study is 1-2 years for obtaining a specialized diploma.

Our specialists of Geofundamentproekt LTD at Samarkand State Institute of Architecture and Construction are not only teachers of this university, but also have extensive practical experience with the work of architectural monuments. We, in cooperation with the Weimar and Potsdam University, have carried out the strengthening and reconstruction of such unique monuments as Tilla Kori, Ishratkhona and Shikhi Zinda in Samarkand. Consulted the department of preservation of historical monuments in Bukhara. They have a large laboratory base, as well as highly qualified specialists in architecture and engineering and construction.

CONCEPT FOR THE RESTORATION OF MONUMENTS AND THE PRESERVATION OF THE TRADITIONAL ARCHITECTURAL DESIGN OF THE TERRITORY NEAR-BY TO THEM

The historically established practice of reconstruction of architectural monuments included:

- Analysis of archival architectural and constructional materials carried out on this site of the monument;
- Study of technology and methods of production of building materials (ceramics, binders, majolica glaze)
- Preparation of a project (architectural and construction drawings) for the restoration of a certain area or the whole object;
- Organization of a competition for the recommended project and its expertise among local specialists, with the involvement of foreign experts, for example, UNESCO (if necessary)
- Certification and laboratory confirmation of the quality and durability of building and finishing materials.

Conducted restoration work in one area should not negatively affect and provoke deterioration in the quality of the historically formed physical and mechanical properties (modes) and conditions in the structures and materials of the monument. For example, how strongly the relief will be reflected on the stability of the architectural monument; the degree of impact of continuous concreting or asphaltting of the earth's surface, the device of carpet, abundantly irrigated lawns on the accumulation of moisture or the formation of dampness in the building structure; how will the additional weight arising during reconstruction and the use of heavy materials such as concrete or reinforced concrete affect the structure of the building; during the reconstruction of the outer majolica of the domes, taking into



account the old bedding of the concrete screed and the problem of removing construction waste when organizing the roof of monuments, the correct organization of watercourses, etc.

When reconstructing historical monuments, architects must, strictly according to drawings and archival materials, restore those damaged places that have become unusable and have begun to crumble. First of all, it is necessary to eliminate the causes of such damage and then carry out restoration work. In principle, it is impossible to allow the restoration work of monuments until a scientific and technical report and a restoration project are drawn up and approved by an expert council, consisting purely of professional architects and engineers with experience in this field. When solving the restoration work of historical monuments, it is necessary to seriously substantiate the principle of its complete cladding (of the building) with modern bricks and artificial majolica. Such a well-established method of restoration in Uzbekistan contradicts international requirements for architectural monuments. These include such monuments as Rukhabad in Samarkand, the At- Termiziy and Nur-Ota mausoleums and many others. This leads to a violation of the historical appearance and its historical significance.

Acceptance of restoration work, and the drawing up of an act must be carried out by representatives of the protection of monuments, designers and public organizations.

Special requirements for the improvement of the territory adjacent to architectural monuments. Recently, at the beginning of Ak-Saray in Shakhrisabz, in subsequent other historical cities, they began to massively resettle and destroy the traditional residential infrastructure and instead introduce modern park landscape architecture from blank paper. Moreover, it is not difficult for a specialist in park landscape design to make sure that the design is uniform, consisting of a huge area of a branched covered asphalt or cobblestone paths, a lawn with abundant irrigation and pine trees. This park architecture, typical of European culture with a moderate temperature, does not quite fit the Central Asian climatic zone with a hot and dry climate. Moreover, the composition of native trees for traditional densely populated historic housing and localities does not match that shown in the design solutions. The adaptation of the surrounding area to architectural monuments is indeed a difficult task. The state spends huge financial resources on compensation and reconstruction and improvement of the area. It seems to us that we need to announce a competition for the best project of reconstruction and improvement of the adjacent to the architectural monuments. Undoubtedly, old craft traditions, private souvenir shops, teahouses and other objects should be taken into account.

10. Bakhodir Matchanov

Chief architect and specialist at Principal Department for Preservation and Utilization of Cultural Objects of the Ministry of Culture of the Republic of Uzbekistan.

REPORT

This article discusses the laws adopted by the state in the field of preservation and use of real estate objects of tangible cultural heritage, the achievements, research as well as promising projects carried out in the educational process. Moreover, there will be proposals for repairs, restoration and archeological research, the creation of a Master-Apprentice system, and the elimination of some of the shortcomings that need to be addressed, such as the impact of the environment on historical monuments.

Uzbekistan is well-known all over the world for its high spirituality, invaluable historical monuments and relics left by our ancestors. The monuments that have survived to the present day have experienced various historical and natural disasters.

After gaining its independence, the treasures of our rich culture, spiritual, historical and architectural heritage began to be investigated in our republic, including historical cities such as Samarkand, Bukhara, Tashkent, Andijan, Shakhrisabz, Khiva and Termez which became more beautiful and started to amaze the people of the world again.

Architectural culture has always served to enhance a spiritual maturity of society by fulfilling its educational function. Therefore, existing problems in repairing historical monuments, taking the concepts created by repairmen into account and their study as well as their analysis are one of the actual problems. In order to solve these problems, a number of state laws, decisions and orders have been adopted and are realized in our life in our country. The adoption of the laws of the Republic of Uzbekistan #269-II "On protection and use of cultural heritage objects" dated August 30, 2001 and #229-DRU "On protection and use of archeological heritage objects" of October 13, 2009 can be a clear example of this.

Besides that, as most of the cultural and archeological objects need repairing, the effective use of their tourist potential does not meet required level the Decree of the President of the Republic of Uzbekistan # F-5181 "On improving the protection and use of objects of material cultural and archaeological heritage" dated January 16, 2018 was adopted. The main aim is to create a single constantly renewable electronic database, which will contain a complete inventory of all material, cultural and archaeological heritage objects in the country, preparation of their passports, demarcation and protection of their boundaries, as well as detailed information about the results of the inventory.

In order to improve the protection and use of cultural heritage objects in Uzbekistan, to pay special attention to their restoration, to ensure the preservation of cultural heritage places in the original as much as possible, the order #VM-265 "On approval of some normative legal acts on the organization of the Department of Cultural Heritage under the Ministry of Culture of the Republic of Uzbekistan and the protection and use of material cultural heritage" dated March 30, 2019 was adopted on the basis of the Resolution PQ-4068 "On measures to radically improve the activities in the field of protection of material cultural heritage" of the President of the Republic of Uzbekistan dated December 19, 2018. One of the main objectives of this order is to organize Scientific-expert council of the Cultural heritage department under the Ministry of Culture of the Republic of Uzbekistan. The Council consists of 11 scholars and highly qualified specialists who have much scientific and practical experience in the fields of history, architecture, material cultural heritage. According to the tasks of the Council, it takes an active part in the scientific consideration of the problems arisen in the process of protection and use of material cultural heritage objects, the preparation of practical and scientific proposals the solution of above mentioned issues and their realization. Besides that, it deals with summarizing the projects related to the excavation, land management, construction, melioration and other domestic affairs, conservation as well as scientific and technical investigation on real estates and their protected areas of material cultural heritage. Moreover, the Council gives scientific conclusions on separately protected historical-cultural areas, reliably protecting the places belonging to the UNESCO World Heritage List in accordance with their historical-cultural value, construction, installation and beautification works in these areas without negatively affecting their incomparable universal value. The conclusions of the Council shall be compulsory to be realized by the Department.

Today, there are 8208 objects of material-cultural heritage in our country, of which 4748 archeological objects, 2250 architectural monuments, 678 monumental works of art, 532 sightseeings of cultural heritage objects. The cities of

Samarkand, Bukhara, Khiva and Shakhrisabz are included in the UNESCO World Heritage List as protected historical monuments. In addition, more than 2.5 million museum items and collections are kept in the museums.

Although much is being done to realize scientific practical prospective projects related to protecting, repairing, investigating and using effectively our cultural heritage as a national wealth, there are still some actual problems which should be solved.

Although the repair and restoration work on the objects of material cultural heritage is at the desired norm, in some cases it is observed that repair and restoration of monuments carried out purposelessly, without scientific study, without the completion of the project, chasing the plan. Before carrying out repair, restoration and conservation work on monuments, we should, first of all, find preventing measurement by studying their current condition scientifically and what factors affect their deterioration. Monuments should deeply be investigated by leading specialists such as scientists, architects, archeologists, engineer-constructors, geologists and art historians to carry out such work. In addition, in case the study by means of the available scientific literature, photographs, and information is insufficient the views of older people living in the area where the building is located should be taken into account.

It is no secret that in some cases, repair, restoration and conservation work is being carried out by contractors who have not enough experience in repairing cultural heritage sites and do not know the secrets of repair. Reconstruction of the foundation and roof of the monument, which has a history of several hundred years, without adequate study, finishing work only on the exterior and interior of the monument, as a result of which groundwater is damaging the foundation of the building. In addition, due to incomplete and non-perfect repair of the roof, as a result of moisture passage, the repaired building remains in need of repair the following year. The 16th-century Ark Ichi Madrasah in Andijan repaired in 2016-18 can be mentioned as a clear example. As a result of poor quality repairs, due to the passage of snow and rain water through the roof of a large room, the bottom of the dome became damp, the plaster began to remove, and the natural ventilation system of the room was destroyed. Moreover, due to the lack of engineering work in the foundation part of the madrasah, groundwater badly affected the foundation part of the building. Moisture appeared in the foundation of the building as a result, and the plaster on the cell walls began to remove.



Figure 1. Andijan. Arc Ichi Madrasah.



Figure 2. Arc ichi Madrasah. The lower part of dome of the big room

It is necessary to restore the existing repair shops of monuments in each of the existing historical monuments to prevent such incidents. For instance, there was a repair shop named after Usto Shirin in Bukhara in the thirties of the 20th century. There were thirty repair masters of different levels and about three hundred assistant workers based on the traditions of the master-apprentice in this enterprise. Most of such repair masters are closed at present time, the remained ones do not meet contemporary requirements. There will be an opportunity to organize repair work properly in case the existing workshops are widened, new working places are created, working conditions are optimized.

As time passes earthquakes and other natural disasters cause some of the monuments to damage and collapse. For this reason splendid houses of certain time remained till present time as historical monuments needing repair as time passed. As natural influences have negatively affected the monument over the years, some of the practical work being done by human being has led to the complete disappearance of the historical monument and the emergence of new- looking buildings in its place. The work on restoration and reconstruction of the mausoleum of Shamun Nabi belonging to the 13th-14th centuries in the Mizdakhkan historical and archeological complex of Khojayli district of the Republic of Karakalpakstan led to destroy the building and rebuild it. New building is built instead of the historical monument. Unfortunately, repairing many monuments, which are our historical treasure, are entrusted some inexperienced designers and repairmen. The work they do is then accepted by the staff of the Regional Cultural Heritage Department without in-depth review.



Figure 3. The mausoleum of Shamun Nabi: before and after repairing

At the same time, when a working group was established to monitor the construction work in 2018-19 in Samarkand, law-breaking was detected at 159 illegally constructed objects in the historical and buffer zones of the city. As a result of such modern constructions, the city architecture also disappears along with the historical appearance of the city.

One of the most actual problems of the present time is the problem of protecting material cultural heritage in our country from negative environmental influence. One of the main reasons of the negative environmental consequences is the violation of the principles of the use of land, water and mineral resources. The natural balance is destroyed as a result of high ecological threat which arose as the Aral Sea dried up and stretched for several thousand square kilometers, millions of tons of dust and salt, which cannot be observed by a naked eye, were blown away with the wind every year [1].

Such factors have a negative impact on cultural heritage sites in areas where air, water and soil have changed, degraded. It also causes the destruction of archeological objects under the influence of anthropogenic processes which means that not only does man destroy the traces of the past, but also the nature equally affects this process. [2].

It is no secret that archeological sites are severely damaged as a result of the acquisition of new lands by farmers around material cultural heritage objects. Under the influence of such factors, historical monuments can be completely destroyed. This type of land use is frequent and the impact in terms of territory is also of great importance.

One of the unfortunate cases is that there are cases when archeological monuments are used as cemeteries. For example, in the Andijan region alone, there are 221 archeological sites, 95 of which are used as cemeteries. Cadastral documents of these objects were prepared in 2019



Figure 4. Kurgantepa district. Archeological monument Sul-tonobod 1. BC 4th – AD 8th centuries

When a new tomb was being dug in the part of the archeological monument "Sultanabad-I" used as a cemetery, very unique pottery and archeological objects were found. It should be noted that no matter wherever place was dug, there were found earthenware items such as jugs, jars, bowls.

It is necessary to move gradually the existing cemeteries located in cultural heritage objects to other areas in order to preserve and fully protect these archeological monuments. It is also necessary to organize annual international expeditions, conduct scientific research and analysis of ancient archeological sites with a history of several thousand years. Many countries have enough experience in restoring archeological sites after excavations at present. It is possible firstly to protect archeological sites from human destructive influence, secondly to control the destruction of archeological sites due to natural and anthropogenic factors.

Another actual issue is the deterioration of monuments in the historical cities of Khiva, Bukhara and Shakhrisabz due to the influence of groundwater, damping and salinization of the foundations of monuments. It is clear that the prevention of such affects and their solution are effective means of reducing groundwater levels with modern technical equipment, special pumps and vertical drains. It is advisable to plant damp absorbing plants, i.e. mulberry trees, which absorb moisture at the same time.

Restoring monuments and giving them a second life is a very delicate and difficult task. This good work requires a high level of creative skill, delicate taste, intelligence, quick wit, knowledge, diligence, patience, will and perseverance from the master. Some confusion and errors occur in the repair work in most cases when above

mentioned rules are not followed. More specifically, the sacred laws of quality and efficiency are being violated in repairing. [3].

The issue of training repair specialists, unfortunately, still remains as a difficult problem. A modern restorer, who meets today's requirement, should be able to study, analyze and critically evaluate international experience in the sphere of repairing, adaptation and restoration of the material cultural heritage objects and apply them in their professional activities. It is necessary to study the traditional schools of architecture formed over the centuries about the reconstruction of existing historic buildings and the repair of monuments. It is important for a restorer to choose the right style and justify it when repairing historical monuments. It is necessary to consult with the proper experts and carry out repair work on the monuments while developing project documentation. In addition, the negative effects of seismic factors on the longevity and durability of cultural heritage objects have not yet been sufficiently studied in practice. The problem of training engineers in this area should be positively solved

Indeed, there is a shortage of experienced specialists who can teach theoretical and practical skills to students in higher educational institutions in the field of repairing, restoration of objects of material cultural heritage. The solution to these problems is to teach traditions of our national architecture deeply, to give theoretical and practical skills on repairing historical monuments to the students studying at universities and professional. It is necessary to organize training courses for teachers in close cooperation with scientists, folk masters, restorers, experts in order to raise the effectiveness of education to a new level of quality. It is also necessary to organize "Master-Apprentice" schools, to educate talented students, to teach students the experience of folk masters of the past and to put complexities of repair into practice, as well as to enrich practical knowledge at the same time. As a result, the connection between theory and design will completely, consistently be supplied.

Tashkent Institute of Architecture and Construction is considered to be a base university in the country, majoring in "Reconstruction and Restoration of Architectural Monuments" and specialty of "Architectural Theory and History, Restoration of Architectural Monuments", and the National Institute of Fine Arts named after Kamoliddin Behzod prepares specialists on "Museology, Conservation Repair and Maintenance of Historical Cultural Objects". It is necessary to revise the disciplines and programs of master's courses and different other specialties in the institutes where repairing, restoration and conservation of objects of material cultural heritage are taught, prepare textbooks and manuals in accordance with modern requirements. It is pleasant that the higher education system has been reformed based on the experience of foreign countries recent years. However, there are still certain shortcomings in the management of some documents, and it is necessary to improve the ways to solve them. For instance, curricula are re-prepared in the departments preparing specialists and signed and approved by the head of the institute in consultation with the relevant ministries and organizations before the start of the academic year. It is advisable to prepare academic curricula by deeply analyzing the subjects related to the specialty. For example, the subject Philosophy in the block of natural sciences and humanities should be registered as "Philosophy of Architecture" for architects and restorers, the subject of "Construction Management" in the block of general sciences should be renamed as "Expertise and Management of Cultural Heritage Objects" and it should be organized retraining course for teachers who teach these disciplines.

It is necessary to arrange a modern laboratory and repair workshop in the specialty field and provide them with the necessary techniques, equipment and training aids and raw materials in order to develop practical knowledge and skills of graduates. Moreover, it is necessary to take measures such as the organization of student internships in real workplaces in the cultural heritage places, where repair work is directly carried out, provide them with internships in foreign countries.

The Scientific-Research Pedagogical Institute (UzSRPI of Restoration) which dealt with repairing, restoration and conservation of material cultural heritage objects in Uzbekistan was established in 1978. Main objectives of the Institute were preservation, repairing, use, analysis of monuments in Central Asia, and developing this area when the institute operated. As a result of the analysis, the progress of repair work carried out at the Institute gradually improved to the level required by the guidelines and instructions set out in international conventions. The comparison with international repairing experience shows that the study of monuments of our country, research methods and practices were at a high level, there was an opportunity to implement all types and technologies of repairing in international practice. Both ancient and modern methods of repairing were equally used. The institute was closed in 1996 as a Limited Liability Company for unknown reasons.

The Decree of the President of the Republic of Uzbekistan # PP-4730 "On measures to improve the activities of the Ministry of Culture of the Republic of Uzbekistan" May 26, 2020 was adopted at present. One of the main objectives of this decision is to establish Scientific- Research Institute of Cultural Heritage under the Ministry of Culture of the

Republic of Uzbekistan. This order, made by the President of the Republic of Uzbekistan Sh.M.Mirziyoyev, has become a priority for scientists, specialists and staff working in the field of material cultural heritage. The establishment of the institute will serve to train scientific and qualified specialists, to increase the number of masters in their field, to bring the repairing monuments to a new level. Besides that, the main aim and task of the institute is to use modern technologies as well as restoration of schools of repairing developed through centuries to improve archeological investigations and making museums as well as repairing, restoration and conservation of cultural heritage real estate objects based on the achievements of construction, physics, chemistry, biology, art history and other disciplines taking specific peculiarities of Uzbekistan into account.

Based on modern material and technical base and physical and chemical laboratory equipment, determining the date of construction of the monument and repairing and restoration of monuments are worked out. They can be used to determine the specificity or difference in period of building materials in different parts of the monument.

Microscopic analysis provides important results in the study of not only mixtures but also bricks. Raw materials, such as limestone and gypsum, which are mined from different deposits and are similar in appearance, can vary greatly in composition, in particular, they can be identified by petrographic analysis. [4].

It is possible to obtain information about the composition of glazed tiles, their application and preparation process with the help of laboratory research, and such information will help to recover lost parts. Some analysis, however, helps to reveal very subtle mysteries of monument construction.

It is necessary to reorganize koshinburrish (decorating with frieze) work based on the study of the Iranian experience to develop frieze work. We also need to use German technology, which is a world leader in the field of repairing, in a repair work. As a variety of new modern repairing materials are being produced in the world day by day, it is necessary to develop measures for the production of repairing materials by using local raw materials and their application in the restoration process on the basis of new technologies in the country through their study and analysis.

Using modern ultrasound tool is important in the repair work. It is possible to detect defects in walls, fences, structures made of different materials up to 5 meters thick with the help of this tool. [5].

The use of georadar in archeological research greatly simplifies the work of archaeologists and provides a lot of additional and useful information, which significantly saves time, investment and labor costs.

Representatives of modern restoration industry should not only carry out project proposals on the basis of new programs, but also to study and develop ancient repair methods which have been formed over the centuries.

Moreover, the masters working in the contracting organizations are required to know the ancient processes of building architectural monuments, arches, domes, as well as various methods of making ganch (ornament made of plaster), koshin (tile), muqarnas (carving inside part of a dome in the shape of a round cup) and kundal (embossing on the walls) in the creation of artistic decorations. This, in turn, will contribute to the further development of the repair industry in Uzbekistan, as well as this field to meet the requirements of international conventions.

Above-mentioned methods of repairing can properly be chosen depending on the condition and nature of thousands of cultural heritage objects in Uzbekistan. Only projects and plans based on the results of in-depth thorough research should be foundation for this work. An analysis of the repair work carried out in the last century confirms the validity of this conclusion.

Repair, restoration and conservation work are carried out at 60-70 monuments included in the repair plan by the state a year. The number of cultural heritage objects in the country is more than 8,000, and most of the monuments are not in satisfactory condition, especially urgent measures should be taken to prevent damage and destruction of archeological sites. As a result of the organization of fundamental and applied research in this field, and effective use of the achievements of science and innovative technologies, design, repair, restoration and conservation work will have a positive impact on preserving the uniqueness of material cultural heritage sites.

Indeed, measures are being taken to develop projects for the reconstruction of historic cities, settlements and protected areas of cultural heritage places. Restoration of the historical appearance of the environment of objects of material cultural heritage, the implementation of amenity projects for local and foreign tourists have been put into practice. A scientific approach was given to the concept of a historical place and its restoration. Along with repairing and beautifying the shrine and its ancient components, the problem of removing structures which do not belong to the shrine has also begun to be solved on a large scale. For example, various factories near the Guri Emir complex and the mausoleum of Burkhaniddin Sogarji (Rukhobod) in Samarkand have been removed from the



historical area, and some of the complexes around the ancient monuments have been restored to their relatively original state. This has become an important direction of repairing sphere of Uzbekistan and has been introduced into the practice of urban planning.

Based what has been mentioned above, it is possible to draw a general conclusion that the continuation of positive changes in the teaching of this specialty, the elimination of obstacles will improve education in the field of architecture and repairing. This, in turn, will give an opportunity to fully meet the high standards set by our country in the field of repairing architectural monuments and reconstruction of historic cities.

In short, historical monuments and relics are unique means expressing long history of our country and our rich national culture. We must consider each monument as an invaluable piece of architecture, preserve and hand them on to future generations.

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