Samuli Miettinen
M.Arch.Partner
JKMM Architects
Finland, Helsinki

Viikki Church in Helsinki

Viiki Kirche in Helsinki

Chiesa Viiki a Helsinki

document in english

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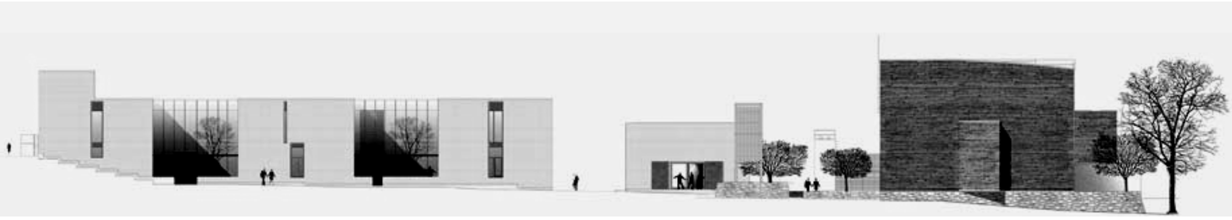


Figure 1

1 Introduction

The Parish Union of Helsinki and the City of Helsinki organized an architectural invite competition for downtown Viikki Latokartano in 2000. The competition was used to find a functional solution that fit in with the cityscape in order to realise the area's public services. Downtown will receive a new church, a social and health centre, a youth centre and sheltered accommodation for the elderly. In addition to planning the service buildings, a central marketplace area, a park and office buildings all needed to be created for the competition. The design of Viikki Church is based on our winning proposal from the competition. It includes church and parish halls for the local parish, offices and clubrooms as well as the spaces that serve these. These spaces gather the area's inhabitants daily for regular activities and festivities. The building can accommodate 500 people at a time, approximately 400 of which can fit in the church space. The building will cover a gross area of 1,600 square metres and will have a volume of about 10,600 cubic metres. The fire category is the lowest one, P3. The building will be protected with a sprinkler system and a manual fire alarm system to increase the size of the permitted fire section and the height of the building.

The Real Estate Department of the Parish Union of Helsinki is building Viikki Church. It has set as its goal the continuation of Finland's high-quality tradition of church architecture. At the same time, the project is a trial project for the promotion of high-quality wooden construction. The use of both traditional building methods and new building solutions in modern construction was researched during the planning stage. JKMM Architects is responsible for the architectural design and the principal design, with Insinööritoimisto Ylimäki & Tinkanen Oy responsible for the structural design. Insinööritoimisto Oy Matti Ollila & Co has designed the element structures.

Finnforest Oy is responsible for realising the pre-fabricated wooden structures. The spruce cladding in the interior was delivered by Matti Taskinen Saha, which is located in Varkaus, on the eastern side of Finland. Vanhat Talot Oy from Keuruu, in the middle of Finland, is supplying and installing the split shakes. Professor Matti Kairi of the Laboratory of Wood Technology at the Helsinki University of Technology, cabinetmaker Kari Virtanen of Nikari Oy, Wood Focus Finland, building conservator Olli Cavén from the Architectural History Department of the National Board of Antiquities, and architect Antti Pihkala of the Regional Historical Museum of Oulu have all acted as experts during the different stages of the project. The Parish Union of Helsinki has signed a contract agreement based on the detailed building plans to work in co-operation with PEAB Seicon Oy, a construction company. The total budget for the target-price project management contract is EUR 6.7 million (VAT 0%).
Construction began on the beginning of March 2004. The construction period is about 16 months, including grounds. The church will be consecrated in September 2005.

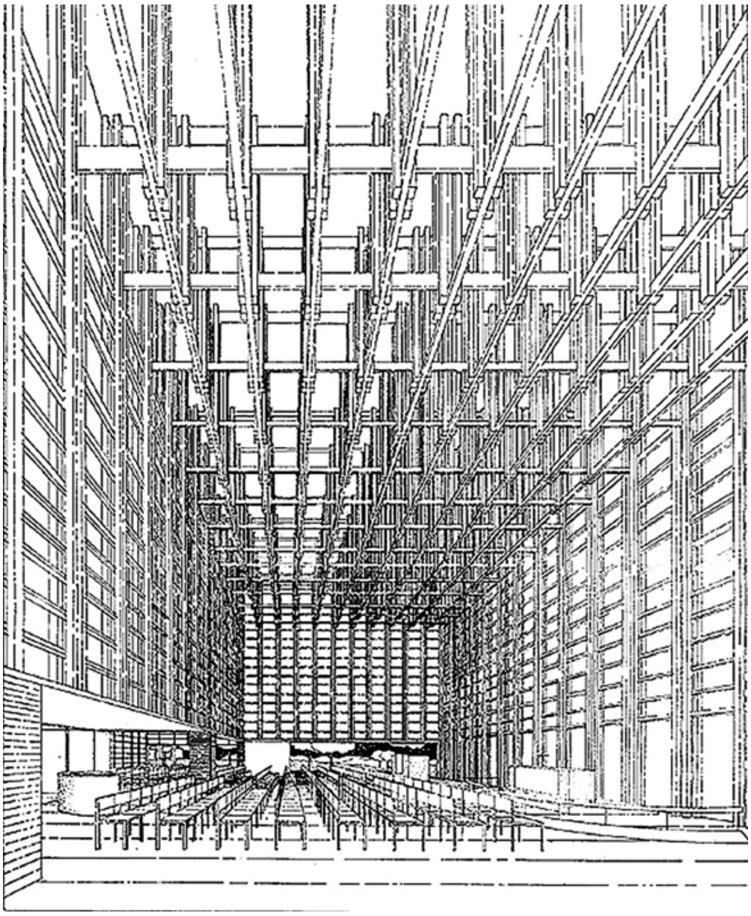


Figure 2

2 The architectural concept

Public spaces are 'imago mundi', a picture of the world, and express our understanding of what is timeless, general and common. An unseen reality and the life of a human being are expressed in the church space. From the first Christian basilica, church architecture has embodied the basic features of all of creation. It has striven to describe the relationship between the created and the transcendent.

The Viikki church is designed to be the central building connecting the eastern and western parts of Latokartano. The church rises in the middle of a tapering space. Its distinctive direction and wood as a building material emphasize the church's position in the area. The secular buildings of the service centre are laid out in a rectangular shape, the architecture of which is created in between the longitudinal brick walls by the intertwined inner and external spaces.

The main spatial themes of church architecture throughout history are pure cruciform compositions. Modern church buildings have even more diverse functions. In Viikki, this cruciform composition can be seen in a broader context. The church hall rises up to form a crucial element in the life of people as an intersection between the festive and the everyday, between an urban space and a natural landscape. Architectural drama is revealed when entering the buildings and as the ceilings rise to transform the spaces into high-ceilinged halls. Light spreads throughout the interior from between the wooden structures. The windows in the lower part of the halls open up to the landscape outside.

2.1 Developing the process

In order for us to realistically and cost-effectively achieve this project's architectural objectives, the building needed to be thought out from start to finish in order to facilitate pre-fabrication. The objective was to effortlessly integrate the pre-fabricated components with each other into an architectural entity. The production of reasonable product parts guided the architectural choices. On the other hand, architectural objectives can be placed ahead of structural efficiency in reasonable amounts in high-quality trial projects on wooden construction. This allows us to try out new implementation methods with an open mind.

Figure 3

2.2 Surfaces

Durable, sturdy, long-life and repairable materials and changeable parts are be used in facades and interiors.

The facades will be covered mainly with mechanically split aspen shakes. The club facilities will be covered with horizontal boards and the belfry with vertical battens. The climate will patinate the unpainted cladding of the facades to silver in time. To ensure high quality, special attention will be focused on the origin, correct felling, drying and working of wood as well as transport, storage and installation. The exterior surfaces of the windows and doors will be manufactured from oak.

The interior walls and floor will mainly be light-coloured, radially sawn spruce. The ceiling elements have been designed as form-pressed veneer elements. The spruce surfaces in the interior of the building are whitewashed with lye. The goal is a harmonious and unified atmosphere. It is easy to remove dirt from the treated surfaces during construction or to restore them with lye years later. Radially sawn spruce adds to the durability of the floor to withstand wear and tear.

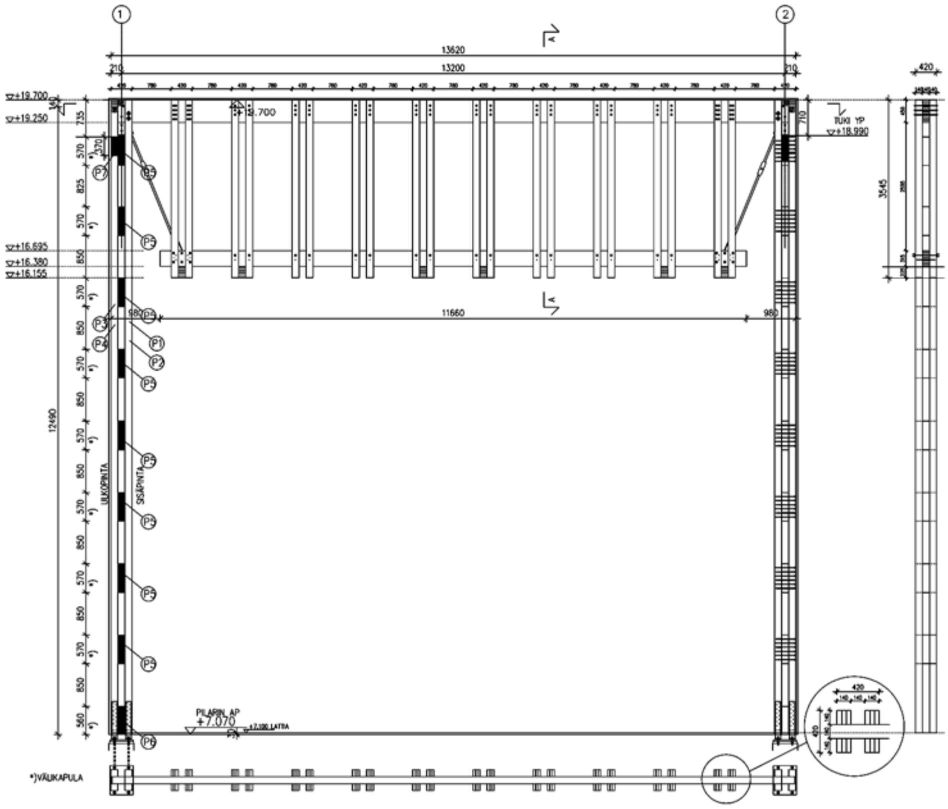


Figure 4

3 The structural concept

3.1 Loads*

The variable loads on structures have been selected in accordance with SFS-ENV 1991(Eurocode 1) and the related NAD document so that the specific snow load is 2.75 kN/m2 and the basic value of the wind pressure is 0.54–0.64 kN/m2. Since reinforced concrete piles have been driven into the ground right up to the bedrock for the whole building, it was not necessary to take the restraint actions caused by the uneven settling of the ground into consideration during the design process.

3.2 Structural system*

The primary girders in the roof of the church hall and parish hall are glulam beams, 12 of which are traditional solid wood and 20 of which are reinforced. The spacing between the girders is 1,200 mm and the spans vary from 8,700 mm in the parish hall to 13,200 mm in the church hall. The floor-to-ceiling height of the church hall is 12,600 mm and the total height of the mass is approximately 15 metres. Owing to the architectural solution for the roofs of the halls, the demand for an economical solution could not be decisive in selecting the structural model of the high girders. It was thus decided that a girder reinforced by a tension rod should be used in place of the traditional "engineer lattice". Particular to this girder is that the material of the tension rod changes from glulam to steel twice travelling down the length of the girder. This is justifiable as it is not possible to join the drawn (tensile stress) wooden rod to the support due to a lack of space. In addition, the building's fire resistance class, P3, supports this solution as no demands are placed on the fire resistance of the load-bearing structures in this class, which made it possible to use unprotected steel. The rods of the reinforced beams are joined to each other using steel dowels and recessed steel plates. It is typical of this type of wooden structure that the proportion of steel in the total weight is rather large (approximately 10%). Eurocode 5 has been complied with during the design process.

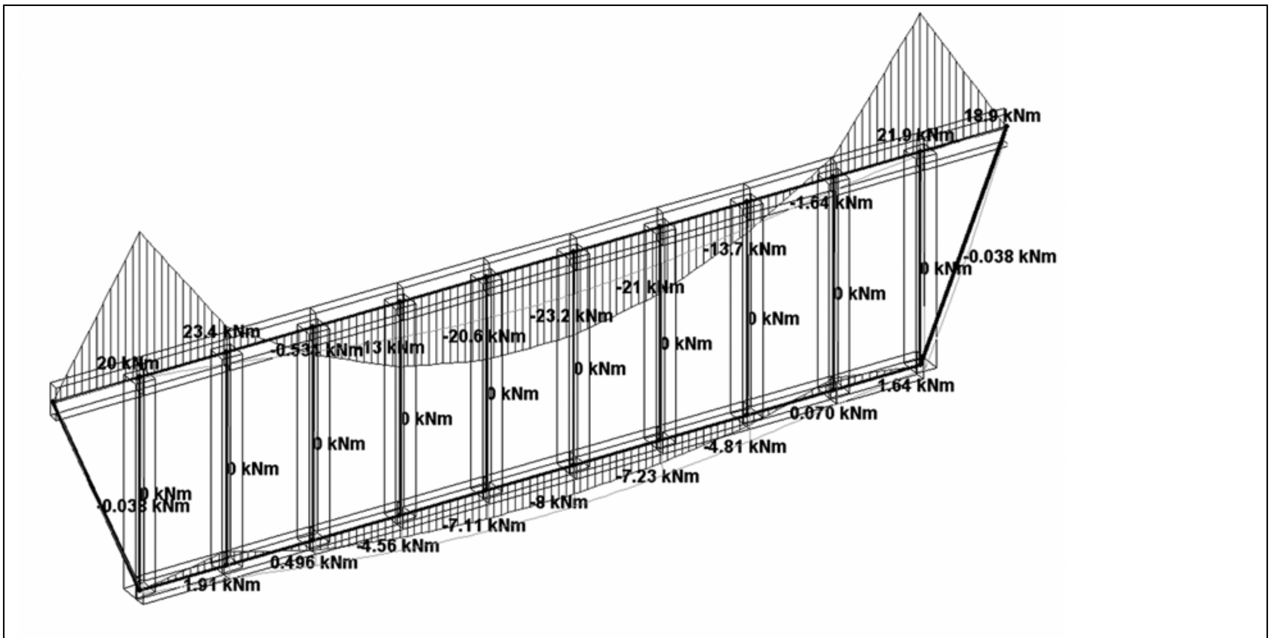


Figure 5: drawing of the reinforced beam

The cluster piers in the halls consist of separate glulam rods that have been loaded axially and that have been connected using mechanical joints. For aesthetical reasons, attempts were made to minimize the cross section of the cluster piers of the halls. This was made possible by the fact that a joint pier was selected as the structural model instead of a frame pier and stiffening was arranged using Kerto-Q panels in the external walls and roof. As the panels are located in the external wall and are thus as far away from the fulcrum as possible, the characteristics of a wooden building are achieved considering the large torsional rigidity and thus the small displacements.

The panels act as a base for the internal cladding of the walls and as braces for the insulation in the roof. In addition, they also contribute to thermal insulation as they are made of wood. The bracing panels are part of the wall's structure and not a separate component, whose only function is bracing.

3.3 Testing

During the planning stage, moisture modelling of the church's model wall panels was carried out at the Laboratory of Wood Technology at the Helsinki University of Technology. This was done to ensure that the panels that were glued to the surface of the laminated veneer panels did not breach the surface layer due to swelling when it became damp or wet as well as that the gaps between them are not disturbingly large when the wood dries. At the same time, the performance of the elastic parquet glue that had been selected was checked. The test run simulated the situation where the coated panels that were to be delivered to the construction site were subjected to moisture for approximately one week, after which they ended up in extremely dry conditions, which is similar to what happens when heating up a building in freezing temperatures in winter.

The testing demonstrated that the panel and the radially sawn lumber that was glued to it worked. The panels stayed straight for the duration of the test and the slats well withstood the distortion caused by the moisture. Based on these results, we decided to implement longitudinal joints for the slats using the rebate joint solution developed by Nikari Oy that allows both surfaces to be used. It was specified that they had to be cut to size and put together with glue on the same day. The panels had to be packaged so that they would not be exposed to moisture during the trip.

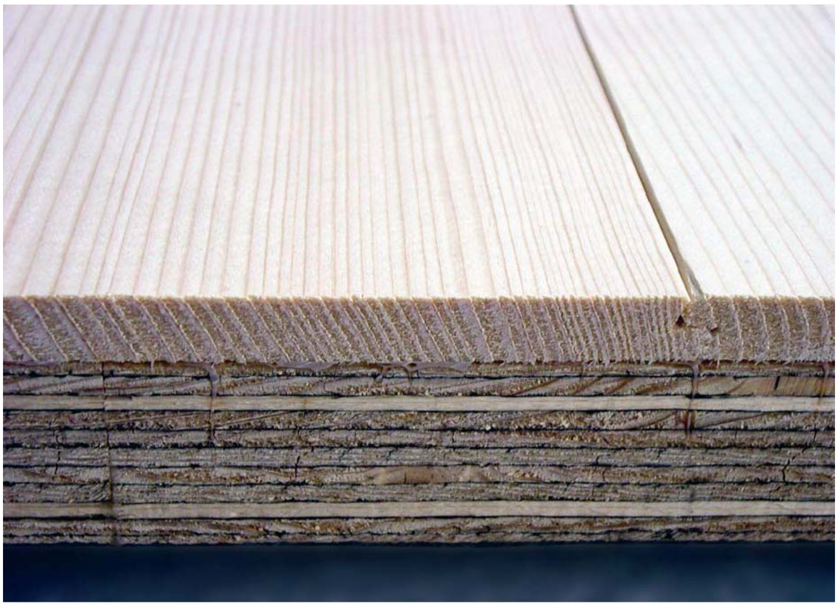


Figure 6: Radially sawn spruce laths glued to Kerto-Q panels

A model wall has been built on the property also to monitor ageing of the shake cladding during the construction period. The trial shake wall has successfully turned grey over the last 18 months. The cellular structure of the shakes has been preserved when splitting the shakes, which gives it a durable façade surface. One of the features of aspen is that its cellular structure hardens, which is why its surface glistens beautifully. The height of the shakes, which are cut in a wedge shape, is 450 mm and the shakes are between 70 and 140 mm wide. The height of the double shake block is 200 mm.

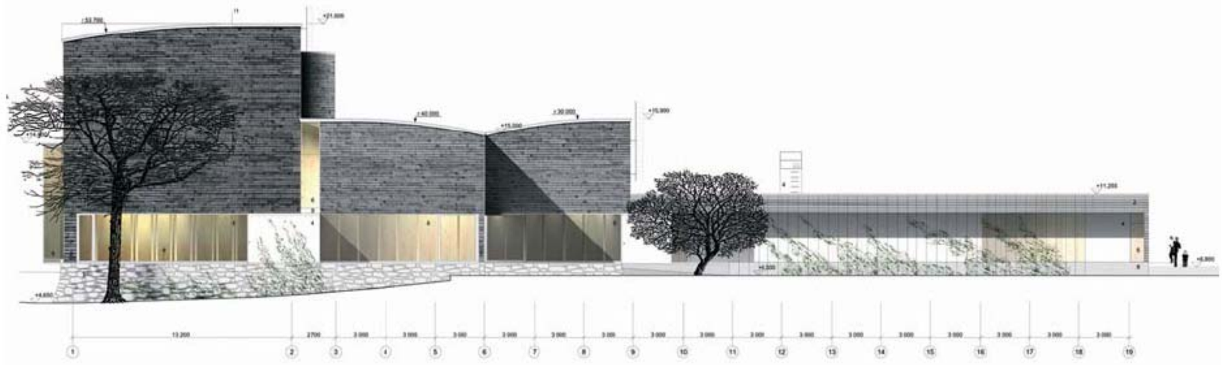


Figure 7: Facade towards south

Figure 8

4 Implementation

4.1 Prefabrication of the structures and product part purchasing (sub production)

The parts for the glulam piers and beams were manufactured at Finnforest's factory in Hartola between April and May 2004 according to the cut lists. The mechanical strength grading of the spruce lumber was augmented visually. The structural and appearance defects of the parts that will be visible were eliminated significantly more often during grading than for a normal grade. The lamellae were extended using finger joints that were realised similar to each other and unnoticeably on both sides of the joint, preserving the features of the wood. The final positioning of the visible surfaces was carried out during the assembly phase after they had been treated with lye. The laminated veneer panels of the wall elements were produced at Finnforest's factory in Lohja. The glulam structures and the wall elements were assembled at Finnforest's factory in Ojakkala, mainly in June and July.

The spruce trunks that were to be used for the slats were picked out of the forest in a selective manner. The logs were sawn into planks using a radial cut. After the lumber had been dried in a kiln, its moisture content was 8–9% of its dry weight. In conjunction with cutting the lumber to size and planing the tongues and grooves, the carpenter graded the wooden slats into four grades for the factory. The slats were glued to the panels once the surfaces of the panels had been sanded using a model template in accordance with separate assembly instructions in order to ensure a uniform appearance. Small machine nails in the parts that remain behind the piers were used to ensure that the slats were attached.

Figure 9

Figure 10

4.2 Weather protection* and installation

It is essential that the frame in these types of wood buildings be protected from the weather during construction in Finland's variable weather conditions; for example, it rained 201 mm in Helsinki this July, which is more than three times the average. Thus, already the conditions on the construction site require that prefabrication be advanced and that work that is susceptible to the weather be transferred to the desired conditions. As for the structural system, it should ensure that the prefabrication is possible and support it. Planning resulted in a prefabricated envelope and frame, whose components were manufactured in a factory and then transported to the construction site by road as they normally would be, after which they were erected as units that immediately improved the temporary stability.

Figure 11

In addition, solutions to protect the project from the weather were developed; these included solutions where a waterproofing element, which minimizes the penetration of water into the structures during erection and which, in the end, acts as a vapour barrier (halls) or as a final waterproofing material (clubroom area), was already placed on the elements in the factory. In this way, the principle of ”ready to go” was applied.

Installation on the frame was commenced in the beginning of July and was finished in October after less than three months of work. The piers were attached to the bolt frame using steel shoes to form masts by supporting each pillar with two slanted supports. Thermal insulation was already installed in the external wall elements at the factory. The installation sector between the elements was insulated and sealed up at the construction site once the piers had been attached. The entity stiffened up once the roof's panel elements had been fastened to the beams from above.

Figure 12

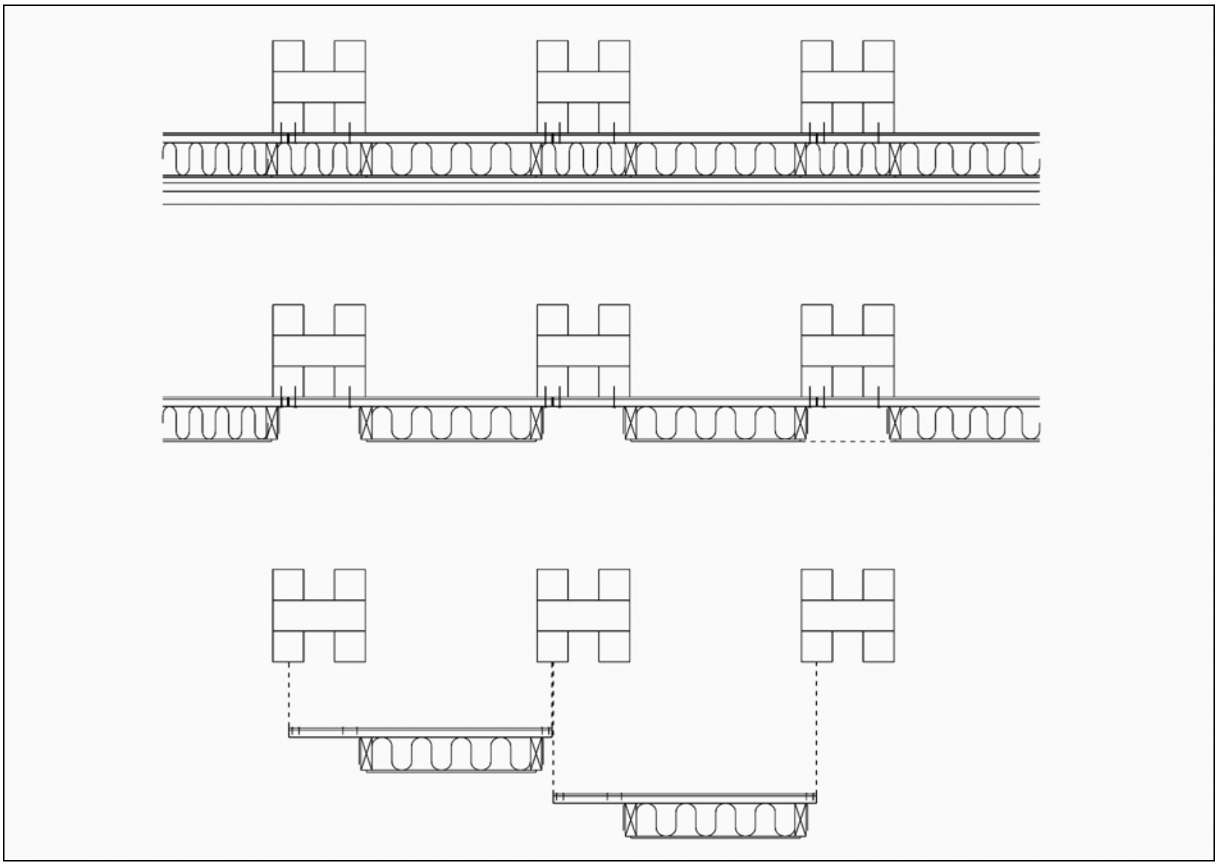


Figure 13: drawing of the assembly principal of the wall elements

Figure 14

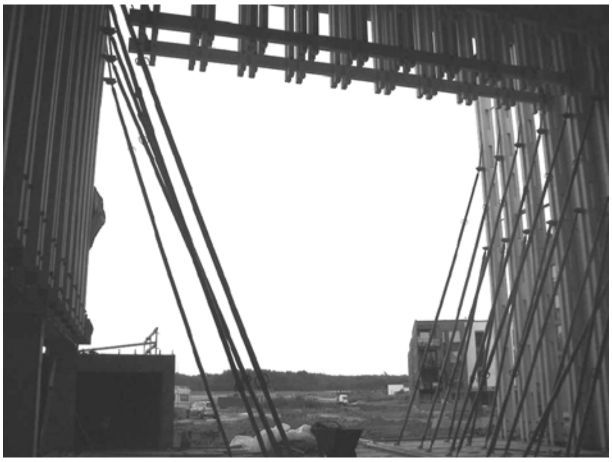
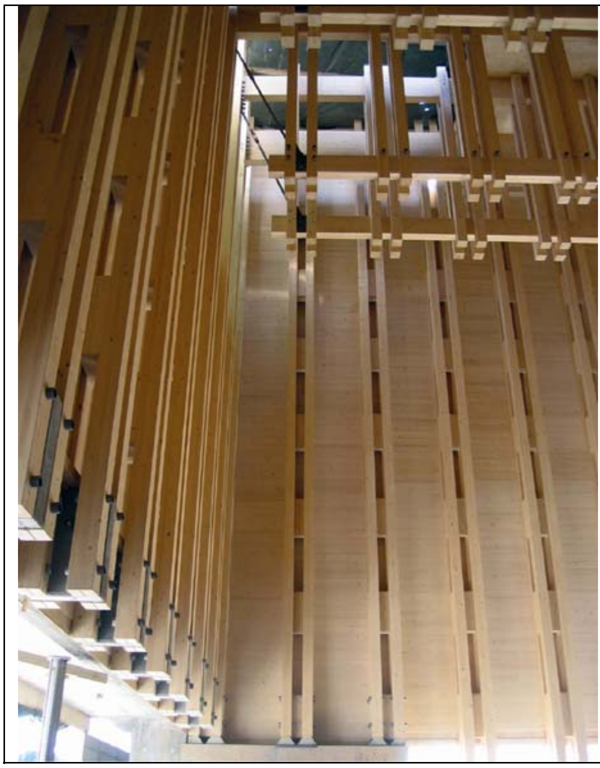


Figure 15

4.3 Quality assurance

- Model wall was installed at the construction site to study the aging of the shakes based on expert statements.
- The moisture life of the clad wood panels was studied through laboratory tests.
- A quality plan was written for selecting the material for the glulam structures.
- Assembly instructions were used to guide the installation of the graded wood slats.
- Model work was used to specify the quality of the pre-fabricated components and to ensure the quality of the performance. In addition, their implementation plans were carefully aligned to match the other building plans.
- A specific installation, moisture control and drainage plan was drafted for construction.
- Construction was guided by simplified work instructions while the client carried out its own monitoring.
- Regular moisture, humidity and temperature measurements of the construction are made at the building site and statistics are maintained for these.
- Finished surfaces are mechanically protected and damaged surfaces are rewashed with lye during the work.

Figure 16



5 Summary

An essential issue in ensuring the sufficient quality of the final product and ensuring the optimal construction schedule is the specification of the degree of pre-fabrication that is suitable for the destination. With the help of components that are finished on site, the pre-fabricated components can be joined together into one entity. Sub production requires the specific planning of the building components, structural physics and logistics as well as the clear division of workload and tasks between the different parties. Flexibility in purchases is advantageous for all of the parties involved in the project and for the success of the final product - no lopsided financial benefit. A high level of quality assurance ensures the trouble-free progression and rationalization of the work.

6 Epilogue

Wood encompasses many symbolic meanings. It is a deeply human and diverse material: warm, tectonic, tactile and workable. The connection between mental images and the material is particularly characteristic of architecture. Modern architecture often stresses appropriateness. Before, building traditions have guided construction to find appropriate but also humane solutions. As a designer, we must find a connection to a living tradition that also includes modern architecture. The shape of the structure includes a mythical message - memories and yearning - in addition to its appropriateness. The church space strives to make the visible that which cannot be described with words.

Samuli Miettinen, M. Arch.

* Jukka Ukko B.Sc (Eng.), Insinööritoimisto Ylimäki & Tinkanen Oy