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RELIABILITY, CONDITION DIAGNOSTICS AND RECONSTRUCTION OF THE EXTREMELY DAMAGED BUILDING

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Subject review

The paper presents condition diagnostics and reconstruction methodology of extremely damaged structures that is developed and improved by experts from the Faculty of Civil Engineering Subotica, University of Novi Sad. The methodology is presented through a case study example of the "Grand Terrace" - central building on the Lake Palić, built from 1909 to 1912. Its reliability decreased due to poor maintenance, damages propagated until structural collapse became imminent and in 1996 it was officially unusable. In early 2006, the Ministry and the city of Subotica initiated its reconstruction. Reconstruction plans were entrusted to experts from the Faculty. Condition diagnostics and proposal for interventions on the "Grand Terrace" were conducted during the first half of 2006. In early 2007 technical design was completed, reconstruction works were carried out from 2007 to 2012 and on September 1st, 2012, one hundred years after construction, an official opening of reconstructed building was held.

Keywords: *condition diagnostics methodology, damaged building, reliability, reconstruction*

Pouzdanost, dijagnostika stanja i rekonstrukcija ekstremno oštećenog objekta

Pregledni članak

Članak prikazuje metodologiju dijagnostike stanja i rekonstrukcije ekstremno oštećenih konstrukcija koju razvijaju i unapređuju stručnjaci Građevinskog fakulteta Subotica, Univerziteta u Novom Sadu. Metodologija je prikazana na primjeru "Velike terase", centralnog objekta na Paliću izgrađenom od 1909. do 1912. Pouzdanost objekta je zbog lošeg održavanja opadala, oštećenja su propagirala pa je 1996. zbog mogućeg urušavanja njegova uporaba zabranjena. Početkom 2006. nadležno ministarstvo i grad Subotica iniciraju rekonstrukciju objekta. Projekte rekonstrukcije povjeravaju stručnjacima Građevinskog fakulteta Subotica. Početkom 2006. izvršena je dijagnostika stanja objekta "Velika terasa" s prijedlogom intervencija. Početkom 2007. završeni su projekti, a u razdoblju 2007. ÷ 2012. izvršena je rekonstrukcija objekta koji je svečano otvoren 1. 9. 2012., 100 godina nakon izgradnje.

Ključne riječi: *metodologija dijagnostike stanja, oštećeni objekat, pouzdanost, rekonstrukcija*

1 Introduction, basic description of the building and its surrounding

Lake Palić was first mentioned in written documents in 1462 as "Paly" [1, 2]. Since the end of the 18th century it was known that the lake water and mud had therapeutic properties so medical doctors from Subotica proposed, in 1837, the erection of the public bath on the lake shore. In 1845, near the bath building a tavern was built and this was a foundation for the future wellness resort. Beside medical and therapeutic reasons, guests visited Palić due to its rich fun and recreational offer. The golden age of the Palić bath and wellness centre began after the construction of the Budapest-Zemun railway in 1883 and a tram line to Subotica in 1897. Number of visitors continuously grew until the beginning of the 1st World War partially due to personal efforts of Mr. Lajos Vermes, sport enthusiast who, in the Olympic spirit, organized sport tournament on the Palić Lake shores in 1880 [2]. A tournament gathered hundreds of world best sport competitors 16 years prior to renewal of modern Olympic Games by Pierre de Coubertin. In the period between 1880 and 1914 in Palić there were regular sport events such as race-walking, cycling, wrestling, fencing and other sports while long tradition was created for rowing, sailing, different ball games, bowling, swimming, skating, ice sailing and tennis [2].

Central building of the Palić Lake complex is the "Grand Terrace" (Fig. 1). that was built in the period from 1909 to 1912 in the Hungarian Art Nuevo style (Hungarian Secession) as multipurpose building with ball rooms and two large terraces where ballroom dance venues, parties, theatre plays, sports competition and art exhibitions were held [2, 3]. The building's net area of 3300 m^2 is organized in a rectangular layout that is spatial diverse with terraces, semi-circular bays and vaulted central pedestrian passage that separates the basement and the ground floor of the building in two symmetrical parts. The hip roof has a central tower with decorative sun symbol on its top. On the northern facade of the building, above the passage, there is a closed terrace covered by the semicircle timber dormer, decorated by wood carvings. South facade of the building, towards the lake, symmetrically positioned relative to the passage, is dominated by two large timber terraces with rich, colourful, decorative local folklore motives carved in wood. Side facades have stairway towers with pronounced timber dormers and semi-circular orioles at their corners. Windows are irregularly positioned and divided into square panes. The basement and ground floor are symmetrically positioned beneath the building and they represent separated spaces within the building. First floor is dedicated to grand and small halls and lake view terrace. Communication through the building is done via two stairways in both sections of the building. The building has continuous foundations made from bricks and with foundation base situated beneath the ground water level that is equivalent to water level of the lake approximately 50 meters away. The structure of the building is made from bricks that partially form a composite structure with timber and/or steel structural elements. Roof structure is made from joint structural elements in timber and steel. Floor structure above the basement and ground floor is made from a system of orthogonal arches and brick barrel vaults supported by walls, steel profiles and arches. Special segment of the structure is vaulted, metal lathe plastered, concrete structure above the grand hall on the first floor that is supported by massive side brick walls and suspended by steel and roof structure above it [1, 4, 5].

a) Palic Lake complex - location of the Big Terrace

b) Big Terrace - The view of the building in 1912 just after the construction

Figure 1 Location of the building and its original shape

During exploitation, maintenance of the building was inadequate and resulted in significant damages and subsequent removal of two semicircle apsidal annexes from the north facade in 1977. In 1991 few interventions were conducted in order to prevent ground floor terraces from collapsing. At the beginning of 2006 the ministry in charge and the city of Subotica, through National investment plan, initiated reconstruction and restoration of the building that is under official state protection as the immovable national cultural heritage [4, 5, 9].

2 Condition diagnostics of the building

Engineers from the Faculty of Civil Engineering Subotica prepared a plan for condition diagnostics of the building which was subsequently accepted and approved by the Investors and according to which condition diagnostics of the overall building was performed [1, 6 ÷ 14]. This, among other, included:

- visual observation,
- gathering and analysis of available technical documentation related to the building,
- expert detailed investigations,
- identification, classification and categorization of all damages and other defects of the building,
- identification and classification of causes to identified damages and defects,
- civil and geodetic surveys and measurements,
- sampling and laboratory testing of material properties,
- foundation probing and geomechanical investigative works, sampling and laboratory tests of foundation soil,
- static, dynamic and other calculation according to specific needs,
- systematization and analysis of all collected data for the purpose of condition diagnostics,
- condition diagnostics of the structure, free surfaces, installations and building as a whole,
- finalizing the technical plans of the completed building, and
- recommendations for the level and scope of interventions that aim to bring the building into a state of reliable use.

Employed methodology (Tab. 1) is carefully defined and adapted for this purpose and it was based on personal professional experience and research done by the Faculty engineers. Tab. 2 shows the time schedule of activities during condition diagnostics of the building [1, 6, 7, 8].

Table 1 Grading and condition description, interventions, maintenance and deadlines

No.	Condition grading	Description	Intervention and maintenance type	Deadline
1	Dangerous	Collapse imminent	Urgent reconstruction/repair	Urgent
2	Not satisfactory	Very damaged	Reconstruction/repair	Up to 1year
3	Poor	Damaged	Intervention and maintenance	Up to 2 years
4	Not recommend	Slightly damaged	Intervention and regular maintenance	Up to 5 years
5	Acceptable	Not damaged	Corrective maintenance	Interventions on "need to" basis
6	Good	Correct	Preventive maintenance	Interventions on "need to" basis

Table 2 Time schedule of activities during condition diagnostics of the building

Activity	Time schedule - duration of activities: 3 months in 2006.																							
	March								April								May							
Initial survey of the object - visual observation	■																							
Development of activity programme		■	■																					
Data gathering and technical documentation inspection		■	■	■	■	■	■	■	■															
Geomechanical survey					■	■																		
Data gathering of other activity related documentation		■	■	■	■	■	■	■	■	■	■													
Structural measurements and geodetic survey							■	■																
Sampling and material testing							■	■	■	■	■	■	■	■										
Control static and dynamic calculation									■	■	■	■	■	■										
Preliminary design of the structure									■	■	■	■	■	■	■	■	■							
Detailed expert survey				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Classification, categorization and damage mapping						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

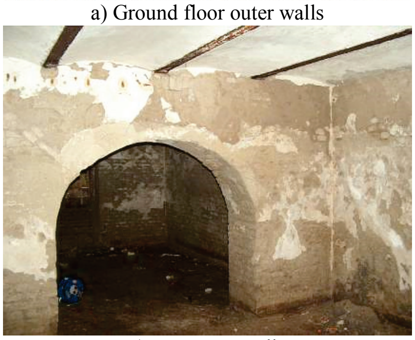
2.1 The structure of the building

This paper is centred on the condition diagnostics that is here described mainly with photographs and general tables. Due to vast amount of data and practical space the detailed drawings, numerical models, calculations and etc. are omitted and readers can contact authors directly for more precise descriptions. Condition diagnostic was presented to the Investor according to general descriptions given in Tab. 1. Following the condition diagnostic, levels of interventions were recommended for the structure: repair, reconstruction and replacements, such that would meet reliability, safety, stability, functionality (usability) and durability criteria prescribed according to standards for specific structural elements and applied materials [1, 7, 9, 11].

Foundations and soil. In an effort to determine geometrical and mechanical parameters of foundations (height, width, foundation depth, type and quality of used material and/or possible damages) there were 8 test pits near the foundation. During excavations an intensive influx of ground water was determined what consequently lead to continuous drainage of water from test pits and pointed to greater water permeability of soil layers. It was determined that the building has shallow foundations, continuous foundations beneath the walls and spot footings beneath the columns and that the foundation depth is 2,0 m while the basement level is 1,0 m below the ground level. Bricks and mortar used for foundations were found to be without significant damages, fissures and/or cracks. Parallel to excavation work at foundations geomechanical samplings and soil testing were performed in order to determine geomechanical soil profile, ground water level and mechanical properties of soil (stiffness and deformability soil parameters). Four boreholes were made with depths of not less than 7 m below ground level. Based on the field investigation work, identification, macro classification and standard geomechanical laboratory testing, it was determined that foundation soil, up to depths of 7,2 to 7,3 m consists of layers of fine to medium grain size compact sand with traces of clay [1]. Control static calculations determined that stresses beneath foundations are in the range of 210 to 240 kPa. Since reconstruction and restoration of the building did not included increased number of stories, increase or redistribution of loads on foundation walls, it was concluded that stresses beneath foundations will remain unchanged. In addition, since the bricks in the foundation were in good condition and there are no signs of damages due to excessive or uneven consolidation during exploitation of the building, it was concluded that there was no need for significant intervention on foundation structure. Quality and mechanical properties of bricks were determined through samples taken from foundation walls. This revealed that bricks quality meets the requirements for brick grade MO100 dN/cm^2 according to national code provisions [1, 10, 15, 16]. Chemical analysis of ground water samples was conducted in laboratories of Institute for health protection in Subotica according to requirements defined in "Guidelines for concrete and reinforcement concrete exposed to effects of aggressive environment" [1]. These analyses revealed that ground water can be categorized as "aggressive - grade A1" what was included as input for Design guidelines for concrete technology during construction of reinforcement concrete structure in the basement [1].

a) Ground floor outer walls

b) First floor



c) Basement walls

d) Half-timbered walls

Figure 2 General condition of the walls

Walls (Fig. 2). The building was constructed with bricks produced in the "old" format 30 × 15 × 7,5 cm; foundations are 90 cm wide. Outer bearing brick walls in the basement are 80 cm wide, in the ground floor 60 cm and in the first story 45 cm. Internal bearing walls have thickness of 45 to 60 cm. at the ground floor, columns were constructed from the cross-shaped bricks with core dimensions of 45 by 45 cm and 4 outlets of 30 cm each

[1, 5]. Partition walls at the ground floor and the first floor have different thicknesses. Parts of the partition walls are constructed with newer bricks made in standard format 25 × 12 × 6,5 cm.

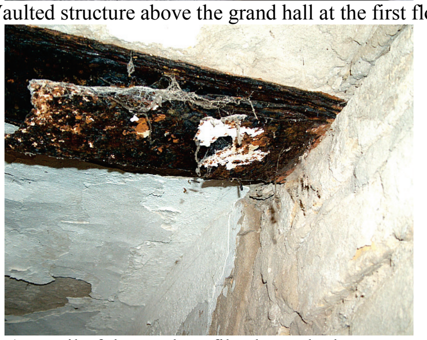
Condition diagnostics included:

- visual inspection (materials, couplers, joints, environmental risks factors…),
- detail expert inspection (detection of damages and defects),
- civil and geodetic measurements (geometry, verticality, imperfections, joints…),
- sampling and laboratory testing of bricks and mortar.

Detail inspection revealed damages of plaster finishing on all facade walls and internal walls due to effects of water and moisture over the years of uncontrolled atmospheric effects (peeled on approx. 50% of wall surfaces). Brick joints were in slightly better state, depending on the position and/or exposition level to aggressive agents. Bearing walls had locally distributed damages in the forms of fissures and cracks, some of which had width over the whole of the wall thickness. Quality of the bricks that was determined from the samples taken from the walls at basement and first story revealed that bricks quality meets the requirements for brick grade MO100 dN/cm^2 according to national code provisions [1, 15].

a) Vaulted structure above the grand hall at the first floor

b) Detail of the structure at the first floor



c) Detail of the steel profile above the basement

d) Detail of one floor structure

Figure 3 General condition of floor structures

Floor structures (Fig. 3). Floor structure above the basement was constructed from the system of orthogonal arches and shallow barrel vaults made from bricks supported by the longitudinal steel profiles. Above ground floor there were full brick vaults supported by walls and arches and/or shallow brick barrel vaults supported by the longitudinal steel profiles. Smaller portion of the structure was made by timber beams with floorboards on top and bottom surface with mud infill [1, 7, 8]. Condition diagnostic included:

- visual inspection (materials, couplers, joints, environmental risks factors, …),
- detail expert inspection (detection of damages and defects),
- civil and geodetic measurements (geometry, verticality, imperfections, joints…),
- sampling and laboratory testing of bricks, mortar, concrete and steel,
- control static and dynamic calculations.

Inspection revealed significant damages of floor structures above the grand hall, first storey, basement and a greater portion of the ground floor that resulted from years of poor maintenance and intensive atmospheric effects, water and moisture. Parts of the structure were deformed or devastated beyond any tolerance. Steel profiles above basement were completely corroded and partially collapsed. Quality of bricks, concrete and steel was determined through test samples taken from undamaged portions of structural elements and they revealed a good compliance with code requirements what leads to conclusion that material choice during construction from 1909 to 1912 was sound.

Roof structure (Fig. 4). Applied diagnostic methodology was in accordance with specific demands for timber structures and it included:

- visual inspection (wood condition - material, moisture effects, environmental risks factors, appearance of biological damages and cracks in the vicinity of joints in critical sections of the structure, steel elements and couplers condition, changes in geometry, twisting, cupping, elements splitting),
- detail expert inspection (damage detection for timber elements, couplers and steel elements),
- civil and geodetic measurements of the structure (geometry, elements, joints, couplers and changes in geometry as a result of defects-distortion),

- sampling and laboratory testing of the undamaged structural elements, and
- control static and dynamic calculations.

Inspections revealed different significant damages, accompanied with deformations of almost all timber and steel structural elements of the roof structure caused by years of atmospheric effects through damaged roofing. Couplers within the timber structure, elements and joints of the steel structure were more or less corroded depending on their position and/or exposure or aggressive agents. Steel ties lost their function during exploitation and, instead of being tightly tensioned, they were completely loose. Tower structures were in bad state generally and they were prone to collapse. Wood and steel quality was determined by sampling from undamaged sections of the structure. Test result showed compliance with current code requirements.

a) Terrace located at the northern facade
b) Detail of the central roof section
c) Detail of the roof structure
d) Detail of the roof structure

Figure 4 General condition of the roof

Table 3 Grading and condition description of foundations

No.	Condition grading	Description	Intervention and maintenance type	Deadline	Manifestation
5	Acceptable	Not damaged	Corrective maintenance	Interventions on "need to" basis	Damp, porous mortar joints
6	Good	Correct	Preventive maintenance	Interventions on "need to" basis	No damage

Table 4 Grading and condition description of walls

No.	Condition grading	Description	Intervention and maintenance type	Deadline	Manifestation
2	Not satisfactory	Very damaged	Reconstruction/sanation	Up to 1year	Damp, porous mortar joints, mould spots
3	Poor	Damaged	Intervention and maintenance	Up to 2 years	Damp, fissures, cracks

Table 5 Grading and condition description of floor structure

No.	Condition grading	Description	Intervention and maintenance type	Deadline	Manifestation
1	Dangerous	Collapse imminent	Urgent reconstruction/sanation	Urgent	Localized failures, deformations, rusted rebar, cracks
2	Not satisfactory	Very damaged	Reconstruction/sanation	Up to 1year	Mould spots, fissures, rusted/exposed rebar

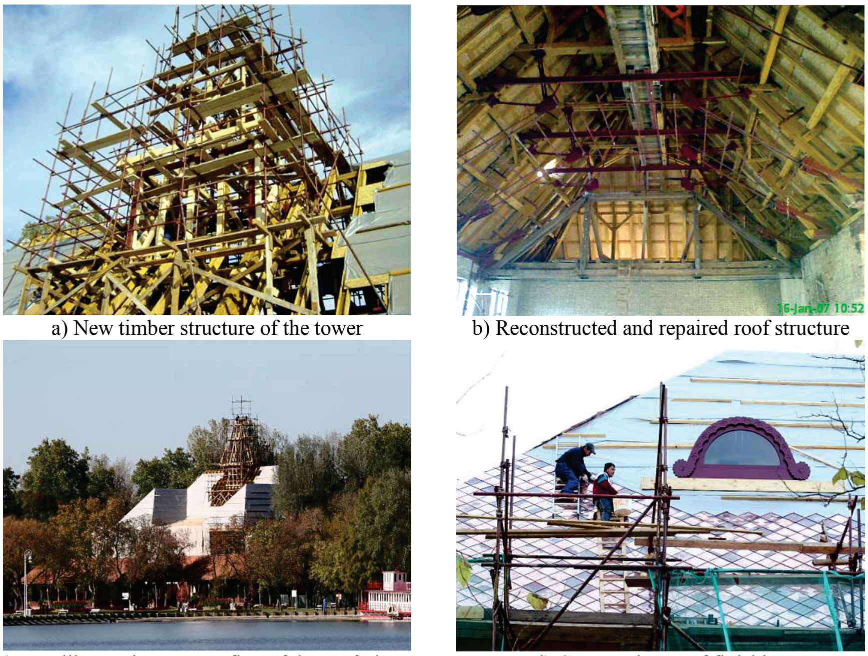
Table 6 Grading and condition description of roof structure

No.	Condition grading	Description	Intervention and maintenance type	Deadline	Manifestation
1	Dangerous	Collapse imminent	Urgent reconstruction/sanation	Urgent	Localized joint failures, deformations, buckling, rust, rotting timber
2	Not satisfactory	Very damaged	Reconstruction/sanation	Up to 1year	Rotting timber, rusted joints, deformations

Recapitulation. Inspection proved that state of the structure and its elements generally do not meet reliability, safety, stability, functionality and durability criteria whether individually or as a whole. Most of the structural elements, apart from the foundations, revealed condition described in Tabs. 3, 4, 5 and 6, according to descriptions given in Tab. 2 [1].

2.2 Surface finishing and installations

Roofing, metal underlayment, wooden decorative elements, tower, orioles, timber dormers, roof guards and roof windows were completely degraded; gutters were broken with signs of intensive dampness of locations below. Two semi-circular bays were missing, removed in 1977 due to significant damages; semi-circular timber dormer above the northern terrace was prone to collapse with temporary supports from 2005 and orioles at first storey corners were completely devastated. On the southern facade, on both terraces, gutters were broken and/or clogged and without rain collectors, roof guards were missing and dilapidated tiles showed signs of moss growth. Terrace floors made from terrazzo tiles were deformed and depressed. Most of the lighting cables were without insulation and exposed. On all, especially side facades, half-timbered type walls were unstable since the timber beams rotted away, including timber dormers above stairways domes along the building height. All facades were damp, especially lower sections, due to effects of capillary water and inadequate conducting of atmospheric water. Moisture measurements on the facade walls from May 13th 2006, showed high moisture percentage: 35 ÷ 65 %, up to a height of 4,50 m [12] on the east wall, and on the northern wall up to a height of 3,50 m [1, 10]. Both internal stairways and approaching stairways from the west side were partially collapsed. Internal surface finishing and building interior were completely neglected and devastated by fire that occurred in the beginning of 1990 during which internal finishing carpentry and interior burnt away, only intensify this condition. Facade finishing carpentry in total was dilapidated or rotten away and glasses on almost all windows were broken. All installation in the building was out of use, dilapidated and/or completely destroyed [1].



a) New timber structure of the tower

b) Reconstructed and repaired roof structure

c) Levelling and waterproofing of the roof planes

d) Copper plate roof finishing

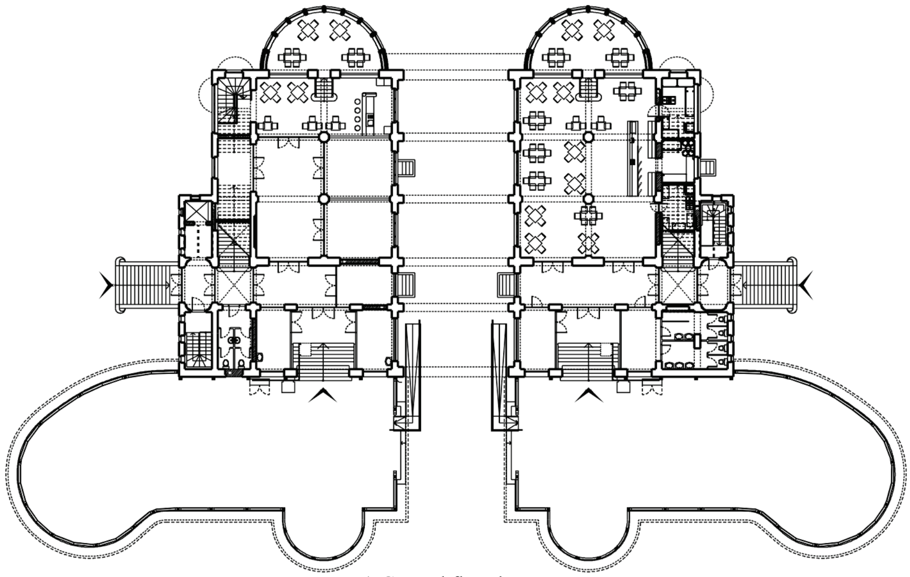
Figure 5 Reconstruction and repair of the roof

3 Reconstruction and repair of the structure

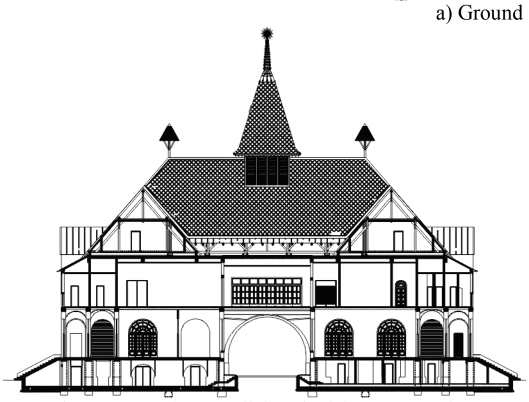
According to diagnosed condition of the structure and Investors demand among other, plans for reconstruction and repair of the structure were completed in the forms of preliminary designs, main designs and detailed construction designs and plans, (Fig. 6) [4, 5]. Static and dynamic analysis were conducted for all structures and structural elements including seismic resistance analysis according to current stricter code demands that place this building into 8th seismicity zone. Design plans include also strengthening and replacements of parts of existing structure in order to meet the seismic resistance demands and possible increase in live loads, all in an effort to improve the reliability of the structure. In accordance with available financial means, interventions were conducted in two phases: Phase I - reconstruction and repair of the roof and Phase II - reconstruction, repair, strengthening and/or replacement of the rest of the structure [4, 5, 17].

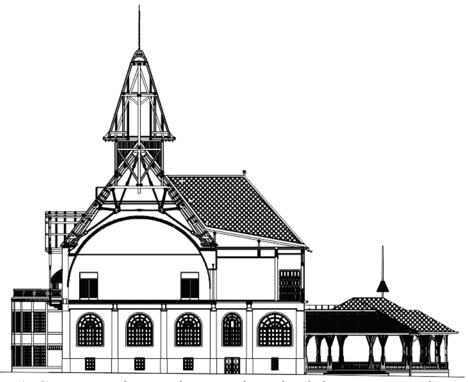
Phase I – reconstruction and repair of the roof (Fig. 5) [4]. Damaged original elements and couplers were replaced by the new ones, with the same dimensions and material properties. Tower structure was replaced by the new one while semi-circular bays, terraces, domes and orioles were completely reconstructed. Steel structure was cleared from rust; completely corroded elements were replaced by the new ones. The whole steel structure was strengthened, couplers were tightened and ties were activated according to their original structural function. Timber structure at first floor terraces was replaced by new reinforced concrete and/or steel structure with wooden board lining. Above ground floor, instead of the partially dilapidated timber structure a new concrete semi prefabricated structure was constructed. In the attic, at the location of the double hangers, over the timber structure, a steel truss was constructed that was connected to walls through anchor plates embedded in concrete head block. Timber structures of the large terraces in the ground floor were reconstructed.

After completing the works on reconstruction and repair of the structure, roof planes were levelled, water proofing was placed and copper tiles cover was placed. Tiles dimensions were 30 × 30 cm and they cover a total area of the roof of approx. 14 000 m^2. Phase I was completed with gutter placement, restoration of decorative elements that included a sun symbol at the top of the tower.



a) Ground floor layout





b) Cross section parallel to the lake promenade c) Cross section orthogonal to the lake promenade

Figure 6 Technical drawings – layout and cross sections

Phase II – reconstruction, repair and strengthening of remaining structure (Figs. 7, 8 and 9) [5, 11]. According to the determined condition of the structure, preliminary design and functional demand by the Investor, Phase I was followed by Phase II which included interventions of divers levels: foundation strengthening, construction of the RC water tight structure, repair and strengthening of the floor structures, construction of new and strengthening of the existing stairways and construction of the new semi-circular bays on the northern facade. Construction of the water tight RC structure in the basement (RC slab of 25 cm thickness for horizontal section and 15 cm thickness for walls) was initiated by the Investor's demand for proposed basement use (wine cellar and restaurant kitchen, etc.) and it represented a demanding construction task due to the fact that the lower horizontal slab surface was considerably lower from the bottom level of the foundation and construction was conducted under high ground water level that had to be constantly monitored and lowered. This intervention required all existing wall foundations to be lowered by constructing concrete foundations in sections beneath the whole building. Concrete used for this purpose had specially and precisely defined properties. Special waterproofing layers were placed as the first line of defence from the ground water.

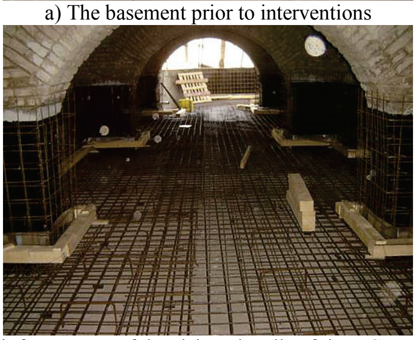
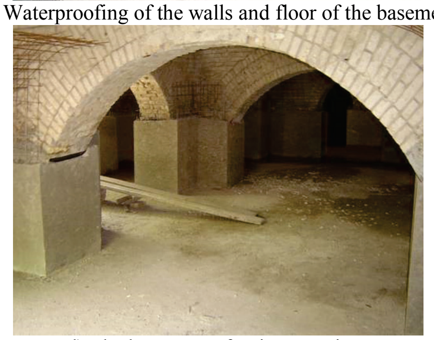
On floor structures above the basement a replacement of bigger portion of the structure was conducted with new, full depth RC slab of 16 cm thickness. This slab is supported by the new basement RC structure walls and/or it was supported within existing brick walls by means of cutting the slab into these walls. This structure, together with RC structure in the basement improved the seismic resistance of the building. Smaller portion of the structure above the basement - brick barrel vaults with steel profiles - were completely reconstructed: old steel profiles were replaced by the new ones and then shallow brick vaults were constructed. Structure of brick barrel vaults and steel profiles above the ground floor (beneath the grand hall) is joined with new RC slab with new steel shear connectors thus creating a composite steel-concrete structure with increased load capacity that also contributes to overall stability and load resistance of the structure. All damaged brick arches were repaired and/or reconstructed [17].

During reconstruction of the floor structures above the basement and the ground floor an earth and mud infill was removed what considerably lowered the dead load since this space was filled with lighter material that has better insulating properties. On the northern facade, at the locations of the previously removed semi-circular bays, new ones were constructed with semi-circular RC slabs, ring beams, ring girders and columns with polygonal cross sections.

At the locations of internal stairways, new RC stairways slab with landings and interior beams and new RC entrance stairways was constructed. Apart from these, light steel stairways structures were constructed on the first floor and between the first floor and the attic. All brick walls of the building were repaired.

During restoration, especially during removal of existing dilapidated structure, complex construction activities were performed sometimes on the very limit of the basic stability of elements and/or even the whole building. All phases, sub phases and construction processes were carefully planned and designed up to their finest details what resulted in construction works being completed without negative consequences for the building and for the workers, while being under constant supervision by the designers, authors of this paper. Reconstruction and repair of this building achieved all of proposed goals from the viewpoint of reliability: safety, stability, functionality whether for individual element or building as a whole.


a) The basement prior to interventions b) Waterproofing of the walls and floor of the basement

c) Reinforcements of the slab and walls of the RC structure d) The basement after interventions

Figure 7 Interventions in basement


a) New full depth RC slab above the basement b) Reconstruction of brick barrel vaults above the basement


c) New space structure above the grand hall d) Reconstructed floor structure of the first floor

Figure 8 Reconstruction of the floor structures

Structural reconstruction and repair was followed by the next phases that included installation works, restoration and finishing of outer and inner surfaces, finishing carpentry, metalwork… according to conservation requirements prescribed by the Inter-municipal Institute for the Protection of Cultural Monuments Subotica and Institute for the Protection of Cultural Monuments of the Autonomous Province of Vojvodina. These requirements demanded that final appearance of the building be an exact match to an original one and they were completely fulfilled. Reconstructed, repaired and restored building was officially opened in a ceremony on September 1st 2012 - one hundred years after its first construction (Fig. 10).

a) Internal appearance of the bays b) Northern facade with completed bays

Figure 9 Semi-circular bays

Figure 10 Appearance of the building after completion of reconstruction and restoration

4 Conclusion

This paper shows a typical example of the scope and the extend of damages and devastations of historically important buildings due to poor or inadequate maintenance. Short exploitation life of buildings, unreliability of their structures especially those subjected to uncontrolled, simultaneous aggressive effects of the environment (water, moisture, frost, etc.) is often direct consequence of poor maintenance. Successful reconstruction, repair and restoration, especially complex buildings and structures that have the status of immovable national cultural heritage, can be achieved only through consistent application of adequate methodology, activity planning, measures and procedures during condition diagnostics, design and construction. Reconstruction, repair and restoration of this extremely damaged building is a typical example of how complex engineering task can be successfully completed and it represents an experience that can be used for other, similar, structures.

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