Common issues regarding the churches of Banat

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Abstract. Banat is a south-western region of Romania in which all villages contain orthodox churches. The churches in question were constructed during the end of the 18th century – beginning of the 19th. It is important mentioning that the religious activity was uninterrupted during this time. The churches are located in the following villages: Poganesti, Voiteg, Zgribesti, Balint, Sanmihaiu Roman, Hezeris, Unip, Capat, Saravale, Hodoni, Igris, Babsa, Ficatari, jebel, Visma, Cadar, Hodos, Olosag. The aim of the study is to identify the primary issues, deteriorations, which became apparent with time and present during evaluation and identifying the cause of this. The observations were made during 2022-2023. The majority of the orthodox churches from Banat consist of a central area (*naos*), sometimes accompanied by transepts on both sides, a sanctuary in the eastern part and a bell tower in the western part. The primary structural degradation consists of cracks in the walls, the arches and domes. The causes of all this are unequal leaning of the walls, uneven weight exerted by the structure, foundations with insufficient width and depth, and the effects of earthquakes from the past. In addition, there is an overall exfoliation and peeling of the plaster, also excessive humidity among the lower part of the walls. This has happened due to capillary ascent of water and the frosting-defrosting process. Most of the time, improper interventions and the use of cement-based materials have accelerated the process of deterioration. Sometimes, local destructions of the roof and wooden extremities are present because of ageing and lack of maintenance of the roof's cover, the effects can be noticed on the sheets of metal or ceramic tiles. All of this inevitably leads to a partial or complete destruction of internal mural pictures, often times of great artistic value. The major conclusion represents a centralization of the damaging factors and the proposal of few measures of mitigating the effects of them.

1 Brief history and particularities of the orthodox churches in Banat

Usually, Orthodox churches from Banat have been started to be built from the end of the 18th century. Almost every locality, disregarding its size, which includes either a Romanian or Serbian community, has at least one orthodox church, and some localities have multiple, if the population is large. If the communities are numerous, there exists at least one orthodox church for each community, be it Romanian (the majority), or Serbian. The service is conducted in accordance with the language spoken by the said community. In the majority

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of cases, the religious activity is continuous even in present times, with an attendance of at least once a week (on Sundays) by the congregation. [1] Usually, right above the front entrance, an inscription carved in the wall can be seen, which includes the construction date or time of latest major works which have taken place, the name of the bishop, of the parish priest, the names of financial contributors etc. [2] (Fig. 1.)

Fig. 1. "Sarba Saravale" Orthodox Church.

From an archaeological point of view, the interior of a church contains a central area called nave, which may or may not be accompanied by lateral apses. (Fig. 2-3)

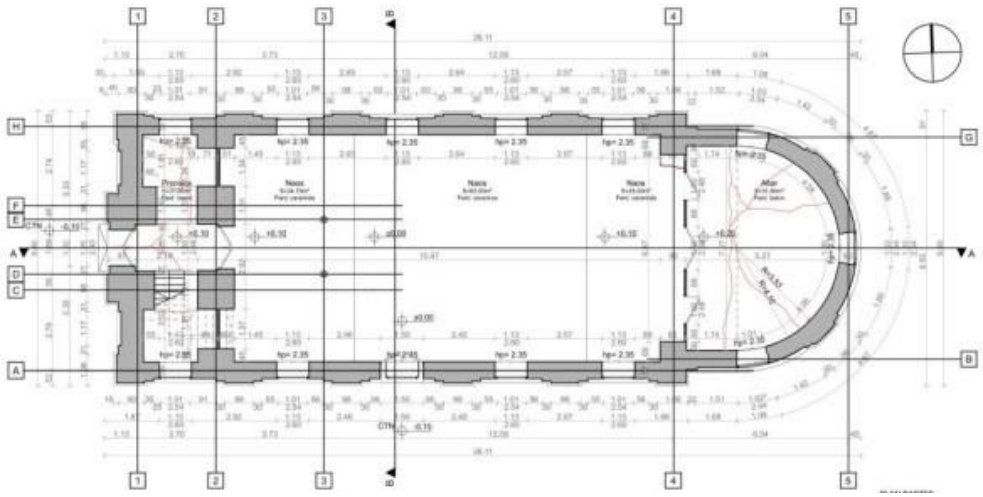

Fig. 2. "Babsa" Orthodox Church.

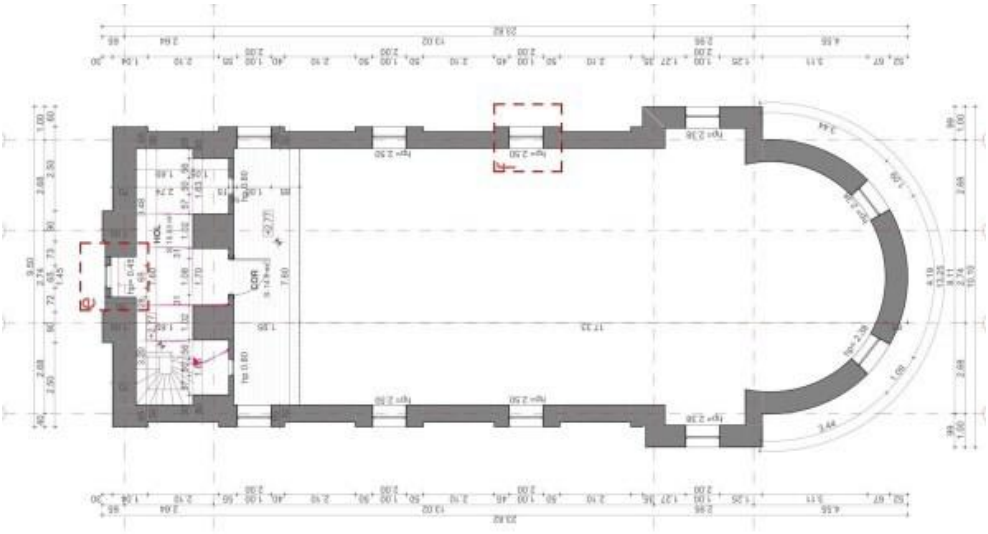

Fig. 3. "Hodoni" Orthodox Church.

In the west side, churches include an intermediate zone called narthex, and in the east side, the most important part called the sanctuary, is situated. The delimitation between the nave and the sanctuary is established through a masonry or wooden wall called iconostasis, incorporating three access doors, a central one and two lateral. The main access to the church is through the narthex. Generally, just above the narthex, there can be found a bell tower housing at least one bell and in some, the bell tower contains a four-faced clock, one face for each side. (Fig. 4-5)

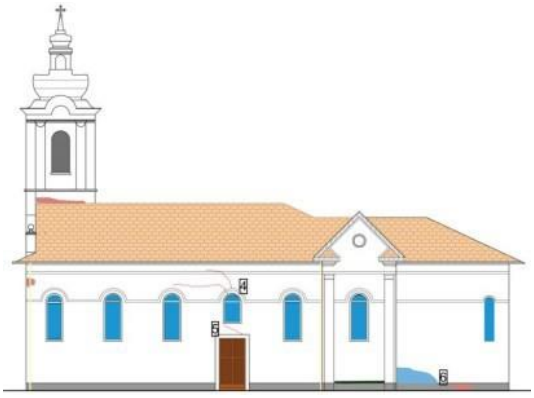

Fig. 4. "Balint" Orthodox Church.

Fig. 5. "Saravale" Orthodox Church.

The masonry or stone foundation is sometimes placed at an insufficient depth. The superstructure is made out of load-bearing brickwork, with walls ranging between 70-120 cm in thickness. The beam is made out of wood and the covering is made of either tiles or sheet metal. The ceiling of the nave takes the form of a vaulted ceiling, which is unrolled in one or more directions. It is made of wooden arches and rigid planks fixed to the lower part on which plaster and paint is applied. (Fig. 6-7)

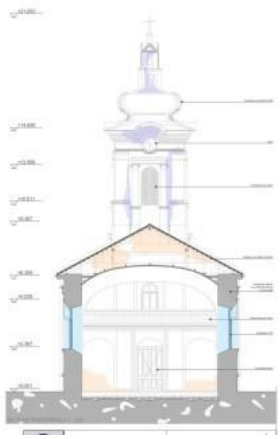

Fig. 6. "Hodos" Orthodox Church.

Fig. 7. Hodos" Orthodox Church.

In some cases, the vault is made out of brick masonry, with arches also made out of masonry in one or two directions.

In the Banat area, numerous vulnerability studies have been carried out in recent years, there is a desire to restore and restore the true value of the Orthodox churches [3, 4].

2 Main deteriorations

Deterioration can be either structural or related to the finishing process. Structural deterioration.

Cracks or fissures can appear in the foundation. They continue to extend towards the upper levels of the building. Structural walls, in addition to cracks and fissures, may also have deterioration of the bricks and joints between them, reducing the horizontal section. (Fig. 8-9)

Fig. 8. "Vizma" Orthodox Church.

Fig. 9. "Vizma" Orthodox Church.

The masonry arches present cracks in the middle of the bottom area with disruption of the masonry continuity. They may even have dislocations and falling of brick. The area above the window gap frequently shows cracks. (Fig. 10-11)

Fig. 10. "Saravale" Orthodox Church.

Fig. 11. "Saravale" Orthodox Church.

The wooden vaults may have splintering, decay. The roof wood may have decayed ends, the wooden elements may be cracked, rotten or even broken (Fig. 12).

Fig. 12. "Saravale" Orthodox Church.

Non-structural degradations:

These are: detachments from the plaster, exfoliation, degradation of the painting (Fig. 13, 14).

Fig. 13. "Babsa" Orthodox Church.

Fig. 14. "Bezdin" Orthodox Church.

3 Causes of degradations

Table 1. Degradation types and causes

The type of degradation	The causes of degradation
Vertical cracks, cracks in the walls	Uneven settlement - insufficient foundations Uneven loads - the much too high weight of the tower acting only on the pronaos.
Crossed oblique cracks	Seismic actions
Cracks, cracks of masonry arches	Seismic actions Uneven settlement Overloads due to the structure - the central tower
Destruction of the wooden vault	Water infiltration from the roof Insect attack on wood
Destruction of the roof wood	Water infiltration - local rotting of wood The appearance of cracks due to drying and the passage of time
Degradations of the bricks in the walls	Absence of plaster - Attack of meteoric waters Water infiltration – the phenomenon of freezing / thawing Washing the joint between the bricks
Plaster exfoliation	Capillary rise of water Non-compliant repairs Absence of water drainage elements - gutters, downspouts The phenomenon of freezing / thawing Bad maintenance of the building
Destruction of the covering	Faulty maintenance Failure to replace degraded elements on time Natural causes – strong winds, storms, blizzards

4 Remedy of degradations

At the foundation level:

Solution 1: a perimeter belt is proposed to be placed at the level of the good foundation ground (established by the geo-study). The belt will support the whole building, working with the existing foundation of the brick, by partially cleaning the joints between bricks and horizontal metal connectors. The belt will enter slightly inside, under the existing foundation

and will stop under the interior floor share (min. 50cm), leaving an area through which the humidity can diffuse outside (Fig. 15). [5]

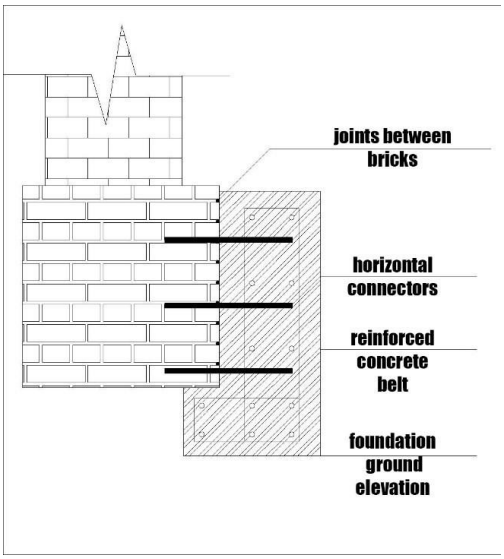

Fig. 15. Proposed solution for the foundation level.

Solution 2: If the geo-study determines a low bearing quality of the ground, local stabilization can be done by injections or micropiles (preferably, compared to the injection method).

An important aspect regarding the intervention at the foundation level is the presence of the tombs marked by the existing funeral plaques. In both solutions should be complemented by a perimetral sidewalk with drainage on the exterior side which should push away the meteoric waters. What have to be taken into consideration is that the too fast or to aggressive lowering of humidity in the walls may bring more problems than it solves. The main problem with this solution, if the humidity lowers too much, is that new fractures may appear in the walls and especially in the mural painting due to changes in the volume of individual bricks.

In the case of the arches supporting the tower:

Solution 1: it is proposed to install a tie at births to take the stretching forces and stop the advancement of cracks. It should be remembered that the longitudinal arches marking the lateral apses initially had metal straps, which meant that the arches did not show structural degradation (Fig. 16).

Solution 2: Drilling at the top of the spring (through the bridge), introducing metal reinforcement and filling with hydraulic mortar. The reinforcements introduced must be perpendicular to the crack direction in order to take over the tensile forces. Fig. 16. [5]

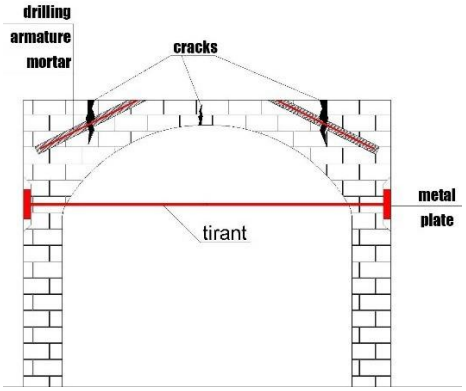

Fig. 16. Proposed solution for the arches.

In the case of cracks in the walls, they will be "stitched" with metal clips inserted in the joints of the masonry.

Then the area is covered with hydraulic lime reinforced with a metal mesh. [6] (Fig. 17).

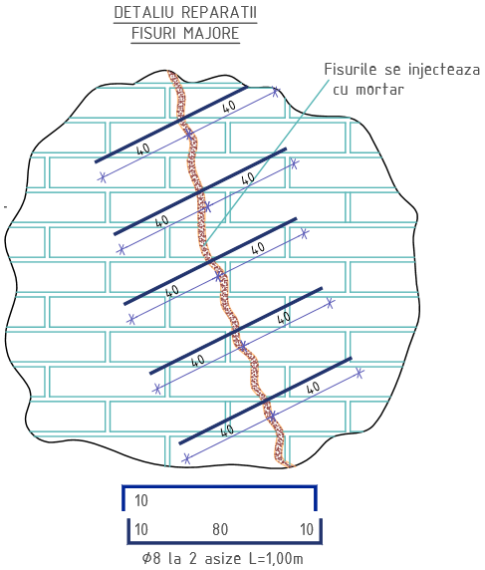

Fig. 17. Proposed Solution for The Cracks in the Walls.

5 Conclusion

The idea pursued in our approach was to find the most viable techniques for saving the visible elements of the church through minimal interventions with maximum effect, thus being minimally invasive on the structural elements.

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