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# Knowledge FOR Resilient soCiEtY

**Disaster Risk Management of Cultural Heritage**

*University of Tuzla*



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# Repair and prevention measures of Cultural Heritage structures

## Chapel of The Virgin Mary in Lipnica



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The chapel dates from the 17th century.

By type it is "house over the storerooms".

It has one floor with three rooms .

The building was designed in a massive structural system with brick walls in a wooden skeleton.

The walls of the basement floor, positioned below the southern half of the object, originally derived from broken stone, while the walls of the ground floor derived from a wooden bonducal structure with filling of a wooden shingle.

They were plastered with mud plaster and finished with a lime mortar.

The roof structure is made of wood with struts.



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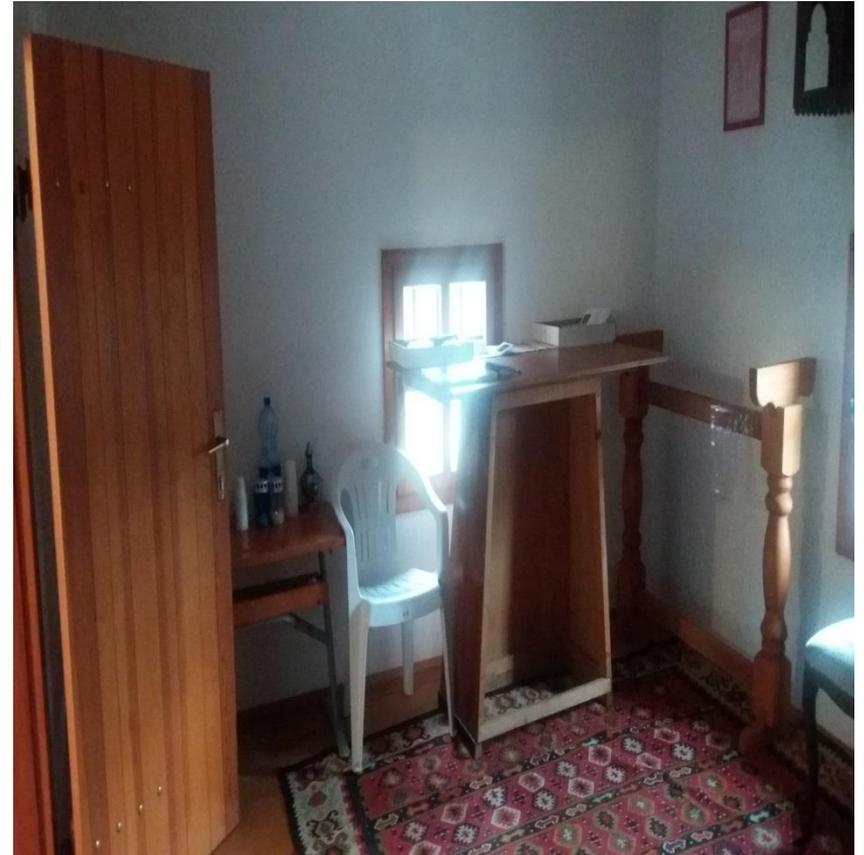
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Two landslides hit this monument.

The first happened in 2001, which was repaired by supporting walls, and the second in 2014, due to weather conditions.

Landslide happened 2001 directly jeopardized monument and its construction.

Danger to the chapel was indicated by cracks on the north and west wall of the room for liturgy.



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## Repair and prevention measures of Cultural Heritage structures

The Institute for the Protection of the Cultural, Historical and Natural Heritage of Tuzla from May 2005 prepared the Implementation Project for the reconstruction of the Chapel of The Virgin Mary in Lipnica , according to which in the summer of 2005 works were undertaken on the rehabilitation of structural elements of the building, and the building remained unchanged in terms of external dimensions, disposition of the object, position and size of the opening and exterior of the object.

During the execution of the works, the following protection measures were recommended:



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-All structural interventions are designed with the original types of materials that are already present in the structure of the building (wood, stone and roasted clay).

-Wooden material for vertical and horizontal constructions is processed by double trimming. With this kind of structure, the beams of wooden skeletal structure of the walls, bondrings, and beams in the ceiling structure were replaced.



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- The joints of wooden elements are made with traditional details (groove and feather , overlaps..) and where necessary, due to the load, metal joints are also permitted.
- All the wooden elements after the installation are coated with a wood coating with insketicidal effect.
- The cover of the building is made of wooden beams, and shingles.
- All the windows were made on the basis of the existing dimensions, shapes and protective metal rods (demiri).
- The staircase and pavement are made of rough stone.





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Due to bad weather conditions in 2014 landslide re-activated.

By re-activating the landslide on the already repaired part with the supporting wall, appeared cracks.



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The slope was repaired by a deep drainage system.

The main drainage arm has a length of about 93 m, while the secondary drainage arms have a total length of about 78 m

The body of the road that is in the middle of the landslide is sanitized by the execution of four stone ribs, and the repair of a labile slope, above the edges of the access road, is carried out in the position south of the chapel.

The gabion-supporting wall was made in the length of about 12 m.

The wall is made up of 6 gabions of dimensions 1 x 1 x 2 meters, set on a reinforced concrete slab of about 15 cm thick.



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As part of this renovation project, concreting of the southern foundation wall of the chapel was carried out.

The appearance of shorter cracks implied the conclusion that the foundation was not sufficiently deep, and reinforced concrete levels were made in three places.

It is recommended reforestation of slopes as a prevention of the occurrence of landslides.



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## Repair and prevention measures of Cultural Heritage structures

After the works of reconstruction and renovation of the chapel realized in 2005, the building itself is in good condition.

What constitutes a specific risk and latent danger is the fact that in the last two decades, on the plot, west and south of the chapel, as well as the surrounding area around the plot with a chapel, there existed landslides, which have already damaged part of the plot, the access road and part of the reinforced concrete support walls built north of the chapel.

This slide represents a latent danger and the building of the chapel.



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At a distance of about 200 meters from the site of the Chapel , a dam near a nearby stream and a lake is formed - an accumulation of about 35 meters in length and a width of about 15 meters in the dam area, which according to the expert opinion of the Mining Institute d.d. Tuzla, was a decisive factor (sloping slope) in launching the landslide in 2014.

*Still the problem of this artificial lake is not solved.*



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Thank you  
for your attention

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