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World's largest wooden church in Kerimäki

Największy drewniany kościół świata w Kerimäki

Keywords: Heritage, Timber, Log, Church, Structures

Słowa kluczowe: dziedzictwo, drewno, bal, kościół, konstrukcje

1. CONSTRUCTION OF THE CHURCH

Construction of a new church was planned in Kerimäki since the 1810s, as the old church had become isolated. According to an ordinance given in 1823, the church was to be built of stone. Construction was postponed because the parishioners understood that building a stone church would be very costly. In the end the emperor granted permission to use timber as the building material [1].

According to the first church plan, only 1500 parishioners would have fit in the church. The residents of Kerimäki did not approve the plan and they appealed to the intendant's office for plans for a larger church. Initially the office did not consent to this request if the building material were timber. It was feared that a very large wooden church would not hold together [2]. It was also doubted that the parson's voice would carry enough in a large church. Finally, in 1844 architect A. F. Granstedt designed a church that would accommodate 5000 people, and construction began immediately [3].

The parishioners committed themselves to a labour-intensive, costly undertaking. The construction work was supervised by distinguished church builder Axel Magnus Tolpo until his sudden death, after which his 23-year-old son, Theodor Tolpo, continued his father's work. The parishioners also took part in the building process according to their income bracket – every man between the ages of 15 and 60 was obliged to participate in the building. The parish appointed professional builders, masons, blacksmiths and carpenters. [4] The parishioners paid these professionals' wages in grain and money.

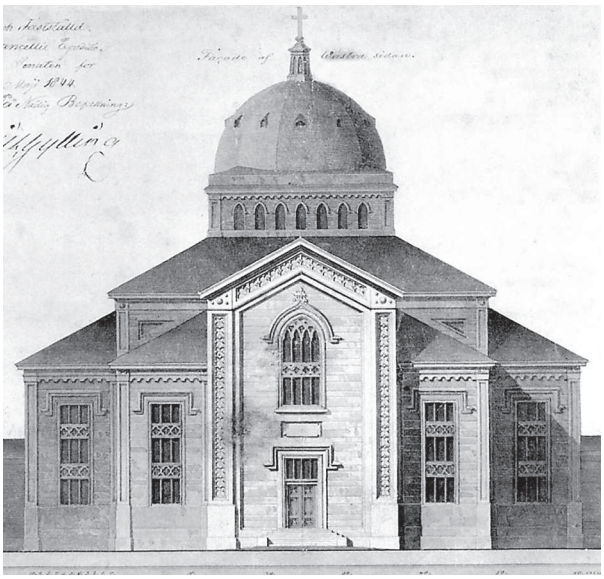

Fig. 1-2. The original drawing of the church by architect A. F. Granstedt. Kerimäki church at the beginning of 20th century (Archive of Kerimäki parish)

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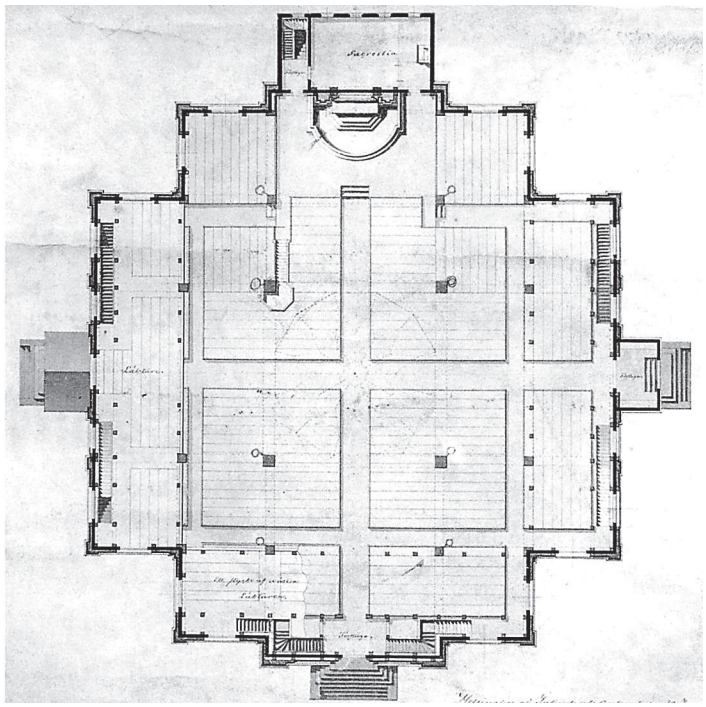

Fig. 3-4. The interior of Kerimäki church (Photo Anu Soikkeli, 2011). The floor plan of the church is a short-armed double cruciform church (Archive of Kerimäki parish)

Construction began in the spring of 1845. Selected stones and timber material from around the parish were brought to the building site during the previous winter. Logs were transported along winter roads by horses or floated along waterways in the summer. [5] Boards were primarily sawed by hand at the building site, as the parishioners didn't want to buy boards from sawmills owned by people from other parishes. The parishioners fulfilled their work obligation without pay, but the craftsmen were paid in grain. Granstedt estimated that 294,000 nails were forged at the building site [6].

Even while the church was being built there was considerable doubt about its structures, but in the end permission was given to install windows in the centre dome. The roof was covered for the most part with wood shingles, since the parish had only enough money to cover the dome with sheet metal. The church was completed in the autumn of 1847 and was consecrated the following summer, when it was also painted [7]. The church was completed relatively quickly, as there was plenty of manpower and workdays were long – 14 hours in the summer and 10 in the winter [8]. A tall bell tower was built at the same time near the main entrance of the church. Its lower part is made of stone and the upper part is made of wood.

Attempts have been made to explain the large size of the church as a result of confusion between ells and metres or a mix-up of drawings. In actuality the size of the church was dictated by the size of the parish: according to the rector back then, the church had to accommodate half of the 12,000 parishioners at a time.

2. ARCHITECTURE AND STYLE OF THE CHURCH

The mid-1800s was a period of change in European church construction. Styles and details in church designs were taken from classical, Gothic, Romanesque and Byzantine styles. Granstedt's own designs were influenced by the cathedrals in


Fig. 5-6. The exterior and interior are extremely well preserved (Photo Anu Soikkeli, 2011)

Firenze and Aachen, for example, as well as Hagia Sophia [9], but the old Finnish church building tradition is also recognizable in the church.

The Kerimäki church is huge: it is 45 metres long, 42 metres wide and 27 metres high at the centre dome. The tip of the cross atop the dome is 37 metres high. The roofs of the arms of the transept are higher than the roof of the twin galleries built as a continuation of the arms. There are seats for 2870 parishioners in the nave, which is divided into three aisles by four massive pillars, and under the galleries. An additional 1830 parishioners fit in the two-storey galleries located in three arms of the cruciform structure; altogether there are seats for nearly 5000 people [10].

The floor plan of the church is a short-armed double cruciform church. The dome is supported by four timber pillars at the centre of the cruciform shape. The pillars are reinforced by richly profiled tie-beams connected to the walls. Open roof trusses shaped like three-leaf clovers are also partly supported by the tie-beams. The nave is well-lit, as three-storey windows in the walls and openings in the dome give abundant light, adding to the feeling of spaciousness in the nave. The church is flooded with light from the three-storey, diamond-patterned vertical windows, upper windows in the east and west gables and side-by-side lanceted windows in the centre dome. The pulpit was situated on the left side of the main aisle of the church on one of the large pillars at the centre of the cruciform shape. The parish clerk led the singing of hymns from a chair next to the altar. The parish clerk's chair was no longer needed after 1894, when a 20-stop pipe organ was installed in the west gallery of the church.

The horizontal log walls of the church are clad with horizontal boarding. The influence of Romanesque and Gothic styles are apparent in the moulding and decorative woodwork of the facades. The corner pilasters imitate stone churches, the friezes carved with a quatrefoil motif framing the main entrance and the arched windows in the east and west gables mimic stonework. The interior decoration shows traces of Gothic features.

3. LATER MODIFICATIONS

The original untreated wood-shingle roof did not last long, and it was covered with galvanised sheet metal in 1904. The green shade of the dome mimics a copper roof; elsewhere the roof is painted black. The footing was repaired with cement mortar and the steps of the side entrances were replaced with concrete steps [11]. The surroundings of the church, which was built on an open hill, have gradually become overgrown with trees, and the church is partly hidden by them.

In 1932 the church was expanded with a smaller nave; a so-called winter church with seats for 200 was built on the side of the church. This winter church was further expanded in 1953, after which it seated 250 [12]. The main nave of the large church did not have heating for the cold season, and large iron stoves installed in 1915 were not able to heat the church, either [13]. Every year on Christmas morning a Christmas service is held in the big church, where according to an old tradition everyone wears a fur coat and mittens during the service. The church has several decorative iron stoves, but they have been unused for over 50 years, already.

The exterior of the church was repainted in the summer of 2009. The surface area of the painted walls was about 4000 m^2. The painting company estimated that 4500 litres of linseed oil paint was used for the job [14]. The previous primer paint was zinc white, which was coated with oil paint. The zinc paint had since hardened and become chalky, which along with changes in the weather made the impermeable layer of paint flake off. Raising funds for the paint job was said to be challenging, as the cost rose to €813,000. The church has to be painted again in about 20 years.

4. STRUCTURE

4. 1. General characteristics and limitations of a log structure

Traditional Finnish log construction was based on a saddle-notch corner joint system, which spread to Finland from the Russo-Byzantine culture in the east during the Iron Age [15]. The saddle-notch corner joint structure is made by notching the top of one horizontal log and the bottom of another, forming an interlocking corner when placed one upon the other. These joints in the crossed logs lock the courses of logs into a sturdy framework, and for this reason a log building should have a sufficient number of interlocking joints. To ensure that the logs are tightly seated against each other, a longitudinal groove is cut along the bottom of the upper log. This groove also prevents rainwater from entering the seam between the logs. The logs are fastened to each other by means of wooden dowels inserted into vertical holes drilled through adjoining logs.

Fig. 7-8. Short corner and long corner of old Finnish log buildings

Of Finnish wood species, pine, spruce and aspen were suitable as logs, although pine was usually preferred because it had the best properties for this type of construction [16]. According to traditional knowledge, trees used for logs were felled in winter, when it was easy to transport them in the forest and the barked logs had time to dry sufficiently during early spring before fungi had a chance to begin growing in them. Timber was readily available, which was one reason why logs were long the most common building material. The oldest preserved wooden churches date back to the 1600s.

Settling of the walls during the shrinking period of the logs is a peculiarity of log construction. Suitable structural designs which take this phenomenon into consideration have been developed over the centuries. This allowance for the shrinking period also affects the building's architecture [17]. The shrinking period of a massive log wall is 3-4 years, and this period cannot be artificially shortened. The wall settles due to shrinking of the wood and tightening of the seams and joints; the logs never fit together as tightly as possible during the construction phase. Tightness of fit can be improved during the construction phase by using dowels, for example. Tight-fitting dowels can be used to draw the logs against each other and prevent the seams from opening when working on the next courses. Most cracks left during the construction phase will close during the first winter as a consequence of the load of snow. The logs dry out during the shrinking period, resulting in the appearance

of small cracks, which cannot and need not be prevented. Careless workmanship or poor-quality wood may cause the seams to open [18]. Thus, in the centuries-old log construction tradition, logs have always been chosen carefully and the grooves cut into the logs have been stuffed with moss and later with flax stuffing.

In the saddle-notch corner joint system the size of the building is dictated by the length of the logs. Logs longer than 10 metres have been used in Finland only in exceptional cases. The appearance of double cruciform churches in the late 1700s was brought about by the length of logs; the objective was to build as large a nave as possible using 5–7.5-metre logs. The length of the logs was dictated by both tree growth and the weight of the timber material, which had to be taken into consideration when building with manpower. It should be noted that full-length logs were only used above and below window and door openings [19].

Fig. 10-11. The pillars are reinforced by richly profiled tie-beams connected to the walls (Photo Anu Soikkeli, 2011)

4.2. Structural system of the Kerimäki church

The floor plan of the church is a short-armed double cruciform church (Fig. 4). The dome is supported by four timber pillars at the centre of the cruciform shape. The pillars are reinforced by richly profiled tie-beams connected to the walls. Open roof trusses shaped like three-leaf clovers are also partly supported by the tie-beams. The nave is well-lit, as three-storey windows in the walls and openings in the dome give abundant light, adding to the feeling of spaciousness in the nave.

The outer walls of the church – which support the roof structure – are made of horizontal logs and the interior pillars are each made of four vertical 15-metre-long, 16-inch-thick (40 cm) posts which are bolted together and made rigid in the horizontal direction by the side galleries. This design was structurally challenging, as the difference in settling between the vertical and horizontal structures in the outer walls and the pillars was over 30 cm. This difference in settling was not resolved with adjustable joints as is done nowadays; instead the difference has been absorbed by the large scale of the building or it was taken into consideration in advance.

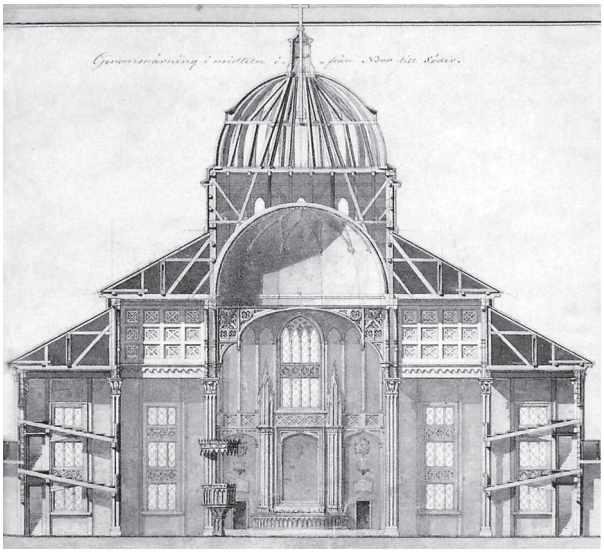

Fig. 9. The walls, punctuated by tall windows, are made rigid with decorative vertical wooden supports hidden in the walls and which allow for settling of the log structure. The log walls form panels which give the building torsional rigidity (Archive of Kerimäki parish)

The designer of the church sought to keep the cohesive log structure of the whole church as rigid as possible. The height of the level log framework is about 15 metres. The walls, punctuated by tall windows, are made rigid with decorative vertical wooden supports hidden in the walls and which allow for settling of the log structure. The log walls form panels which give the building torsional rigidity. Beams carved with a quatrefoil motif frame the arched windows, adding rigidity to the frame.

The roof is comprised of thirteen structurally independent components. Above the level log frame the roof surfaces rise in two steps. The highest, central component of the roof structure is formed by the wooden dome.

Italian architect Andrea Palladio (1508-1580) had developed various truss and girder structures already during the Renaissance period. The roof structures of this building also employ truss analogy, although not fully, as the roof structures also contain curved structural components and stabilising tie-beams. The joints of the beams are so-called contact joints, made with the carpentry skills of that time: dovetail or notched joints locked with wooden pegs and tightened, if necessary, with forged bolts.

5. CONCLUSION

The Kerimäki church is a monument in which the constructive potential of timber material – in view of the circumstances of the time – was exploited to the extreme. When it was built, the ingenious double cruciform structure of the church was 80 years ahead of its time and in all a masterpiece of carpentry skills of that time. Church services are still held in the church during the summer, and it is also a venue for concerts and a popular tourist attraction.

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Abstract

The Kerimäki church is the world's largest wooden Christian church and it has the most spacious interior in Finland. The church was designed by architect A. F. Granstedt; its construction took three years and was completed in 1847. The parishioners had to take part in the building process according to their income bracket. Every man between the ages of 15 and 60 was obliged to participate in the building.

The Kerimäki church is 45 metres long, 42 metres wide and 27 metres high. The height of the dome is 37 metres and there are altogether 1670 metres of pews. The seating capacity is for over 3000 people, but standing room included, the church can accommodate 5000 people. According to the floor plan it is a short-armed double cruciform church. The church is a miracle of its own time, a masterpiece of carpentry with its pews, columns, galleries, tie-beams, arches, domes and lanterns.

The church was originally intended to be built of stone, but because of its high cost the parish was allowed to build the church using timber. However, the exterior of the church imitates a stone building in many ways. The log walls of the church were clad with horizontal boards. The corner pilasters imitate stone churches, and the friezes carved with a quatrefoil motif framing the main entrance and the arched windows in the east and west gables mimic stonework.

The emphasis of this paper is on the unique construction system and architecture of the church.

Streszczenie

Kościół w Kerimäki jest największym drewnianym kościołem chrześcijańskim na świecie i ma najbardziej przestronne wnętrze w Finlandii. Kościół został zaprojektowany przez architekta A. F. Granstedta, a jego budowa zajęła trzy lata i została ukończona w 1847 roku. Udział parafian w procesie budowania kościoła był uzależniony od ich statusu majątkowego. Każdy mężczyzna w wieku od 15 do 60 lat był zobowiązany do pomocy przy budowie.

Kościół Kerimäki ma 45 metrów długości, 42 metry szerokości i 27 metrów wysokości. Wysokość kopuły wynosi 37 metrów, a całkowita długość ławek to 1670 metrów. Przewidziano 3000 miejsc siedzących, a jeśli weźmie się pod uwagę również miejsca stojące to kościół może pomieścić 5000 osób. Budynek został zaprojektowany na planie krótko-ramiennego podwójnego krzyża. Kościół był cudem swojej epoki, ciesielskim arcydziełem z ozdobnymi ławkami, kolumnami, galeriami, belkami stropowymi, łukami, kopułami i latarniami.

W pierwotnym zamierzeniu kościół miał być zbudowany z kamienia, ale z powodu wysokich kosztów materiału parafii pozwolono zbudować go z drewna. Niemniej, od zewnątrz kościół na różne sposoby imituje budynek kamienny. Jego ściany z bali zostały pokryte poziomymi deskami. Narożne pilastry imitują te stosowane w kościołach kamiennych, podobnie jak motyw czterolistka wyrzeźbiony na fryzach, otaczających główne wejście i łukowe okna na wschodniej i zachodniej ścianie szczytowej.

Szczególny nacisk w tej prezentacji został położony na unikatowy system konstrukcyjny i architekturę kościoła.