

HISTORY OF THE CHANGES IN THE ROOF STRUCTURE OF A HISTORICAL WOODEN CHURCH

Jacek HULIMKA¹, Magda TUNKEL²

Faculty of Civil Engineering, Silesian University of Technology, Gliwice, Poland

Faculty of Architecture, Construction and Applied Arts, Academy of Silesia, Katowice, Poland

A b s t r a c t

During the many years of exploiting building structures, many changes and reconstructions were carried out. Sacral structures were no exception. The article shows an example of a historical wooden church, in which at some point in time the roof was reconstructed. As a result of the above, the system of ridgepoles typical for wooden Silesian churches was destroyed. In 2012 the structure was renovated, bringing back the original roof arrangement. However, this required a change in the geometry of the secondary elements of the structure which did not fit with its original body. After, the works were completed the building regained its original system of ridgepoles, while the secondary elements were reconstructed, thus eliminating the existing problems with water drainage.

Keywords: wooden church, wooden roof, reconstruction, renovation, roof drainage

1. INTRODUCTION

Renovations of historical structures require particular precision and care because of among others their historical value, cultural significance, as well as unique architectural and constructional properties. Historical structures not only in a historical approach show off carpentry skills but are also an inseparable part of cultural heritage. That is why, all works connected with the renovation, repair, or rebuilding of such a structure should strive to maintain its original form. That means, not only restoring its original structure and appearance, but also respecting the authenticity of materials, construction techniques, and architectural style. Care for nearly every element of the renovation works process should move towards maintaining the historical structure in the best condition possible. This means not only careful preparation and implementation of works, but also the use of high-quality materials and maintenance products, that will ensure the durability and protection of the building for many years to come. Therefore, precision and care while performing renovation works on historical structures allow them keep their unique character and values for future generations, at the same time protecting these

¹ Corresponding author: Faculty of Civil Engineering, Silesian University of Technology, Akademicka 5, 44-100 Gliwice, Poland, jacek.hulimka@polsl.pl

buildings from degradation and a loss of their cultural heritage. In striving to maintain heritage buildings in their fully original form yet with a goal of carrying out the necessary renovation and repair works a method that proves invaluable is the more and more widely used digitalization and photogrammetry. Thanks to this method forms of preparing revision and design documentation pertaining to the planning, implementation, and further exploitation of historical structures put particular emphasis on the architectural and conservation inventories, which without a doubt are the basic and most important forms of technical documentation [1]. Laser scanning is of secondary importance to the present article, yet it is still extremely important assuming that the goal is maintaining buildings, and especially historical buildings in their unaltered state. Its main benefit is the speed of getting large amounts of data in a very short time, which provides a great advantage over other measuring methods. Scanning can also be used in engineering, geodesy, and construction works of structures of high complexity, as well as the possibility to study construction damages and deformations [2]. Thanks to photogrammetric methods it is possible to complete structure inventory in a very short time as well as monitor the changes occurring in it. Such activities allow for a quick reaction to threats, by introducing structural strengthening or making an immediate decision to carry out repair and renovation works [3]. In laser scanning methods of structures, we can also see the targeted interpretation of the existing state in correlation with the planned investments concerning, for example, the renovation of a roof, replacing the window-and door frame-woodwork, or repairing the elevation. In using the so-called digital twin the scope of works may be planned, but above all the effect of the planned changes can be seen and critically evaluated, as a result avoiding wrong decisions [4]. In the described case the existence of such documentation (impossible due to the time period of previously carried out reconstructions) would be extremely helpful in recreating the original roof arrangement.

In addition, while implementing renovation, repair, or reconstruction works it is extremely important to properly evaluate how well the structure or its part has been preserved. Renovations of wooden churches, especially taking into account repairing wooden roof trusses, require expert knowledge. Initially, we may distinguish a few steps that should be considered during the process of a renovation connected with the repair of wooden roof trusses or restoring their original appearance.

The first step is an exact evaluation of the wooden construction. The renovators must precisely evaluate the state of the wood, in order to determine if it requires repairs, or if it may still be exploited. Damaged or degraded elements of wooden constructions, including roof trusses, must be repaired, or replaced with new ones similar to the original ones. In certain cases, it may be necessary to strengthen the construction by adding additional beams or other strengthening elements. It is for those reasons that it is very important to evaluate how well the structure has been preserved and to become familiar with the available technical documentation, as well as archival non-technical documentation. It is worth mentioning that in the case of sacral structures, valuable sources of knowledge are historic monument registry cards obtained from the Provincial Heritage Monument Protection Office, as well as post-visitation protocols made by bishops [4]. Such documentation may provide a lot of technical information about the building, including information about previously completed repair works and reconstructions.

In conclusion, the renovation of wooden churches and in particular the repair of wooden roof trusses is a comprehensive process that requires both expert technical knowledge as well as respect for the historical and cultural value of the structure.

In the subsequent part of the article, the case of a historical wooden church is presented. As a result of previously completed works, the original architectural arrangement of the roof was altered, destroying its initial form, so typical for churches in Upper Silesia. As a result of a renovation, the original roofs were recreated, and secondary fragments of the construction were adapted to them.

2. STRUCTURE DESCRIPTION

2.1. Architecture and construction

The Holy Trinity Church in Koszęcin was erected in the years 1721-1724 as the third church built in this location – the previous two were both destroyed in fires. The construction was financed by the Father Szymon Motłoch Foundation, while the builder was the carpenter Jacob Ridzinger, from the Nysa area [5, 6].

The dimensions of the outline of the church plan, 35.7×18.2 m (Fig. 1), place it among a group of the largest wooden churches in Upper Silesia [4, 7]. The structure has a typical east-west orientation, with the presbytery located on the east side (Fig. 1, 2). The body of the building boasts a single nave, with the presbytery enclosed on three sides in the east, a tower with a church porch in the west, a tetragonal sacristy in the south, and a side church porch in the north. On the floor above the presbytery, there is a collator loge, accessible via the stairs that were later enclosed with an additional extension in the corner of the nave and the sacristy [8, 9].

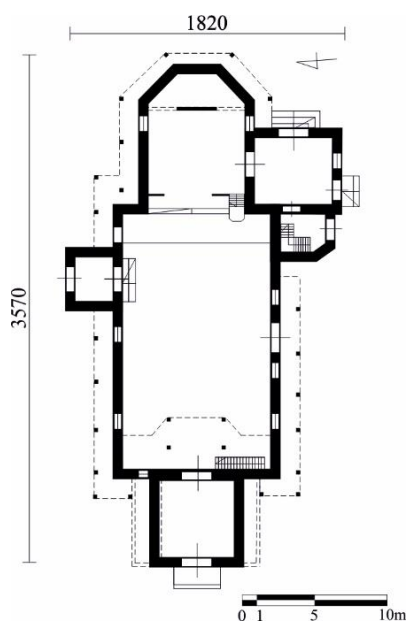


Fig. 1. Functional diagram of the church



Fig. 2. Location of the church on the premises of a cemetery

From the constructional point of view the nave, presbytery, and the sacristy with the collator loge are built in a log-frame structure, with various beam joinery techniques – dovetail, scarf, and finger. The roof trusses above the nave and the presbytery were built as queen-post, collar-beam, covered with wooden shingles on the roof patches. Typically for Silesian wooden churches the roof above the nave is higher than that above the presbytery. The roof above the presbytery has a hexagonal steeple built-in with a lantern and a tented roof. The roofing of the nave and the presbytery was completed in the form of a flat vaulted ceiling with beams and full boarding. The nave was separated from the presbytery with a rood screen with a flat arch. The roof above the collator loge was originally three-hipped, transverse to the roof above the presbytery. The building was set on a stone and brick underpinning [10, 11].

A musical choir was built into the nave supported on six beams, which is accessible via external stairs situated in one of the corners of the nave.

The church is surrounded by open arcatures, leaving the walls beneath them uncovered, while above the arcatures they are boarded with shingles.

The tower boasts a skeleton construction, slightly converging upwards, boarded with vertical boards with desks further sealing the joints. The tower was topped off with a tented roof with an octagonal lantern

Figure 3 shows archival photographs taken from reports [5, 12].



Fig. 3. Archival photographs [5, 12]

2.2. Furnishings

The most important elements of the church furnishings consist of the main Baroque altar from the 18th century with an altarpiece of the Pieta with sculptures of St. Cyprian and St. Valentine on the sides, side altars (left with a painting of St. Anne with sculptures of St. Theresa and St. Barbara, and right, with a sculpture of St. John of Nepomuk), a Baroque pulpit, a baptismal font, and organs from the 19th century. Other fragments of the original furnishings from earlier churches are housed in the collections of the Silesian Museum [4, 12].

Many polychromies have been preserved on the ceilings and walls.

3. CHANGES IN THE ROOF CONSTRUCTION

3.1. The original arrangement of the roof construction

Numerous renovations and reconstructions occurred during the history of the church, all of which have not been properly documented. From the point of view of the present text, the most important reconstruction was that of the roof above the nave and the presbytery, combined with enclosing the stairs leading to the collator loge.

In their original form, the roofs above the nave (higher) and the presbytery (lower) were made as typical pitched roofs with separated ridgepoles situated on two levels. Such a solution was typical of Silesian wooden churches – it has been documented in 67% of the preserved structures [4]. The three-hipped roof above the collator loge transversely touched the roof above the presbytery. Such a roof arrangement ensured easy rainwater drainage, also at the contact points of the nave with the presbytery as well as in the valleys of the roofs of the presbytery and the collator loge. In the plan described above the stairs leading to the collator loge (from the west) were located outside the outline of the building and were probably covered with a small roof or a low enclosure [9].

At some point in time, the stairs leading to the collator loge were enclosed with two additional walls, while the western part of the loge roof was stretched out over the new space, slightly changing the roof's slope. The above is clearly visible in Fig. 4, where the additional walls are marked in red, while the new roof is marked in green. As a result of the above, there was a certain interference of the new roof with the original roofs, which led to the creation of a no-drainage zone in the corner of the nave and the loge. In order to avoid this at that time the original joints of the roofs above the nave and the sacristy were reconstructed, changing the stepped roof-to-roof transition to a gentle transition on a curvature (marked in blue in Fig. 4). For symmetry an identical solution was used on the northern side. As was mentioned, the data of this reconstruction remains unknown, however, the roofs were functioning in the described arrangement until 2012.

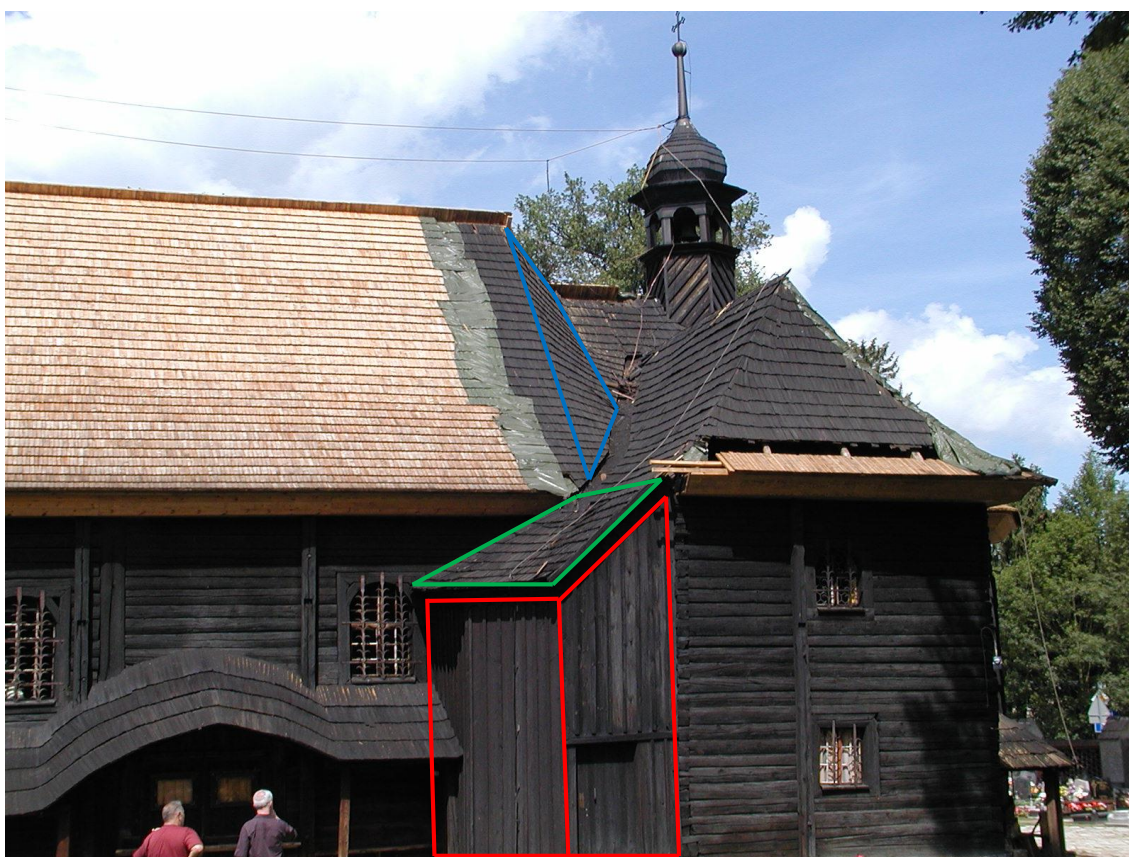


Fig. 4. View of the church during the renovation of the roof in 2012; walls around the stairs were outlined in red, the roof above the stairway enclosure was outlined in green, and the changed roof joint above the nave and the sacristy in blue

3.2. Return to the original arrangement of roof construction

In 2012 works were undertaken to restore the original arrangement of the main roofs: above the nave and the presbytery. The original stepped roof-to-roof transition was very well visible in the attic of the structure where fragments of the endings of the higher roof (above the nave) in its original form were preserved (Fig. 5). Works started on the northern side where they were completed without any problems.



Fig. 5. Fragments of the original roof end above the nave (higher)

After moving on to the southern side, the contractor faced the previously described problem of the spatial interference of the new fragment of the roof above the stairs to the collar loge with the original (recreated) roof arrangement with a sharp change in the level of the ridgepole. Attempts to recreate such an arrangement resulted in the appearance of the aforementioned non-drainage fragment of the roof, which is unacceptable when the roof is shingled. In such a situation the contractor after consulting with the conservator of monuments, asked one of the authors of the article to develop a technical solution.

A thorough examination of the construction of the enclosure of the stairs leading to the collar loge clearly showed its secondary character. Thus this was not an original solution, resulting in the disruption of the original construction and architectural arrangement. In such a situation, from a technical point of view, two solutions were possible. The first of these was the complete removal of the stairway enclosure possibly creating a small roof above it. The second meant leaving the stair enclosure however at a slightly lower level so that it could be covered but without interfering with the main roof in its original form.

Due to the historical character of the structure, the final decision was left to the conservator of monuments, who supervised the works. As a result of an analysis of source materials, including archival photographs and drawings a decision was made to lower the original enclosure of the stairs and cover it with a small roof situated below the canopy of the main roofs – which may be seen in Fig. 6. This allowed the renovation of both of the main roofs on the south side to continue as well.



Fig. 6. View of the church after roof renovation: a red oval marks the roof above the lowered stair enclosure, while a red arrow the restored recess of the ridgepole

4. CONCLUSIONS

Over the years reconstructions often occur in historical buildings, some of which disrupt the original architectural or construction solutions. In the described example the non-original enclosure of the external stairs forced a serious change to the roof arrangement over a three-hundred year old wooden church. This change was quite significant since the recess of the ridgepole over the presbytery (in relation to the nave) was done away with, yet it is one of the distinguishing features of wooden Silesian churches.

As a result of the decision made by the conservator of monuments renovation works began with the goal to return to the original architectural form. However, an obstacle was the interference of the secondary roof with the original one which resulted in the creation of a non-drainage zone in the place where the roofs connected. In the aforementioned situation, a decision was made to change the shape and height of the secondary elements (of unknown age) in order to restore the original arrangement of the roofs.

The described case is one of many, where it is necessary to make a decision about a certain classification of building structure fragments as far as their historical value. Only then is it possible to carry out comprehensive renovation works during which certain parts of the building elements are removed or changed to recreate or highlight the elements that are the most valuable historically.

ADDITIONAL INFORMATION

The presentation of this article (Renowacja Budynków i Modernizacja Obszarów Zabudowanych XI, Zielona Góra, 2024) was financed under the research project BK-230/RB6/2024 in Silesian University of Technology, Department of Structural Engineering.

REFERENCES

1. Uścińowicz, J 2022. [Standards of Conservation Documentation of Wooden Architecture as the Basis of Monitoring and Management]. In: [*Documentation and Monitoring in Management of Wooden Building Structures in Father Krzysztof Kluk Museum of Agriculture in Ciechanowiec and the Ryfylke Museum*]. Ciechanowiec: Muzeum Rolnictwa im. ks. Krzysztofa Kluka, 43-67.
2. Pawłowicz, JA and Szafranko, E 2016. Technical assessment of historic buildings on the basis of information obtained from a three-dimensional point clouds. *Civil and Environmental Engineering Reports* **20** (1), 71-78.
3. Siejek, M, Kasza, D and Wajs, R 2024. Methodology of spatial data acquisition and development of high-definition map for autonomous vehicles – case study from Wrocław, Poland. *Civil and Environmental Engineering Reports* **34** (1), 87-103.
4. Tunkel, M 2023. [*Features of Model Wooden Sacral Architecture of Upper Silesia Based on the Analysis of Preserved Structures*]. Doctoral Thesis. Gliwice: Politechnika Śląska.
5. Kornecki, M and Rejduch-Samek, I 1960. [*The Catalogue of Art Monuments in Poland, vol. VI: Katowice Voivodeship, bull. 8: Lubliniec County*]. Warszawa: Instytut Sztuki PAN.
6. Dobrowolski, T 1946. [*The Oldest Silesian Churches as Signs of Ancient Times*]. Katowice: Wydawnictwo Instytutu Śląskiego.
7. Kubik, J 2018. [*Wooden Churches in Silesia*]. Gliwice: Wokół nas.
8. Linette, E and Linette, R 1960. [*The Catalogue of Art Monuments in Poland, vol. VII: Opole Voivodeship, bull. 10: Olesno County*]. Warszawa: Instytut Sztuki PAN.

9. Tunkel, M 2019. [The Holy Trinity Historical Church in Koszęcin as an Example of Typical Architectural and Construction Solutions in Wooden Sacral Architecture of Upper Silesia] In: Gromysz, K and Knapik-Jajkiewicz (ed) [*The Approach to Problems of Civil Engineering*]. Gliwice, Wydawnictwo Politechniki Śląskiej, 131-138.
10. Buchta, H and Kopernik, L 2006. [The Catalogue of Wooden Churches – Koszęcin]. *Krajoznawca Górnośląski online* **21**.
11. Myrcik, J 1994. [*Koszęcin and the Surrounding Area: Historical outline, people, monuments*]. Koszęcin: Rada i Zarząd Gminy.
12. Myrcik, J 2003. [*The Historical Holy Trinity Church in Koszęcin*]. Koszęcin: Ośrodek Kultury i Edukacji Regionalnej w Koszęcinie.