Conservation, consolidation and restoration of the Holy Annunciation Church, Vatasesti village, region of Oltenia, Romania - Architectural and structural particularities

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Abstract. The present article discusses the process of architectural and structural diagnosis of a late 18th century, brick masonry built, Christian church located in Vătășești village, Vâlcea county, Romania, presenting the particularities discovered. The church is dedicated to Saint John the Baptist and The Holy Annunciation and it is listed under the LMI code (List of historical monuments of Romania) VL-II-m-B-09968. Its registration in the list of historical monuments inscribed in the National Cultural Heritage of Romania was realized especially thanks to its original byzantine style mural paintings (frescoes) still left almost intact on the interior walls, the only serious damage made to it being found on the paintings once found on the outside walls. In order to properly conserve, consolidate and restore the vernacular monument, the process of diagnosis had to include research and investigations of various and complementary areas such as 3D scanning using laser scan technology, the archaeological report, the mural paintings restoration experts report, the chemical analysis of the painted surface, the biological analysis of different materials, humidity reports, stratigraphy research, the geological and topographical reports, the compression strength of bricks test and structural analysis using 3D modelling and the Etabs software. The materials and techniques used for the consolidation and restoration works had to be non-invasive, ecological and reversible, using steel nets and hydraulic lime for the consolidation of the brick masonry. The architectural interventions on the drainage system, facades, roof, interior floors, lighting system, and all the interventions that the article describes were subordinated by the need to preserve and highlight the Romanian orthodox frescoes that give great value to the monument. This article explains the importance of proper research and measurements ought to be done in order to have a well-coordinated process later, designing the consolidation and restoration project.

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1 Introduction

In the Wallachia medieval region of Romania, eastern Christian or byzantine religious art entered the cultural space immediately after the founding of the medieval state, in the late 13th century. The abundance of religious artefacts and monuments inherited from that period reflects the geopolitical context in which they were built.

The south Romanian expression of Christian orthodox architecture is a mixture of the Romanic, Greek and Slavic styles of the period. The first churches that were built in the region represent the influence of the byzantine architecture and iconographic representation, with the Greek alphabet and language used for writing. From the same period of time, we find monuments of Serbian influenced architecture and mural art, with byzantine iconography, but with Slavic, Cyrillic alphabet used for mural inscriptions and writings.

As the medieval state evolved, it searched for an arts and architecture style of its own.

In the 16th century, extending to the end of the 17th century, the Romanian style was perfected to what we call today as the Brancovenesc style also known as the Wallachian Renaissance or the Romanian Renaissance. Brancovenesc art was mostly focused on architecture, but also manifested through painting and sculpture.

Although the statal arts were represented by the styles and influences mentioned, the population living in the rural areas in small villages kept a style of their own.

Coming from pre-medieval times and surviving through the existence of the Wallachian state and to this day is the traditional style, a style influenced by the pre-christian mythology and folklore. The traditional manner is reflected in religious beliefs, art, architecture, literature, music, iconography, and in every aspect of the daily life.

The building techniques of the traditional village churches used carved wood structure, shingle roofing, frescoes applied on wood with traditional iconography inspired by Christian religious beliefs, but different of the byzantine style of representation.

In the 18th century, after the brancovanian era came to an end, an interesting mixture happened between the traditional style and the Brancovenesc.

Rural communities started to build their community churches by brick masonry for the walls, gravel or river rock for the foundations and they used arches, vaults, or domes for interior ceilings. The roof structure was made of timber and for the roof finish they used wood shingle or ceramic tiles.

Decorating the interior and the exterior of the 18th century community churches of southern Romania, the fresco mural paintings used a byzantine influenced style, but with additions of traditional scenes, a fact that makes this particular category of churches so unique. Adding to this, the writings on the iconographic paintings are a mixture between the Cyrillic and Latin alphabets.

For the west façade, the most diverse scenes appear, such as forest flora and fauna describing scenes, hunting scenes (Fig. 1), traditional dances, daily job scenes (Fig. 2), even daily argument scenes (Fig. 3), and always in the center of those is depicted the icon of the patron saint or the patron holiday of the church.

Fig. 1. Detail of the west façade of St. John church in Olăneşti, Romania.

Fig. 2. Exterior painting of the church of Slătioara village, Vâlcea county, Romania.

Fig. 3. Detail of the west façade of the church in Mierea, Vâlcea county, Romania.

The range of the traditional living scenes appearing on this category of churches is very diverse and they are a unique category of the Romanian cultural heritage.

2 History and characteristics of the holy annunciation church

The Holy Annunciation church of Vătăşeşti village is an example of the 18th century mixture between styles.

Located on a really hard to reach hill area, as you can see in Fig. 4, its dimensions are a bit larger than most of the churches of its kind, and the mural paintings are of high quality, both in technique and style of representation.

As it is costumed for the religious buildings in the region, here is a fresco painted inscription above the entrance that, in this case, tells us that the church was finished during the time of Alexander Moruzzi, a prince that ruled Wallachia between the 1793 and 1801 AD. That tells us the approximate date of the paintings, making the building itself a bit older.

The planimetric configuration is a simple positioning on a west to east axe of the main spaces needed: a portal, a narthex, the naos and the altar (Fig. 5). From outside it appears like a simple nave with an apse for the altar and an arched portal.

Light hardly enters the interior space by six small windows.

Fig. 4. Aerial view of the Holy Annunciation church of Vătășești.

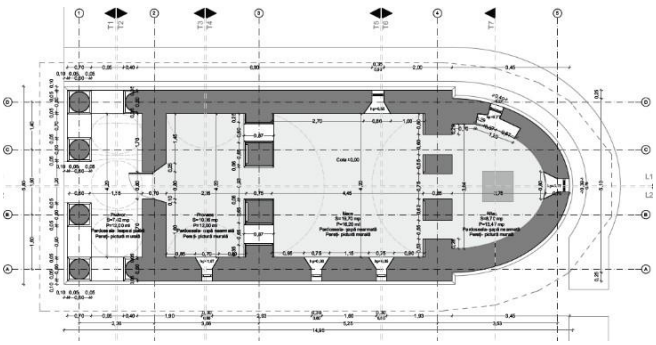

Fig. 5. Survey showing the planimetric layout of the church.

Outside finishing of the walls are lime plaster, mural paintings only on the west façade and going round the church is a traditional belt that comes from the symbol of a rope that holds together the people. (Fig. 6, Fig. 7)

The layout of the mural paintings is the same in every room, although the saints and scenes are different. Starting from the floor, all around the interior, is painted a decorative curtain of 90 centimeters height.

On the perimetral walls, from 90 centimetres of height until the intersection with the ceilings, there is a segment of standing saints passing through the rooms, but the saints are categorized by their purpose. In the narthex we find monk saints, in the naos we always find the first martyrs of the church, such as Saint George or Saint Dimitrios and in the altar, on the apse are painted hierarch saints such as Saint Basil or Saint Nicholas.

Up on the vaults and domes, following the West-East axe, is a sequence of scenes, coming from outside you find icons of Old Testament Messiah, then the life of The Virgin in the narthex, The Trinity in the naos with scenes from the life of Christ, and The Virgin Mary and the Son icon in the altar.

The walls that separate the rooms keep the same layout of paintings and contain different scenes serving different purposes in the Christian orthodox ritual. The wall separating the portal from the narthex depicts the Last Judgement scene for the outside, meanwhile inside this wall presents the founders of the church. The wall between the narthex and the naos holds icons of different Saints. The transversal wall that catches all attention is the altarpiece which you may see in Fig. 8.

Fig. 6. West façade.

Fig. 7. North façade.

Fig. 8. The altarpiece.

The portal is a small room that communicates with the outdoors by a series of three arches on the west façade, and another two arches on each side of the church. On the entering wall of the church it only has one small door surrounded by a mural painting depicting The Last Judgement, a common scene for the entrance of the churches of Wallachia since the 17th century.

The first room you enter in is the pronaos or the narthex, a small 2 by 4 meters' room. The ceiling is a vault oriented from south to north. The narthex communicates with the naos by 3 arches presented on the east wall.

As Fig. 9 shows, depicted on the western wall of the narthex are the founders with their families holding a model of this church, a very important piece in the restoration process puzzle. Comparing the original painted image with the present state of the monument we concluded that the roof was badly changed and needed restorative interventions according to the original appearance.

Entering the naos, on the interior of the arch is located a very common scene of late byzantine influence, Saint Zosimus giving communion to Saint Mary of Egypt, a symbolic scene of those who are ready for the communion and could enter the naos.

The naos is a 4 by 5 meters' room. Its ceiling is a vault oriented from east to west. Fig. 10 shows the mural paintings on the vault above the naos room.

The naos room faces the altarpiece or the iconostasis. In this category of churches, the altarpiece is usually made of brick masonry that closes the room to the ceiling and supports the naos vault.

The altarpiece of the Holy Annunciation church in Vătășești is unique. It is built of brick masonry, with three arched doors connecting the rooms, and at the top of the altarpiece it is not connected with the naos vault like usual, it actually ends with an offset decoration profile. (Fig. 11).

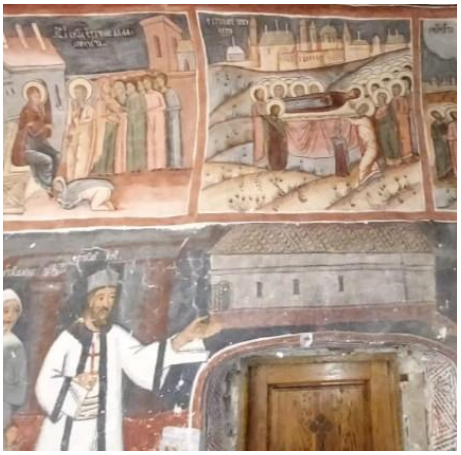

Fig. 9. Detail of the western wall of the narthex.

Fig. 10. Detail of the vault above the naos.

Fig. 11. Zoom in on the altar piece after the cleaning of the paintings try-out.

Facing the altar, painted on the back of the iconostasis are two very important scenes, one with The Sacrifice of Isaac, from the book of Genesis, and another with the Temptations of Jesus in the desert. In this last scene it is very interesting that Jesus stands on a temple which is actually represented by this church.

The altar is present in the only apse of the building, at the eastern end of it. It is covered by a half of a dome. The apse is elliptical, with a length of about 3 meters and a width of 3,75 meters.

3 Diagnosis of the monument

The Holy Annunciation church was built in a period of many changes, as mentioned before, and it is a result of the mixture between the late byzantine influences in the territory and the rural area resources, means and lack of skilled workers.

The techniques used, such as the brick masonry, the fresco mural painting or the quality of the roof structure are rather vernacular, therefore the most critical phase of the conservation and restoration project was the diagnosis process.

3.1 The methods of diagnosis that were used can be divided in 3 categories or 3 steps of learning about the monument.

1. At first, we took the classic drawn surveys, the visits on site with different experts and sharing ideas in order to learn as much as we could about the monument. (Fig. 12)
2. The second step was actually the proper, professional diagnosis methods such as the 3D scanning using laser scan technology[1] and the reports coming from different specialists such as the archaeological report [2], the mural paintings restoration experts report, the chemical analysis of the painted surface, the biological analysis of different materials, humidity reports (Fig. 13), stratigraphy research [3] (Fig. 14), the geological and topographical reports [4] and the compression strength of bricks.
3. Finally, the third step was to introduce all data on different computer software of 3D modelling such as *ETABS* [5] in order to understand and test the proposed interventions on the building.

Fig. 12. Longitudinal section of the church.

Fig. 13. Humidity test taken at the height of 1 meter showing high values.

Fig. 14. Stratigraphic tests that confirmed the oldest layer of mural painting.

3.2 Research, investigations and outcomes

For the first contact with the church, the drawn survey and photographic documentation are necessary. Also, it is good to visit the site several times in order to feel and observe the general condition of the building.

From a macro point of view, it's useful to learn about the environment, the climate, the landscape of the natural context in which the monument is located, in order to get to detail scale and explain the source of humidity or the reason of each degradation the historical structure has suffered.

The model generated by the 3D scanning using laser scan technology together with all the drawn surveys showed the lack of proper building technique that we had anticipated.

Particularities shown by the surveys were the lack of perpendicularity and parallelism of the walls and the lack of symmetry of the church by the central axe on the East-West direction. The building is not splitable in two equal parts, with the north side being narrower that the south side.

A very important discovery was the slight leaning of the building towards the south-east intersection of the altar apse and the naos, where the most important structural cracks were found.

The archaeological research and excavations revealed many particularities that shaped the interventional project. In order to understand the cause of the major cracks in the walls, the first archaeologist diggings aimed the most affected areas, generally the intersections of walls between the altar and the nave. On the south-eastern side researchers found graves dated later than the construction of the building, graves that were located immediately near the foundations. This finding led to the belief that the diggings of the graves had repercussions on the integrity of the structure.

The general quality of the foundations was discovered to be very poor in terms of techniques and depth. They only reach between a minimum of 60 to 70 centimetres of depth, while in the region the conventional freezing depth is of 1 meter. This allows water to freeze underneath the rock boulders causing displacements of the soil under the foundations, hence the small cracks that randomly appear and have no structural correspondent. Technically, the foundations were built of rock boulders and lime mortar, a problem being the fact that due to humidity the mortar was washed away.

An important finding was the original brick floor and the original level of the church 30 centimetres lower over which different layers of concrete were poured.

Another particularity that the investigating team found was that all through the walls crossed wood tyrants at 3 levels of height. The first level, based at 90 cm above ground level, was rotten because of the ascending humidity. The two upper levels of tyrants were in good condition, one can be seen passing through the arches in the portico, the upper one passes through the attic.

The walls presented two classic categories of cracks, ones coming down from the arches and vaults to the foundations, and others upward and downward the windows and doors.

The arches and vaults in the narthex, naos and altar were cracked on the middle axe direction, due to the dis- placement on the walls. In the portico were no damages found, because of its small dimensions. Particularities here were found when looking at the vaults and domes from the attic of the building. Here the investigating team found out that the capstone, the keystone of the arched shapes was made by wood pickets. Due to fluctuations of humidity these pickets changed their shape and volume and this process may have generated some part of the cracks in the vaults.

The strength tests of the bricks showed that the structure is sensitive and needs light consolidating interventions.

The roof of the church was in a bad shape both technically and aesthetically. Biological tests showed that the roof structure had many cavities that were inhabited by woodworms. The general layout was not sufficient. The wood shingle was of poor quality and clearly not original.

The general shape of the roof was modified in the past with the addition of a bell-tower above the portico. This unfortunate choice led to the damaging of the paintings on the west façade, the paintings showing daily village life scenes.

The report of mural paintings conservation and restoration experts, chemical and stratigraphic analysis of the frescoes and the humidity reports are very important diagnosis processes on a monument of which the painted surface is the most important heritage.

Chemical and stratigraphic analysis revealed that all paintings were original. The fresco support layer is very well applied on the walls, but problems appear again with the technique of the painters, both in the quality of the carbonation process and the quality of some of the pigments.

On the exterior of the church, we could intervene with the consolidation works almost on all surfaces, besides the western wall where some remains of the original frescoes still exist.

Humidity report showed that an intervention was needed in order to stop the ascension of moisture.

The diagnosis of the conservation status of the church showed both original technical flaws and of the late interventions on the monument.

Some of the original lacks in technique or materials used are particularities that are best preserved because they show the vernacular feel and originality of the monument.

3.3 Previous interventions revealed by the diagnosis process can be split into two categories, reversible and irreversible interventions

1. Reversible interventions

The repainting of decorative motifs on the columns in the portico and the painting of the profiled belt that goes around the exterior are reversible and did not cause damages, especially as the belt was not painted originally.

The presence of concrete floors and sidewalks is a reversible intervention, even if they encouraged the humidity and moisture to rise from the foundations to the walls. Fortunately, the moisture only damaged the decorative curtains painted up to the height of 90 centimetres and the original flooring found underneath the concrete slabs, a brick flooring that can be replaced with one of higher quality.

2. Irreversible interventions

The most important and unfortunate intervention that the monument has suffered is the change of the roof with the addition of the bell-tower and the attic wall on the western façade.

This adding was a volumetric alteration which could be restored to the original, but in order to reach the bell, they drilled a hole in the narthex vault and destroyed a painted scene. That is the only religious scene that was damaged in the interior of the church, but it yet isn't the most damage that this intervention caused.

Due to the reshaping of the roof, the unique scenes painted on the outside wall of the portico were washed away by rain.

Still, you may identify silhouettes of trees, hills and people on the façade, but the scenes are lost forever.

To these interventions can be added many holes drilled in the interior serving the purpose of hanging drapes, candles, lamps, and the drilling of two holes that served two chimneys.

4 Diagnosis conclusions. Architectural project considerations

1. The restoration of the original volumetric configuration of the roof, with the overhang present on every façade and the removal of the bell-tower in order to preserve the remains of the outside paintings is the only volumetric change that the architectural project [6] proposed.
2. Another impacting change proposed, not for the general state of the monument, but for the visitor, was lowering the floor level to the original level. This change gives more height in the interior, enhancing the perspective on the frescoes. The general feeling is more suitable for a church.
3. In order to maintain the vernacular feel of the materials and techniques used, the finishes and all architectural details must use traditional techniques and compatible materials as much as possible.
4. All structural consolidation works projected [7] had to avoid interventions on the painted surface.
5. All original metallic objects, such as the metallic crosses located on top of the roof and the chandelier in the narthex, needed to be restored and repositioned. The same approach was recommended for the wooden objects, both exterior, like the door and the windows, and for the interior ones, such as the icon frames and liturgical objects.

6. For the interior lightening it was recommended to avoid using candles, in order to preserve the mural paintings for a long time, and all the wiring was projected to pass under the floor. Light objects are to be placed above thin metallic poles placed in every corner of the rooms. The metal poles' role is to keep any wiring or light lamps away from the painted surface.
7. For the heating system in the interior, it was recommended to find a system that does not touch the walls.
8. For the exterior infrastructure, another important aspect is to create a drainage system and sidewalks that keep the meteorological waters and the moisture away from the building.

5 Concept of the intervention

5.1 Infrastructure. Foundations

1. In order to reduce the differential settlements of the foundations and to increase their volume so the efforts can be better received by the natural ground, underbuilding works (Fig. 15) were projected. Another reason for the underbuilding approach was the consolidation of the link between walls and foundations.
2. Having seen the condition of the boulder masonry of the foundation, first of all they had to be injected with a new mortar of hydraulic lime in order to glue the boulders back and prevent them from falling apart when digging underneath.
3. Above the underpinnings our team projected a concrete beam that goes around the church, in order to keep the foundations together.
4. Once the consolidation of the foundations was finished, the remaining ditches were filled with a drainage system made of different sorts of gravel and the drainage tube. Above this, the sidewalks needed to be off-set from the walls with a minimum distance of 10 centimetres, in order to allow a minimum ventilation of the infrastructure.

5.2 Masonry walls

The consolidations of the masonry walls aim to enhance the load-bearing capacity and the structural collaboration of the intersections. Several types of works were projected and implemented.

1. For the reinforcement of the walls, we used longitudinal reinforcement made of helical stainless-steel bars, with high mechanical performance, placed between the rows of masonry in order to stitch the structural elements. The bars were fixed using hydraulic lime.
2. A perimeter belt positioned on the level of the intersection between the vaults and the walls, at about 3 meters of height, in order to prevent the walls from drifting apart. The belt is made of galvanized steel fiber with high resistance. The steel fiber belt was fixed using mortars based on hydraulic lime.
3. In order to restore the structural continuity of the building, all walls besides the western façade were meshed with fiberglass and aramid nets specific for the reinforcement, improvement and anti-seismic adaptation of masonry. (Fig. 16)
4. In places where the masonry was damaged, or were the wooden tyrants where rotten we restored the brick- work using bricks and hydraulic lime-based mortars.

The hydraulic lime recommended and used has a low elastic modulus that creates a perfect balance and a compatibility between the mechanical strength of mortars and the characteristic strength typical of masonry structures of all types. [8]

5. All decoration profiles of the walls were rebuilt using templates. (Fig. 17)

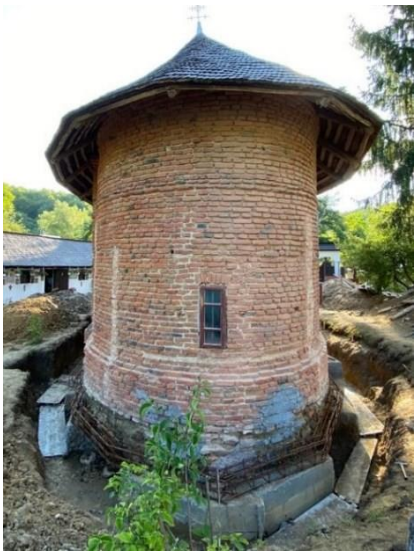

Fig. 15. Underbuilding works phase.

Fig. 16. Wall consolidation works.

Fig. 17. Finished restoration work.

5.3 Vaults and domes

This category of interventions seeks to prevent the vaults and the dome above the altar to collapse. (Fig. 18)

The interventions were implemented only on the outer surfaces, from the attic. No mural paintings were touched by the new works.

1. In places where the masonry was damaged, or were the wooden pickets where rotten we restored the brick- work using bricks and hydraulic lime-based mortars.
2. To hold together the cracks in the vaults we also used clamps and stiches of galvanized wrought iron fixed with hydraulic lime. (Fig. 19)

3. All vaults and domes were strengthened using the fiberglass and aramid nets specific for the reinforcement, improvement and anti-seismic adaptation of masonry. (Fig. 20)
4. The attic was also consolidated in the same manner as the vaults and domes and on the top of the attic was placed a thicker layer of lime so the roof structure would apply pressure uniformly onto the walls.

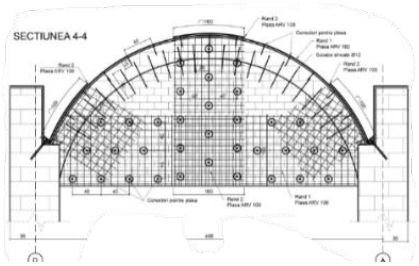

Fig. 18. Projected consolidation detail of the vault above the naos.

Fig. 19. Stitches of galvanized wrought iron fixed on the vault above the naos.

Fig. 20. Fiberglass and aramid nets reinforcing the vaults.

5.4 Roof

In order to restore the church to the original look found in the paintings and having considered the alterations that the roof has suffered over time, our team chose the integral renewal of the roof structure.

1. The new roof structure is similar to the original, but with a larger offset of the overhang in order to keep rain away from the base of the masonry walls, and by this to prevent humidity and moisture to climb again all to the frescoes. The new roof has a perimetral overhang, so the west façade can be safeguarded.
2. The new roof structure was projected to uniformly download structural efforts on to the walls. The assembly of timber is made of fireproof treated wood.
3. The finish of the roofing is wood shingle. Between the shingle and the structure, a layer of lathing was positioned. On the lathing a rain barrier and a vapour control layer were put, in order to keep the humidity away from the attic.
4. All wood used for the roof was impregnated with flame retardant and antiseptic substances in order to achieve fire resistance and to make the structure more resistant to the effects of various types of insects and microorganisms.

5.5 Interior finishing

All the interior was excavated in order to move the flooring to the original level. Under the original level a great volume of gravel was placed, in order to allow the ventilation of the infrastructure. Above the gravel, a underflooring heating system was the choice for a heating system that does not touch the walls. The system is also offset from the walls with a minimum distance of 10 centimetres.

The walking level must be a brick floor, as the original flooring that was found.

All installation and equipment should not touch or pass through the mural paintings.

All finishing should respect the diagnosis conclusions and considerations mentioned in chapter 4.

6 Conclusion

Fig. 21. Picture showing the initial status of the church.

Fig. 22. Picture of the church at the end of consolidation of the foundations phase.

Fig. 23. The Holy Annunciation church at the end of the structural major interventions.

The architectural and engineering projects put together for the consolidation and restoration of the Holy Annunciation church seek to respect and apply all contemporary principles of interventions on historic buildings and cultural heritage theory (Fig. 21-23).

The preliminary research, which included many visits and analysis on the site, the 3D scanning using laser scan technology and the reports coming from different specialists such as the archaeological report, the mural paintings restoration experts report, the geological and topographical reports, the chemical analysis of the painted surface, the biological analysis of different materials, humidity reports and the compression strength of bricks, aimed to apply the prudence and minimal interventional principles.

Marking and reversibility of the intervention principles are respected both in the consolidation manner and the architectural details that were implemented. All the materials used support future interventions and compatibilities.

In the end, the purpose of this project is to preserve the mural painting component of the monument and to restore the monument, using compatible, reversible techniques and materials, based on thorough research and detailed investigations.

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