

The Captain's tower in Bihac

Doc.dr. Maja Popovac dipl.ing.arh
Faculty of Civil Engineering
University "Dzemal Bijedic", Mostar
e-mail: maja.popovac@unmo.ba

ABSTRACT

Kapetanova Kula is situated in Old city core of Bihac, and it is proclaimed National monument under governmental protection.

Today's condition of the monument is poor due to serious destruction of the façade by the atmospheric waters.

The project covers repair of the walls from both sides, substitution of openings, amendment of roof covering, major changes in ground floor (pavement and partition). Currently, this monument is transformed into a museum. It is important to have perfect condition for artefacts as well as for the building itself. That is why, we proposed the system of ventilation and heating. Main source of energy would be water/water heat pump and ventilation unit would be placed under the roof.

KEYWORDS

Bihac, Captain's, tower, reconstruction, historic, stone



Figure 1. Captain's tower in Austro-Hungarian period

Historical information

Toponym Bihac dates from 1260. from a charter of Hungary's King Bela IV. In mediaeval times the town developed as a free royal borough with a fortress and two monasteries, one Dominican and one Franciscan, several churches, a large number of commercial and residential buildings, and several defence towers.

In the 16th century Bihac and its surrounding fortified towns became part of the so-called Military Frontier consisting of a defensive zone fortified against the increasingly frequent incursions by Ottoman troops.

The Ottoman Army, led by the Bey of the Segedin Sanjak, Hasan Pasha Predojevic, occupied the town in June 1592. Over the next three centuries Bihac was to be an important fortress in the extreme west for the Ottoman Empire and the point of departure for Ottoman incursions and steady pressure on the borders of Croatia.

The chronicler Ivan Tomasic is of the view, which he bases on H. Strauss and *Bihačke kule i gradine* (Bihac's Towers and Castle) (publ. Oblitelj, Zagreb 1923), that the Captain's tower was built around 1205 and that it was one of four towers in Bihac, three of which were destroyed in 1291/92.

Kreševljakovic notes that there were three towers in Bihac, the remains of the Bihac fort referred to above. "The first of the towers was demolished in 1870, the second in 1889, and the third is still standing, being used as a prison. This tower was the headquarters of the Captains of Bihac. It was built before 1592." (*Hamdija Kreševljaković, 1954, p. 71*).

With the arrival of the Austro-Hungarians, the tower was converted into a prison. From then on, until well after Bihac had spread beyond its ramparts, the Captain's tower was used solely as a prison. It remained in use as the district prison until 1959. In the 1970s the building was restored and converted for use as a museum.

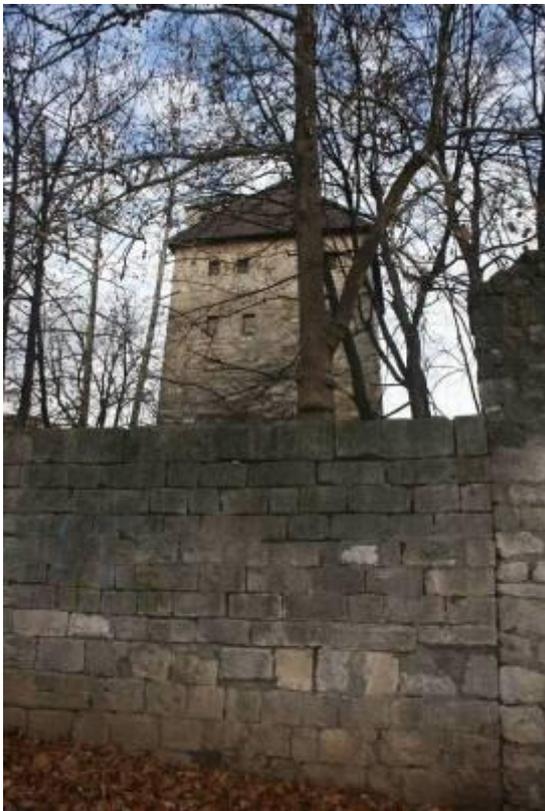


Figure 3. and 4. Captain's tower today

Climate

Bihac climate is moderately continental with warm summers and cold winters. The temperature varies from -22°C in winter to $+35^{\circ}\text{C}$ during the summer time., with average temperature of 12°C . Average precipitation is 1250 – 1500 mm.

Variation in winter day/night temperatures are very unfavourable for the Captain's Tower masonry. The ice on the structure surface is melting during the daily sun, and in the form of water it is getting deeper in the joints and cracks. During the night, with minus temperatures, the water froze – making further damage while it expands to ice.

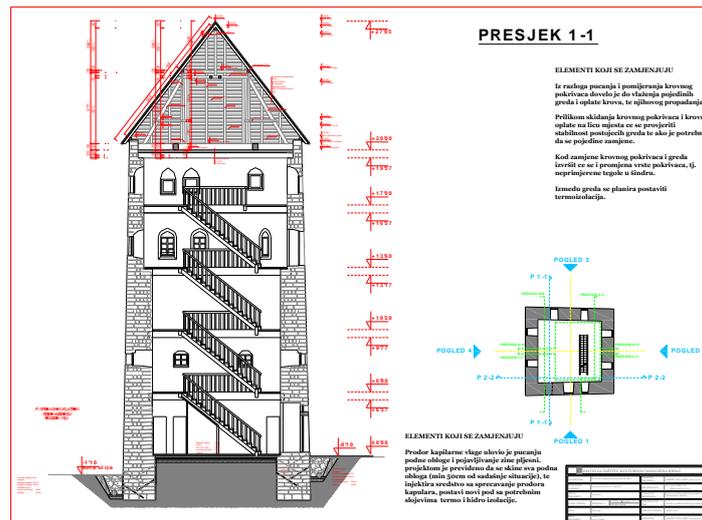


Figure 5. Captain's tower – cross section

Current condition of the monument

Captain's tower in Bihac is a monument that went through numerous reconstructions. Available documents shows that this tower was built at the beginning of the 13th century, but we find no records about its original appearance. It served for different purposes – from defence tower, Ottoman Captain headquarters, Austro-Hungarian and Yugoslav jail, until it became museum in mid of the 20th century. Different assignments led to numerous transformations – visible mainly on windows and interior arrangement. Small and irregularly placed medieval and Ottoman windows were enlarged and regularly aligned in Austro-Hungarian period, and then again in 1969 reconstruction returned to Ottoman-time scheme and shape.

Current condition of the Captain's Tower is very serious. Seemingly stiff and solid structure of the Tower is damaged initially by the rain water, and the by different vegetation (grass, moos, small bushes).

Due to enormous quantity of water that residue in the walls, just by entering to the ground floor of the Tower, one can feel great humidity. This is effecting not just the structure of the walls, but also the condition of the artefacts, and health of the visitors and staff.

Considering the fact that the Tower is situated at the highest spot of the plateau and that the most visible impairments are in the zone of the rain water affluence from the roof, the conclusion was unanimous – the water in the structure is coming from the cracks in the outer side of the walls.

Long time exposure to the atmospheric water and humidity in the walls contributed to destruction of the mortar on the façade and inside of the structure. Thanks to the admirable thickness of the walls, the situation is currently not critical, but if this

exposure to damaging factor continues – the problem will shortly cause serious structural damage.

Also, one of the problems is adverse ascent of the paved courtyard in front of the entrance to the Tower, which causes direct flow of the rain water to the structure.

The roof structure is in good condition, except of one small hole in the roof cover.

Previous interventions in the interior of the Tower were numerous and aggressive.

Every single wall carries traces of the cement mortar, inadequate repairs, electric cables and also burn in the ground floor. Last floor shows very visible reinforced concrete beam. In the ground floor there are some partitions made of different materials, mostly wood, which are unsuitable.

Project phases

Considering the fact that the financial side of all reconstructions in BiH is poor, the project foresees four phases of the reconstruction (dependant on the assured grant):

Phase 1

1. scaffolding
2. roof reconstruction (shingle and roof window)
3. façade repair (cleaning, joints repair, protection layer)
4. injection works
5. window replacement (3 layer glass), repair of the stone frames, missing caging
6. repair of the plateau ascent in front of the Tower

Phase 2

1. repair of the ground floor (lower layers and pavement)
2. toilette
3. electric installation
4. repair of the interior walls
5. glass partitions in the ground floor
6. entrance door and windshield

Phase 3

1. protection layer smear for the interior walls
2. sandpapering and painting of the floor constructions
3. assemblage of the wooden ceiling in first three floors
4. carpets on floors 1 to 4

Phase 4

1. ventilation system (including previous construction works on the attic for the air-conditioning unit, openings for 24 air throttles under the roof)



Figure 6. Example of scaffolding



Figure 7. Example of shingles

RECONSTRUCTION WORKS

Scaffolding assembly

The scaffolding would be mounted around the entire Tower and will be used for works on the roof, repair of the walls.

Roof exchange

Current roof covering is inappropriate and damaged. The roof construction is in good condition and needs no intervention except possible cleaning and protection coating. The roof will have no thermal insulation. On the roof construction it is necessary to mount wooden flooring, hydro insulation, vertical battens, longitudinal battens and wooden shingle made of chestnut three.

Also, for the air-conditioning unit air throttles should be made under the crown of the wall, as well as some strengthening of the structure for the a-c unit weight. Thermal insulation will be added in the floor construction.



Figure 8. and 9. Façade damage

Façade repair

This activity is the key for the longevity of the Captain's tower. They will be performed in few phases:

1. cleaning of the façade with metal and plastic brushes (joints and stone surface)
2. removal of the cement mortar
3. removal of the damaged lime mortar
4. replacement of the damaged and missing stone blocks
5. repointing of the joints
6. injection works (lime hydraulic mortar Rofix 993)
7. covering stone protection coating

Earthworks

In order to be able to perform injection works it will be necessary to excavate 80cm from inner and outer side of the walls, and 50cm on entire inside of the tower.

For the repair of the adverse ascent it will be necessary to excavate average 20 cm on entire plateau in front of the Tower.

Removal of the partitions in the ground floor

Dismantle all wooden parts and pay special attention to the brick wall laying on the inside part of the stone wall.

New flooring in the ground floor

After the injection works two 20cm layers of tampon (up to 30mm) will be laid. After that, 5cm thick stone pavement will be laid onto a layer of sand (1-4mm).

Walls repair from inner side

Walls on ground, first and second floor will require same treatment as façade. Second floor masonry is not so representative, and the project specifies at least 3 layers of lime coating. Third floor was plastered and it went through recent reconstruction, and it will need no further interventions.

Fourth floor shows reinforced concrete beams under the ceiling – it would require some minor removal of the concrete and same treatment as second floor.



Figure 10. Ground floor today



Figure 11. 4th floor today

Floor construction

This task will require just sandpapering and painting of the floor constructions, assemblage of the wooden ceiling in first three floors, and laying of the carpets in last 4 floors.

Window replacement

As this reconstruction is meant not only to preserve the monument, but also to improve the conditions in entire facility and save the energy, windows are very important part of the assignment. Although average reconstruction does not foresee three layer glass with insulation gas and Low e coating – this one is an exception.

As I mentioned above, the windows on this monument were subject of constant change. That, and the fact that the walls are extremely thick - allows us to consider thicker window frames with three layer glass.

Before the windows are to be built in, it is necessary to change all damaged stone frames and caging.

Electric installations

Current installations are old, damaged and bad looking. New project implies telescopic column by the staircase through entire Tower. This column would also carry all switches and plug-ins. Other electric cables would be led under the ceiling. Lights foreseen by project are on rails, mounted on the wooden beams of the floor structure.

Water and sewage

Water and sewage will use existing connections.

New partitions in ground floor

Ground floor requires new space organization because of the museum. All walls accept toilette will be out of tempered glass, with one doors. This kind of structure is light and easy to assemble with minimum damage to historical structure. Water/water heat pump would be placed inside this new room for staff.

Ventilation

In order to provide longevity and good conditions within the Tower, it is important to provide perfect ventilation. As the flooring structure is not historical – it will be possible to place the pipes in corners on the tower. Main source of energy would be water-water heat pump.



Figure 12. 2nd floor



Figure 13. Detail - 1th floor

CONCLUSION

Captain's Tower in Bihac requires serious reconstruction of stone walls. Current condition shows that damage is result of aggressive atmospheric water followed by vegetation. After the consolidation of the walls from both sides and injection works, it will be possible to prevent leaks into the structure.

Air-conditioning unit will require air throttles made under the crown of the wall, as well as some strengthening of the structure for the main unit weight.

Roof covering should be changed and replaced by traditional chestnut shingles.

Thermal insulation should be placed in upper floor ceiling (fitted in roof construction).

Windows should be made with three layer glass (Low e + argon filling).

Electric installations should go through telescopic pipe by the staircase. Light should be adjustable and light weight.

Partition walls in the ground floor should be mostly made of tempered glass. Ventilation will be very important in this facility – because of assurance of its longevity as well as because of the valuable artefacts. Unit placed under the roof will provide necessary air exchange in entire building. Main source of energy would be water-water heat pump situated in the ground floor.

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