

"From Material to Structure" MECHANICAL BEHAVIOUR AND FAILURES OF THE TIMBER STRUCTURES

Malopolska (Polonia Minor), a southern region of Poland abounds in specimens of historical architecture. In the study there were three main rooms which had different functions to suit the family's needs. Additions to the main house included a kitchen with a half and a pantry. The exterior of the building has preserved its original character. It is a single story symmetrical structure with a central porch opening onto a driveway, two windows on each side and a massive Polish mansard shingle roof. The extension on the right

houses the kitchen and pantry which are slightly offset from the main house. It is worth pointing out that extensions and additions of all sorts were very characteristic of the Polish manor houses. They originated from the needs of the generations of their inhabitants. Their volumes demonstrate successive layers which enriched the architecture and added individuality to the buildings, as was the case with Tetmajerowa.

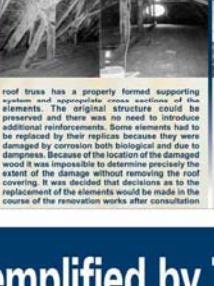
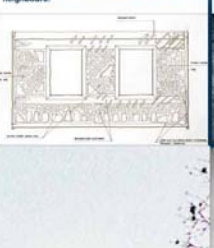
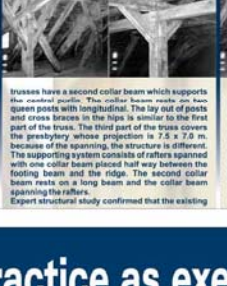
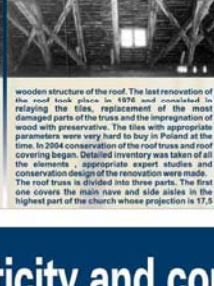
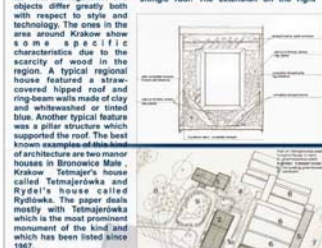
lost nothing of its original character and the interior looks as if it has stood still. In 1996 refurbishment works started. They continued for nine months. The roofing, which had been replaced a few years before, did not require any interference. Neither did the basic elements of the roof structure. The manor had no foundations. The walls stood on ground beams which needed replacement because in the early 1900s they were found to be in very poor condition. Completely new foundations were then laid. The existing loadings were not altered. The existing loadings were not altered. The existing loadings were not altered.

foundations at the same time. Most of the walls were dismantled and rebuilt. The literature on the subject refers to the building as a wooden manor. However, the facts look slightly different. Many walls were built using a technique which is not very durable, namely a mixture of wood, brushwood, straw joined with clay-based mortar. This posed a great conservation problem during the refurbishing. According to historical research, the basic building material in the area in both the 19th and 20th centuries was wood. Plastered structures of walls was obsolete at the time although it occurred

in utility buildings. And yet, residential houses made of brushwood were not a rarity. According to the literature on the subject, there were whole villages built using this technique in the area around Krakow in the early 1900s. The structure was also typical of many houses of the gentry which often did not differ very much from the cottages of peasants. Their specific feature was their location: They were set in vast parkland, far away from neighbours.

Therefore the problem of preserving the authentic structure of the walls proved quite complex. When plaster was removed and detailed inventory taken, it turned out that every wall had its unique structure. On the whole, there were two types of wall structure. The rooms in the eastern part of the main building had a (sumikowo-takowa) construction while the rest of the walls consisted of a post and frame filled with bricks, stones, wood, brushwood, all joined by means of clay-based mortar. Significant

fragments of inside walls were made of brick. A variety of structure and detailed inventory taken, it turned out that every wall had its unique structure. On the whole, there were two types of wall structure. The rooms in the eastern part of the main building had a (sumikowo-takowa) construction while the rest of the walls consisted of a post and frame filled with bricks, stones, wood, brushwood, all joined by means of clay-based mortar. Significant



A significant conservation problem is related to preservation of historical wooden roof trusses, especially in churches. They are valuable examples of spatial structures but the main threat to their existence is the passing time and leaking roof coverings. In the 1930s, baffling materials with good technical parameters became available in Poland. They enabled roof coverings. Until then, damaged roof coverings, especially tiles, caused the walls to be flooded by rainwater but, first of all, resulted in dampness and corrosion of roof trusses, including the historical or antique ones. In such cases, the conservation and renovation activities consisted in replacing the damaged sides with tin or copper sheets. There were two reasons for this. The first one was lack of appropriate tiles and the other one was the weight of such covering. In 1950, the restoration work commenced when much damage had already been done not only to the covering but also to the roof trusses. A significant example is St. Anthony's church in Wrocław which was in poor condition. The main problem was the roof covering. Many tiles were missing which caused profuse leaking. This resulted in dampness of the vaults and

wooden structure of the roof. The last renovation of the roof took place in 1976 and consisted in relaying the tiles, replacement of the most damaged parts of the truss and the impregnation of wood with preservative. The tiles with appropriate parameters were very hard to buy in Poland at the time. In 2004 conservation of the roof truss and roof covering began. Detailed inventory was taken of all the elements. Appropriate expert studies and conservation designs of the renovation were made. The roof truss was divided into three parts. The first one covers the main nave and side aisles in the highest part of the church whose projection is 17.5

m. The system used here consisted of rafters and collar beams with side and central purlins. The main trusses have an additional collar beam supported on the queen post which reaches the ridge while in the upper section of the truss there is a long beam and an additional purlin. In the hips there are diagonal cross braces. The posts rest on a tie beam (barka, postestones) lying on footing beams spanning the side walls of the nave. The second part of the truss covers the lower part of the church whose projection is 17.5 x 4.5 m. Its structure is slightly different. The supporting system consists of transverse trusses. The main

trusses have a second collar beam which supports the central purlin. The collar beam rests on queen posts with longitudinal. The layout of posts and cross braces in the hips is similar to the first part of the truss. The third part of the truss covers the presbytery whose projection is 7.5 x 7.0 m. Because of the spanning, the structure is different. The supporting system consists of rafters spanned with one collar beam placed half way between the footing beam and the ridge. The second collar beam rests on a long beam and the collar beam spanning the rafters. Expert structural study confirmed that the existing

roof truss has a properly formed supporting system, and appropriate cross sections of the elements. The original structure could be preserved and there was no need to introduce additional reinforcements. Some elements had to be replaced by their replicas because they were damaged by corrosion both biological and due to dampness. Because of the location of the damaged wood it was impossible to determine precisely the extent of the damage without removing the roof covering. It was decided that decisions as to the replacement of the elements would be made in the course of the renovation works after consultation

with the conservator. When the works began, most of the damage to the wood proved superficial. After the damaged layer had been removed, the cross section of the supporting elements was sufficient for the statics of the system. Finally, it turned out that only 6% of the truss needed replacement. As for the roof covering, it had to be completely replaced. The highest quality ceramic tiles were used for the purpose. Similar problems occurred when the roof covering and wooden trusses of two other