Technologies for Safeguarding of Cultural Heritage in Slovakia

State of the Art report

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1. Introduction

Even the realisation phase of cultural heritage safeguarding belongs to the most important phases of whole this process, not enough attention is still given to it in Slovakia. A good realised renovation can successfully fulfil all ideas, concepts and designs, but a wrong realised one can destroy any best designs - it can even destroy historic building as a whole.

Building tradition on Slovak territory goes back for centuries. Probably the oldest masonry work in Central Europe (walls, gates, pavements) – 3.500 years old was found in Spišský Štvrtok (Northeast Slovakia). First modern materials (bricks, roof tiles, lime, etc.) and technologies (masonry works, plasters, hard floors realisation, roof tiles covering, etc.) were used in Western Slovakia by Romans – 2.000 years ago. Early Middle age time handled already such materials and technologies routinely. Existence of professional builder's communities – buildings works in several regions of nowadays Slovakia during the top Middle age times was current and the results of their work still belong to the most valuable parts of our cultural heritage. Even such cities like Vienna and Budapest were co-built in 18th and 19th century with a major participation of builders and handcrafters from our region.

Unfortunately - this continuity was hardly influenced and damaged by the communist regime. Independent building companies were liquidated, education and training of skilled handcrafters was reduced mostly on modern concrete block of flats technologies and the overall bad motivation led to rapid degradation of building works quality. Results of such development are seen everywhere and it will take decades to overcome them.

2. State of cultural heritage in Slovakia

2.1 Legal protection and registration

Legal protection of cultural heritage has a long tradition on our territory. The first general (Hungarian) act of architectural heritage protection was given in 1881 (not to mention several particular Acts of the Queen Maria Theresa and the King Joseph II. in 1749, 1776, 1782). In 1958 new and relatively progressive Act (No. 27/1958) was given by the National Council of Slovak Republic. This Act was later replaced by a new, but not that progressive one in 1987 (No. 27/1987). Since the 1st of April this year the newest Act on cultural heritage protection was set into function. According to it single architectural, archaeology and industry heritage buildings (non movable things), or building complexes are registered as Cultural Monuments (app. 12.000 buildings). They can be placed either in an independent position, or they can belong to an area of higher cultural value. According to it the Act divides such areas into three levels:

- Reserve of Monuments (core of settlements of highest value, 28 in Slovakia - 18 of urban type, 10 of rural type)

- Zone of Monuments (cores of settlements of lower value, about 88 of them in Slovakia nowadays)
- Zone of Protection (usually laid around settlements, or monuments of highest value)

The registration of cultural property is a task, which is to be fulfilled by the state. Already in 1951 an institution for cultural heritage protection was established – nowadays under the name Monument's Office. This office has its centre in Bratislava and works through eight regional offices spread according to counties.

Cultural monuments protection is also reflected in other laws, like for example the Building Act. According to it all building plans on monuments – buildings, as also on protected areas (even the building work which are planned to be realise on not protected buildings) have to be consulted in beforehand with state cultural monuments protection authority. If any historical or archaeological findings are made during the realisation, the renovation works have to be stopped immediately and an authorised officer has to be informed.

2.2 Technical state of non-movable property

According to the information of the Monument's Office, approximately ¼ of all monument buildings are in partially, or critically damaged technical state. The main reasons of this situation have to be found in political change in 1948, when the communists took over the power. Due to socialisation of private property most of the buildings have lost their owners, who naturally and continuously organised a regular maintenance of them. Also the isolation from modern world (information, materials and technologies) and general lack of state funding has caused introduction of not appropriate building materials and technologies.

2.3 Influencing of building's renovation realisation process

Realisation of building works on architectural heritage is under control of state Monuments offices. Already in preparation process they give their demands for protection of constructions, historical material, details, etc. of the building. Before a renovation process can start an official standpoint of Monument office to the design is required. During the renovation works a supervisor from Monument office controls the quality of them.

Besides highly motivated and technically educated, e.g. skilled officers, there are still officers to meet, who are not enough educated – especially in building technologies and materials. This usually leads to conflicts with building companies, resulting in a lot of cases to damages on architectural heritage. Such conflicts (those who results from not appropriate technical knowledge) creates then a bad image of Monuments offices officers and they lead in some cases to ignoring of officer's standpoints by the realisators, or even to hiding of archaeological, or historic findings which occur during the realisation. But also a shallow understanding of architectural heritage renovation methodology and of the background of officer's standpoints, leading then also to conflicts during realisation, from the side of realisers has to be mentioned.

3. Realisation of renovation works

3.1 Structure of realisation relationships

An owner or a manager of the property usually finances the building works. Designers of projects (usually architects, or building engineers – e.g. a private designing company) have to be authorised to such work as persons – passing special examination. Also a certain practical experience is required. Realisers – usually a private building company are during the realisation controlled by a Building Supervisor – an educated authorised person, passing special examination. Also a supervisor from Monument office and from the side of the designer usually takes part in the

realisation process. There is no special knowledge, or skills officially asked for work on architectural heritage renovation, neither from the designer, nor from the realiser.

3.2 Designing of realisation process

Each building realisation (except of simple, or little extended works) needs to be prepared. To ensure a proper pre-realisation phase directives for pre-realisation designing were introduced in Slovakia already in seventies. This part of the whole designing process was obligatory realised by the realisator – a building company - in several steps (according to extend of building works - up to three). In early nineties the pre-realisation designing process position was changed from obligatory works to works free of choice, which practically means – the realisators usually puts now quite a limited, or even no attention to it.

Building companies usually underestimate pre-realisation site surveys and they are often not enough educated in methodological questions of protection of monuments. This leads to use of inappropriate technologies and building materials and to several conflicts with Monuments offices officers, trying to ignore their expert standpoints and to force “builders” solutions. Underestimating of pre-realisation preparation also means the need of solving several practical questions on the building site, forcing interests of “builders” rather then of monuments protection.

3.3 Available technologies

Up from the beginning of nineties there are no artificial barriers for introduction of any modern materials and technologies (technologies of buildings = techniques and procedures of buildings realisation) into Slovakia and to use them also in cultural heritage safeguarding. There are now other limits, which influence results of building works:

- First of all is an appropriate knowledge of long-term influence of materials and technology procedures to old building constructions, or even knowledge of appropriate technologies for use on architecture heritage at all.
- Another very important limit is general lack of funding for architectural heritage conservation - even a lot of available funding does not directly lead only to an appropriate realisation.
- The choosing of technologies, in several cases, happens on a level between a building company (which offers “their” technology they have the capacity to realise it – must not be fully appropriate for use on “that” exact building) on one side and the owner (who usually does have very limited knowledge on long-term influence of materials and technologies to “his” building, but is for the first sensitive to the cost of works) on the other side.

3.4 Ensuring of realisation

Even the right choose for an appropriate technology is still not a victory. Several technologies are very sensitive to the right way of their application – to exact following of its realisation procedure. Results depend on skilled, handsome, motivated and disciplined workers and their managers. Such teams are available – but they are difficult to find. Or they need to be educated, which needs some time and this is not always possible to get.

4. Overview on typical technologies used for renovation of architectural monuments In Slovakia

4.1 Destruction of constructions

Techniques used in Slovakia for destruction of constructions can be divided into several groups:

- **Destruction by handwork** - Suitable for small amount of works, or in the case of destruction of constructions built from high quality historic material. Can be highly recommended for further use (recycling) on other historic buildings, or construction, subsidising missing historic material. Some of Monument offices in Slovakia have a special storage for such materials, but a specialised market with recycled building materials in Slovakia does not exist.
- **Destruction by using mechanisms** - Widely used in Slovakia, but usually by using only small – hand mechanisms, not huge machines.
- **Specialised ways of destruction** - Techniques using explosives, expansive power of some materials, burning through constructions, water streams etc. cane be mentioned. Use of explosives is limited only to authorised personal.

4.2 Dealing with basements

Technologies for dealing with basements in Slovakia (deepening, widening, and strengthening) can be divided into two groups:

- **Traditional technologies** - Using masonry works, or using concrete are being recommended for use at small buildings, small parts of fundaments to be deal with, at simple problems, etc. Procedure of their realisation is usually organised into narrow sections (app. 1 meter), to ensure an excellent connection with old constructions. During realisation of such technologies a massive support of other load bearing construction of handled building is usually needed, with precise monitoring of its possible deformations. These technologies are considered to be risky - because of a high probability of damaging of the handled building.
- **Progressive technologies** - Techniques of injections, piles and flow injection can be mentioned. Such techniques are recommended for use at complicated geological situations, highly damaged, or large buildings. They are usually more expensive as traditional technologies, but are less risky. Nowadays usually micropiles and stream injections – soilcrete techniques are used.

4.3 Moisture problems solutions

Dealing with unwanted moisture in buildings is one of typical problems of architectural monuments renovations in Slovakia. Beside a wide knowledge of possible technologies, there is only a limited knowledge of real acting of moisture in constructions, which does not always lead to dealing with this problem in the right way. Nowadays used technologies to fight moisture can be divided into following groups:

- **Ventilation technologies** - Such techniques are based on establishing such an air flow around humid construction, which allow the moisture to dry fully, or particularly out. They are usually realised by digging a channel around outside constructions, or using special profiled foils to ensure enough ventilation. Such technologies are considered as “soft” technologies, invading handled building on a minimal way and are therefore highly recommended for use at historic buildings.
- **Supplementary insulation technologies** - Such techniques are based on a principle of adding an extra mechanical moisture barrier – foils, or tins into the walls. There are several ways and procedures how to realise them, but such methods are also a bit risky, because they usually have to cut the building, or a handled construction in horizontal level. As such methods are of invasive nature, they are usually not very welcomed by architectural conservation officers.
- **Technologies of infusion barriers** - Such techniques are based on infusing chemicals into constructions, which afterwards – after their crystallisation create a physical barrier to moisture. Use of such techniques was widely spread in eighties, but their results are in some cases

controversial. Such techniques are sensitive on a precise way of following their realisation procedure; they are expensive and if to use them, a high pressure and individual proportioning, rather then air pressure and common proportioning of splitter holes can be recommended. As such methods are also of particularly invasive nature, they are usually not very welcomed by architectural conservation officers.

- **Technologies on based elektrophysical principles** - Such techniques are based on several ways to create an electromagnetic field in construction, which forces the molecules of moisture to move out of it. Even such techniques can be obtained in a form using modern materials based on scientific experiments, results of using them are doubtful as there are not very much examples of their successful realisation in Slovakia.
- **Additional technologies** - Among additional technologies especially diffusion-isolative plasters can be mentioned, which are widely used since nineties. Results of their use looks to be promising, as their application (even in many difficult conditions) was successful. Even they can be (on a lower quality) prepared at the building site, premixed dry commercial products of high quality are used. As such method is not of invasive nature, it is usually welcomed by architectural conservation officers.
- **Related technologies** - Among related technologies such techniques can be mentioned which lower the content of moisture in the soil, surrounding a building. Diffusive paving were during last decade widely introduces into cities and drainage are widely recommended - and also used, but they are often considered as the only one non-invasive way to deal with moisture, which does not always work.

4.4 Handling of load bearing constructions

Failures of load bearing constructions (horizontal, and vertical) like walls, columns, vaults, ceilings, and roofs are quite common, as they usually refer to not appropriate or missing maintenance in the past and they are usually to be found on about ¼ of architectural heritage buildings in Slovakia. Problems of designing appropriate technologies can be divided into following groups:

- **Right judgement of the reasons of failures** - Not always the right reason for damages – crashes in constructions are being handled, as there are technologies on the market - aimed on dealing with consequences, but used for solving failures, without handling their reasons. In 70-ties and 80-ties usual way of strengthening constructions was the use of deep injection of cement based mortars into the joints. This technology was introduced in a massive way not respecting an actual state of walls – it was even used in situation, were it was not needed. Results are now non-reversibly “concreted” historic masonry works.
- **Following of methodology** - Even modern methodological recommendations for architectural monuments protection are known in the country, they are usually not followed. The best example is use of concrete, or reinforced concrete also in such situations, where it is not needed for ensuring of stability of the constructions.
- **Preparing right mortar mixes** - Mortar mixes are usually based on cement, in last years with an addition of lime, but generally not following methodological recommendations concerning matching of new mortars to old ones and to ensuring reversibility of mortars. But there is also a not appropriate knowledge on acting of materials in constructions and any clear recommendations for mortar mixing aiming on Slovak reality were still not elaborated.
- **Dealing with conservation of ruins** - Slovakia is quite rich on ruins, especially on castle ruins, which usually contain only several vertical constructions and a few vaults. Clear conservation recommendations for realisation were still not elaborated; a lot of wrong techniques are used - like using cements, concrete, deforming the skyline of ruins by introducing straight realised top of walls etc. Some new solutions – like using small vegetation for protection of the top of wall

were introduced, but usually only on limited level and without enough in-country research background.

- **Handling of wood constructions** - Even the knowledge on real acting of wood constructions in buildings, coming out of in-country research is known in scientific circles, practical influence of such knowledge is limited. Wood is still usually considered as a material of low quality and short lifetime, which leads to several destructions of historical wooden constructions, like ceilings and roof, replacing them – in the best case – by new copies.

4.5 Plasters, floors, pavements, insulations, etc.

There are a lot of different technologies in the area of surfaces renovation, reconstruction, or conservation. Restoration works can be study at the University of Arts and the State Restoration Ateliers – a part of state structure of monument protection structure - work also for restoration of specific details for architectural heritage renovation. Besides restorators most of building works on surfaces is done by usual building workers, whose skills are on a various level. One of typical problems of plasters renovation at many historic buildings is creating of hard – plain surfaces (following nowadays regulation on plasters surfaces) instead of creating soft – crimpled surfaces.

5. Information, knowledge, skills, communication

5.1 Research

Continual, long-term research and monitoring of realised in-country renovations was usually (because of several reasons) interrupted, so there is only a limited precise knowledge on the reasons for success or failure of several technologies. Results of even those successful researches are mostly still not widely known.

5.2 Education and training

Due to many reasons there is not always a deeper knowledge of use of appropriate materials and technologies for architectural heritage conservation in Slovakia. Education on specialised **secondary schools** for handcrafters and for their foremen was during 70-ties and 80-ties deformed in favour of simplified building technology processes – panel block of flats buildings. During the last decade specific subjects were introduced into their curriculum in order to prepare workers educated and skilled in specific technologies used at buildings renovation - especially in failures renovations technologies area, as also in traditional technologies and materials.

On **university** level an education on building technologies for architectural heritage renovation (especially for realisers of building work – civil engineers, studying on civil engineering faculties) was not taught for some decades. The continuity of it was broken in 70-ties - renovation of cultural heritage was considered at very low priority. During the 90-ties it is now under slow introduction back into study programmes, but skilled and educated university teachers staff is still rare. A major attention to this topic is given at the **Civil engineering Faculty in Bratislava** – study specialisation **Realisation buildings**, where each year about 40 students can pass through a two years block of subjects oriented on realisation of renovation works.

Architectural heritage conservation was during the 90-ties widely introduced into post-graduate study programmes of several institutions (like **Slovak Chamber of Building Engineers, Academia Istropolitana Nova**, etc.), where also issues concerning realisation of architectural monuments renovation is taught.

5.3 Communication among architectural conservation realisation participants

Ongoing traditional division between groups of designers (usually architects), conservation officers (usually historicians, architects, etc.) and realisators (usually building engineer) contributes to formulation and defence of isolated group interests, instead of creating cross-sector cooperation. Also a not appropriate knowledge of architectural conservation methodology from the side of realisators, as also not appropriate knowledge on technologies from the sides of designers and officers does not help the establish the right way and level of communication.

6. Conclusions

Even the problems coming out of this analysis are sometimes highly urgent and the amount of problems and not appropriate renovation is still huge, there are already examples of realisations, which were managed properly and which can be shown as good examples. The amount of such one is growing.

To better nowadays situation in realisation of cultural heritage safeguarding in Slovakia several recommendations can be introduced, among them like:

- bettering and deepening communication among all involved institution,
- aiming of research on material and technologies suitable for use on Slovak territory,
- wider and accessible spreading of in-country experience,
- learning from foreign experience, especially from their basic research,
- establishing of authorisation for architectural heritage renovation realisators