

THE COMPLETION OF THE CONSERVATION PLAN FOR THE M. KOGĂLNICEANU STREET REFORMED CHURCH, CLUJ NAPOCA, ROMANIA

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ABSTRACT:

The Reformed Church from M. Kogalniceanu Street: The building of the impressive church on the Kogalniceanu street began in 1486, due to the support offered by King Matei Corvin.

The Reformed Church from M. Kogalniceanu Street possess the highest governmental listing of significance available in Romania. The list number is: **CJ-II-m-A-07380**. The A is the qualification for the highest governmental listing.

The church has several major problems, such as cracks in the gothic vaults, humidity in the walls, damages in the roof structure. To prevent bigger damages and additional expenses for conservation is necessary to conduct full survey, research and detailed planning. First Part.

Description the Arhitectural surveye and data acquisition using a Riegl terrestrial Laser Scanner and hand measurements and presenting the final results after the documentation. For the details we used a Leica Laser Scanner.

Second Part

Presenting the conservation plan and the structural modeling of the building

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Second Part

Presenting the conservation plan and the structural modeling of the building

After the complete conservation plan is carried out the owner can gather funds always for the most important and the highest emergency works, completing the detailed plans and carrying out the work itself.

Parallel to the studies and development of the conservation plan a number of emergency works was carried out:

A **training program** was organised parallel to the studies:

- **architecture students** and young professionals was involved in the **architectural survey** of the church using the 3D laser scanner,
- **structural engineer students** was involved in structural survey of the **baroque roof** and the **gothic star vaults**, as well as in the **computer aided modeling** of these structures;
- **art historian** and **archeologist students** were involved in the archeological and art historian study of the building.

During the work were completed the followings:

- specialized surveys to document the condition of the building

- architectural survey using different surveye techniques
- testing to determine appropriate conservation techniques
- develop detailed conservation recommendations
- develop detailed technical drawings
- budget estimates
- creat a conservation master plan
- creat a Historic Structure Report

Brief description of the building

The Reformed Church from M. Kogalniceanu Street: The building of the impressive church on the Kogalniceanu street began in 1486, due to the support offered by King Matei Corvin. The works were completed around the year 1510. The church, oriented on the East-West axis, is a perfect illustration of the late gothic style. Consequent to the struggles that took place during the Reform age, the church was deserted until the mid 16th century. In 1579, Prince Bathory decided that the church should be managed by the Jesuits. In 1662, when the Diet took place in Cluj, it was ruled that the church should belong to the Reformed. The archway of the building was restored between 1638 and 1645. Meanwhile, the tower located on the southern side, as well as the monastery, were destroyed. The church is a unique monument not only due to the fact that it is so old, but also due to its size; it is one of the largest churches in South-Eastern Europe.

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Figure 1. The Church before the conservation works in 1958

Importance of the project

The church has several major problems, such as cracks in the gothic vaults, humidity in the walls, damages in the roof structure. To prevent bigger damages and additional expenses for conservation is necessary to conduct full survey, research and detailed planning.

The priority in addressing the various conservation works will be the end result of the studies, researches and the documentation for obtaining the building permit.

The documentation for obtaining the building permit will include the overall plan, once having the building permit the owner only needs to contract the detailed execution drawings and specifications, than to tender the contractor for a phase for which in meanwhile funds have been accumulated.

The grant for the work for the complete Conservation Plan was given by the Getty Foundation to the Transylvanian Reformed Church District.

Description the Architectural survey and data acquisition using a Riegl terrestrial Laser Scanner and hand measurements and presenting the final results after the documentation.

We collected the data with different methods. To the exterior and interior measurements we used a RIEGL LMS-Z420i long-range 3D laser scanner. We decided to use this technique because is very accurate and is a hand-free technique and we was able to collect data from places where we could not reach without scaffoldings. This method wad considerably more

economical than the traditional way. From 22 scan positions we obtain a point cloud. The scanner was set to scan in each 5 cm to a distance of 25 m. From this scanned data we managed to create 2D Cad drawings without the fine details.

For reference to check the accuracy of the laser scanner we measured each stones position from the gothic vault with a TRIMBLE total station. The difference between the two measurements was in the range of a few millimeters. The roof structure was measured with traditional techniques. Based on collected data, we made a 3D model (point cloud and mash) of the surveyed building, which is suitable for measurements, further planning and preparation of plans. Finally we made 2D ortho photos and 2D Cad drawings to meet any need.



Figure 2. Measuring with RIEGL LMS-Z420i 3D laser scanner

3D scanning is one of the safest and consistent measurement methods that can be comprehensively used for historic buildings geometry definition and condition assessment. It is also suitable for true-colour and detailed surveying of internal and external construction solutions.

The terrestrial laser scanner system RIEGL LMS-Z420i consists of a high performance long-range 3D laser scanner, associated operating and processing software, and a calibrated and definitely orientated high-resolution digital camera.

The system provides data which lend itself to automatic or semi-automatic processing of scan data and image data to generate products such as textured triangulated surfaces or orthophotos with depth information.

A standard Windows notebook and the bundled software package RiSCAN PRO enable the user to instantly acquire high-quality 3D data in the field and provide a variety of registration, post processing and export functions.

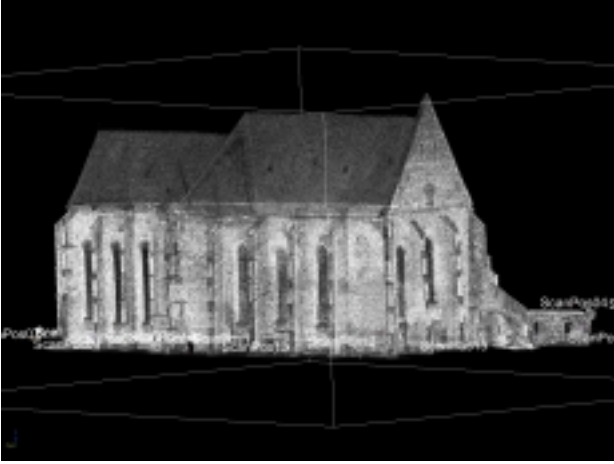


Figure 3. The point cloud

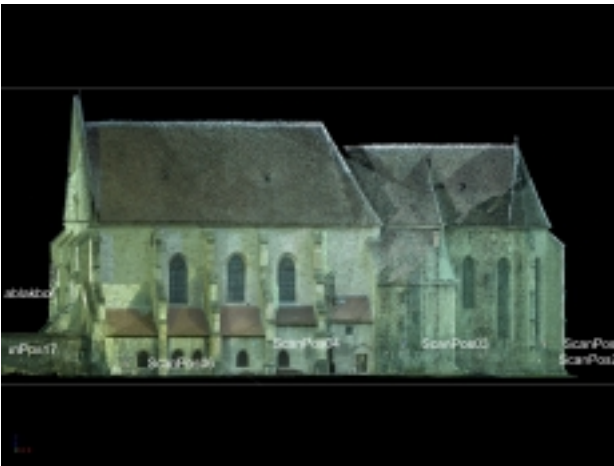


Figure 4. The colored point cloud

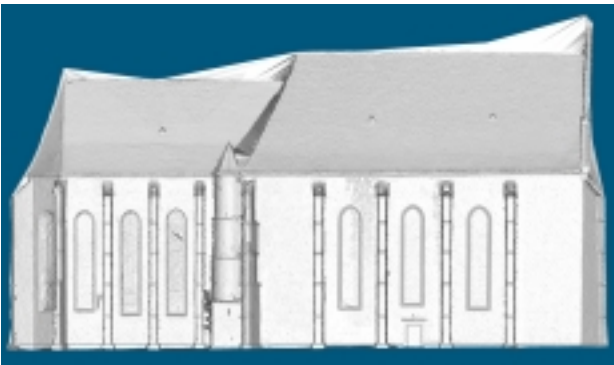


Figure 5. The ortho mesh from the north's elevation

Using the point cloud we made sections in each 2 m in transversal, longitudinal directions and parallel with the ground plan. Using this sections combined with the topographic measurements we prepared the plans in 2D Cad drawing format.

During the preparation of the 2D Cad drawings we realized that the material what we have is not enough, because we are not able to draw the details of the door and window carved stone frames.

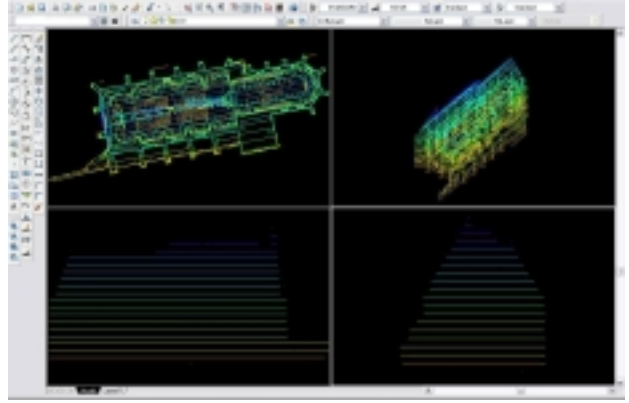


Figure 6. The slices made cutting the point cloud

To complete this work we contacted the University of Iasi and we rented a LEICA 3D laser scanner to do a very accurate scanning for the important architectural details. For the main entrance we realized 3 scans from different scan positions with a 5 mm distance between the scanned points.



Figure 7. Colored point cloud of the main entrance



Figure 8. The floor plan of the church

In the same time with the survey work some other works was carried out as it follows:

Archeological study – includes as emergency works opening the crypt and digging excavating around the church, also executing a drainage in order to recreate breath ability of the structure.

Geodesic – topographic – survey of the site, including external heights and dimensions of the church
Itself.

Building biology and physics study – based also on in situ data gathering and lab analysis – concerning humidity in walls, biological attack of the timber in roof structure; the final documentation.

Using all the collected data and the full structural and architectural survey we prepared a study of the load bearing structure – based computer aided modeling of the main load bearing structures as the roof structure and the vaults.

Modeling the roof structure

The roof structure is part of a hall-type gothic church, with one of the largest span in Central-Eastern Europe: 15,30m (an early gothic choir, late gothic vault of the nave); The roof was rebuilt – probably – after the fire in 1798; with a 55,6° angle, or 3/2 ratio (approximately); in case of the nave; and even 59,7°, or 12/7 ratio for the choir – characteristic angles to the medieval roof structures. On the other hand the structural concept is of a late baroque structure – the intermediate period to eclectic – the superior levels have clearly eclectic structural solutions.

In order to carry out the measured survey of the baroque roof structure first a set of hand drawings were done, and later these drawings were transferred to a dwg format.

As all the roof surveys have to have the layout of the building as a starting point, in parallel the topographical / geodesic survey was carried out, and the outer line of the building was constructed in the same CAD format; The survey is necessary in order to identify all the elements, details and sub-ansambles to be able to study the mechanical behavior of the roof itself. As the results of the measured survey we can present the layout of the roof structure, all the characteristic cross sections, meaning main and secondary trusses, as well as the longitudinal bracing system and the joint details.

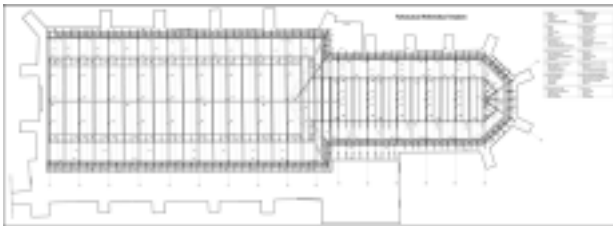


Figure 9. The plan of the roof structure



Figure 10. The main truss of the nave

Calculus was done with the program: AXIS VM7 / 8 and was carried out for the following units: – 3 main trusses (and secondary trusses in between) for the nave; – 3 main trusses (and secondary trusses in between) for the nave; – Complex overall model.

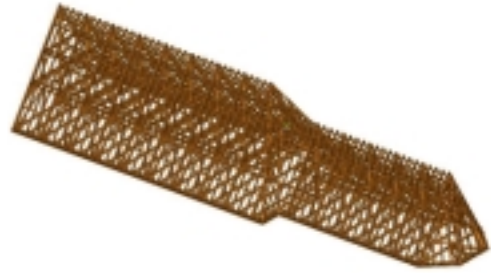


Figure 11. The complex 3D model of the roof structure

Modeling the vaults

The ceilings are the original star vaults, dating back to the second half of the 17th century, both on the octagonal choir and above the nave. The western gallery and southern arcade has a cross vaulting ceiling. The vaults are mainly well preserved though essential cracks can be seen longitudinally between the walls and vaults, especially in the nave, as well as perpendicular on the walls. Cracks can be seen both from inside the church and from the roof structure. A huge overload was accumulated as pigeon guano at the vaults' springs. The overload was removed during the project. The cracks on the upper side was checked and an overall structural analysis was carried out in order to identify the most important causes of the damage. The upper part of the vault has to be repointed, the rib stones have to be checked and the ones that moved have to be fixed.

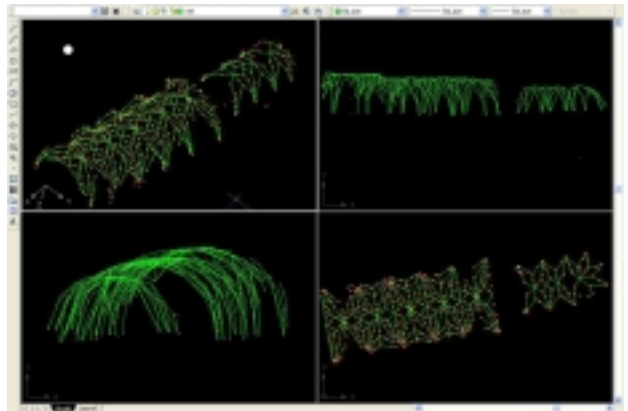


Figure 12. The wire model of the star vaults



Figure 13. The 3D model of the vaults in AXIS VM8



Figure 14. 360° multi image realized with the Leica scanner

Conservation principles and philosophy guiding the project

Our common Heritage, the **built environment** is the key to our knowledge of the past, our understanding of the present and confidence in the future. This legacy inspires us not only to care for the artefacts of previous generations, but also to make the right decisions for future generations. This learning process is active and dynamic.

This project can be a **good illustration** of the **positive values of networking** in favor of cultural heritage, built and natural environment. The future of our rich Transylvanian cultural heritage will be best assured and sustained by partnerships between the public and private sectors. Such synergies, at all levels and between all sizes of organization and the public, will be a positive feature of the future cultural environment and its sustainable development.



Figure 15. Training program was organised for students

The **highest priority** is to retain the **historic character** and appearance of the Church. Through the rigorous application of the highest international standards of conservation throughout all phases of the work, the project will serve as a demonstration of excellence throughout Romania and the region. Also, of great importance in the project will be the **training of local personnel** in the principles and methods of conservation to establish a pool of qualified professionals capable of undertaking future restoration projects.

Special research will be intended to stimulate the study and **understanding of important structures** in Transylvania, and encourage scholarly exchange, dialogue, and publication. The

wider range of expertise required in this conservation project is to act as a stimulus and provide training opportunities in a broad range of sciences, from geology to archaeology, from engineering to timber construction, and from museum to public and community administration.

Modern materials will be used whenever interventions could not be achieved to appropriate levels of safety with traditional technology. All modern insertions what will be needed for the adaptive use of the church will be designed in such fashion as to permit, if necessary, their removal or alteration in future, without damage to the adjacent original fabric. Furthermore, when new elements required, the modern materials and techniques employed are readily distinguishable.



Figure 16. Artefacts

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