Construction-technical survey of a historical building in Loket

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ABSTRACT

The main objective of the article is to inform about the construction-technical survey, which focuses on the existing historical building from the first half of the 19th century, in Loket city, Czech Republic. In the past, the building was hit by floods, which affected its technical condition, the deterioration of which also affected the subsequent abandonment of the building, and neglect of maintenance. The main research issues stem from the building-technical survey focused on the condition of structures, especially the load-bearing wall structures, the ceiling structures, and the roof structures. After detecting the faults and other possible damage, we look for their causes and find out which of them are fatal to the building and which can easily remove. Of the evaluated structures, we focus mainly on their damage due to moisture, excessive structures loading, and changes in foundation conditions caused by previous floods. Furthermore, we assess the impact of failures on the structure and operation of the building. In conclusion, we propose measures based on the structure´s found failures and possibilities for their repair.

RESULTS

Cracks in the joints of perimeter masonry:

Cracks in the joints of the perimeter masonry in the area around the window openings (lintel, lining, window sill) at both extreme parts of the building can be caused by two possible causes.

a) The building foundation

The first possibility is a change in the soil conditions in the basement of the building, caused by the mentioned floods in 2009. As these are old cracks in the vertical and horizontal joints of the masonry, these cracks indicate a gradual decline of the structure (foundation), see figure below.

b) Structure overload

The second possibility, due to cracks in the place of the window lintel, is the overload of the lintel by the wooden ceiling, or the ceiling beam placed in the place above the window lintel. Due to the fact that the building has changed the purpose of use many times in the past (housing, civic amenities), there were changes in the values of the live load, while increasing these live load values could lead to the overloading of the ceiling structure. Due to the subsequent distribution of forces, it decreased in the weakened place of the lintel, which caused cracks in the brick vault, which were reflected in the plaster at the junction of the lintel and the window lining. With a slight decrease in the window lintel, the ceiling structure in the place where the beam was placed probably also decreased, which also caused a decrease in the window sill above the ceiling structure due to the occurrence of deformations.

Humidity in the basement:

Due to the flooding of the basement in the past (floods in 2009), the current situation is most likely caused by insufficient drying of the premises after water depletion. According to the previous operators of the building, there was no waterlogging of the foundation/basement structures due to ground moisture. Whether the building has a waterproofing layer (original or additional) is not known.

Rotten and damaged wooden truss elements:

In the past, the roof most likely underwent a partial reconstruction, during which the roof covering (currently profiled sheet metal) was replaced and a waterproofing under-roof layer - foil - was additionally used in the truss of the building south wing. The attacked wooden truss elements are located in the parts of the north wing and the central part, without the hydro insulating foil. For this reason, the cause of the disintegration of the tops of wooden tie beams is mainly moisture in the structure due to leakage into it, which in long-term action, together with suitable temperature conditions and truss maintenance, causes wood-destroying rot, wood-destroying fungi and wood-destroying insects. As some wooden elements have deep surface scratches of a specific form, these may be ingestions caused by beetles "*Corymbia Rubra*" or "*Lyctus brunneus*".

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The western and eastern facades of the building with the marked places and direction of the cracks.

The probe in the window sill and lintel on the 2nd floor of the building east wing.

The extent of wooden truss elements damage

CONCLUSION

Due to the age of the building, its long-term non-use, and due to the occurrence of several types of defects and structural failures, we recommend performing:

- Removal of plasters in the entire extent of the basement space in order to determine the extent of damage due to moisture, or due to static load action (settlement of subfloors, loading, etc.).
- Carry out humidity measurements of the affected wall and ceiling structures in the cellars.
- In the place of cracks on the facade of the building, perform a complete removal of the plaster inside the building, in the affected places around the window openings, and finding out the actual extent of damage by static load cracks.
- Carry out crack measurements using a plaster target.
- Carry out a diagnosis of wooden elements in the truss, find out the actual extent of damage to elements exposed to moisture / wood-destroying insects, fungi, and rot.
- Revealing the ceiling structures in place of the designed partitions in order to determine the actual condition of the ceiling beams as part of the verification of their load-bearing capacity.

Creating a digital model of a building using a 3D scanner or digital photogrammetry for accurate measurement of failures in one time period. It is important to choose the right LOD before starting work