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International working party for
**documentation and conservation**
of buildings, sites and neigbourhoods of the
**modern movement**

# *Wood and Modern Movement*

preservation technology
dossier 4
august 2000

HELSINKI UNIVERSITY OF TECHNOLOGY
LIFELONG LEARNING INSTITUTE DIPOLI

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# Colophon

**Wood and Modern Movement**
Proceedings International DOCOMOMO Seminar, June 3-4, 1999, Dipoli Congress Center, Espoo, Finland

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# Contents

# Preface

## Wood in Modern Architecture

Although Modern Movement is often understood as architecture of white walls, glass and metal structures, wood plays a very important role as a material of constructions as well as of architectural expression. Wood is not only used as sawn timber. It is also a raw material of several new building materials such as plywood, chopped wood and mesonite, and it is also the material of constructional innovations such as balloon frame construction which has become significant in modern architecture.

## The 4th DOCOMOMO Technology Seminar

The international technology seminar 'Wood and Modern Movement' took place at the Dipoli Congress Centre in Espoo, Finland, on June 3, 1999. The seminar focused on history, constructions and restoration of wood, wood products and wooden constructions in MoMo architecture.
This dossier presents the proceedings of the international seminar starting with three theoretical lectures on architecture and technology of using wood. These are followed by several shorter papers on the main theme. The organisers were extremely satisfied with the numerous high quality abstracts offered for the seminar. All of them could not be treated during the one day seminar but we had an opportunity to publish four of them as articles in this dossier. The last article is a collection of the OTAWOOD team's short papers which shows us present and future possibilities of wood. Let us explore this part of the dossier when we are struggling with the problems of conserving and reinforcing wood and wooden structures.

## Wood and Tree

Every participant of the seminar was given a living tree plant, a little spruce. Thus we wanted to remind the participants of the difference between organic and inorganic materials in a very concrete way. Wood is a living building material, contrary to metal, glass, stone and brick. Wood has a certain life span with a beginning and an end. When we use wood we must understand, accept and take into account the mechanisms of ageing—which sometimes can be hard in modern movement building.
I planted my spruce in front of a small 200-year-old barn built of logs. The barn would not last very long without continuous care but the newly planted spruce will live hundreds of years, unless it is used as a log for a new barn. But that is an another story.

*Juha Lemström*
*Member of Seminar Programme Committee*
*DOCOMOMO International Specialist Committee on Technology*

The little DOCOMOMO spruce grows as living building material, a symbol of continuity.

# Introduction

## Wood and Modern Movement Seminar

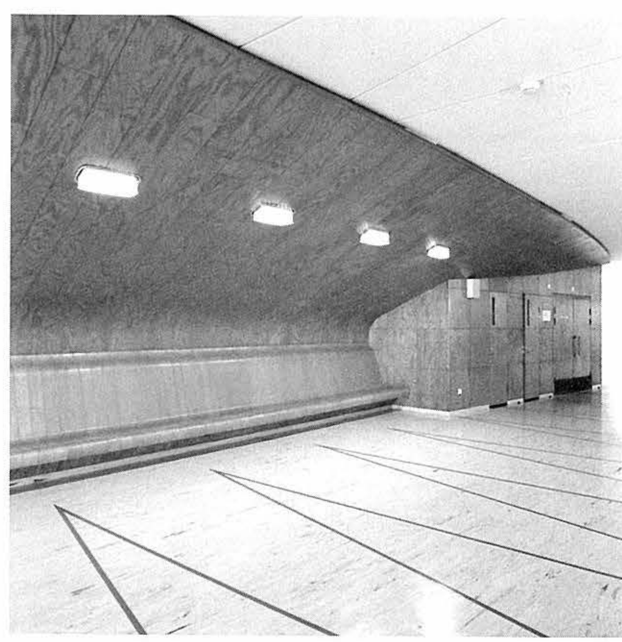
**Docomomo ISC/T**
**Wood and Modern Movement Seminar**
**June 3-4, 1999**
The 4th seminar of the Docomomo Specialist Committee on Technology consisted of a one day seminar focusing on the preservation of modern movement in architecture and highlighting their background.

The previous seminars with different topics were held in 1996 in Eindhoven "Curtain Wall Refurbishment", in 1997 also in Eindhoven "The Fair Face of Concrete" and in 1998 in Copenhagen "Preserving Modern Windows and Glass". All seminars have been very successful. The seminar topics and presentations have been put together in a dossier format to enable a wider information spread out.

The seminar of 1999 was held at one of the main works of Alvar Aalto, the Otaniemi Campus area. The meeting itself took place in the intriguing and expressive Dipoli-building designed by Pietiläs. The seminar was organized by the HUT (Helsinki University of Technology), Lifelong Learning Institute Dipoli. In spite of the seminar presentations the participants were offered extraordinary setting, pleasant surrounding, additional seminar exhibition and a tasty buffet. A special flavour to the seminar was added by little plant of spruce that was given to each participant as a reminder that tree/wood is an alive, constantly renewing nature material and in that meaning also one of the best materials for building.

The Wood and Modern Movement seminar wanted to bring forth the role of wood in Modern Movement architecture, which ever so often is seen as an architecture of concrete, steel and glass. Wood, however, has been used as a complementary construction detail and interior in Modern Movement. Wood has of traditional reasons been an important part especially in Nordic countries, many parts of Central Europe and in North America, too.

The 5th International DOCOMOMO conference autumn 1998 in Stockholm clearly brought up the part of the Modern Movement architecture in the everyday living environment. Wood has played a very significant role in this aspect. Wood has also been a frequently used building material during the Modern Movement period both in low-cost buildings and constructions. The organisers of the Modern Movevent and Wood Seminar got already during the preparation a very good picture of the idea that a simple, light wooden small house is the "model building" of the Modern Movement—especially at the forest zone of the northern hemisphere. Many Docomomo countries sent abstracts highlighting specifically the small wooden houses and their development.



Helsinki School of Economics. Photos: Nurmela Raimoranta Tasa Architects.


The Lasipalatsi Building. Photos: Alli Architects.

Although ICS / Technology has had the aim to keep the focus on technical questions, we have not wanted to forget the theoretic and historic perspectives either. Professor Tore Tallqvist from the Tampere University of Technology held a praiseworthy lecture of Alvar Aalto's way of using wood and the profound background of his works that aroused a lot of discussion. Tallqvist has been working in the Aalto office and was able to indicate long historic lines of thoughts that continue unbroken from many hundred year's history to modern architecture of Aalto. He condensed the curve of development to six different concepts, which he explained through actual and fulfilled cases. The concepts are Simultaneity, Closeness opening out, Renewal and Tradition, Global and Local, Dominating Middle Zone and The Humanised Space. Alvar Aalto used wood in his architecture already in the early modernism. Wood was not only a necessary material but also a central way to give architectural form both to interiors and facades. Good examples of this are the lecture of the Viipuri Library, Villa Mairea and the Pavilion of the New York World Fair.

Wood as a building material and raw material to buildings has had a very significant role in the USA, which was interestingly told to us by M.Arch Thomas Jester, who also spoke about the evolution of engineered wood products in the U.S. and how they were used in innovative ways by architects during the 1930's.

The same theme and problems in several conservation- and research cases were described in Modern Movement architecture in Norway, Germany, Denmark and Finland.

The ISC / Technology also aims to inform about practical and concrete point of views in restoration building. Wood is an organic material that grows old and wears out especially outdoors. Wooden buildings are very sensitive to damage, building mistakes and mismanagement. When conservating wooden buildings difficult problems often appear. The construction of many original Modern Movement building has been constructed in a way that it is technically impossible for the building to hold out under weather and other conditions and thus they get damaged very quickly. The architectural value of these buildings often lies precisely in these "delicate structures" and the architect is confronted by a challenging paradox; only by changing something architecturally essential it is possible to preserve the building. Architect Panu Kaila spoke about this very precisely and clearly when introducing the conservation of the Venice Pavilion by Alvar Aalto. There are still many sectors to be developed within the conservation business and we in Finland are expecting a lot to happen in future in this area. We received a glimpse of the future developments when visiting the Wood laboratory of Helsinki University of Technology.

Additionally a professional excursion was arranged in Helsinki on the second day. The aim of the excursion was to deepen the knowledge of Modern Movement buildings, wooden building and problems and solutions of their conservation. The day started with a bus tour in Puu-Käpylä (Wooden-Kapyla 1920) and the Olympic Village (late 1930's and late 1940's). Seminar participants also visited the HUT Main Building (by Alvar and Elissa Aalto) and the HUT Wood Research and Innovation Laboratory, where the OTAWOOD-team presented some of their latest research of new wood-based materials and process methods.

The excursion day ended with a brief visit to Otahalli (Sportshall of the Otaniemi Science Park) with very special and interested wooden roof construction (designed by Alvar Aalto, 1952) and last not but least with a visit to the famous wooden chapel of the Students Village in Otaniemi designed by Heikki Siren, 1957).

A more detailed visit was paid to Helsinki School of Economics (1952), said to be the most beautiful University building in Finland, and the Lasipalatsi building (1936). The conservation work of both buildings has been carried out lately and the architects of both projects showed us around in the buildings and answered all questions. These cases have been presented in detail in the Finnish Architecture Review Arkkitehti ARK 2/99, too. Both projects are also closely related to the next seminar on Colours in Modern Movement going to be held in Belgium as both cases offered combinations of composedly coloured interiors, decorative painting and architecture.

*Juha Lemström, Architect*
*Member of Seminar Programme Committee*
*DOCOMOMO International Specialist Committee on Technology*

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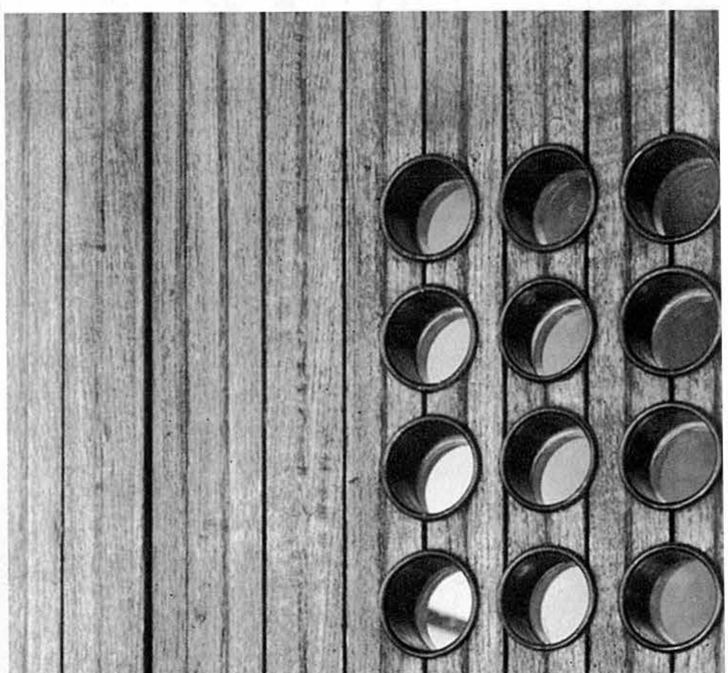
# *Lectures*



# Opening

*by Hubert-Jan Henket*

It is an emotional moment for me to open this DOCOMOMO preservation technology symposium in the beautiful building of Dipoli, designed in the sixties by one of Finland's most distinguished architects Reima Pietilä. My admiration for Reima Pietilä's work stems from the period when I worked for him and his wife Raili in 1970. For this reason, it is a particular pleasure for me to welcome Raili Pietilä at this symposium.

Also welcome to all of you present here. Altogether we represent 22 different nations, which for a technology symposium is a record.

For those of you who don't know DOCOMOMO, we are the internationl organisation for the Documentation and Conservation of Building and Sites of the Modern Movement. We established ourselves in Eindhoven, the Netherlands in 1988 and at the moment our network consists of over 1400 architects, architectural historians, preservation technologists, civil servants and lovers of MOMO participating in 40 national working parties worldwide.

The symposium of today is the fourth in a sequence of preservation technology symposia. The first of which was dedicated to curtain walls (1994), the second to exposed concrete (1996), the third to windows and glass (1998) and this one to the Modern Movement and Wood.

To give a definition of the Modern Movement is not very easy, because it is very diverse in its approach and its regional translations, although it has some very universal key characteristics. It's most characteristic element is that it always strives for innovation in social, technical and aesthetic terms.

The first major technical innovation in wood construction was the introduction of the light weight frame by Washington Snow in 1832, pieces of timber connected with nails to form a skeleton. One of the speakers today, Tom Jester, will talk about this subject. Many experiments were carried out, yet when Walter Gropius advised the president of the AEG Werke in Germany in 1910 to develop industrially produced prefabricated timber frame housing, this gentleman was not convinced. Only in 1931 Gropius actually made his first wooden houses, The Kupferhauser. Before WW II it was particularly in the United States that lightweight timber frame houses became most advanced as for example the dwellings of the Tennessee Valley Authority show. In the meantime Gropius had moved to the US and together with Conrad Wachsman he developed the Package House (1943-1945). Prof. Jos Tomlow will tell us more about it this afternoon. In the fifties and sixties many commercial experiments with lightweight timber framing were carried out but very few with architectural value.

As regards to timber veneers we may say that in World War I, plywood became popular for cars, floor boards etc., but because the glues were not sufficient, it did not really break through. This only happened after the development of synthetic resins in Germany in 1932. The search for application of plywood in the early twentieth century is demonstrated by the work of some architects who knew each others work. Rietveld's Chair of 1924 shows a curved thin back and curved seat, both cut out of a sheet of timber. Copying plywood, he obviously wanted to use plywood, but he wasn't capable of bending it as yet. His first chair using curved plywood for the seat and the back (on a tubular frame) is from 1927. In 1930 Jean Prouvé shows his first plywood chair on a steel frame, whereas Alvar Aalto's first all plywood butaca chair is from 1932. One of the masters of plywood was of course Buckminster Fuller, who made huge geodesic domes with a diameter of over 12.5 m, out of plywood sheets.

It is interesting to note that apart from experiments in furniture and timber framing, architects of the Modern Movement were not all that innovative in relation to the application of wood for building components. Just look at the details of Rietveld's Schröderhouse (1924), the Unie Building (1928) by Oud or the villa Savoy by Le Corbusier (1932). They give a rather traditional impression as compared to the structural application of timber in for example the Dynamo Collective house of 1932 by Gordeev in Novosibrisk. As far as aesthetics in wood is concerned, the Villa Mairea of 1938 by Alvar Aalto is of course one of the master pieces of our century. I am looking forward to hear Tore Tallqvist and Marianne Heikinheimo about this subject today.
In the last 50 years architects carried out many experiments in wood. Just as a demonstration I like to show some innovative work I am involved in. It concerns the application of "Lignostone", a timber product that is derived from compressing beachwood veneer, until it gets some of the characteristics of stone. This material is used for bowling balls and laboratory tabes. From the left over bits, we constructed mullions for a glued glass curtain wall solution for the Teylers Museum in Haarlem in the Netherlands.

And to come to the latest developments in the world of timber today, I like to mention the charming little spruce in front of each of you, barely three years old, which is a welcome present from the Finnish Timber Board for all of us, to take home after the symposium. May this present and this symposium be a stimulance to all of us to use and preserve the beautiful and ecologically sound material wood in the most appropriate way.

*Hubert-Jan Henket*
*Chaiman of DOCOMOMO International*

# Beyond the Balloon Frame

## Engineered Wood Comes of Age in the USA

Engineered wood products came of age in the United States of America during the 1930s as engineering principles were applied to wood fabrication. Fiberboards, plywood products, and glued laminated timber all benefited from industry and government research, and promotion by architect contributed to the acceptance of new materials. This paper discusses the evolution of engineered wood products in the U.S. and describes how architects and engineers used innovative wood products.

*by Thomas C. Jester*

**The balloon frame** has been celebrated by historians as one of the most significant and revolutionary developments in the history of building technology. More recent scholarship, however, suggests that the balloon frame evolved gradually as a folk development from vernacular building practices in the Midwest prior to 1833.[1] Even though the balloon frame provided a more structurally- and cost-efficient method of construction, differences in practical application were common in part because wood as a commodity varied in quality and dimension. Like the balloon frame, engineered wood products were the result of empirical knowledge, experimentation, and, most often, a process of graduation evolution and standardization. But engineered wood materials added another dimension: scientific knowledge. As construction materials, many engineered wood products, which offered properties superior to traditional wood products, came of age in the first three decades of the twentieth century, and the "one-man panel" (4'X 8') shown here is emblematic of the dramatic changes that occurred during this period.

In the following few minutes, I would like to briefly outline how and why engineered wood developed in the United States and describe some of the new materials that were introduced between 1900 and 1940. Throughout the paper, I will describe how architects and engineers embraced and used engineered wood products, particularly proponents of the modern movement. A question that I will explore is the degree to which modern architects contributed to the acceptance of engineered wood products by the construction industry.

In a 1952 article titled "Plywood is Engineered Wood," Thomas D. Perry, author of one of the first comprehensive texts on plywood former chief engineer for the U.S. Plywood Corporation, explained that plywood had gradually evolved as engineering principles were applied to wood fabrication.[2] Applying engineering principles to wood fabrication is a succinct definition of engineered wood and applies not only to plywood, but to other wood products—including fiberboards and glued laminated timber.

Despite the fact that construction was severely limited between during the height of the Depression (1929–1933), the 1930s represented a coming of age time for a variety of engineered wood products. Many of the engineered wood products existed prior to the 1930 but had not been developed extensively for construction purposes or with much reliability. Industrialization and experimentation made possible new wood building products with distinctive physical, mechanical and chemical properties—in contrast to more traditional wood products and building methods. More detailed information about material properties enabled standardization to occur, which also enabled trade associations to better promote their products. The American Society for Testing and Materials (ASTM) was founded in 1898, and the National Bureau of Standards (NBS) launched a program in 1937 to test many of the fiberboard products that were being promoted for housing construction. The results were published in a series called *the Buildings Materials and Structures Reports.*

### Fiberboards: The Beginnings of Engineered Wood

The gradual shift from traditional wood products and utilization to the era when science and industrialization could help transform wood into materials that could be more reliably controlled began in the early twentieth century and quickly accelerated in the 1920s and 1930s. The bias against wood reached a critical level in the early twentieth century as other materials—better known for their association with the modern movement—gained prominence. One engineer observed in 1939:

> *Timber, once a cherished structural material, was relegated to the position of a stepchild when steel and reinforced concrete made their appearance... Yet it remains a useful, though in many respects, capricious structural material. Being produced in by nature on its own terms without the benefit of an*

*engineer's advice, it comes to us as a non-homogeneous and non-uniform material. Since its strength and its very dimensions are sensitive to various influence, its intelligent use requires considerable theoretical understanding [science] and practical experience.*[3]

**Transforming wood** into a more homogeneous, uniform products was to be a constant battle for the manufacturers that hoped to convinse the building industry engineered wood was a reliable commodity. Manufacturers of lumber products were among the first to attempt to develop homogeneous wood products for construction purposes in the first decades of the twentieth century—often based on proprietary formulas and processes. Companies experimented with a variety of processes in an effort to create products from all types of wood waste. Nearly all of the products were mechanically produced from pulp chips separated by steam. Most often the application of heat, adhesives, and hydraulic pressing were used to form dense boards of interlocked fibers.

Successful mass production of fiberboard is first credited to the Agasote Millboard Company, which manufactured Homasote, a fiberboard composed of recycled newsprint and petroleum wax, beginning in 1909.[4] Prefabricated "Precision-Built" homes made of Homasote provided the company with a successful marketing device in 1936. Based on a 4 inch module, the Precision Built homes were finished on the interior with Homasote panels, and exteriors could be finished with grooved Homasote siding or more traditional shingles, brick, or stucco. Later, during World War II, architect William Wurster designed a series of defense houses using new wood materials, including one with Homasote that could be manufactured quickly Essentially a post-and-beam system with infill, Wurster's modern design permitted an open plan.[5]

**Some early fiberboards,** such as Insulite, were used as insulation boards over which plaster was typically be applied, or as sheathing beneath cladding. Insulite, a product that was introduced in 1914, was produced by the Minnesota and Ontario Paper Company. Others, including Celotex, a fiberboard introduced in 1920 and composed of bagasse (sugar cane waste), were promoted for their acoustical properties Many companies offered fiberboard for use as interior finishes, either applied with flush joints or covered with battens. Beaverboard, invented in 1903 in Beaver Falls by J.P. Lewis, was made with an inner layers of ground wood laminated with layers of longer, closely knit cooked fibers. The outer layers included sulfites and other additives, and silicate of soda was used to cement the layers together as pressure and steam were applied. Beaverboard could be painted, stained, or left unfinished. Mass-produced well into the late 1920s, Beaverboard, like many other fiberboards, remained popular until the ascendancy of gypsum wall boards (drywall) in the mid 1930s.

The company with perhaps the most successful line of products was the Masonite Corporation, which was founded by William Mason in 1924 with investors from lumber and paper companies around Wausau, Wisconsin.[6] Mason's 1925 patent for a machine that exploded wood fibers launched the beginning of the process for manufacturing fiberboards of varying densities. The Masonite Corporation's early products were used as insulation boards, insulating lath, and sheathing. As a finish material, Masonite was often detailed with beveled joints covered by either wood or metal battens. After Mason obtained another patent in 1928 for higher density fiberboards, which were called hardboards, the company began selling its products to other companies for distribution. Masonite introduced Tempered Presdwood in 1932, a refined, heat-treated hardboard with improved resistance to abrasion and moisture. Saturated with oil and baked in the final step of the manufacturing process, Presdwood was suitable for exterior applications and in bathrooms and kitchens.[7] In 1933, Masonite sponsored a promotional house at the Century of Progress Exposition, shown here, to demonstrate how the novel hardboard could be used by architects.

**The number of fiberboard manufacturers** proliferated in the 1930s, and new products were marketed as "modern" and "new." Shown here are two more examples: Weatherwood and Nu-Wood. Manufacturers of early fiberboards made a host of promotional claims, such as fire- and water-resistance, acoustical and insulation characteristics, but the early products were not backed by any testing data. By the 1930s, however, the National Bureau of Standards had begun testing the properties of various fiberboards, and manufacturers gradually began to provide more data in advertising materials sent to architects and builders. Most early engineered wood products were not used for structural purposes.

This was the case with the many fiberboards that m However, gradually testing by corporations and government agencies provided valuable data to engineer wood into products with more predictable bending, tensile, and strength properties. The early bias against wood as a structural material was eventually replaced as the result of research, experimentation, and practical application.

## Plywood

Unlike fiberboards, almost all of which were initially developed by private companies, plywood's development and evolution as a construction material owes much more to government research that began during World War I. Plywood, which was first introduced in the mid-nineteenth century, came of age in the 1930s as a novel new finish and structural good. The benefits of plywood included a high strength-to-weight ratio, dimensional stability, resistance to splitting, and an ability to be molded into compound curves.[8] Plywood not only had desirable physical properties, but it also helped speed construction, and was an economical substitute for the heavier, more costly timber that it eventually supplanted.

The term plywood—used to describe a material made up of an odd number of veneers glued together with the grain of each ply perpendicular to the next-was adopted in 1919 by the Veneer Manufacturers Association, which changed its name to the Plywood Manufacturers Association the same year.[9] Adopting the name plywood (a term already in use in Europe) was an effort to reduce the seemingly endless number of appellations—scale boards, pasted wood, and built-up wood—that were used to describe the material in the early twentieth century.[10] With a new name, extensive testing, and creative marketing, plywood would soon become known as wood's "modern miracle."

## The Birth of a Modern Industry

The earliest known plywood patent, granted to John K. Mayo in 1865, covered the manufacture of "scale boards." The patent referred to the material as useful for covering and lining structures.[11] No historical evidence exists to indicate that plywood was produced for this purpose under this patent. In fact, custom-ordered plywood panels were manufactured by producers of hardwood veneers in the late nineteenth century primarily for use by furniture makers for drawer bottoms and other concealed parts. As the material proved itself durable and reliable in the furniture industry it gradually became a stock item in lumber yards, where it was used for various architectural applications. As early as 1890, hardwood plywood was probably used for panels in some doors, replacing raised or fielded solid lumber panels.[12]

While plywood had its origins in the hard wood veneer industry, it was the softwood plywood manufacturers that later dominated the market. In 1905, the Portland Manufacturing Company exhibited hand-made Douglas fir plywood panels at the Lewis and Clark Centennial Exposition in Portland, Oregon.[13] In the early decades of this century, plywood was often manufactured in door factories. In fact, the few independent plywood manufacturers were closely allied with door manufacturers. The Wasserman/Edwards house in California, which is attributed to Julia Morgan, demonstrates the early use of plywood doors.

**The plywood industry developed slowly** until World War I, when the federal government's Forest Products Laboratory conducted extensive tests to develop reliable plywood for airplane construction.[14] After the War, manufacturers of Douglas fir plywood began selling their product to automobile manufacturers to complement their existing sales to door fabricators.[15] Sold as a material for floor boards, problems with delamination of the sheets (usually caused by moisture) led most manufacturers to turn to steel. This failure was soon offset as plywood emerged as a real competitor in the building materials market.

## Making it Stick: Manufacture and Glue

Although manufacturing techniques have improved, principally in making processes more continuous and automated, plywood manufacture still follows the same basic steps used historically to transform timber into panels.[16] Manufacture began with peeling bark off logs, which were then rotated against a knife to create veneers to assemble plywood panels. Veneers were subsequently flattened, clipped to various lengths, temporarily taped (with cloth or paper tape), patched, and dried. Veneers were glued together using either a cold press or hot press.[17] In the cold process, the adhesive was applied in liquid form by a mechanical spreader. The assembled plies were pressed with either a hand- or motor-operated screw press, or a hydraulic press. Unlike cold pressing, which required many hours of pressure, hot pressing required less time, and panels could be processed quickly. Hot pressing techniques, which were used for plywoods that employed adhesives in the form of synthetic resin sheets and some liquid adhesives, particularly blood albumin, required higher pressure, but permitted thinner adhesive spreads. The final manufacturing step was trimming the plywood to standard panel dimensions and surface sanding both faces to the required thickness.

**The success of plywood** as a desirable construction material hinged on the quality of the adhesive used to join the veneers.[18] Continued improvements in plywood adhesives corresponded to an increase in the level of respect it was accorded —as a reliable building products—by builders and architects. The earliest plywood panels were manufactured with water-soluble hide glue and could not be used where they were exposed to wet and weather. Vegetable glues, made from cassava flour, were introduced in 1905 by Frank G. Perkins, owner of the Perkins Glue Company. Although vegetable glue was an important improvement—it was inexpensive, was easy to manipulate, and could be stored for longer periods of time than hide glues—it was not water-resistant. Casein glue, which is made from milk proteins, was first introduced in the US around 1900 and became the first water-resistant glue used in the manufacture of plywood. Plywoods laminated with casein glues were widely used during World War I for aircraft and other military applications. In 1912, Henry Haskell, founder of the Michigan-based Haskelite Corporation, perfected another early water resistant glue based on blood albumin. Plywood manufactured with Haskell's proprietary glue had to be hot pressed. Soybean glues also imparted improved water-resistance to plywood and were first imported in the early 1920s. The Douglas fir industry began to use soybean glue more widely after I.F. Laucks, owner of the Lauks Company, which manufactured glues, introduced domestically produced soybean glue in 1927.[19] Yet it was the introduction of resin-bonded plywood, which had the greatest level of water-resistance of all plywoods then available, that opened new markets in construction. Synthetic resin glue in sheet form, called Tego, was first made available as an import product from Germany in 1931.[20] Domestic production of synthetic resin adhesives, which was based on phenol formaldehyde, began in 1935. In one advertisement, the Resinous Products Company of Philadelphia asserted that plywood bonded with Tego was "virtually a different materials, made with precise engineering methods."

Several manufacturing advances occurred during World War II. Electronic heating devices, which were based on radio-frequency technology, were used to replace convection systems as a means of rapidly polymerizing heat-reactive resins.[21] This system enabled plywood adhesives to be cured at lower temperatures without changing the moisture content of the panels. War production needs also lead to the development of processes-called bag-molding-for forming plywood with compound curvatures.[22]

## Promoting Plywood: New Audiences

The introduction of plywood to the construction trades accounted for much of the industry's growth beginning in the 1930s. In 1919, US Plywood was formed and would eventually become the largest and most innovative plywood company to distribute and, after 1930, manufacture plywood products—many for construction.[23] By 1932 more than fifty manufacturers were in operation.[24] The greatest growth occurred after World War II, when the number of manufacturers grew to more than 150. Between 1939 and 1947, total industry output increased 380 percent.[25]

By the 1930s improved mass production techniques were emerging that allowed plywood to be manufactured as a uniform and standardized commodity. Abundant softwoods, particularly large Douglas fir trees, were easily machined, keeping production costs low. The Pacific Coast Manufacturers Association, which later became the Douglas Fir Plywood Association, organized in 1924 to create a grading system and develop new markets for Douglas fir plywood, presciently recognizing the potential for plywood in construction.[26] Distribution to builders was aided by a network of wholesalers, like US Plywood, who helped make plywood a stock item in lumber yards around the country.

Despite these promotional efforts, in the late 1930s plywood was still considered a relatively new building material. Architects were the object of aggressive advertising campaigns beginning in the early 1930s. Articles began to appear in trade and professional journals about the potential of plywood construction. The manufacturers began to organize themselves in an effort to promote plywood products at conferences, in catalogs, and at fairs and expositions. The House of Plywood, designed by Lawrence Kocher and built for the New York World's Fair in 1939, is perhaps the best known example of this effort. All but three of the homes exhibited were traditional, but the plywood industry clearly sought to associate its product with modern design.[27]

Prefabrication was viewed by many as the panacea for housing shortages during the 1930s. Throughout the decade, builders, architects, and research foundations studied housing and experimented with prefabricated plywood walls and partitions.[28] In 1934, the US Department of Agriculture's Forest Products Laboratory constructed a plywood house, using walls of exterior-grade plywood and stressed-skin panels to carry part of the roof load.[29] The first commercially prefabricated house that used exterior plywood was developed by Foster Gunnison in 1936.[30] These efforts and others promoting plywood for sheathing, flooring, and siding reinforced plywood's standing as a reliable alternative to solid-sawn lumber and other building products, and effectively contributed to the standardization of the material—whether for mass-production or custom designs.

The Douglas Fir Plywood Association also offered a plywood house after it purchased the rights to the "Dri-Bilt" house system. Designed by Jacques Willis in 1938, Dri-Bilt houses required no plaster, relying instead on plywood for walls, subfloors, ceilings, and partitions.[31] The Dri-Bilt house was marketed both as a packaged house—much like those sold by Sears earlier in the century, but available only through local lumber yards—and the prototype for prefabricated housing. More than a million Dri-Bilt houses were constructed before World War II. However, the promise of prefabrication was not fully realized, and traditional balloon-framed and platform-framed housing ultimately remained the dominant form of wood construction. Despite the failure of prefabrication, the plywood industry managed to infiltrate the construction industry by promoting its product as a substitute for solid-sawn sheathing and subflooring.

**Modernists also embraced plywood** for exterior applications and played a significant role in the promoting the material. The advertisement shown here, featured a young Richard Neutra, who actively solicited for new materials from manufacturers for his experimental designs[32] He is quoted, saying: "Plywood is perhaps the most significant of the more recently perfected structural items which usher in a renaissance of wood construction and bring it up to date." In 1936, Neutra designed a demonstration house using plywood—painted white—for the exterior, taking advantage of new waterproof plywood panels.[33] Free of ornament, the design nevertheless required aluminum battens clipped to metal fasteners between the panels, which were spaced 40 inches apart on wood studs. These panels expanded the market for waterproof plywood as an exterior siding. The standard-sized sheets of plywood fit both the Modernists' desire for modular materials and the manufacturers' need for a well-defined commodity. The But standardization did not limit the application of plywood; at the construction site the material was easily worked as needed.

Other modernists were similarly intrigued by plywood. For instance, in 1938, Gregory Ain, a protégéé of Neutra's, designed a small studio for cinematographer Slavko Vorkapich in Beverly Hills.[34] The exterior is strikingly planar compared to the Neutra house, but the plywood ceiling exhibits the batten detail that plagued early designers who used plywood. The summer house for Clara Fargo Thomas at Somes Sound in Maine illustrates the use of plywood as a modern interior finish. Designed by George Howe in 1939, much of the interior is finished with ¼ inch birch, oak, and Douglas Fir plywood panels. Panels are attached to the studs with flush brass screws, and the plywood was finished with spar varnish. Howe included a 1/8 inch reveal between each panel to reinforce a sense of verticality within the volume and maintain a contrast with the sweeping roof plane. Dramatic in its siting, Fortune's Rock seamlessly blends traditional and modern wood materials. Finally, it is not surprising the Buxminster Fuller saw the future in new materials; his prototype for the Dymaxion Dwelling Machine included radiating plywood flooring, among other materials used during the war: metal alloys, plastics, and rubber.[35] Built in 1945 and intended as a war conversion program for Beech Aircraft, the house was erected in Wichita, Kansas. Beech hoped to manufacture 200 units a day, and in spite of public enthusiasm for Fuller's prototype, mass-production never materialized. The house is now being restored by the Henry Ford Museum and Greenfield Village in Michigan, which acquired the innovative house.

**Structural applications** were not the only uses for plywood; new products built around plywood were also regularly introduced by manufacturers. Flush plywood doors—used for schools, public buildings, and residences-were available by 1930.[36] These doors were typically built of 5-ply panels sandwiching a core glued-up from small blocks of solid sawn lumber. Hollow-core doors, usually 3-ply sheets applied over wood stiles and rails with a wood or fiberboard lattice-work core, were introduced in the late 1930s and remain popular. United States Plywood, which was based in New York City, introduced a parquet plywood flooring product in the 1930s, which was installed like linoleum tile. Parquet tiles were typically 12 inches on a side and adjacent sides had either a tongue or a groove to mate with neighboring tiles. Haskelite Corporation based in Grand Rapids, Michigan, manufactured a similar product, which it described as "compounded lumber" flooring.

Decorative paneling was another plywood product marketed to architects and builders. Initially, expensive hardwood veneers were used as the facing ply for panels in high quality applications. But as residential markets for plywood grew, factory-prefinished paneling was introduced. First available from the United States Plywood Corporation in the mid-1940s as Plankweld, prefinished hardwood panels were widely used during the 1950s.[37] Plankweld was initially sold in a 16 by 96 inch size with mortise and tenon edges. Usually constructed of 1/4 inch stock, panels were finished with a roller-applied color compound and sealed with a lacquer or clear synthetic coating.[38] Other prefinished products offered by US Plywood included striated panels sold under the trade name Weldtex, and simulated "random-width board" panels with v-grooves-a "craftsman grade" paneling known within the industry as the "Orangeburg" pattern, named for the South Carolina town where the material was manufactured. Such products were nearly ubiquitous in basement rec rooms.

**Another novel wood product** was Flexwood, a thin wood veneer with a cotton backing. This material, which made its appearance in the early 1930s, and was dubbed "wood wallpaper." U.S. Plywood purchased the rights to the material and its advertisements touted the material as modern, although the material was favored most by architects working in the Moderne and Art Deco idioms. This extant example from an apartment in Washington, D.C. shows the types of curved finishes that could be achieved.

## Plywood's Influence on Building Practices

While plywood was only gradually accepted by the building industry, its influence on construction practices (and its later hegemony over other methods) was dramatic. Timber planks remained the material of choice for sheathing, roof decking, and subflooring until the early 1930s, when plywood began making a mark as an important building material. Adoption of plywood as a substitute for solid-sawn lumber escalated as more and more building codes and housing agencies gave the nod to plywood construction.

The concept of using plywood as a sheathing material is credited to Armin Elmendorf, a Forest Products Laboratory engineer, who began testing plywood in 1917.[39] But it wasn't until the Forest Products Laboratory tested various sheathing methods in 1935 that plywood (1/4 inch) was found conclusively to be stiffer than any other sheathing types.

**The ability to manufacture** large economical panels sped construction because plywood panels fit standard stud and joist spacing. This meant less cutting and less waste, reducing labor costs. Because the panels were comparatively light, workers could easily handle the material on the site and on scaffolding. Also, the material could be mechanically cut on site faster than planks. Plywood wall and roof sheathing afforded more strength rigidity in wood-framed structures than diagonal or horizontal sheathing (even when braced). Panels could be nailed close to the edges without fear of splitting, and fewer nails were needed than for traditional lumber sheathing. Large sheets of plywood also limited the number of joints in a wall, significantly decreasing the amount of air infiltration (and effectively increasing the insulating value of the wall) that would have been expected with solid-sawn boards. Plywood, typically 5/8 inch thick, also became desirable as a base for flooring materials such as linoleum. Plywood bases didn't require sanding, large areas could be covered quickly, the number of joints was reduced, and nail-popping was avoided.

## Forming Concrete

As a material for concrete forms, concrete-form grade plywood was superior to heavy wood planks and metal. First used for concrete forms in the late 1920s, the advantages of plywood were immediately apparent. With a large surface area, panels created fewer linear feet of joint lines (fins) and blemishes. Forms could also be reused—sometimes as many as 15 times-because plywood could be removed without damaging the material. Factory prefinishing the plywood with oil minimized moisture loss in the concrete and aided curing. The stiffness and strength of plywood panels made them capable withstanding the loads imposed by uncured concrete with a minimum amount of reinforcing.

By the late 1930s, plywood had become the most common concrete form material for both utilitarian and decorative types of construction. In addition to its use for foundations and slab construction, more elaborate forms were used to create "architectural concrete." Plywood forms made curved elements possible that were more difficult to create with other form materials. Carefully conceived and installed plywood forms also enabled designers to create large areas of smooth and textured finishes, and imitation joints with moldings.

**Standards played an important part** in plywood's success as a construction material. Building on its first standards adopted in the 1920s, the Douglas Fir Plywood Association developed new standards for quality of surface, finish and structure in 1932 that were issued by the Bureau of Standards in 1933. Many of the association's products, such as Plyscord (sheathing and subflooring), Plyform (form panels), Plywall (wallboard), Plypanel (casework and fine paneling), were trademarked in the late 1930s, which gave the products more recognition and validated standardization. By the early 1930s, the now-ubiquitous 4-by-8 foot panel—described by the Douglas Fir Plywood Association as the "one-man panel"—was being produced and by the end of the decade had become the most popular size.

## Structural Glued Laminated Timber

In the mid-1930s, when plywood was making substantial inroads in the building industry, another novel engineered wood material was introduced in the U.S.: structural glued laminated timber. As with many other engineered wood products, glued laminated timber emerged as the result of technology transfer and was refined through extensive testing to mollify skeptical engineers and code officials.

**Glued laminated timber** existed in Europe prior to its introduction in the United States. Its origins can be traced to Germany, where in 1901 Otto Karl Hetzer obtained a patent wood beam built up from several laminations bonded with adhesive. A patent for curved arches followed in 1906, the Hetzer process, as it became known, was licensed in many European countries and even Sweden, Norway, and Finland. Engineer Guttorm Brekke, who would later work for Weyerhaeuser in St. Paul, Minnesota, purchased the patents rights to the emerging technology and introduced glued laminated timber plants near Oslo and Toreboda Sweden.[40] Shown here is the Central Railway Station in Stockholm, dating to 1925.

German-trained engineer and architect Max Hanisch, Sr. introduced structural glued laminated timber in the U.S. after emigrating from Germany in 1923. Hanisch worked for Hetzer, and he had hoped to promote this construction technology in America. Without financial backing, however, Hanisch was forced to practice architecture and engineering in Racine and Milwaukee, Wisconsin, and his first opportunity to specify glued laminated timber did not come until 1934. That year Hanisch received a commission for a school and gymnasium in Peshtigo, Wisconsin. During schematic design Hanisch changed the roof structure from an interlocking arch roof to structural glued laminated timber. Cost savings over the more conventional roof system convinced the client to accept the new material. Thompson Brothers, boat builders in Peshtigo, manufactured the arches, and shortly thereafter Hanisch, his brothers, and the Thompson Brothers incorporated as Unit Structures, the first laminating plant in the U.S. Building officials rejected the new material for the Peshtigo gymnasium, and a compromise was developed that included mechanical connections, including metal strapping and bolts. Despite the unnecessary reinforcement, the building is considered the first use of glued laminated timber construction in the U.S., and it paved the way for the material's acceptance.

Hanisch designed numerous other buildings in the Midwest using glued laminated timber, examples of which include the Bay Shore Dance Hall in Marinette, Wisconsin and St. Leonard's Church in Laona, Wisconsin—both in 1936.

**South of Peshtigo, in Madison,** the government's Forest Product Laboratory, mentioned earlier for its research on plywood, independently began testing glued laminated timber. The newly formed Unit Structures manufactured arches for the laboratory's experimental structure erected during the winter of 1934-35. Loading, which exceeded specifications by 50 percent, determined that deflection was well within acceptable limits.[41] The Forest Products Laboratory conducted full-scale testing to failure on a new machine, and the data resulted in a final report, *U.S.D.A. Technical Bulletin No. 691, The Glued Laminated Timber Arch*, published in 1939.

Dissemination of the report amounted to a government stamp of approval, and Unit Structures assured the growth of this technology by licensing its patented system to a number of wood fabricators during World War II.

Wartime steel shortages meant that substitute materials were needed for construction. Concrete and glued laminated timber emerged as a viable alternatives to steel, and both materials made possible the spans required for large buildings, such as hangars and drill halls, illustrated here by the Navy Drill Hall and Reception Center at the Great Lakes Station outside Chicago.[42] The Reception Center was designed by Skidmore, Owings, and Merrill in 1942.

By the conclusion of the war, practical applications glued laminated timber had prepared the material for more general use after having accelerating knowledge about glued laminated timber properties. The war applications paved the way for additional government research at the Forest Products Laboratory, and led to the eventual creation and adoption of codified standards by the American Institute for Timber Construction (formed in 1952).

## Science and Wood: A Difficult Marriage

The promise of progress through engineered wood products resulting from science proved to be only partially fulfilled. Engineered wood products signaled the desire of the scientific community to transform wood, but the transformation could not be completed as planned: wood remains a difficult material to engineer and control. Nevertheless, significant advances in wood technology is the legacy of the first three decades of the twentieth century, and the modernist agenda clearly helped engineered wood products gain wider acceptance. The efforts to promote engineered wood continued even in the 1960s at the Seattle World's Fair, where the Hofsbrau Restaurant, showcasing curved plywood, could be juxtaposed with the Space Needle as signs of progress. But engineered wood was readily adapted to more traditional building methods and styles.[43] Wood also retained its associations with warmth and beauty, placing this notion of the material at odds with the industrial conception of wood as an engineered product. Since we will next turn to Aalto, I leave you with an image of Baker Dormitory at the Massachusetts Institute of Technology, a brick building where Alvar Aalto included a detail of an industrial material—plywood—and brought out its essential character and tactile nature with great skill.

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42 Robert Friedel, "Scarcity and Promise: Materials and American Domestic Culture During World War II," In Donald Albrecht, ed., *World War II and the American Dream* (Cambridge: Massachusetts: MIT Press, 1995), 63-64. See also Rhude, "Structural Glued Laminated Timber," 20-21.
43 Ironically, the American Plywood Association (formerly the Douglas Fir Plywood Association) recently changed it name to the Engineered Wood Association, recalling the material's past-perhaps unknowingly- by paying homage to the time when plywood was touted as an engineered wood product with discernable properties and characteristics.

# Understanding and Interpreting the Spirit is a Necessity for Restoration

## Timeless Patterns in Alvar Aalto's Use of Wood

*by Tore Tallqvist*

When an architect is involved in a restoration project, his tasks are rarely set only by neglected maintenance or a building's deterioration. In such a case the task could be given to a restorer with good judgement or a skillful craftsmen; they would be familiar with traditional building materials and older, partly forgotten working methods. Unfortunately it is not that simple in real life. Restoration generally signifies remarkable efforts in planning, decision making, complementary design and demand for change. Alongside the restoration there are nearly always new needs to be satisfied. Modern technology and new norms must be integrated into the structure of the restored building. In the physical design it is therefore necessary to weigh the historical aspect against the functional. By understanding the spirit and essential of the entirety, the old can be restored and changed, it can be transformed to something new in a natural way.

The staging is dependent on how we as restoring architects focus on the authenticity and scenery as well as style and atmosphere. This requires both understanding and interpreting the spirit of the building. The demand for thoroughly understanding the whole applies equally when restoring a medieval stone church or a 20th century culturally recognised building to be saved as an example of the modernism of our time.

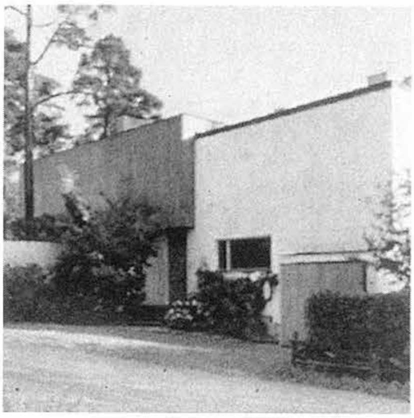
How does an architect combine his professional skills with the special understanding of modernism and its preservation? There are naturally several possibilities and every building and the historical situation of the assignment set their specific requirements. But one could formulate a general requirement. When we want to keep modernism alive, it is particularly important for all parties involved to understand and respect the spirit of building the to be preserved. Modernism is to a great extent architecture of concept. We must find and bring out the concept behind the form to be able to manage and adapt modernism and its spirit. A successful restoration demands that the concept of the building can be interpreted as a whole and as details also after the restoration has been completed.

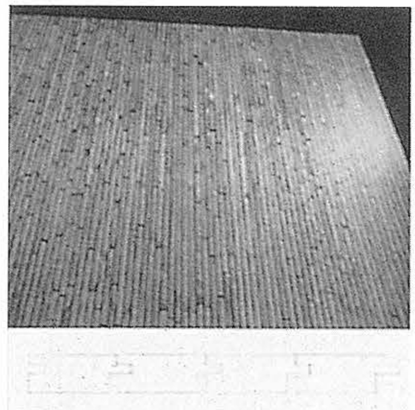
The title of my presentation here is *A study of Aalto's use of wood*. The focus has been narrowed to one architect's office and one building material. I have also narrowed the scope to one time period, to the years 1934 to 1939. Six buildings have been selected to describe Aalto's architecture and his use of wood during this five-year period. One of the chosen examples is Villa Mairea whose traditional Finnish wooden sauna can be seen on the picture (on page 27). Its white functionalist chimney, as well as the kitchen wing to the right, reveal the building´ s home in modernism.

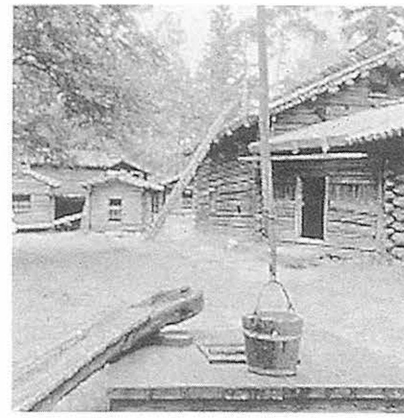
Even if the focus is narrow and very specific, the starting point in my method outlined earlier is bringing out the ideas to serve as a basis for the restoration of modernistic buildings. One could express it as developing a method to describe another.

The method is based on detaching ideas and patterns in Aalto's architecture and in his way of using wood as a building material. The connecting is done by comparing six buildings by Aalto constructed in the 1930s with applications of the same concept during an earlier phase in history. Aalto's architecture and use of wood as a building material is represented by the following six buildings: 1. Aalto's home in Helsinki, 2. the Finnish Pavilion at the Paris World Fair, 3. terrace row in Sunila, 4. terrace house in Kauttua, 5. Villa Mairea in Noormarkku and 6. the Finnish Pavilion at the New York World Fair.

Of the corresponding picture pairs (on page 30) the four topmost photographs are from traditional Finnish architecture. The remaining two pictures below depict a famous painting by Albert Edelfelt and a similarly famous library interior by Carl-Ludvig Engel, architect of the Empire period. Wood as a material or motive and the mutual idea content connects the applications through time. By thus detaching ideas one can demystify them; let the picture pairs represent the mental images of the lasting and then return to Aalto's architecture and the content bound to time. With such a method it should be possible to consciously interpret the concept behind a restoration object, to distinguish the connection to the lasting and the changing vital for architectural quality. My purpose is therefore to sketch a model which enables one to study how ideas, both timeless and time-bound are intertwined. The intimate connection between the lasting and the changing must be valid also in the art of restoration.


Aalto's home (picture 1a).


Panel and exterior wall (picture 1b).


Niemelä croft (picture 1).

## 1. Aalto's home

Riihitie 10, Helsinki
(1935-36)

Aalto's home is the first example. In 1934 Aalto acquired a lot in Munkkiniemi which at that time was a new part of the city emerging north of the city centre. Aalto lived and worked in Munkkiniemi for forty years up to his death in 1976. His home was completed in 1936.

The building in Riihitie 10 is characterised to a great extent by numerous divisions in two and corresponding simultaneity. If we study the plans, we can distinguish space for work and leisure, public and private areas, rooms that serve and rooms that are served. By separating these opposites and then recombining their possibilities, the building emerges as a power field consisting of border zones and simultaneity themes. Already when we approach the building from the street, we can grasp the building as a whole, as a double house of dark wood and whitewashed brick. The main entrance below the panelling can be understood as a border zone of wood and brick between the garden and the street.

Gustaf Strengell (1878-1937), on of Finland's few writing architects during the first decades of the 1900s, visited Aalto for the last time soon after Riihitie 10 had been completed. During his visit Strengell characterised Aalto's home as the Niemelä croft of Finnish architecture. Niemelä croft (seen in the picture 1), which was moved to the open air museum in Seurasaari nearly a hundred years ago, can be seen as an icon of traditional Finnish architecture. In his older days Aalto recalled Strengell's comparison as the comments about his home in Riihitie that he valued most.

Strengell's comment was based mainly on the proximity to nature and the intimacy that characterise Aalto's home and Niemelä croft. The comparison stands also when one studies the double character or simultaneity theme as an architectural concept, as is done here. Niemelä croft is built as a complete milieu around two opposite yards with the well as a mutual simultaneity theme. The main building of the croft consists of two spaces complementing each other similarly to the house in Riihitie. In Niemelä croft, however, one half is the original building while the other half is a later addition.

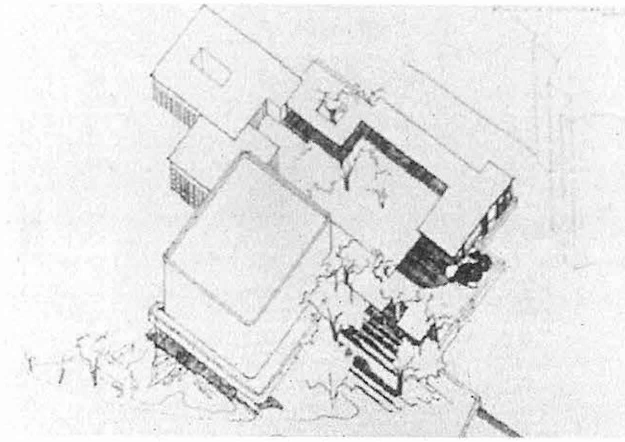
When the wooden and brick parts of the house in Riihitie are contrasted, the two main spaces are given an opportunity to communicate with each other. Aalto has perceived an opportunity for dialogue and utilised it. The hard brick wall emerges as a soft whitewashed surface while the wooden surface, fragile by character, is accentuated by the hard contour of the narrow panelling. Thus the simultaneity theme of the whole building is transferred to the different parts of the house.

When an American architect once visited Aalto's office, he wanted to know which module was used in the office. Aalto's answer was very clear: "one millimetre or, to be more precise, a fraction of a millimetre". Aalto liked to both include and formulate an inner context into most things. In the panelling of his own house Aalto has needed even five millimetres in each direction. On the wooden surface he thus creates three simultaneity themes at the same time. Due to the freely and visibly varying lengths of the panelling, Aalto creates ***surface and lines, extension and contraction***. The structure of the wooden panelling and the visible knots create a further third simultaneity; ***present and absent time***. On the wooden surface the three main factors of architecture appear in a pure form: Strength, Geometry and Time.

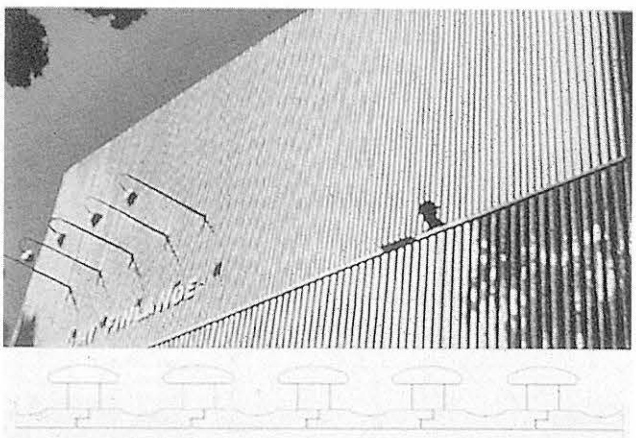
## 2. The Paris Pavilion

Trocadero Park, Paris
(1936-37)

Aalto's Paris Pavilion is example number two. Aalto won first and second prize in the design competition for the Finnish pavilion at the Paris World Fair in 1936. His proposal for the competition *Le bois est en marche, The Forest on a March*, was awarded first prize and it was carried out the following year in the Trocadero Park in Paris. In the design the entire architectural idea of the Pavilion can be discerned. The main entrance dominates the whole and consists of a closed square space on two floors. In one of its



A bird's-eye view of the Paris Pavilion (picture 2a).



The Paris Pavilion and panelling of the exterior wall (picture 2b).

Farm in Korpilahti (picture 2).

four corners a diagonal passage opens up which gradually takes the visitor to the exit through open spaces freely grouped around the inner yard. In the sloping terrain of the park the horizontal planes and the vertical lines are emphasised. The inner yard of the Pavilion appears as a Finnish forest glade in a French park.

The open closedness and the triangular whole which surrounds the inner yard can clearly be seen in the picture 2a, which depicts the Pavilion's axonometrically from a bird's-eye view. A similar application of an open closedness can with similar clarity be seen in the picture 2, which depicts a farm in Korpilahti, in central Finland. The dwellings here surround a square yard. When the remaining farm buildings, which serve different side functions, are grouped freely outside the closed yard, a middle terrain emerges. This middle terrain makes the farm an organic part of the surrounding cultivated and natural areas.

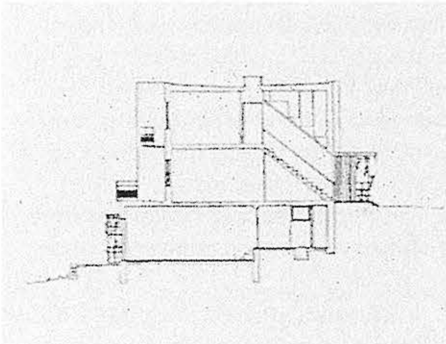
The photograph (picture 2b) depicts the closed upper part of the Paris Pavilion's main facade. Below is a detailed drawing of the specially made wooden panel of the facade. The pavilion's closed structure is formed as a double facade where a concave panel is mostly covered by convex, rounded wooden rods. The idea of the open closedness, characteristic of the Paris Pavilion's composition of space, is here repeated on a small scale in the wooden panelled exterior wall of the main space.

## 3. Housing Area
Sunila Mill Area
(1936-37)

Example number three comes from Sunila, an industrial area near the port of Kotka by the Gulf of Finland. In the mid 1930s Aalto was commissioned to plan the new industrial community of Sunila. He visited the area to be planned in the summer of 1936 and already in September the same year he was able to present this overall plan for the area as well as plans for the most important buildings in the housing area. The workers' terrace row extending along the main road to the mill became the most renowned of the dwellings. In the picture 3a a cross section of the terrace row can be seen. It has been erected in a sloping terrain in three storeys. The flats on the first two floors have direct access to the ground. The top-floor flat can be reached via a staircase which combines a round modern skylight at the top and a traditional porch below built of wood.

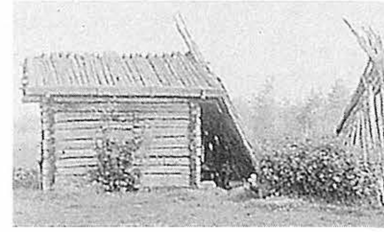
The cross section of the terrace row shows how the three floors are grouped in relation to each other. The staircase is reserved for the two airy flats at the top. The terrace row has been erected in brick and concrete using modern construction technology. Simultaneously the traditional way of building in wood is found in the secondary complementary parts of the building. The cross section of the terrace row can be compared to the log cabin (seen in the picture 3), where the log part once represented modern building technology, innovation, while the hut, representing earlier architecture, remained as a convention in the form of an entry motif. Renewal and tradition succeed in making time alive in the architectural form. In Sunila the wood used as a building material gives tradition a presence in the modernistic architecture.

The terrace row's main facade towards the road leading to the area can be seen in the picture 3b. Here renewal and tradition appear as each other's conditions. Closed perpendicular wall surfaces



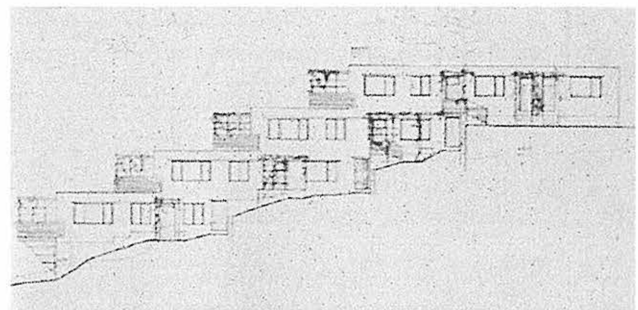
Cross section of Terrace Row (picture 3a).

Terrace Row and Part of Main Facade (picture 3b).



Log Cabin and Hut (picture 3).

separate the flats from each other and create vertical lines whose modern expressive geometry connects to the tree trunks in the surrounding forest. In the white modernism the small scale of the terrace row is united with the surroundings when wood is used as a building material in the complementary parts of the building. The traditional landscape of roofs does not exist anymore, it has been replaced by the pine forest's silhouette above the terrace row. The house's complementary wooden details thus gain in importance due to the forest surrounding which it is part of.



Sidefacade, Kauttua House (picture 4a).

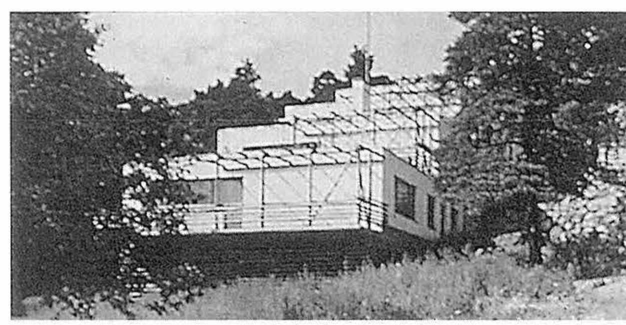
## 4. Terrace House

Kauttua Mill Area
(1937-38)

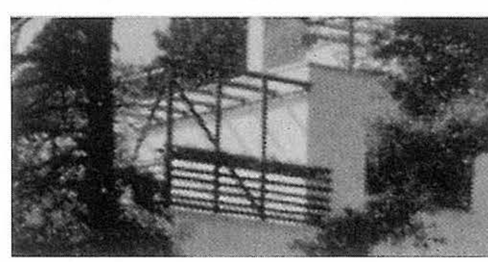
Kauttua terrace house is example number four. The terrace house that Aalto created in Kauttua in 1938 enables private entrances on ground level for all four housing levels. Each flat has in addition its own sheltered balcony or terrace. The house in Kauttua is a modern application of the idea of combining the global and the local. The whitewashed terrace house in brick could in its modernistic design appear anywhere in the Europe of the 1930s. The main windows of the side facade with the terraces are designed as Chicago windows typical of that time. However, the whole takes into consideration conditions set by place. While the distance between the terraces are similar in the upper part of the building, the dimensions of the building's lower parts follow the terrain on the site organically. Details in natural wood combines traditional architecture with impulses coming from the outside.

At all times new impressions and ideas have come from the outside. The impressions have been adopted and remodelled according to local needs and resources. On Viitala farm in Ostrobothnia (seen in the picture 4) we can find in the gavel of the red ochre storehouse two classical examples of how Finnish people have earlier remodelled impressions acquired from the outside.

One application can be perceived in the traditional red ochre of the gavel. Exterior walls were for a long time treated with red ochre when we here in the North wanted to give the impression that the house



Terrace House, Kauttua Mill Area (picture 4b).



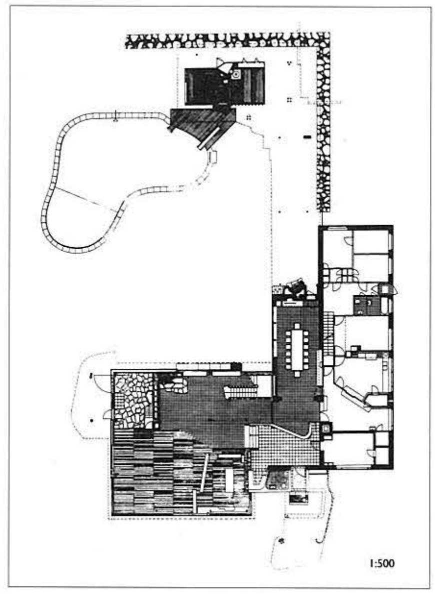
Kauttua House and facade with the corner (picture 4c).

Viitala storehouse gavel (picture 4).

was built of bricks. Building in stone has been something very exclusive and therefore very rare. Being able to build of bricks has to many been something to dream about. The illusion partly became reality when the red paint was used to imitate the brick wall.
The other application is demonstrated in the gavel's strong profile and in the carefully modelled window trims. The storehouse was a building whose design was traditionally attended carefully. The rich design in the gavel expressed affluence also here on Viitala. When classical temple architecture dictated the design of the gavel as a motif bound to the time, the stone blocks were substituted by wood from the farm's own forest. While the gavel's form language built on classicism, the application itself was tied to peripheral local circumstances. Building in wood gave the global form a local content.
In the picture 4c the corner of the Kauttua terrace house is visible. While the stone facade gives the whole an international functionalist impression, the architecture adheres to the local conditions; this is expressed in the entrance structures, balcony rails and pergolas which consciously are modelled in natural wood. The complementary details in wood give the international style a distinct local touch.

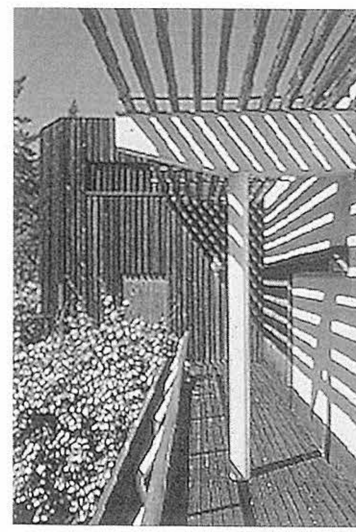
## 5. Villa Mairea
Noormarkku
(1938-39)

Villa Mairea is our example number five. Villa Mairea was constructed and planned simultaneously during the years 1938 and 1939. Earlier it was a common practice to deliver the last working plan when the last nail was driven on the building site. To the right we can see an interior picture of Villa Mairea. The big glass wall in the hall has been pushed to the side and the living room hall opens towards the inner garden court. In the background one can see the traditional Finnish wooden sauna with its functionalistic white chimney as the finishing touch. The open garden court is surrounded by a pine forest.
Mairea's main plan consists of two simple volumes, both of which comprise 200 square metres. The square wooden part contains the most important interiors of the villa, while the rectangular stone part contains the service facilities, the kitchen and the staff's private quarters. Two functionally different worlds built with different methods condition each other and create a middle zone which separates and unites the two simple volumes. The tiled floor here unites the hall of the square space with the dining room and the main entrance. With this hall Aalto accomplishes a border zone in both wood and stone. The middle zone is intensified in its position in the middle and its extension when the stone floor opens up on the threshold towards the inner garden court. The concept of the border room can be detached from its application in Villa Mairea with the help of another example found in Finnish art from the turn of the century. In Albert Edelfelt's oil painting Christ and




Villa Mairea plan (picture 5a).

Villa Mairea interior (picture 5b).



Villa Mairea balcony corner of the studio (picture 5c).

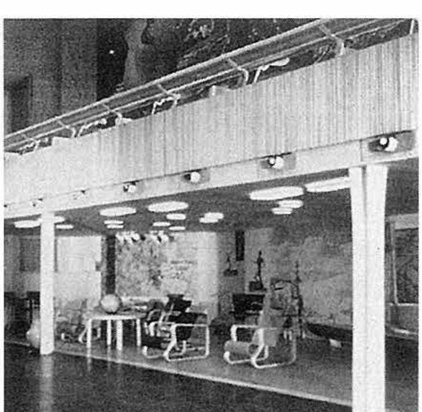
Albert Edelfelt's painting of Christ (picture 5).

Magdalene, painted fifty years earlier, we encounter a border space that has been constructed of corresponding elements. The kneeling figure of Magdalene in brown contrasts to the figure of Christ in white. A border expanse stems from Magdalene's desperation and Christ's conciliatory gesture. The border space is intensified and opens simultaneously towards the white birch trunks in the stony terrain. In the background a peninsula is outlined which also opens up towards a Finnish sea landscape.
Thus both Aalto and Edelfelt utilise the border space as a timeless pattern which enables countless variations in entireties and details. As and example the same theme appears on Villa Mairea's upper floor where the dominant part of the exterior containing a studio in wood join in the corner with the white stone exterior wall of the master bedroom. The drawn-back wall of the upper floor leaves space for a balcony which in the inner corner is emphasised as a border space in wood and stone, between an inner space providing facilities for work and rest. The dependence of the opposite materials and opposite functions on each other is visible in the treatment of detail. Aalto lets the slatted pergola roof be supported by a high concrete beam painted white. The architectural motif organically grows from a way of life or values where wood takes a central role in the dialogue. The border space grows out of the dialogue.

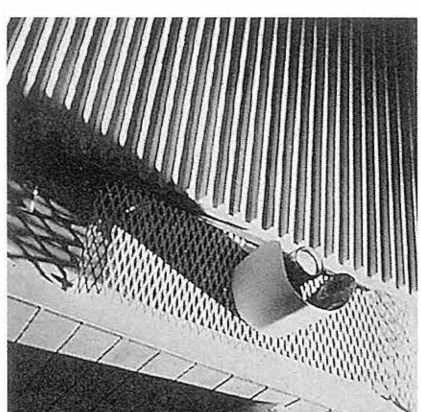
## 6. New York Pavilion

New York
(1938-39)

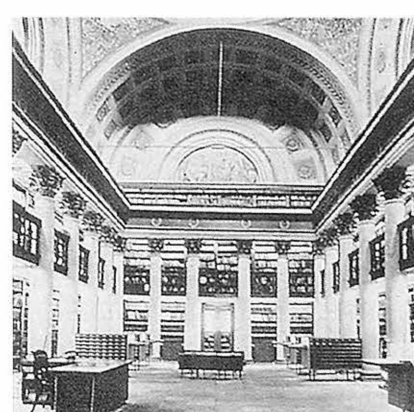
The sixth and last remaining picture illustrates how Aalto used wood as a building material. Aalto completed a second pavilion for Finland at a World Fair in the 1930s. This time the place was New York. The task was to produce an interior design for a ready-made module in a long rectangular exhibition hall which had been allocated by the Americans. In the spring of 1938 a design competition for the exhibition pavilion was announced which Aalto won. Below a publicity photograph of the interior of the completed pavilion is seen. Aalto described the interior as a facade turned to the inside. The undulating wall also became known as the *aurora borealis* or *the northern lights* wall.
Aalto had previously been commissioned to humanise a form too regular and hard. Wood provided Aalto with the suitable solution in this situation. A classical example is the lecture hall in the Viipuri library where he covered coarse concrete beams across the hall with an undulating longitudinal wooden ceiling. He also consciously provided the modern metal windows in the Viipuri library with wooden lists.
In New York Aalto applied the same method but this time the challenge was to transform an insignificant rectangular space into an eventful exhibition space. The undulating wooden wall with three ledges was placed diagonally in the hall and received on its opposite side a rectilinear balcony as a contrasting theme. The undulating wall and the balcony rail was panelled with wooden panel and between these a border space was created which was characterised by both contractions and extensions. The square space had been humanised and the wood took a central and decisive role in this transformation.
A classical example of the same method of humanising a space using wood can be found in the university Library in Helsinki, one of Carl-Ludvig Engel's most central creations. The University Library (1835–45) was also a topical building for Aalto when he was creating his plan for the competition for the World Fair Pavilion in New York. His proposal for an extension to the library had recently won second prize in a design competition which was won by the Finnish architect Aarne Ervi.
In the University Library Engel had created an intensive and strong feeling of space in the building's three main halls by creating rooms within rooms. Wooden columns and surface treated marble stucco run in parallel with the stone walls leaving free space for bookshelves and balconies. Thus a spacious entirety is created where the inner room erected of wood represents the intimate and the cosy while the surrounding vaulted room represents the expansive and the grand.



The New York Pavilion interior (picture 6a).



The New York Pavilion and panelling on the balcony rail (picture 6b).



University Library in Helsinki (picture 6).

The humanised space can also be studied in the profiled balcony rails in the New York Pavilion. The metal parts which hide the technical installations have a soft form while the vertical wooden lists along the parapet has got its hard accentuation from the triangular profile. The wooden material humanises the whole in order to then observe the presence of modern technology in a sharp profile.

## Simultaneity and Inner Connection

I have in the previous tried to detach some patterns that appear in Aalto's architecture and in his use of wood as a building material. The result can be perceived as a serving dish where six possible conceptual patterns are on display. Each picture illustrates how one pattern has been applied in Finland at an earlier date in history. The patterns are thus no longer dependent on their specific Aalto application. We can partly demystify the conceptual contents in Aalto's architecture and get insight into how he has helped himself to the timeless on the dish. The six patterns could be given the following titles: 1. Simultaneity, 2. Closedness Opening Out, 3. Renewal and Tradition, 4. Global and Local, 5. Dominating Middle Zone and 6. Humanised Space.

By studying thoroughly how detached patterns coexist in architecture, we can deduce the starting points for an architect's working methods. Similarly as in the work of other predecessors of modernism Aalto's life philosophy is reflected both in his working methods and in the architectural form. By understanding the concepts and their inner connection we are better prepared, in my opinion, to deal with and grasp the necessary change that is an integral part of restoring modernism.

As a conclusion I would like to draw your attention to how the conceptual patterns not only are visible in the whole building and in its parts, but also in the details of the building. The careful consideration of detail is important when restoring modernism, while it is the detail that makes it possible to make the whole concept content visible. When a pattern appears at different scales in the same building, an inner connection evolves that clarifies and brings to life the conceptual content.

In the following the Aalto building described earlier can exemplify how one and the same pattern appears in the single detail. The conceptual content lets the detail emerge as a whole—almost in the same way as "waves" in a literary text sometimes can have the meaning "sea". Six details in wood in six buildings illustrate how the inner connection is established in the form.

### 1. Simultaneity
Niemelä croft, Konginkangas

The first pattern is "simultaneity" that we encountered in Aalto's home and in the strict profile of the panelled facade. His home has generally been called, since Gustaf Strengell's days, the Niemelä croft of modern Finnish architecture. In Niemelä croft we could observe different simultaneities that confirmed the architectural form of the whole.

As an example we take a window detail that appears in Aalto's home in Riihitie. The completion of the window frame and trimmings has been rounded softly towards the inside of the room, while the corresponding corner outwards has been modelled in a sharp angle. The wood has been dematerialised as a building material when the form identifies itself against its border. Also in the smallest detail in the building the opposites condition each other. The simultaneity is combined with the inner context.

### 2. Closedness opening out
Farm, Korpilahti

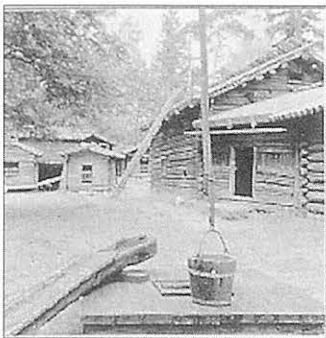
The following pattern, pattern number two on the serving dish, can be called Closedness Opening Out. The pattern takes a central role in the architectural conception of the Paris Pavilion, but is equally visible on the farm in Korpilahti. In the picture 2 we can observe how the pattern functions in traditional architecture. Due to the middle zone the yard's closed form opens out towards its surroundings and its built environment becomes part of the surrounding cultural and natural landscape.

In the Paris Pavilion we encounter in its remotest corner a plywood counter ceiling in whose form we can read the conceptual pattern of both the farm and the Paris Pavilion. The end part of the counter ceiling appears as a closed contraction and its front part as an open extension. The middle is articulated as a contraction of the extension. In the plywood ceiling's pure geometry the closedness opening out appears as an Aalto theme. In the plywood counter ceiling the Paris Pavilion repeats its conceptual pattern in the single detail.

### 3. Renewal and Tradition
Log Cabin and Hut
Välimäki croft, Konnevesi

The third pattern on the dish was here called *Renewal and Tradition*. The photograph of Välimäki croft (3) illustrates how architecture at all times has evolved as a combination of innovation and convention. The log house once represented renewal while the hut, which represents older building technology, represented tradition. The building received its vivid form from the idea of keeping both the traditional and the modern—to be on the safe side.

In the terrace Row in Sunila Aalto similarly outlined the entirety as a dialogue between renewal and tradition. The overall conception was also adapted in the design of the inner staircase which was placed between a modern circular skylight and a traditional wooden porch. In the wooden panelling of the porch itself the conceptual pattern was repeated at a scale of detail. The semicircular lists repeated the geometry of the skylight. The porch and the traditional panel wall thus received a modern accentuation.



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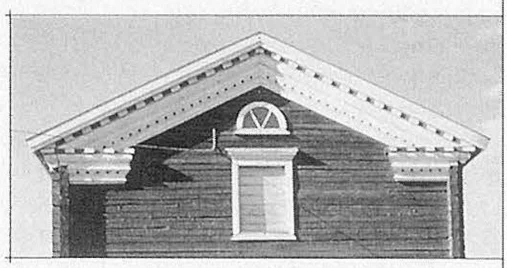

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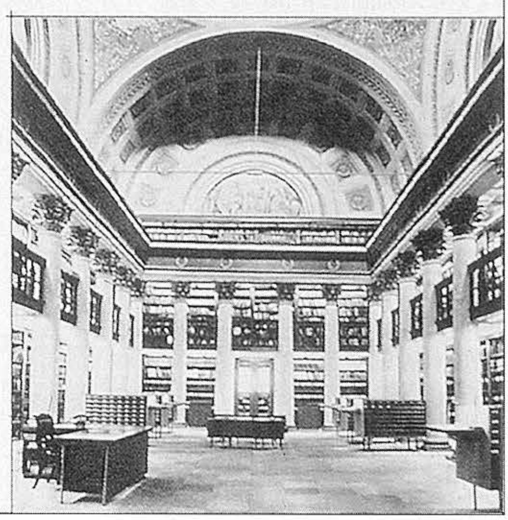


1. Niemelä croft, Konginkangas, 2. Farm, Korpilahti, 3. Log Cabin and Hut, Välimäki croft, Konnevesi, 4. Gavel of Storehouse, Viitala farm, Kuortane, 5. Christ and Magdalene, oil painting, Albert Edelfelt, 6. University Library, Helsinki, Carl-Ludvig Engel.

## 4. Global and Local

Gavel of Storehouse,
Viitala farm, Kuortane

The fourth conceptual pattern on the dish underlines how the architectural form evolves from outside influence together with an interest in the local restrictions. The storehouse gavel on Viitala farm (seen in the picture 4) illustrates the pattern *Global and Local* where the red ochre is used to substitute the red brick used in Europe and where the classically designed gavel has been constructed of wood rather than stone.

Also in the terrace house in Kauttua Aalto combined motifs from traditional architecture with international modernism. As a complement to the rational overall concept the rustic treatment of wood gave space for a wild and even romantic accentuation. The global and the local appear in the details of the pergola wall along the terrace. When the natural wood is outlined against the modernistic white wall, the conceptual pattern appears even though the visual field is minimised and diminishing to zero.

## 5. Dominating Middle Zone

Christ and Magdalene
oil painting, Albert Edelfelt

The fifth pattern could here be called *Dominating Middle Zone*. The pattern creates the central theme in the architecture of Villa Mairea but allows itself, as here, be applied also in art. In Albert Edelfelt's painting "Christ and Magdalene" from 1890 (seen in the picture 5) the story in the landscape is built up with the middle space as the dominating pattern. The feeling and atmosphere are expressed in the painting mainly through the dominating middle zone.

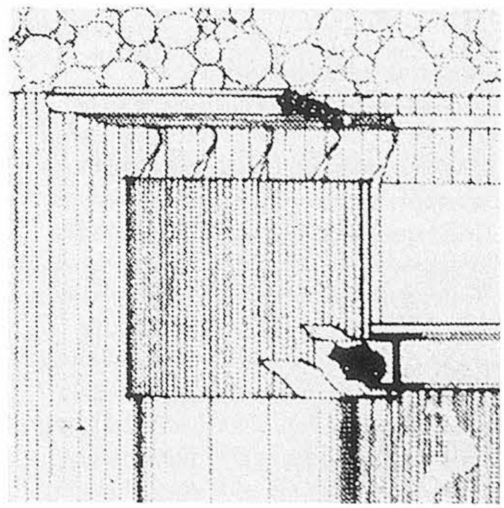
The architecture of Villa Mairea can as a whole be interpreted as a feat of strength between the contraction and extension. In the field of force the hall in the main interior forms a middle zone which separates and combines opposites into each other's requirements. In the plan on the left the hall appears as a small Villa Mairea, as a checked field; the floor of the hall is tiled. The border space is further contracted by the wooden staircase. The stairs receives a vertical emphasis from the wooden rods surrounding the stairwell. The first step, the threshold step, has been designed as a contracted horizontal motif. Thus the staircase develops its own middle zone. An inner connection confirms the organic form. The staircase in Villa Mairea, its vertical lathes and the threshold step can be understood as a contraction of the conceptual world of the whole building.

## 6. The Humanised Space

University Library, Helsinki
Carl-Ludvig Engel

The sixth and last pattern is here called *Humanised space*. The conceptual pattern is illustrated by the main interior in the University Library (seen in the picture 6) where a room of wood has been constructed inside a room of stone. With this main concept C-L Engel has achieved an interior which has been considered by many one of the most beautiful profane rooms in Finnish history of architecture. In the middle zone between the stone and wooden part bookshelves have been placed alongside the walls. The backs of the books create their own surface behind the Corinthian columns.

In Villa Mairea Aalto succeeded in creating a wooden staircase that did not creak. He boasted about this accomplishment which was possible thanks to a construction where steel beams support a wooden step element. In the New York Pavilion Aalto combined metal and wood in a similar way. In the picture 6c we can see a cross section of the balcony ledge. The horizontal expressive extension into the room was made possible by the steel beams. In the single detail where the I-beam of the joists meets the parapet, a motif evolves where the hard material represents construction and technology while the wood as a complementary material has the task of softening the technical form. The cross section of the balcony rail gives evidence of Aalto's effort to use wood also in the details in order to humanise the room. What the Pavilion's *Northern lights* wall accomplished in relation to the given rectangular room, was also accomplished here with the wooden details in relation to the steel and technology. The soft wood combined with the hard steel created a palpable atmosphere and feeling.



New York Pavilion, cross section of the balcony ledge (picture 6c).

## Conclusion

Ladies and Gentlemen, I would like to finish by drawing some general conclusions.

Concepts can in modernistic architecture be detached from their applications. In Aalto's architecture, however, the wood can not be detached from its context without the ideas being lost.

The wood in Aalto's buildings represents tradition, the local, the humane, the romantic. The wood makes the absent time visible also in his buildings. The message of the concept appears, however, only together with and in relation to its opposite. Therefore one can answer the question of how Aalto used wood only when wood as a building material is understood in a wider context.

Two decisive key concepts in Aalto's architecture and his use of wood are simultaneity and inner connection. The wood as a building material takes a central role in entireties and parts but requires its coactor to be on the scene. Only in the dialogue is the architectural form brought to life.

The question of how Aalto used wood in his architecture must ultimately be answered by asking how Aalto created architecture. We must detach the timeless patterns to find the personal and the time-bound. Behind the concepts and design we can perceive modern attitudes and a modern philosophy of life.

When confronting the challenge of conserving and restoring modern architecture, it is essential to always keep in mind that modern architecture is of its nature architecture of concepts. When modernism is being restored it is essentially the conceptual content that should be respected and maintained visible and living, in the entirety, in the parts and in the single details.

# Modern Times for Norwegian Wood

*by Eirik T. Bøe*

**Those buildings that fall in line with** the international trends within modernism have so far largely influenced the perception of the Norwegian villa architecture of the 1930s. I choose to call these buildings monuments and throughout the history of architecture great emphasis obviously is put on the monument; the main work that transcends or sums up its own time. A study of the architecture of the 1930s based on the monuments may seem inadequate, however, as these only makes up a fraction of what was produced and may be unrepresentative. Villa Dammann, Stenersen or Ditlev-Simonsen all suggest rather clearly that we are part of an international development, but the design never seemed to make an impact on the common private housing. At the same time the monuments are also characterised by the building material being brick and concrete. These are among the reasons why the wooden house architecture is given little or no attention.

In its time, however, the wooden villa seemed to be the preferred building concept. The Oslo area experienced an explosive growth in the amount of wooden houses in the 1930s. At the same time there was a great need for social housing that could have been met by building a large number of semi-detached houses and apartment buildings.

In the first part of this essay I will illustrate the underlying structural reasons that the villa architecture of the 1930s in Norway was made of wood by comparing Oslo and its neighbouring county Aker. Oslo and Aker are especially suited for this comparison as the area has always set the standard for the rest of the country due to the distinguished architects of the 1930s who lived and worked there.

Furthermore I will compare the relation between local ideals and international impulses by analysing a certain type of wooden house that was developed in the early 1930s in Aker, by the architects Aasland and Korsmo. Aasland and Korsmo are most widely known for their contributions to those monuments mentioned earlier, that border on the international modern movement. While working on the more famous villas in brick and concrete they also designed houses that in my opinion became important models in Norwegian wooden house functionalism.

## The planning strategy of Aker County along the borders of Oslo

The fusion of Oslo Town with Aker County, which surrounded Oslo, had been discussed since the turn of the century. Oslo suffered from lack of space and had a major housing problem, Aker on the other hand was a largely agricultural area, and had large unspoiled areas. At the same time Aker had a conservative government, will the Labour Party gained control in Oslo. In the 1930s most of Oslo was already exploited and the demand for new housing areas was huge.

**The planning office** in Aker was founded in 1920 and headed by August Nielsen. Between 1920 and 1934 the amount of planning cases grew rapidly. The escalation clearly shows how important a thoroughly regulated building strategy was to the county, but what kind of housing was preferred?

Until Labour won the election in 1946, the conservative forces running Aker seemed to cling to the concept of it being a rural area—not a town. As opposed to Oslo's housing policies, those of Aker were concerned with the owners of private villas. They were the electorate of the leading conservative party Høyre, and considered ideal citizens of Aker. It is unlikely that Høyre, while in power throughout the 1920s and 1930s, would not try to secure their power through an active housing policy that was in the best interest of the owners of private villas. For Aker this meant an emphasis on planning and building light and open villa areas. It's typical that the county in the 1920s bought large areas to make the Ideal Garden City, Sogn Hageby. As opposed to an English garden city Sogn hageby was a city of gardens. The idea behind this policy was clearly pronounced in the pamphlet made when Sogn Hageby was put up for sale:

> *«The idea of the project can be expressed in a few words: A beautiful and homely town of gardens close to wonderful nature! A green town where the young can grow up strong and healthy without the negative social and moral influence of the big city.»*[1]

One often gets the impression that an active housing policy by necessity is synonymous with social housing projects. Oslo had a great need for social housing, the available areas were few, and Labour party built its power on the many workers lacking suitable homes. In Oslo, the issue of housing *meant* social housing projects. In Aker, however, there was little lack of housing and no shortage of land. Instead of making way for the social housing projects, the county could do good business by attracting wealthy taxpayers from Oslo wanting a villa. No reason therefore to build neither high nor dense.

August Nielsen's statements to Akersposten after a visit to a suburban village outside Gøteborg illustrate the view on apartment buildings versus garden cities:

> *«The inhabitants where mainly workers. The blue and yellow flag was waving from all the flagpoles. But when I entered these tiny homes I saw a bust of Lenin on the mantelpiece, and I asked why they had not hoisted the red flag outside. "No, why? We're Swedish" they answered. So these tiny houses make an impact on the consciousness of each of them. They no longer feel homeless, and consequently no longer international.»*[2]

So according to Nielsen the building of small houses curbed the danger of communism. Hopefully the "red danger" would be nullified in the peaceful setting of the garden city. The signature *ww* in Akersposten a year later in 1929 gave praise to the same area in Gøteborg: "Satisfaction is poison to communism, and dissatisfaction and class hatred grows in high rise apartment buildings and not in beautiful and well organised suburbs.[3]

This dogma shows the conservative view on social housing projects. Privately owned houses where clearly preferable to large apartment buildings. In general social housing projects were virtually non existent in Aker.

**Oslo and Aker** were separated both by an administrative and a physical border. Harald Hals, the planning commissioner in Oslo, wanted the city to grow as an organic whole by eliminating those borders and let Oslo grow into Aker. August Nielsen however, never wanted high rise buildings and felt as early as 1928 that the time had passed for this housing concept:

"The leading principle of city planning used to be the erection of high rise buildings.[4] This principle is now discarded mostly because of socio-political circumstances". What Nielsen probably had in mind were the socio-political circumstances in the apartment buildings in Oslo. In the polarised political climate the fear of dissatisfied workers living in large numbers in one and two room apartments was most likely highly real.

In view of Aker's desire to be an autonomous county their policy seemed to be to underline the differences between Oslo and Aker. This was carried out in two ways: Where high rise buildings were unavoidable it was placed close to Oslo, as an extension of the inner city. Outside these apartment areas, like the Kirkeveien-ring, a green belt was kept open between the villas and the city. The remnants of this green belt remain apparent even today, and contain many of the city's football fields.

In this area on the border of Oslo the architects Aasland and Korsmo made their first projects together at Nedre Frøen.

## Nedre Frøen

The area of Nedre Frøen lies on the West Side of Oslo next to the University in an area marking the passage between the mural city and the villas. In August 1929 Aasland and Korsmo's planning proposition for the area was accepted, and here they built their first 12 villas together. The projecting of the first house, Lille Frøens vei 16, started in the summer of 1929, and the last one, Apalveien 28, was finished by the summer of 1932. All the houses on Nedre Frøen had the rectangular volume, horizontal panelling, and stretched pyramid roof in common. The houses lack wings, but had occasional smaller projections.

It is my opinion that by giving a detailed description of Lille Frøens vei 16 I can adequately characterise and analyse the houses in the whole area. Aasland and Korsmo themselves said to *Byggekunst* in 1930 that the house "struck a chord for the whole area".[5] The house also contains all the major characteristics for the Nedre Frøen project; flying hip roof, horizontal cladding, vertical symmetrical windows and the ground floor mainly made of plastered brick or concrete walls. The house rests as a fond motif in Suhms gate and thereby has a particularly striking location—the architects therefore would have put great emphasis on the design. The house is also drawn in great detail even in early blueprints.

## Lille Frøens vei 16

The Villa was built for the pharmacist Nilsen. It had a kitchen, servants' quarters, living room and a cabinet on the ground floor, and bedrooms and bath one floor up. The villa and the site were formed as a whole, with pergola, low garden walls and a garage. The main impression is of a confined house with certain horizontal features, which is enhanced by the use of different materials on the ground floor and the first floor. In addition the contrast in material volumes gives the house a certain light elegance. The white plaster wall in the ground floor brings a light and floating character to the brightly coloured wooden panels in the first floor. At the very top the roof seems to be floating in thin air; an effect caused by wide angles and the shadow between the roof and the outer walls. The garden walls are integrated with the house and form a firm base for the body in the more public facades facing south and west. The facades hold the building in a firm grip, and lend it peace. The size of the windows—and the corner window facing southeast—underline the light character of the house.

Lille Frøens vei 16 is the most characteristic of the villas at Nedre Frøen. Features of this house are used and further developed in the later houses. The house, however, is bigger than the rest, and has extensive garden walls and more metal-framed windows than the others. In addition there are two features characteristic for the area that Nilsen's villa hasn't got: Visible wooden bearings on the sides of the house and a chimney built into the outer wall. The chimney cuts trough the wooden panelling on the first floor and breaks the horizontal outline that characterise several of the other houses. Apoteker

Nilsen´ s villa is the only one cast in concrete. Most of the parts that are plastered on the other Nedre Frøen houses are made of brick or rabiz plaster.
Nedre Frøen was the last big project Aasland and Korsmo did before they were signed to draw up a draft for the houses in Havna allé where they use a more international design.
Lille Frøens vei is in my opinion best characterised as new interpretations of the new Empire style of the 1920s in Aker.
New Empire is by no means an unambiguous expression. It is merely one of many used on the architecture of the 1920s. 1920s classicism, new classicism, Scandinavian dorisism and romantic classicism are other terms that have been applied to the classicist movement in Norway from WW1 and until the mid 20s.[6] All these terms are problematic, because of the earlier classicist periods. In particular the similar classicist movement of the first half of the 19th century causes confusion. It was called neo-classicism or Empire. Also, confusion may occur because one was to some extent inspired by this period.
Thus before I can use the term new Empire I have to clarify my use of it.

## New Empire

In spite of the many terms that have been used, the architecture of the 1920s has received little interest from the architectural historians in Norway. Christian Norberg-Schulz has written about the period in general in *Norges kunsthistorie*, and H. Von Achen in his essay on the architecture in Bergen from 1900 to 1930.[7] These works are just meant to be general descriptions and not scientific studies. Espen Johnsen's master's dissertation from 1993 on the architects Blakstad and Munthe-Kaas´ development from National Romanticism to New Classicism is, as far as I know, the most thorough study of New Classicism in Norway. The paper puts great emphasis on the different stylistic orientations, and I have therefore used it as a base for my definition of New Empire.[8]
Johnsen uses the term New Classicism as a common term for the classically oriented architecture in the northern countries in the 1920s. He identifies two distinct styles in the new classicist movement: Scandinavian Dorisism and New Empire.[9]
According to Johnsen most of the architects working in the new classic style were inspired by the classic heritage in their own countries from the late 18th century until approximately 1840. This was probably a reaction to National Romanticism's focus on the rural architecture in the valleys. In a certain period these expressions were perceived as more Norwegian than our young city architecture. The focus on the classic heritage was also connected to a proposed law from 1918 about protection of all buildings older than 1850. The proposal gave way to large-scale registration throughout the land, with the empire style houses an important part of the survey.
At the same time several of the leading architects from the period were studying in Sweden, where the education was oriented towards the classic Roman and Greek ideals.
Johnsen views the New Empire style of the 1920s as a local villa style, as opposed to the Scandinavian dorisisim, which in his view is a more abstract New Classicism independent of any specific location.[10] By its method and by the intention of the architects it was traditionally an eclectic style. The articulation lies closer to classicism than it does to National Romanticism, with axial layout of the inner volumes, and symmetries. General characteristics are the defined cubic volumes with confined forms, axial and symmetric layout of inner volumes.[11]

## The New Empire in light of Aasland and Korsmos earlier work

The New Empire style seems to have been widely recognised in Aker County as the 1920s progressed. As far as I know there has been no scientific study made on this alleged trend. A survey of the area around Blindern displays such a high number of houses built in this style that I dare call it the main trend in Western Aker from the beginning of the 1920s.
Especially Nicolai Beer contributed, in cooperation with Kristoffer Andreasen Vl Lange (1886–1977), with clear examples of 18th and early 19th century features in their small villas in the area that today constitutes the campus of the University of Oslo at Blindern. Between 1921 and 1925 the production of single or double houses in a concentrated area is significant. These houses are characterised by hip roof, and two sectioned windows divided in six or eight, vertical painted panelling and that they are square single houses or rectangular double houses. The facades are symmetrical where there is access to the garden, the door is centred on the facade or symmetrical in the middle of each side of the double houses. There is little direct contact between the outside and the inside. More often than not the garden door will lead to a small terrace. The houses appear to be confined, and the barrier between nature and culture is maintained in the best classical tradition. The details of the earliest houses are clearly classical, with corners with pilasters, and entrance including canopy formed as a pediment. The houses also have narrow pilasters dividing the facade into three or four.
**More similar houses** designed by Beer and Lange are located in Prestegårdsveien. The blueprints of Prestegårdsveien 1 are from 1921. Its closest neighbour is the main building of Nedre Blindern farm, a distinguished building in Empire style from 1790. These two buildings are remarkably similar in body panelling pilasters and in the shape of the roof. Beer and Lange have chosen more typical Empire windows and a stricter form of the roof, in coherence with the classic ideal. Another Aker farmhouse that could have inspired the architects is Bellevue or Mellom-Tøyen, built in 1822. This seems likely

especially because of the cornice between the two floors that divides the vertical panelling, the roof and the narrow pilasters in the facade. Beer and Lange's cornice is not as dominating as the one in Mellom-Tøyen. Likewise the pilasters and cornice on their houses are built with narrow boards, on top of the panelling. Another divergence is horizontal panelling. This was not common on the old farmhouses in Aker.

This is only one of many examples of houses from the 1920s that picked up the formal language of the Aker Empire Style.

In my opinion, therefore, what we see is locally adapted villa architecture with classic features; in other words what Johnsen defines as New Empire. It may be that the new classic trend of the 1920s was initiated by international ideas, but in Aker it seems to have gotten a local design. One didn't turn to the national icons, nor to famous foreign monuments, but to ideas from the immediate surroundings. Beer and Lange's houses are early works and their production is large. Their contribution has been significant to the development of the New Empire Style in Aker.

It was in this New Empire area Aasland and Korsmo started their production of detached houses in 1929, and their project can be identified somewhere between the classicism of the 1920s and the modern language of the architecture in the decade that was to follow. In my opinion the houses in the Nedre Frøen area was an attempt to modernise the starting point—New Empire.

**The new interpretation** is most clearly visible in the free treatment of the facade, larger windows, more open plan and the division of the house into independent volumes. Generally the houses appear as more complex. But still a lot of the New Empire language remains present in the general outlines of the houses, like the closed rectangular or quadratic main volumes, the low hip-roof and the vertical symmetric facades. The proportions between the window openings in the ground and first floors also indicate how the architects have one foot in the New Empire tradition.

The calm New Empire got a modern injection, which resulted in a more complex house form. After Nedre Frøen Aasland and Korsmo projected another building site at Havna, close to Frøen, here they further developed the design from Nedre Frøen. It is however the Nedre Frøen design that Aasland and Korsmo use in their ensuing production of houses, besides their houses in a more purified international style.

Aasland and Korsmo have usually been connected to what we in Norway call functionalism, and Korsmo in particular is commonly referred to as a dedicated internationally orientated modernist. With reference to what I mentioned above, it could however be interesting to ask which relationship Aasland and Korsmo around 1930 had to the architectural styles of the past. This question is hard to give a clear answer to, since there are no written sources to base a study on. Through a focus on their education and early projects I believe however that I can cast a light on the reasons why they chose to design Nedre Frøen as they did.

## Aasland and Korsmos background in the architectural styles of the past

Sverre Aasland was educated at the Technische Hochschüle in München (TAM) in 1926. Sadly all the archives from the school were destroyed during the war. We therefore know little about Aasland in particular. I have to present a more general view of the school.

Contrary to a widespread impression of Germany at that time, the country contained more than freshly converted modernists. TAM, situated in the conservative Bavaria, was not among the first universities to adopt the Bauhaus educational program. The Bavarian educational institution was rather on the opposite side, orientated towards the Heimat style, a German version of the National Romantic Style. Several of the teachers were among the founders of "Der Block", which was established as a counterpart to the radical "Der Ring" group. "Der Block" group consisted of several colleagues from the technological universities in Germany, and represented an architectural view based on the architecture of the German people and its nature, and the places which framed this architecture.[12]

The Heimat style had in other words an impact on the school. Aasland also made several study tours around Europe, and was very likely not unaffected by the new trends in German and European architecture in the 1920s.

Arne Korsmo finished his diploma work at the Norwegian technical university (NTH) in Trondheim in September 1926. NTH was at that time still heavily influenced by the classicist trends if Korsmo's diploma work is used as a yardstick. The diploma project that year was "A luxurious villa in a residential district". Korsmo's answer to this was a voluptuous house in Louis XVI Style, with three floors, surrounded by a park, with terraces, alleys and pavilions, most unheard of in Lutheran Norway.

**Korsmo's first project,** from 1927, a detached house with two dwellings, reveals his education in the historical styles. The house is in typical New Empire style, the way this style is defined above. In this house Korsmo displays how he masters the classic formal language, at the same time, as his personal style is apparent. The north facade and the plan both have modern elements that break with the New Empire style.

Aasland and Korsmo's education shows how dependent the architects must have been on the classical language of the architectural styles of the past. The Nedre Frøen project is therefore in more than one way in accordance with the background of the architects.

If we study Aasland and Korsmo's production between 1928 and 1930 it was mostly new interpretations of the New Empire style, as described above, that was central. This interpretation was something they worked with through their co-operation until they split in 1935.

To fit such a new interpretation a house has to have the following main features: The house has to be divided into different volumes, which is to say that the house must be divided horizontally, with materials in different texture or colour. Under this main criteria at least one of the following elements must appear: Hip roof, part of the first floor must be plastered or the first floor must be wider than the ground floor. An additional common element is the plastered white chimney on the outside of the facade.

## With skirt and blouse

In an unsigned article in Byggekunst in 1939, the term «Skirt-and-blouse-house» is used as a pejorative in an angry statement about houses with the same features that are characteristic for Aasland and Korsmo's Nedre Frøen houses[13]. The article refers to houses where the panelling shifts from standing to lying between the ground- and the first floor, and two colours and rabitz plaster are characteristic features.

After my first encounter with the Skirt-and-blouse term, it seemed to cover the essence of these houses so well that it was hard to evade. In the above-mentioned new interpretation of the New Empire the blouse cantilevers over the shirt and the two garments are in different colours. As we know the length of the skirt can differ, but in the Skirt-and-blouse-houses the ground floor usually is higher than the first floor. In the following I will try to explain where Aasland and Korsmo got the idea for the Skirt-and-blouse-house and briefly discuss how they were received in their time.

**I first investigated** possible external factors that could have been the reason why the architects had to choose the skirt-and-blouse solution. My first thesis was that the county planning office had put up some restrictions for the sites regarding fire, which said that the ground floor of the houses had to be plastered or in another fire proof material. I have not found any general regulations, or any specific ones for Lille Frøens vei 16, to support this. Neither have I found that the owner of the house demanded this solution. Thus we are left with the possibility that it was the architects that wanted this solution. What Aasland and Korsmo wrote in Byggekunst in 1939 confirms this:

> *The residential district along the axis from the University to Slemdalsveien should have been built in masonry—today it is almost nothing but wooden villas. Our first plan was based on concrete. A hilltop on the site was originally planned as row houses, but the neighbours refused them.*[14]

Aasland and Korsmos conscious attitude to the area is clearly displayed in the quotation. They were convinced that Nedre Frøen, bordering on Oslo, should be raised in brick. It is possibly this attitude that is expressed in Lille Frøens vei 16 and followed up in the other houses that front Apalveien and Oslo. Aasland and Korsmo's mural intentions seem to be clearly expressed, but they say little about the design.

I have not found local or other Norwegian inspirations for the Skirt-and-blouse-house. The traditional lofthouse (stabbur) fulfils many of the criterias, but the transformation seems to be too complex to be likely. Instead I have found a simpler and therefore more convincing explanation.

Before the plans for Nedre Frøen were approved, Aasland and Korsmo in April 1929 had delivered a plan where parts of the site were row houses—according to their statement above. The ground floor was in brick, first and second in plastered brick. If we disassemble one of the row houses, we will at the same time see the obvious resemblance to Lille Frøens vei 16. A cubic form, dual coloured facades and almost identical window solutions, leave little doubt about the inspiration for Lille Frøens vei. As mentioned Aasland and Korsmo didn't get the opportunity to raise the row houses, but chose instead to take out an element, which they combined with the local New Empire tradition.

**The row houses** had obvious functionalist features, and the rejection of the project from a rather conservative County may not surprise, even if the County occasionally did think differently. The question of where Aasland and Korsmo got the idea to the row houses from is still to be answered.

The row houses are not placed strictly in a row; the facades are withdrawn from each other. This motif is probably picked up from one of the most famous German modernist *Siedlungen* in Bruchfeldstrasse in Frankfurt. The architect Ernst May, County planning officer in Frankfurt between 1925 and 1930, raised between 1926/27 the famous Zick Zack-houses, as a part of a larger grind of Siedlungen in the Frankfurt area. Both Aasland and Korsmo had visited Frankfurt and probably seen the row houses, or they were familiar with them through magazines. If we look at the picture in *Byggekunst* from 1931, of Lille Frøens vei 16, it's taken from the angle where the resemblance between the Zick-Zack houses and their own house is most obvious.

**The road from Frankfurt to Frøen** may seem long but the connection is possible. There is however no direct connection between the Zick-Zack houses and the further development of the skirt-and-blouse houses in Norway. I therefore see Lille Frøens vei 16 as the link that makes it possible to propose a thorough explanation for the origin of the later Skirt-and-blouse-houses. Lille Frøens vei 16 is the first house of this type that Aasland and Korsmo designed, and even in the next houses they chose an architectural expression that was closer to the local New Empire, and the traces from Frankfurt are more distant.

It is hard to prove the thesis that Lille Frøens vei 16 was the first Skirt-and-blouse-house in Norway, but it's indisputably a very early example of a type of house that would spread to the major parts of Oslo and Aker. For that reason it's interesting to examine how the house was presented and received in the media of its time.

**In 1933 architect Finn Bryn** commented on the new wooden houses that came after the breakthrough of functionalism, in an article in *Kunst og Kultur.* [15] He is of the opinion that new plans have been invented, something which has left its mark on the facades. In spite of flat roofs and horizontal lines the wooden houses have retained a homely look. Bryn put emphasis on two examples from the Frøen area designed by Magnus Paulsson and Ove Bang. This is Anne Maries vei nr. 16 and 18, but he also adds:

> *[...] wood is a material that is well known to Norwegian architects, and makes it easy for them to find a natural, rational and national form. In several villas at Frøen and Havna by the architects Aasland and Korsmo, you can see efforts to get out of the national stagnation by building parts of the facade in masonry. This has achieved quite a decorative effect, but as a result of a certain formalism the trend can hardly be said to be in the spirit of modern architecture.* [16]

The most noteworthy about this quotation is not the content so much as the fact that Finn Bryn chose to put emphasis on Aasland and Korsmo's Nedre Frøen houses. Bryn was one of the most famous functionalist architects of his time. Together with Johan Ellefsen he was projecting the largest and most complex functionalistic building masses at the University at Blindern. When he chose to comment on the houses that I now have defined as Skirt-and-blouse-houses, it proves that the architectural elite had not forgotten the houses at this time. Bryn is not entirely positive about the buildings, because they did not in his opinion answer to demands houses in the modern architectural spirit should satisfy—without him or anyone else ever explaining what they meant by that. He could, however, not neglect them. The comment also shows that the houses were not understood as modern or national. As shown above, my opinion is the same as Bryn's; the buildings can be described as neither national nor international, but as locally adapted.

**The way the houses** are mentioned by Bryn in *Kunst og Kultur*, it gives the impression that the houses were widely recognised. The paint firm Monopol must also have thought this when they wanted to advertise for their new paint, Monoline, under the headline "Funkis demands a modern paint [ ]". [17] The ad shows a drawing of a house that is almost identical to Lille Frøens vei 16. The drawing is simple, but shows, besides the shape of the house, the main principals, the two horizontally divided volumes, slightly shifted on each other, with a floating roof above.

Lille Frøens vei 16 is itself is also used in several ads, among them the one for the steel window Fenestra Crittall. [18] The steel window was an invention that was mentioned in several articles, one of which was in *Hus og have* and commented the steel windows in Lille Frøens vei 16. [19] In an article about modern kitchens in *Hus og have* from March 1931 there is a picture of the kitchen in Lille Frøens vei 16 and Korsmos own flat. [20]

**Pharmacist Nilsen's villa,** Lille Frøens vei 16, is the only one being used in commercials and ads for building products in the magazines *Hus og have* and *Vi selv og våre* hjem in the period 1928 to 1935. This could indicate that the house must have been known in its time, and viewed as both commercially tempting and widely known. On the other hand the ads probably raised the house's status and made it even more recognised. We can therefore assume that the Skirt-and-blouse-house, Lille Frøens vei 16, after a while emerged as an attractive example of a modern house.

In an article from the 23 Januar 1931, in *Akersposten*, Lille Frøens vei 16 and some others are pictured on the front page as examples of the "monstrous" houses that were allowed in Aker County. "Loud contrasts in types and colours, smashed into older buildings". The author of the article does not comment on each picture, which he thinks speak for them selves. That he chose to storm and rage over Lille Frøens vei 16 could be accidental, but situated as a motive in Suhms gate, before the building of everything that surrounds it today, it must have been more conspicuous than at present, and therefore a natural target for critics.

**«Hypermodern»** is the expression *Aftenposten* used February 23rd 1932. In an article about the projecting of Havna allé, Aasland and Korsmo are mentioned as the "men behind the many hypermodern houses at Lille Frøen". Until then Nedre Frøen was the only place where Aasland and Korsmo had built houses in the Frøen area, and Lille Frøens vei 16 was still the first and the most visible in the townscape. Aftenposten's article is written in a way that gives the impression that the Nedre Frøen buildings were well-known examples of new and modern architecture.

The houses at Nedre Frøen must also have been a success from the architects' point of view, when they in 1930 chose to publish two of the houses in *Byggekunst*: it goes without saying that Lille Frøens vei 16 was one of them, the other was dr. ing. Bergve's house in Apalveien 18. [21] These were the first houses the architects published, and taken into consideration that the architects were young and ambitious, they must have thought that this would enhance their reputation. We are therefore reminded of the fact that at the time there were not only young architects believing in functionalism, but many that were about to leave or were reinterpreting the Classicism of the 1920s. Against this background the houses from Nedre Frøen can have attracted attention, but still within known forms.

**One may ask oneself** why Aasland and Korsmo's later production so quickly overshadowed the Nedre Frøen houses. It could be because they did not represent the genuine and pure architecture that the spearheads of the architectural profession held as an ideal. The houses were hybrids between New Empire and the modern architecture, and in that way they represented a transitional stage that many tried to leave behind. In spite of that Aasland and Korsmo continued until 1934 to draw houses of this kind, as a sideline to their more internationally oriented houses. This tendency could be due to the ones that bought the houses, but the architects also seem to have affection for this type of house. Between 1929 and 1932 they put up 17 Skirt-and-blouse-houses in Aker. Most of the houses are in the area of Nedre Frøen and Sogn. This is not a comprehensive list, but it gives an indication of how large the production was in a concentrated period, in a visible area near Oslo.

Up until today the houses have lived a quiet and anonymous life, with little attention in the literature, in spite of the amount of houses raised in the genre. In the Riksantikvarens listing plan for 20th century architecture none of this type is included. There are however two exceptions from this silence, Dag Myklebust in a little article in *Fremtid for fortiden* from 1982, where he focuses exactly on this type of house, and by Tore Dreng's description of a Skirt-and-blouse-house, in his book *Gamle trehus*. The house mentioned is a simplified version of Aasland and Korsmo's houses, and was built in 1936.

**Lille Frøens vei 16** emerges in Aasland and Korsmo's collected works as a very original and independent creation. It will never get Villa Dammann's status as a monument. But as a representative work of the taste of the period, and as an example of adoption of international tendencies to a local situation, I see the house as a key work in the understanding of Norwegian architecture of the 1930s.

## International formalism

In my opening remarks I mentioned that the houses that touch the international mural development characterise the reception of Norwegian architecture of the 1930s. In the same period as the buildings at Nedre Frøen, Aasland and Korsmo erected some mural villas like the ones in Havna allé. Aker County rarely allowed mural houses, but since Havna allé was a dead end, and the houses were few and well hidden by wooden houses, they accepted it. In my Master's dissertation I compared the Havna allé houses with the Weisenhof exhibition in Stuttgart in 1927. The result of this comparison showed that Aasland and Korsmo had the ambition to make their one Weisenhof exhibition. All the houses had similar features as the exhibition houses, all the way down to the colours. Aasland and Korsmo are not alone in being dependent on European models, something that Ove Bang's Le Corbusier inspired Villa Ditlev-Simonsen is a typical example of.

On this background it is possible to speak of Aasland and Korsmo and the Norwegian "avant-garde" as formalists. They collected local, national and international impressions, and designed their projects based on them. This method is in principle not different from the method employed by architects working in Historicism, National Romanticism and New Empire used, although the architects in the 1920s and 1930s were more independent from their sources of inspiration.

The peculiarity is that Aasland and Korsmo worked in a time where functionalism got its breakthrough. The new architecture was promoted as the end of copying of style. The form should be directed by the project—not by conventional architectural language.

My analysis of Aasland and Korsmo indicates that for them this was a truth with modifications.

## Concluding remarks

The opinion that functionalism is a liberation from the formalism of earlier epochs comes from the functionalist architects themselves. With Le Corbusier's five points for a new architecture the architect was ideally liberated from his predecessors, and the points represented the break from the traditional architectural styles in its approach to the building tasks. Le Corbuiser comments his points like this "The five points involve a fundamental new aesthetic. Nothing of the architecture of earlier areas is present any longer".[22]

Through the above I hopefully have indicated how Aasland and Korsmo demonstrated a greater degree of freedom in the design of the more low key Skirt-and-blouse-houses than in their mural buildings. I am therefore of the opinion that the newly won liberty that followed the breakthrough of functionalism appears to have gotten an especially pronounced manifestation in the wooden houses like the Skirt-and-blouse-houses and other variants of locally adapted wood houses in the Oslo region. With hip roofs, saddle roofs and rectangular volumes they do not hide their local heritage, but at the same time they have radical elements inspired of the new movements in Europe. That's why they in my opinion form a synthesis of local tradition and modernism that is unique, not only in the 1930s. In the new interpretation of the wooden houses there were no models to follow and no known inspirations, because the leading architects of the time had not occupied themselves with that kind of architecture.

**Aker County's attitude** to row houses and blocks of flats seems significant both for their strategy of keeping a green buffer between Oslo and Aker and for their scepticism to dense housing in international style, that potentially could make way for unintentional radicalism. This made Aker a playground for experiments with wooden architecture for Oslo's architect elite.

In the literature by art historians so far the main focus has been on what I call monuments in the international style, and which I in my opening remarks called monuments. A reading of the 1930s detached houses or villa architecture based on these key buildings is however not adequate, when the Skirt-and-blouse-houses and other variants of locally adapted wood houses does not fit in.

This last mentioned building type constitutes a far larger quantity of houses than the buildings in international style. At the same time they are examples of Norwegian functionalism where local features are dominant and where the architects haven't necessarily turned to the romantic valley architecture. In my opinion these examples manifest a rare authority in competition with the international orientated transmissions.

**Our architectural contribution** in a European context must therefore be searched for among this type of houses. If Norwegian architecture of the 1930s is to be given a representative face then Villa Dammann would not be enough, it must be given room for models like Lille Frøens vei 16 and its equals. The houses constitute a broad current in Norwegian architecture of the 1930s. This survey thus only touches the surface of a field by showing a few examples of an architecture that is comprehensive but not truly outlined.

**Endnotes**

1 A/S Akersbanen, *Sogn hageby*, Oslo 1929, p. 4
2 *Akersposten*, 3. april, 1928
3 Wewe, *Akersposten*, 3. april, 1928
4 Ibid.
5 *Byggekunst*, 1930, p. 179
6 Johnsen, Espen, *Gudolf Blakstad og Herman Munthe-Kaas. Prosjekter og byggverk 1916-1924*, hovedfagsoppgave, UiO, høst, 1993, p. 22
7 Norberg-Schulz, Christian, "Fra nasjonalromantikk til funksjonalisme. Norsk arkitektur 1914-1940", *Norges kunsthistorie*, bind 6, Oslo 1981, p. 35-46
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12 General information from *Architekturschule München 1868-1993*, München, 1993 and Pommer, Ricard and Otto, Christian, *Weissenhof an the Modern Movement in Architecture*, Chicago, 1991
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14 *Byggekunst*, 1930, p. 179
15 Bryn, Finn, Nutiedens stil i norsk arkitektur, *Kunst og kultur*, Oslo 1933, s. 1-18.
16 Ibid. S. 7
17 *Hus og Have*, nr. 2, 1932, s. 179
18 ex *Hus og Have*, nr. 5, 1931, s. 91
19 Ibid. P. 60
20 *Hus og Have*, nr. 5, 1931, p. 91
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# The Venice Pavilion of Alvar Aalto

## Problems in the Conservation of Modern Architecture

*by Panu Kaila*

### The Building of the pavilion

The Finnish Pavilion for the biennale of Venice was built in 1956 thanks to Ms Maire Gullichsen, the chair of the Contemporary Arts Society. She raised the funds necessary not only for participation, but also for the building, as she thought that only a pavilion of its own would put Finland on the map of the famous Biennale. Hers was the idea to make a transportable wooden "tent", built of ready-made elements from the Ahlstrom Company for forestry workers huts. She asked her friend Alvar Aalto to be the architect, and Aalto "with some amusement accepted the invitation to design the smallest pavilion in the world, as well, as the smallest building he had ever constructed". By then it was the end of February, and the pavilion was to be erected by mid May. At that time Aalto was very busy with several large design projects on his hands. Aalto thought of building something that would be "a combination of the Good Soldier Svejk's field altar, a Lapp tent and Palazzo Pazzi". It was known already that Finland would join the common Nordic Pavilion and thus there was no need for a permanent Finnish pavilion in Venice. In his specification Aalto wrote that his small wooden hut could be used afterwards for various exhibitions in the Mediterranean region, and be stored inside when it was not in use. "The pavilion is a totally non-permanent structure that can be dismantled and stored, or if necessary moved elsewhere between exhibitions." This idea has lived as a legend ever since, although the light, pillar foundation of the first sketches was changed into a solid concrete floor slab by the final drawings. Also, when the structure was erected the wooden elements were bolted together in a way, which didn't allow easy dismantling.
Another theme of the pavilion was the three great white triangles on the facades. Aalto brought forward functional arguments for them: they support and bind the light-weight construction. "The concept is one of large white triangles holding together the mountable wall structure like string round a parcel." In fact, the crucial metal piece that bonded two triangles together was left off, and these triangles were not supporting but loading the construction instead. Alvar Aalto and his newlywed wife and colleague Elissa were present when the pavilion was erected an inaugurated in Venice.

### The time of decay and the reconstruction

After 1956 the maintenance of the pavilion was neglected and its facades were badly damaged over the next 20 years. The pavilion was no more used by Finland, but by Argentina, Portugal and Iceland. Even the ownership was uncertain. In 1976 the pavilion with its ruined facades was rescued through

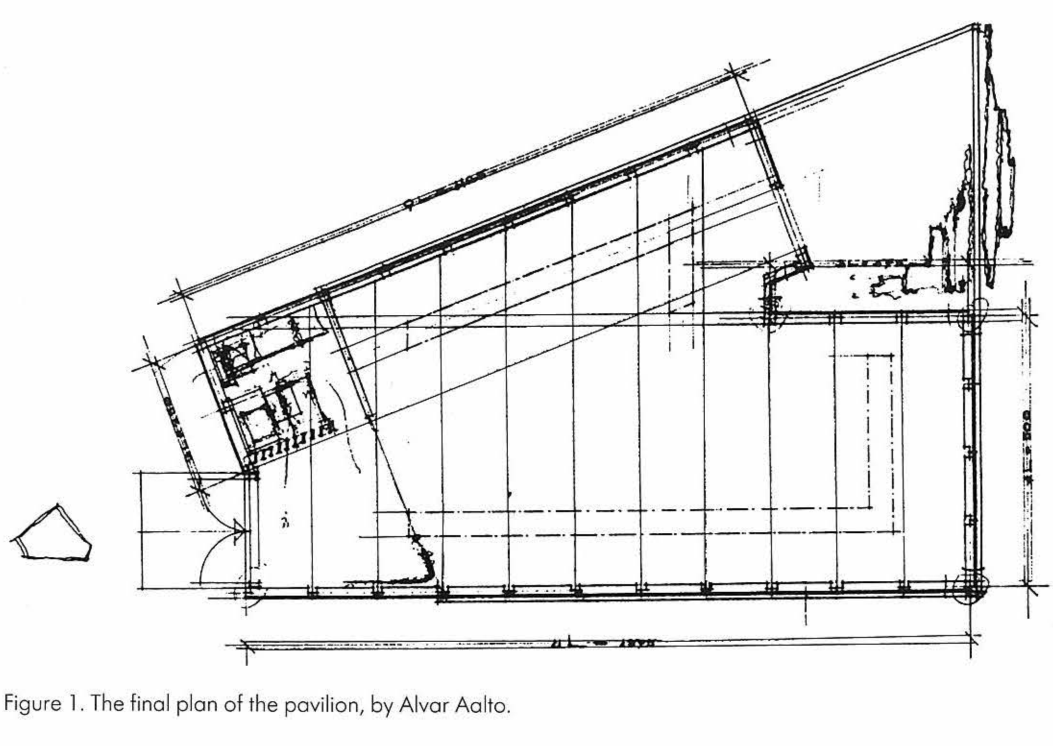


Figure 1. The final plan of the pavilion, by Alvar Aalto.

restoration with Biennale funds and with architect Frederik Fogh as designer. Again, the restoration had to be realized very fast, within only forty days. However, some of the original details were changed to make them better, some were changed for other reasons.
After this, the maintenance seems to have been less efficient again. The triangles were painted with hard, thick anti-fire paint, which trapped moisture inside the wood. As the pavilion was repaired for the consecutive biennales, some rotten wood was removed and replaced by gypsum. In 1992 the Finnish Museum of Architecture decided to finance a new restoration of the pavilion and I was invited to plan it. The investigation of the building showed that the triangles were totally rotten in large areas and the wall panels were damaged from below. As these were not original, but dated from the restoration of 1976, it was decided to rebuild the facades once again.

## The problems of the restoration

The restoration for the biennale of 1993 was planned by myself, consulting with architect Elissa Aalto. From the side of the owner, the Finnish Museum of Architecture, which made the final decisions, intendant Timo Keinänen was an important member of the planning team. In Venice, architect Emanuele

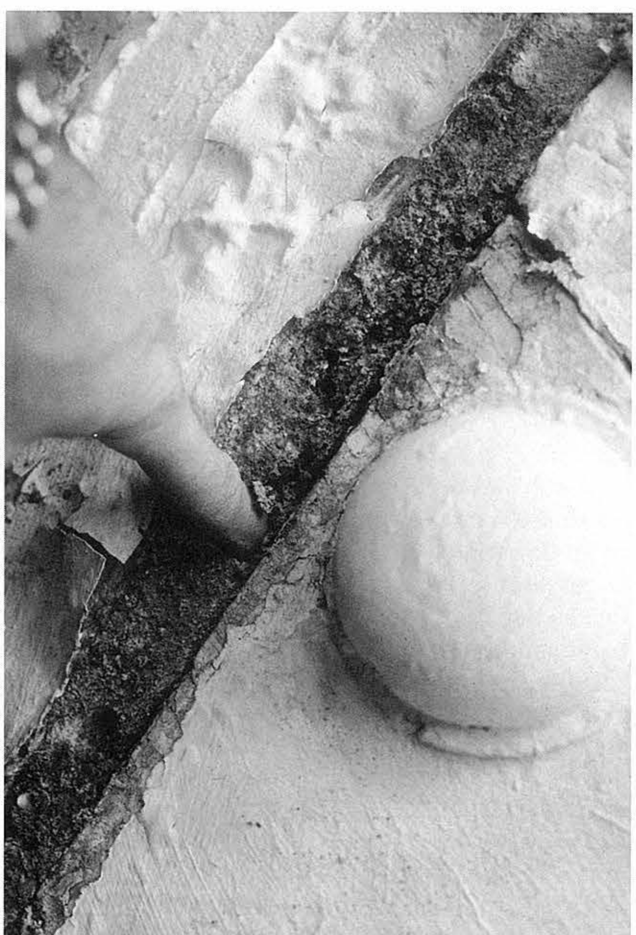


Figure 2. The timber of the triangles was in many parts totally decomposed by funghi, thanks to the hard thick plastic paint.

Armani acted as the link with the authorities for building permission and other formalities. Erkki Hiipakka was the master carpenter of the site, and he also provided alla timber from Finland. The Italian master builder was Corrado Pedrocco. The practical work was realized to a great extent by students of architecture on a course, planned and organized by myself. Different details and materials were studied in Venice and in our Laboratory of Building Anatomy and Pathology in Tampere University of Technology. The reports will be published in English.

Many interesting problems were met. What is the value of original drawings in the restoration, compared with how the building was really constructed? What to do with the missing but important link between the two triangles? If an original material is not durable enough, should we still use the same for the sake of authenticity? How to make a wooden facade durable enough for the humid climate of Venice? This project revealed many problems typical in the restoration of modern architecture.

The most important interventions were related to the wall panels, the triangles, the entrance and the roof.

## The wall panels

In the original drawings each wall panel has a facade of 20 boards of pine, rebated, with open joints. In the early photographs we can see that when the pavilion was built the amount was only 14—thus the boards were considerably wider and the looks somewhat cooler. Did these boards have rebated or tongued and grooved joints? We don't know. In the restoration of 1976 the number of the boards was still 14 but larch was used instead of pine and the joints were tongued and grooved. Larch, as it usually grows very fast and with large annual rings, is generally less durable than pine, but as architect Fogh wrote in his report, "the fine Finnish pine was not available at such short notice." In 1993 I planned to use 14 boards per panel with rebated joints as in the original drawings. Also, I thought to leave some of the better panels on the south gable unchanged, as a memory of the restoration of 1976. However, when in Venice we found out that the new boards were smaller—by mistake not only their profile but also their width was taken from Aalto's drawing. There was no possibility to change them anymore, so it was best to reconstruct the facades using the original drawings as a rule. As the boards were so much smaller, we couldn't leave some panels unchanged. However, when these new facade boards were nailed on the wall panels, although they were of the original width, they seemed to bee too tightly close to each other and did not allow the necessary allowance for expansion. So we decided to use only 19 boards for each panel. This is one of the details in our restoration which can be disscussed. On the other hand, maybe the tightness of the boards was one reason for the early decay of the original facade-from photos which show the situation

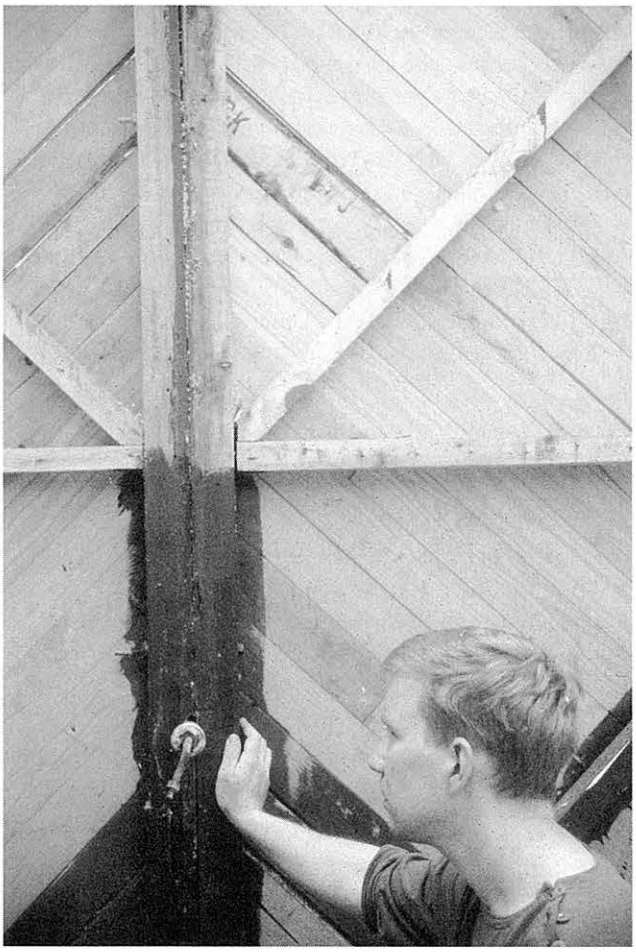


Figure 3. When the weather boarding was removed the diagonal bracing and the cross-wise inner boarding became visible.

before 1976 we see that the boards are bulging out due to swelling in many places.

The larch boards of 1976 were badly damage on some parts of the attic and on the lower parts or the walls, especially on the northern facade facing luxuriant vegetation. We analysed the insect damage and found the wood boring weewils of Cossonous-family to be guilty of the destruction. This insect however consumes only damp wood, so that the real troubelmaker was the high moisture content of the wood. The paint system which was used 1976 was at least partially responsible for the dampness in wood. Then how to prevent our facade from decaying at similar speed? Heartwood of pine would be more durable, but it would add considerably the costs. Also, heartwood ought to be painted only next year, to allow some time for resinous components to evaporate from the surface. In our case, it was absolutely necessary to paint the pavilion for the biennale, which was opening a month later. So we ended up deciding to use CCA-impregnated pine timber for the facade boards.

Between the panels there were lapping lists of aluminium. The profile of the lists had also been changed in 1976, and we brought from Finland new ones made true to Aalto's original design. The detail drawing showed that the lists were not long enough to reach the whole height of the panel, but that there were two pieces, the higher part lapping one centimetre below the wall panel. In old photos we saw that when the pavilion was built, these lists reached more than one centimetre below the panels. In the restored state from 1976, the lists were of one piece and were not overhanging. It is most likely that the original lists were destroyed by the demolition of the weather boarding. The building site gave us a lesson: when the joint between the two parts was done as designed, one lapping on the other, it became evident that the 1,5 mm aluminium was too thick to make a nice joint but was bending outwards. The only way to cure that was to make a head joint instead of a lapping one, and to move the lower parts downwards. In this way we reached exactly the same effect of the lists hanging two centimetres lower than the panel board as in the old photos—the builders of 1956 must have met the same problem and solved it in the same way. The authentic mistake reproduced in an authentic way, by mistake!
Only the weather boarding of the walls was renewed. The frames are original and in good condition, as well as the diagonal boarding inside the walls. In these parts the species of wood is pine and the nails Finnish square wire nails—all timber changed in 1976 has round Italian wire nails.

### The triangles

The large white triangles of laminated wood were reconstructed in 1976. One piece of the original triangles was saved and then used as a table in the pavilion—this table disappeared mysteriously during our work. Luckily we had measured and photographed it, and found that the joints inside the laminated wood were reinforced with lists of plywood, as Aalto had designed. In 1976, the lamination was made in another manner. Instead of pine larch was used, and with such wide annual rings that before the microscopical analysis we suspected it to be poplar! Only parts under the eaves were protected, in other areas the timber was in terrible state. The wood had been painted with a thick hard coat with inevitable cracks along the joints. The measured moisture content was about 35% in the lower part, and it was literally possible to push a finger through the wood!
On the triangles there is a row of round bulbs. We found that some of the semi-globes which should cover the bolts on the triangles were fake—they were placed at even intervals to look nice and not necessarily on the bolts. Thus some of the bolts were only sunk and hidden on the bare surface, while some had the globes on them. This is again a typical solution of Aalto—the end justifies the means. Fogh wrote that the globes were reproduced in Milan in 1976, but we found that some of them were a little different from the others and were obviously original. Maybe most of the globes were destroyed in the

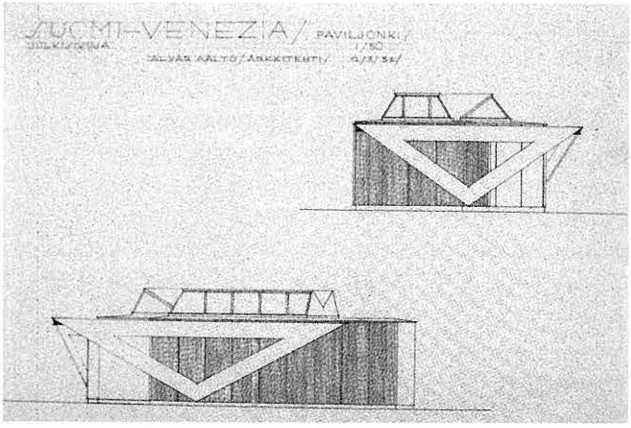


Figure 4. The plan of the southern facade - the two black metal pieces are well visible.

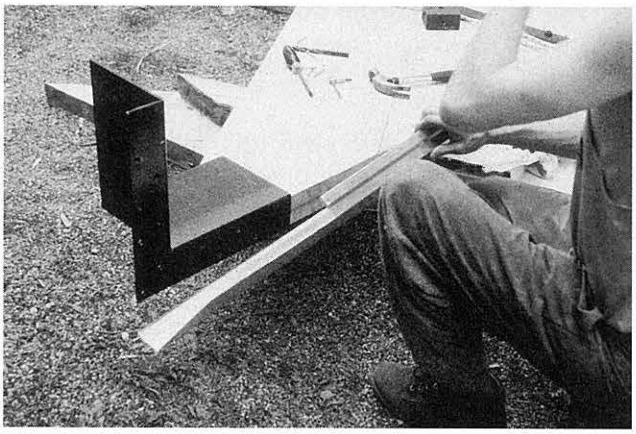


Figure 5. The new black metal in the corner of a triangle before its erection.

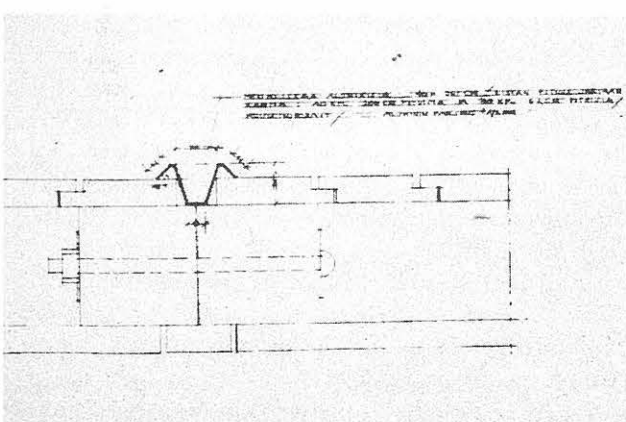


Figure 6. The lapping list of aluminium and the profile of the profile of the facade board in Aalto's detail in scale 1:1. The text says: Lapping list of aluminium. 40x361 cm/the length divides in two: 40 purchase length 162 cm/screws of aluminium/the thickness of aluminium 1 ½ mm. (The height of a panel is 360 cm.)

demolition of 1976, but some had survived. We removed them carefully and reused them.

The new triangles were made in Finland of heartwood of pine, transported to Venice in pieces and put together on the site. We had no machinery but lifted them to their place by sheer manpower—one triangle weighs about 700kgs. I mentioned above that Aalto designed specific metal parts to join together the triangles in the corners. These were painted black to be clearly seen against the white triangles. But for some reason only one of them was actually used; the other was never there. I suppose that it was so difficult to place the heavy triangles exactly in the right position that the workers just left one joint open and threw the metal piece away. We also had to fight a lot to get this joint properly done. After the restoration of 1976 there was also only one metal part left, but this was cut smaller so that it was not visible but hiding behind the corner of the triangle; moreover it was painted white to camouflage it perfectly. Aalto's idea of visible irons, which put the emphasis on the joints, was totally lost.

Now there was the question; should we add this detail or not? Also in this case, after consulting with Elissa Aalto and in spite of strong opposition by some students I decided to follow the original drawings. Alvar Aalto had written himself that the triangles were there to reinforce the system; for him every form should have a function—or at least should look like having one. I suppose that Aalto never noticed this minute missing detail, but had he done so he surely would have wanted to correct it to hide the fact that the triangles were only a decor with no real function.

## The entrance

The original door had two symmetric wings of massive mahogany and it was of natural brown colour. In 1976, it was changed into an asymmetric one of larch, which was panelled and painted blue as the facade. This was a very striking change. Also, the door started to decay and its lower part was, lapped by a horizontal board. In 1993, instead of doing some more lapping, the whole door was replaced by a new one of massive mahogany, which was made in Venice as it was cheaper to do so than to transport it from Finland. As the Venetian carpenter was provided with a copy of Aalto's original drawing he suggested strengthening it by visible bracing, which was accepted. The door was treated with teak-oil (whale oil).

The slab of carrara-marbler at the entrance was replaced in 1976 by three long slates of pietra d'istriastone, with texts commemorating Aalto and Fogh. The new entrance was now designed with square slates according to Aalto's drawing. To save money the existing pietra d'istria slates were just cut smaller—the piece with the text was deposited inside. In the backyard, the white solid stone benches from 1976 were moved farther away and the fountain of the same date which had also watered and ruined the wooden wall behind it was removed. The pavement of the back yard was laid again with square pieces of stone instead the longer ones from 1976.

Originally the pavilion was standing directly on white sand—in 1976 a drainage system was constructed with a planted green strip along the wall and with

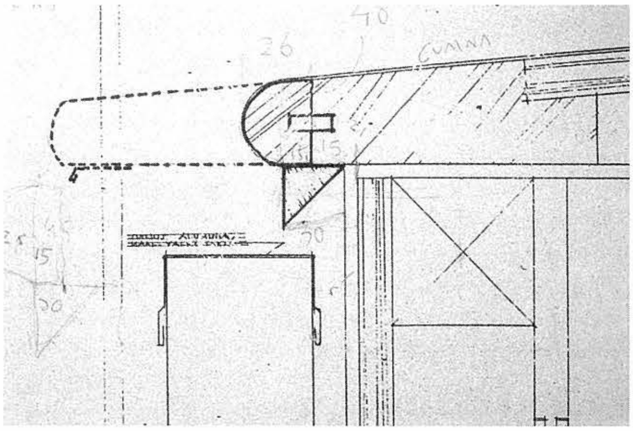


Figure 7. The original eaves, its reconstructed parts (bold line) and the long eaves form 1976 (dotted line).

ugly bricks sticking from the ground between the sand and the green. This plantation totally destroyed the looks of the pavilion as a light temporary construction on a field of sand. All vegetation as well as the bricks was removed and the white sand yard restored.

## The painting

When the facade was reconstructed in 1976 "it was not possible to reproduce the original colours", as Fogh wrote. We do not know why. As no sample of the original boards was left, we could not analyse the pigments either. Anyway, the pavilion has always been dark blue, which was popular among Finnish architects from the 1920's to the 1950's. As a surprise Elissa Aalto found some colour slides which she had taken 1956! There we could see that the attic part of the pavilion was not blue but grey—also this detail was lost in 1976, if not earlier.
In Finland we have a long collaboration with paint factory Uulatuote ltd specialized in traditional paints. At first the director denied us his paint as he heard that we were to paint CCA-treated wood. However I was able to persuade him to deliver his paint, as I believe that if the treatment is properly done with a final vacuum and the timber is not worked afterwards the linseed oil paint will not flake off. With this paint I ventured to paint also the heartwood of the triangles without ageing it. This can be considered as a test project as well. So we brought from Finland this traditional linseed oil paint, made of pressed and boiled Belgian linseed oil and not of modern modified oil, and with no solvents whatsoever. In this special case the pigment was lead white, as in 1956. The white triangles were primed with this paint diluted with some additional linseed oil (no solvents) and then painted once over, as the time was to short to paint them twice.

The genuine Prussian blue is hard to find today, but in Venice there is a superb paint shop in Calle Lunga di San Barnaba. I had analyzed their Prussian blue in Finland and it was genuine. The paint was mixed on the site. The grey colour was pigmented mainly with lamp black—this is well available as it is still used for printing ink. Also in this case it was possible only to prime and paint over once. I visited the pavilion in March 1996 and at least after these three years all the painted surfaces are in excellent condition.

## The roof

The pavilion has always had a felt roof. We were hoping to find rests of the original felt under the recent ones, but it was just a vain hope. The first layers were analyzed in Finland in a laboratory of a felt-roofing factory and it was certainly a material never used in Finland. Later it came out that the boarding under the felt was larch—thus it also derives only from 1976.
When the roof was restored in 1976 the eaves were enlarged, to provide better protection for the walls. However, this was a very important visual change: the elegance of the eaves was lost. Now the short eaves of the original drawings were reconstructed again, with the triangular lists for water drops below. The leaking felt roofing was at first only patched, as time was too short, and then totally renewed only in 1994.

## The critics

A building is a product of different phases: the planning, the building, planning of the restorations, the restorations. All this has affected to the monument, which we have now in our hands as material reality, and we should now restore once again. In the case of modern architecture, there are many features that differ from the restoration of old historic monuments. In their will to create a new and better world the modernists often used new materials and new materials and new solutions which did not have the test of the centuries behind them. It was often experimental building with obvious failures. Should we repeat the failures? Should we follow the advice of the old Confucius: "After a mistake do not correct, it's an authentic mistake."
In this case, a perfect set of architect's original drawings was available, from the first sketches to the final plan, from the site plan to details. However, the plans cannot usually be realized exactly as they are, several modifications will take place during the erection. As to these changes, there were photographs showing not only the newly built pavilion but also some taken during its erection, black and white as well as colour slides. Even the architect,

Elissa Aalto, who was in fact in charge of the works when the pavilion was built could still be consulted. The pavilion had met many smaller interventions of maintenance and one major restoration, which were published. However, we had no samples of the original removed parts left.
The interventions during a restoration take place for three architectural motives. First, there can be damages in the structures, which need to be repaired to restore the *firmitas* of the building. Secondly, changes in the function may need interventions to restore the *utilitas*. Thirdly, some changes in the looks of the building may be wanted to restore its *venustas*. These can be the removal of ugly later additions, the reconstruction of demolished parts or the modernizing of a building to match our taste. In addition to these basic needs to restore the architectural value of building often also a need to restore its historic value of a building often also a need to restore its historic value to set forth. This is more hypothetical than real. Everything that has taken place in the past is the *historia*, and all demolitions and terrible additions are part of the real history. So any change will reduce its historic value, not increase it. In fact, it is literally impossible to increase the historic value of a building by restoration. That value, either remains as it is or decreases through our action. But once realized also our intervention will be a part of the history of the building, and the next generation will have no better right to remove it than we have now to remove the work of our predecessors.
In the case of Aalto's pavilion, the building was badly damaged and there was an obvious need to restore its *firmitas*. This was the reason why the work was done; without the damage there would not have been any restoration. The function of the pavilion has never changed, only electricity is a later addition. Thus there was no need for any action for the *utilitas*. But as the *firmitas* provided the justification for restoration, so the *venustas* provided the justification for the *utilitas*. But as the *firmitas* provided the solution for this method. Then how did we deal with the *historia*? I must confess that we did not pay much honour to the previous restoration of 1976. Alvar Aalto, his work and his design, was the overruling commander of our restoration. Every piece of material which, dated from 1956 was left, but many of the later changes were removed, obviously losing a section of the *historia*. It is true that there parts were damaged, but had they been from 1956 we would have sought methods to cure the damage by smaller interventions, like by lapping only the damaged parts instead of changing them totally. In our reconstruction we decided that the *venustas* of Aaltos's plan was much above that of the restoration of 1976, so when the damaged parts were reconstructed the original design of Aalto served as a model. For us this *venustas* also justified the sacrifice of some *historia*.

The restoration is open for discussion. The discussion is important. That's why I have tried to report the things as they happened, frankly and leaving out the usual gilding. Some values were gained and some were lost. The discussion cannot change things that have been done, but it can affect the future restorations.

The quotations in this paper are from: Keinänen, Timo (ed.), *Alvar Aalto: The Finnish Pavilion at the Venice Biennale*, Opere e progetti, Electa, Milan (sine anno)

# Konrad Wachsmann's Use of Log Building Traditions in Modern Architecture

## Wood housing of the Christoph & Unmack firm (Niesky, Saxony)

Wood housing in Germany is traditional. Despite its traditional image, wood still kept in early 20th C. an important part of the building material market. The use of modern machinery resulted in both high-precision dimensioning of wooden parts and in an extremely fast production, compared with traditional crafts. The Christoph & Unmack wood element firm in Niesky, about 100 km southeast of Berlin, became the world's leading producer of prefabricated wooden houses. The modern architect Konrad Wachsmann (1901–1980) worked as a chief architect for C&U from 1926–1929. In this paper the log building type of C&U will be presented, in comparison with its traditional predecessors (in German: Blockhaus).

*by Jos Tomlow*

### A. The Slavonic influenced Log building (*Schrotholzhäuser*)

1500/earlier? –1900 /1/

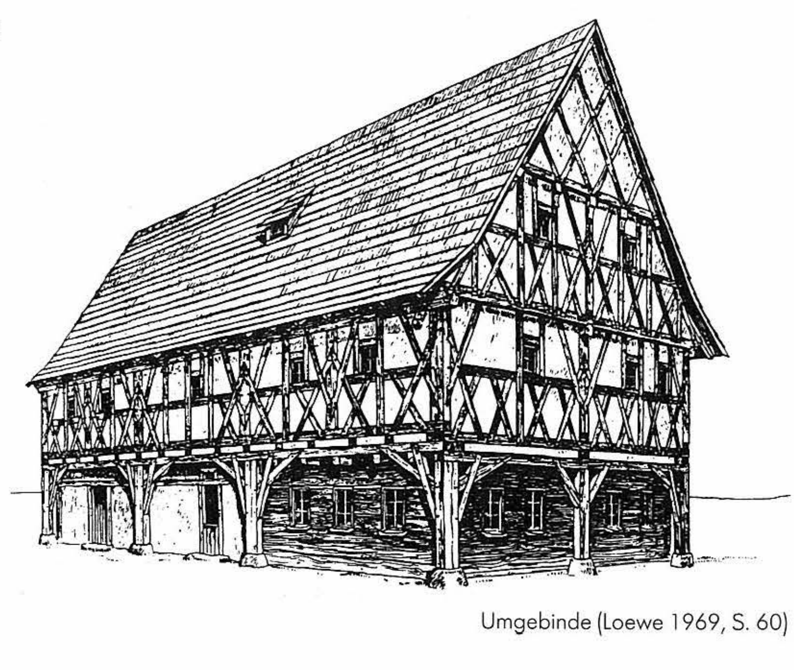
In the middle of European landscape around Niesky including Upper-Lausitia, Silesia (Poland) and the Tsjech Republic, Slavonic log building was traditional. The early housing type built in the Slavonic influenced tradition are known as *"Schrotholzhäuser"*, which etymologically roots in beams hewn to smooth square logs, with a specific ax, called Schrotbeil (later the logs were sawn). Those *Schrotholzhäuser* that survived around Niesky date from after 1700. The beams or logs show general dimensions from 18 cm x 24 cm, with a length up to 12 m. Big quantities of wood are used in this building type and the pine trees, from which these big logs were taken, must have been quite old. Since pine is resinous the logs were protected naturally against rot or worms. Starting from stones as a foundation layer, the logs are mostly put on each other without any profile. Since they were freshly hewn, after being built, during the natural drying process, they tend to take the shape of the neighbours, and this meant that only simple joint filling like fatted wool were thought necessary to make the walls weather tight. On the other hand the system did not suffice on the long term. The joints became uneven because of different shrinking in log parts (most in the top region of a trunk) and this gave free play for wind and water. The dissolving of individual beam layers resulted and even real structural defeats occur, notwithstanding the thick dimensions of the parts and the repeated connections by long wooden nails.

Apart of the corner type with alternating crossing of the logs, many house corners show a smooth surface, which resulted from locking the beam ends to each other. Complicated carving became necessary for the smooth corners and yet this solution leads to exposed faces which are vulnerable for weathering. Criticism is also inspired by the rather bad state of existing examples of the *Schrotholzhäuser*. My conclusion about this kind of log building is: Despite complicated corner details, they are technically vulnerable for defeats and not very intelligent in functional respect.

### B. Slavonic log building mixed with half-timbered structures (*Umgebinde*)

approx.1520–1900 /2/

In the Southern part of the region, another house type became popular, which shows a mix of Slavonic one-storey log building with an upper storey of German type half-timbered houses. These houses are called *"Umgebinde"*-houses, after an wooden arch structure which carries the upper storey. The most

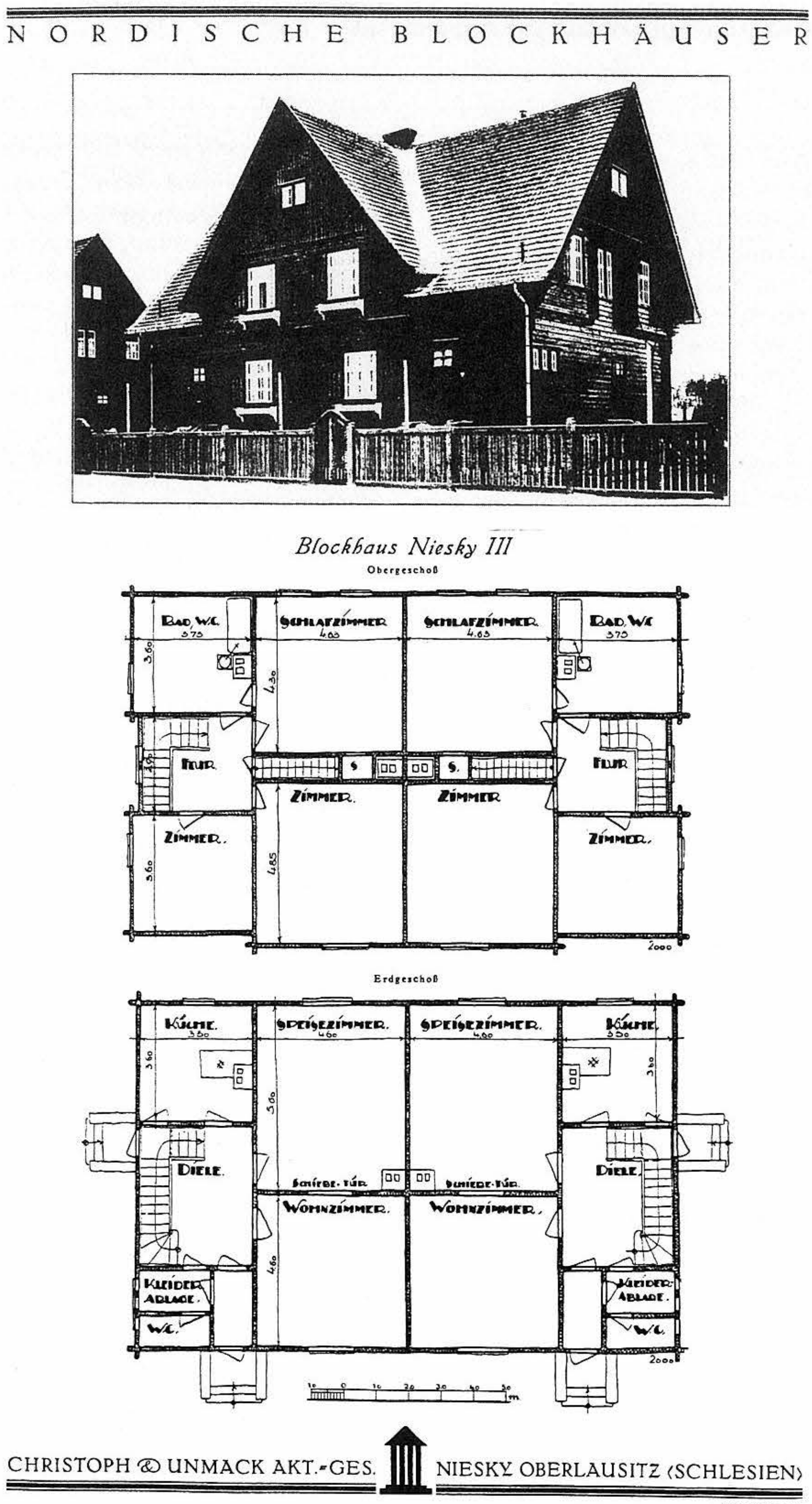


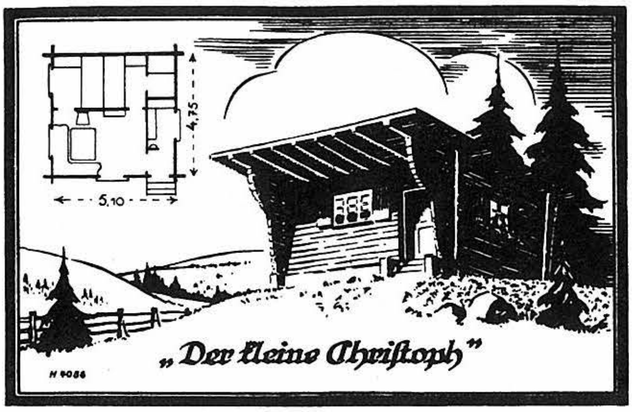
Umgebinde (Loewe 1969, S. 60)

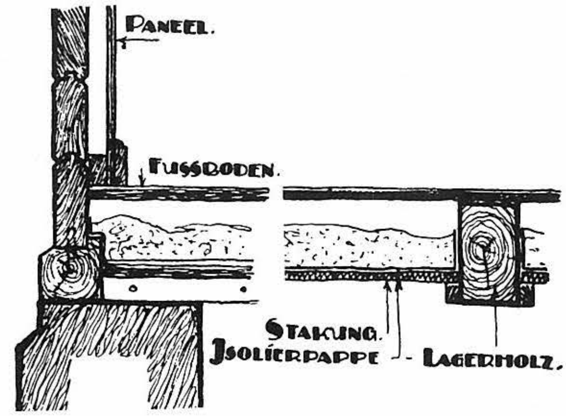
important renewal were that the log walls of the houses were thinner—f.i. half-trunks with the smooth side outwards and cladding by vertical planks inside—and better protected than in the *Schrotholzhäuser*. This, from a view point of building physics, is a highly interesting development, which was building tradition until 1900 with hardly any change in the basic concept, must further stay out of scope in this paper for lack of space.

## C. C&U log building 1st phase: firm-catalogue houses (*Nordische Blockhäuser*)
1907–1940 /3/

The next step of development is the Christoph & Unmack firm in Niesky, which still shows its vast production in about hundred dwellings in Niesky itself, dating mostly from 1920–1930. The commercial success rooted in the purchase in 1882 of a patent on

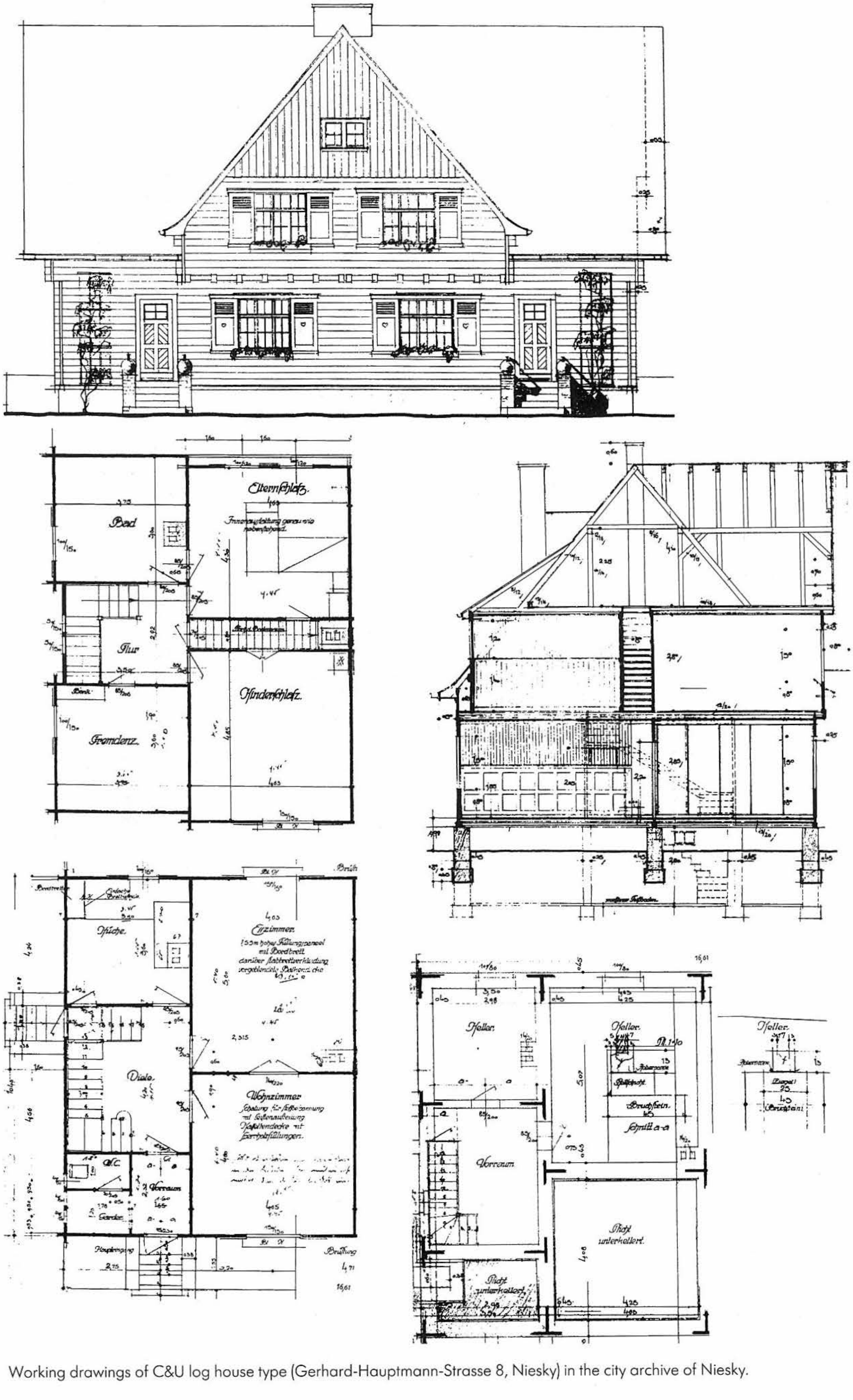





a barrack system, called *"Döcker-Bauten"* after its inventor, a Danish officer. The firm policy was to add to the transportable barrack-like buildings of the *Döcker-Bauten* type a complete new and huge market segment of "real" houses. Esthetically, they wanted to give their barracks the appeal of a firm standing house, and they subsequently managed to open this brick- and stone-possessed market for the material wood. Among other building types, C&U started in1907 the production of *Nordische Blockhäuser* of the log building type, which were inspired by both regional and scandinavian traditions.
The new wooden log houses were presented in optimistic catalogues. They were built with beams and elements made on the basis of new high-precision fabrication methods. They were convincing in firmness, in the low material quantity needed and in low costs (fix prices). Because of the thin walls of only 7 cm logs plus interior cladding, they took about 20% less surface than a conventional house in brickwork.
The structural success of the logs rooted in a very sophisticated profile within dimensions of 7 cm thickness and 16 cm height. The logs were connected both by an exact fitting groove and wooden dowels. The edges of the logs were snubbed, which helped to concentrate the loads in the central part of the walls (avoiding splitting of the wood). The contact of the wall with the foundation—generally perfectly executed in brick or granite stone—was established by a somewhat wider and thicker wooden element with an inclined top in the exterior part. For structural reasons, the corners were made with logs which continue over the corner point. The C&U firm concentrated all its know-how in the development of the details to find the right and structural sufficient dimensions, which were remarkably slender.

After an experience of 100 years the fire authorities in Niesky are optimistic about these houses, since they hardly burn. Houses dating from the twenties or thirties which still stand, are generally sound. The rough wood was dried in open air and after this in hot-air halls in order to get a controlled low moisture level for the elements. Wood rot could be avoided both by structural details and with a low use of chemicals. Rain water was kept from the (air-ventilated) facade by lifting the entrance level somewhat and by using cantilevered roofs. Heating systems were chosen traditional which meant preferably no central heating and heating sources in only a reduced part of the house. Enough fire protection was established by keeping some distance between the individual house blocks—mostly semi-attached dwellings—which was in line with a garden city lay out of most settlements for C&U buildings.
From the view point of building physics many houses turn out to be almost sufficient (according to recent norms). Especially the use of the log building principle, with 7 cm thick massive walls of horizontal wooden beams, finished inside with planks, ensured a reasonable heat insulation, also in terms of acoustical insulation.
Recent modernization, which tries to 'improve' the heat-insulation and acoustical properties often show bad results, since the houses stay what they are: "wooden houses": introduction of plastic window frames in connection with central heating generates moisture problems. An extreme renovation example is a house in Niesky, which has a new cladding outside in brick.



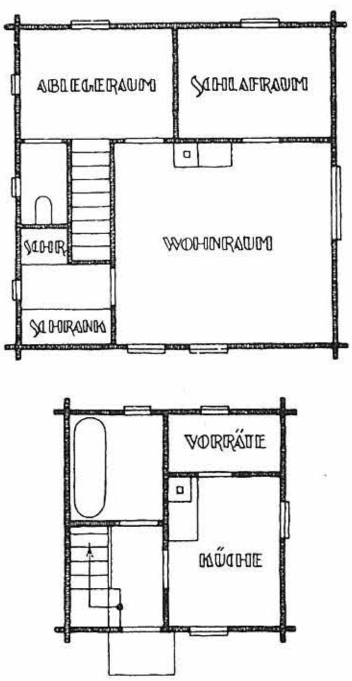

Working drawings of C&U log house type (Gerhard-Hauptmann-Strasse 8, Niesky) in the city archive of Niesky.

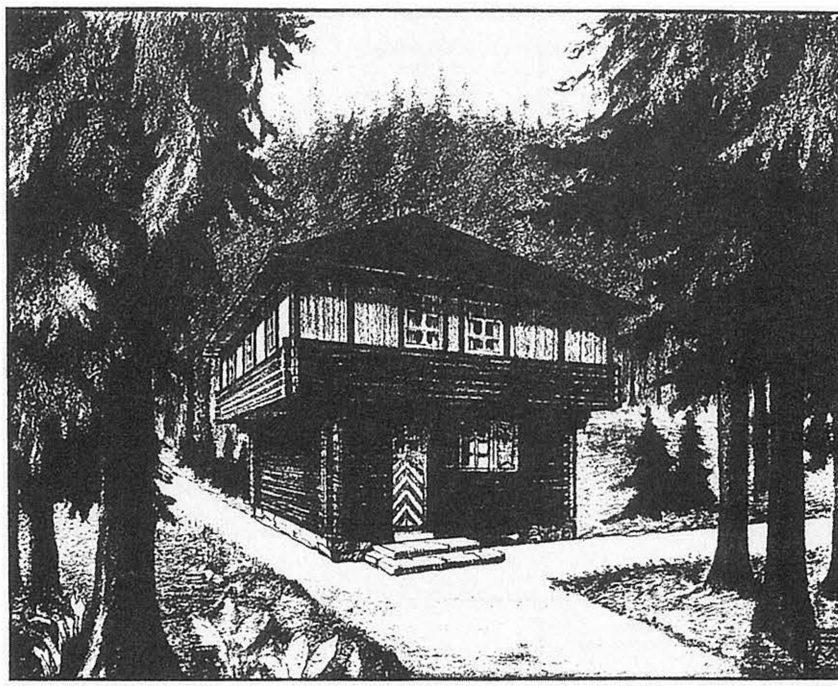
## D. C&U log building 2nd phase: (*Jugendstil*) houses designed by Albinmüller

1914–approx. 1930 /3,4/

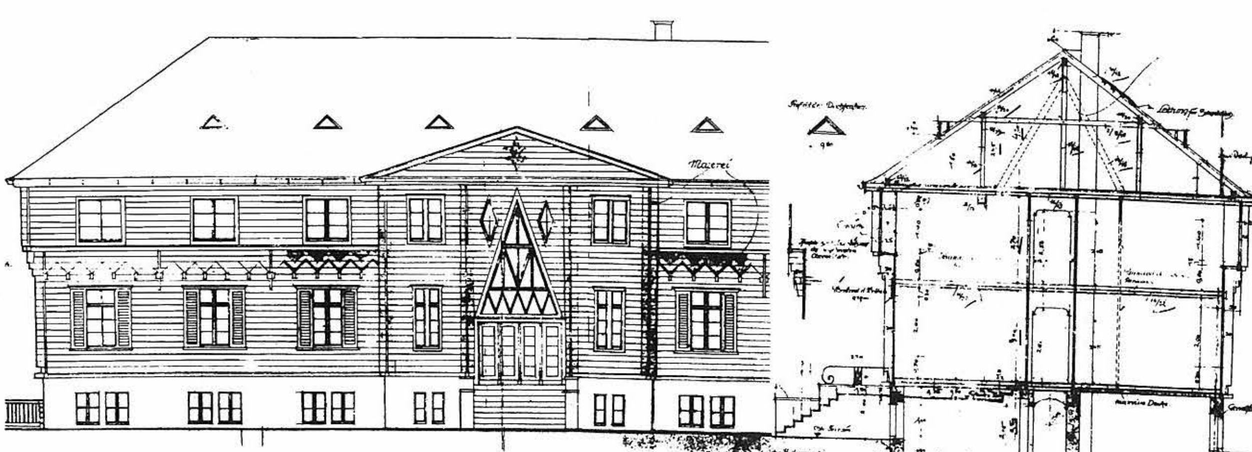
In the second phase, the firm, in a quite comfortable position because of its presence on the housing market, was eager to find cooperation with academic "architects". Especially functionalist architects were also interested to work within the new industrial methods. From many possible examples Prof. Albinmüller (artist' name of Albin Müller) from the Künstlerkolonie in Darmstadt, was one of the prominent figures. Albinmüller started with designs for C&U houses in a romantic colorful *Jugendstil*. These designs, part of them in color reproduction, were published in Albinmüller's "Holzhäuser" of 1921, financed by C&U. This publication is an important step from the commercial C&U catalogues towards the mature architectural theory in Wachsmann's "Holzhausbau" of 1930.

Albinmüller builds in this first period many houses, contributing original decorations, vaguely reminiscent of cubism. He introduced functional ideas like cantilevering wardrobes in the second floor facade of a bachelor's boarding house (1923, Plittstrasse 4, Niesky; working drawing below from city archive). In this boarding house, one can still find most of the original interior surfaces and one can look at stucco-imitating ceilings of a 'rich' design of which Albinmüller was especially fond of. Technically the cassettes in these ceilings consist of wooden frame profiles, holding flat boards in between. In later times Albinmüller will build decent modern architecture in the C&U-systems, unfortunately loosing somewhat the material appeal of wood, for instance a restaurant for a theater exhibition in Magdeburg.



ENTWURF: PROFESSOR ALBINMÜLLER, DARMSTADT AUSFÜHRUNG: CHRISTOPH & UNMACK A.-G., NIESKY C



## E. C&U log building 3rd phase: (*modern*) houses designed by Konrad Wachsmann

1925–1929 /3,5,6,7/

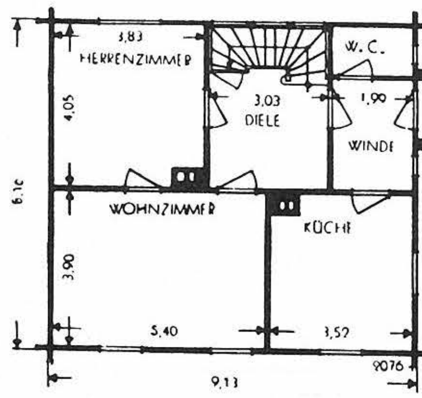
Wachsmann himself writes down his observations on the C&U firm in his book "Holzhausbau" (1930), a magnificent analysis of different building systems, starting from European and US-American traditions, beautifully presented in photographs and lay-out.

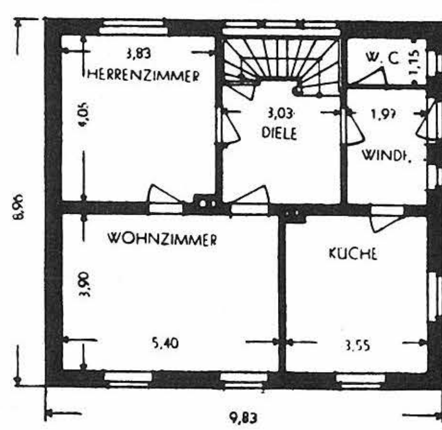
Below and next page: illustrations from Wachsmann's book "Holzhausbau" with technical information and a full page illustration on the director's house.

Historically highly relevant is that he illustrates the chapter on modern log building system with numerous photographs of the "director's house" building process. A technical problem of the log building type, is the high tendency of shrinking of the wood in the direction perpendicular to the trunk axis. This tendency of shrinking is many times as much as parallel to the trunk axis, and Wachsmann calculates the shrinking of log walls with up to 10 cm per 3 m. Although this problem was already dealt with in earlier C&U houses (and even in the traditional *Umgebindehaus*), I will discuss it in connection with the presentation of Wachsmann's work for C&U. The solution that the C&U firm found, was to permit the storey heights to shrink in a naturally way (f.i. from 3.00 m to 2.90 m). For this, of course, one had to prepare a perfect detailing with sliding parts over windows, door's and paneled walls and even with sleeves for vertical technical pipes.

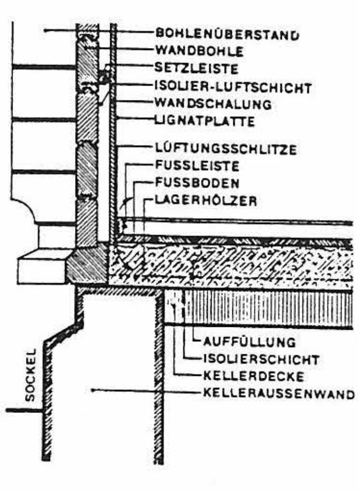
Along the small facades the girders of the top floor structure protrude somewhat from the exterior surface, which again is due to structural soundness, avoiding too high loads on end parts. Small metal caps avoid rain water introduction.

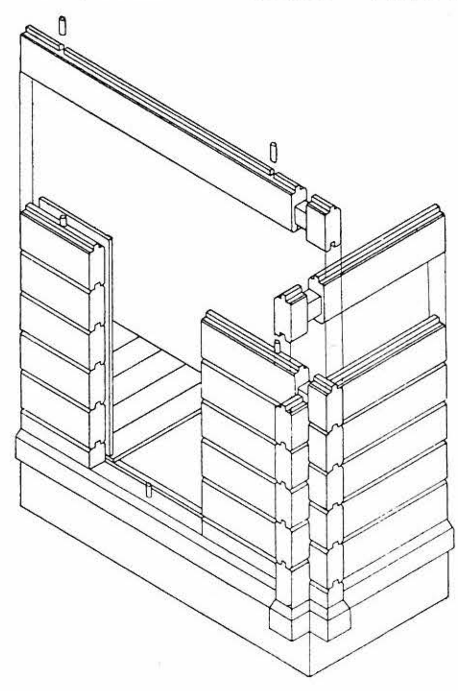
An important decision of the C&U firm—and proof of its far-reaching view—was to require the German patent of the Swiss product *"Lignat"*. Lignat was a

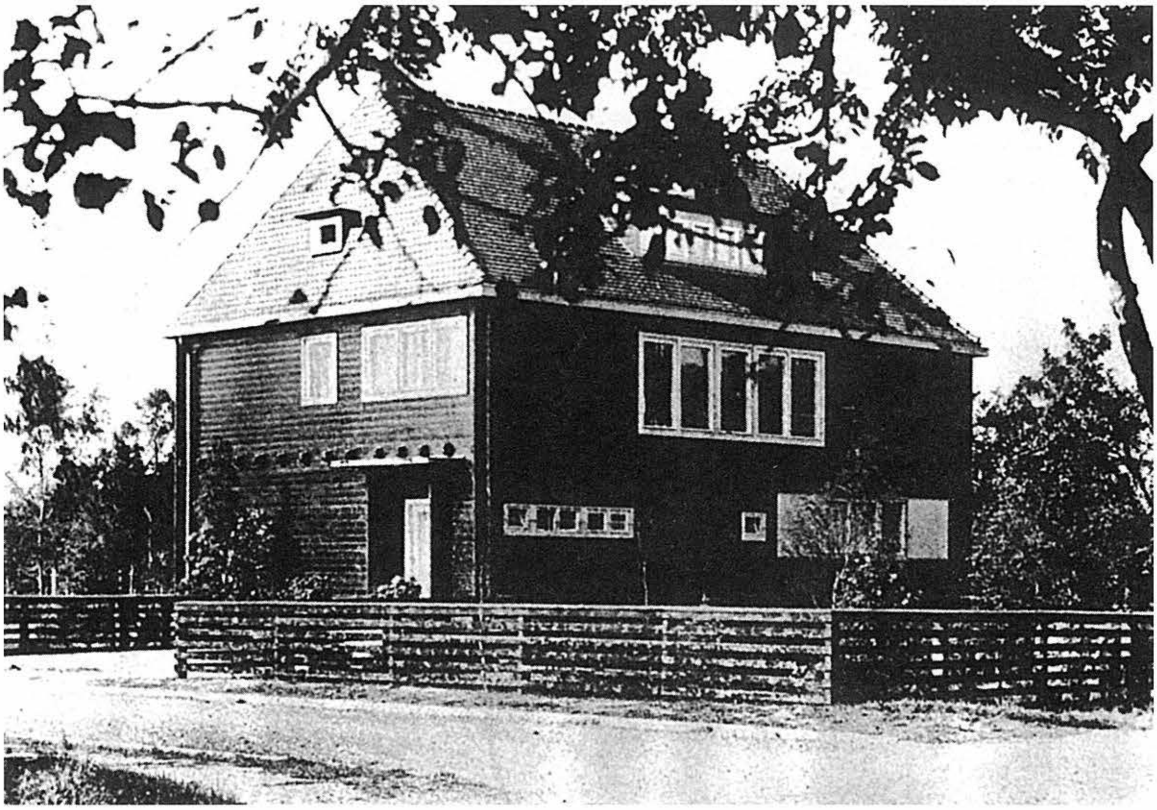


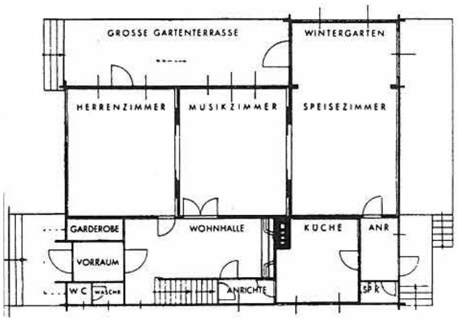




| Holzhaus | | Massivhaus | | | |
|---|---|---|---|---|---|
| Bebaute Fläche | 74,50 qm | Bebaute Fläche | 88,08 qm | Unterschied | 13,58 qm |
| Umbauter Raum | 745,00 cbm | umbauter Raum | 880,80 cbm | Unterschied | 135,80 cbm |

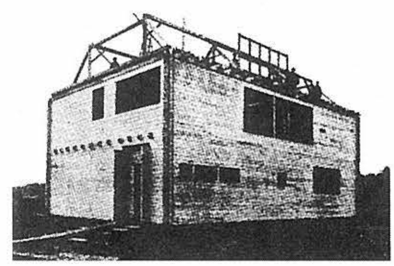







Grundriß vom Erdgeschoß
Der Dachstuhl wird aufgesetzt



Direktorwohnhaus in Niesky (O.-L.). Gesamtansicht von der strasse.

normally 6 mm thick board of rather big plate dimensions. *Lignat* cinsisted of a material mixture (asbestos, shredded paper, cement, chemicals) and the boards were used as a cladding of the interior walls and ceilings. The material was very popular since it did not burn and it was not affected by moisture. (Nowadays the fabrication of such fibrous cement is thought to be unhealthy).

A question mark may be given concerning the modernity of the "director's house", because its pitched roof is quite high, and some will think of conservative architecture of the thirties. Wachsmann himself accounts that he needed the roof's weight in order to keep the joints between the logs pressed together. On the other hand the four facades show a modern appeal (for the year 1929) with their free and functional window distribution in an abstract geometrical lay-out. Remarkably are also the generous exterior stairs to front door and garden terrace (slightly different from the published plan). In the interior hall the landing of the stair and first floor balcony is consciously interrupted by the whitewashed volume of the chimney, which is thus free standing in order to enhance fire-protection.

The hall windows are concentrated in a 6 m long and 2 m high window series along the top end of the stair. These windows are beautiful from both inside and outside, but they are also the source of a structural defect in this house, similar existent in some other C&U houses. Because the exterior log wall of the hall is not stabilized by perpendicular walls over a length of some 7 m and, since the stair along this wall disconnects the floor structure from the wall, the wall tends to buckle. Because the material wood is "forgiving" such distortions of the wall surface are not fatal for the wall. Another reason for this kind of defeats is the behavior of wood to subsequently change form during long term loading.

Konrad Wachsmann's position in the C&U firm is not very clear from a historical point of view. On the one hand he builds the—for advertisement reasons very important—"director's house" and he publishes an important book with, again, a decent advertisement effect for the Christoph & Unmack firm. On the other hand, in the conventional C&U catalogue of 1928 his name or work does not appear. Maybe, one can ask, Wachsmann was too much of an individualist and too much a revolutionary constructor to keep in (slow) pace with the conventional thinking of the C&U firm. For sure is that he contributed modernity to the already existent honesty in structural design and freshness of the wooden architecture of C&U.

In 1930 Wachsmann opened an own office in Berlin, representing still the C&U firm. Konrad Wachsmann's influence on the products of the C&U firm is smaller than thought by scholars. However, without doubt Wachsmann's theoretical work—f.i. the publication of his book "Holzhausbau – Technik und Gestaltung" (Berlin 1930)—modernized the somewhat traditional, yet generally respected image of the firm. As an important contribution to the Modern Movement architecture may be regarded his own executed projects, f.i. the "director's house" (1929) for a chief engineer of C&U in Niesky, which is a log building. Other wooden buildings designed by Wachsmann for C&U, but not of the log building type are: the famous Albert Einstein House in Caputh near Berlin (1929), an office of the B.V.G. Berlin (1928), a youth hostel in the 'Riesengebirge' (competition entry), a 'Kinder-Walderholungsheim' in Spremberg (child's leisure center), a tennis club in Berlin, and the geological institute in Ratibor.

During the thirties living and working in Germany became impossible for the Jew Wachsmann and he managed to reach the USA. In a fruitful cooperation with Walter Gropius a modernized version of industrialized wooden building can be developed: the *General Panel System*. Inspired by more research work as a teacher in the 'New Bauhaus', the Institute of Design and the ITT in Chicago, he will become one of the world's most respected teachers of industrialized building and design (publication: 'Wendepunkt im Bauen' in 1959).

One of the aims of this paper on Wachsmann's work for the Christopher & Unmack firm, is to save the existing houses, not only from natural decay—which seems the smaller problem—but also from misunderstanding by the present generation.


**Acknowledgments**

The paper makes ample use of a diploma work (civil engineer) by Käte Hilger Systematik zur Baukonstruktion und *zur modernen Sanierung von Holzhäusern unter Berücksichtigung denkmalpflegerischer Aspekte am Beispiel der Häuser von Christoph & Unmack (1920-1935) in Niesky* (typescript 1997) at the Hochschule für Technik, Wirtschaft und Sozialwesen Zittau/Görlitz (FH), consulted by Prof. Dr.-Ing. Christian Schurig and Prof. Dr.-Ing. Jos Tomlow. Sources for our studies were the city archive and the museum of Niesky, and the Rietschen 'Ehrlichthof'. Thanks goes to students R. Böhm, D.Däumler, T.Haag from Weimar.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# Prototype of the Undulating Wooden Ceiling in Viipuri Library

## A Case Study

*by Marianna Heikinheimo*

### Introduction

The city library of Viipuri was designed by Alvar Aalto between 1927–35. The building was allowed to fall into disrepair in the post war years. It was rehabilitated in 1960. Since late 1980's there is an international restoration process going on. A prototype of the wooden ceiling was fitted into the auditorium of Viipuri Library in 1998 as part of the present attempt to concerve this early monument of modern architecture. The prototype is a natural-sized study of the original ceiling, a possible method for making a reconstruction. It was carried out as a joint training project by the joiners of Heinola Institute and the Finnish restoration committee. The undulating ceiling is an early manifesto of Aalto's architectural idiom. The auditorium is one of the principal interiors of the building.

Aalto took many decisions at building site in close co-operation with carpenters. Details were changed and the result can not be read from the architect drawings. The original ceiling was destroyed between 1944 and 1960 when the building was abandoned.

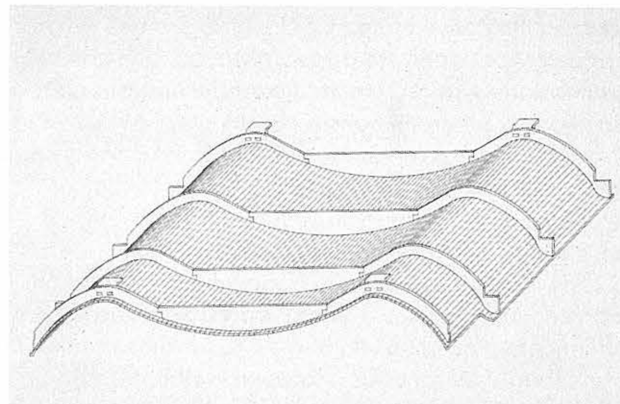

Fig. 1. An axonometric drawing of the prototype. The Finnish Committee for The Restoration of The Viipuri Library (VKRY), architect Marianna Heikinheimo.

Architect Sverker Gardberg had previously carried out some research in early 1990's on the geometry of the ceiling. His research on this issue has not been

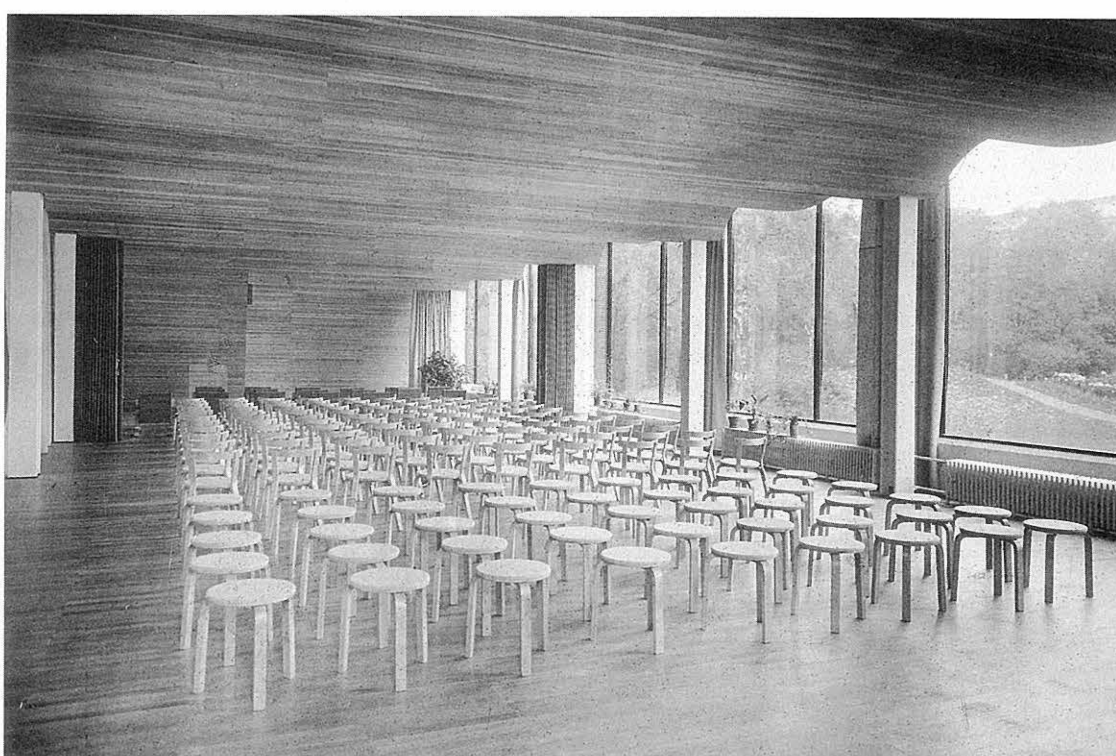

Fig. 2. The interior of the lecture hall in 1935. The architecture here is basically an interplay of three elements: steel columns, wooden ceiling and the glass wall. Alvar Aalto Foundation (AAF).

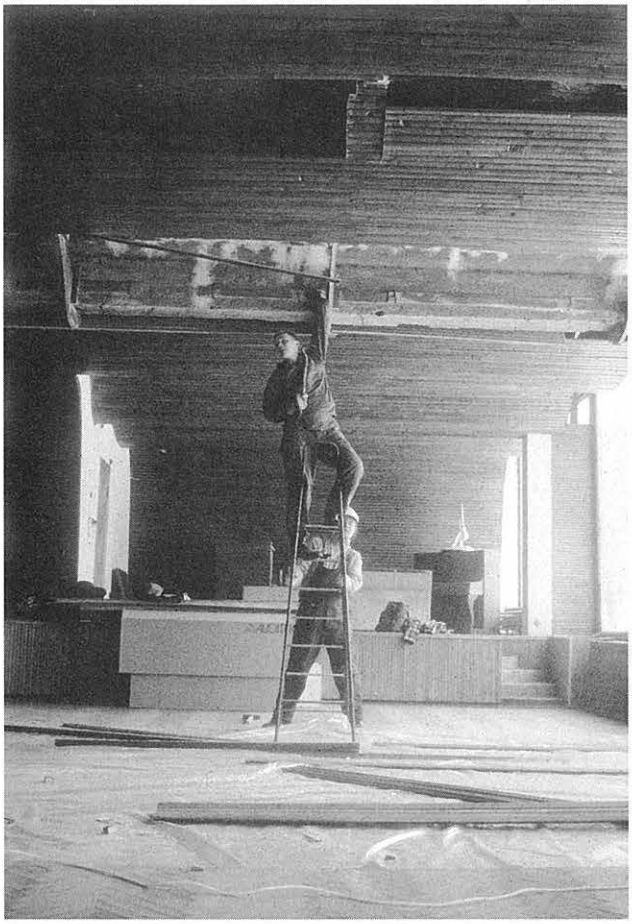

Fig. 3. The present ceiling dates from year 1960 and it only vakely reminds of Aalto's idea. This project started with no piece left of the original ceiling. A part of the existing ceiling was pulled down to make a place for the prototype. Photo M. Heikinheimo.

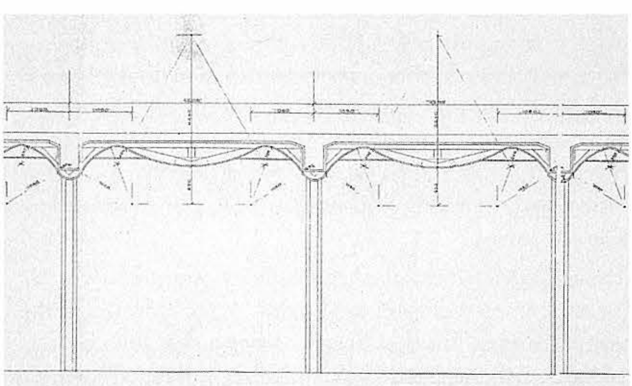

Fig. 4. A section drawn by Alvar Aalto on a scale 1:10. AAF.

conclusive, in part because it was based only on archive material when practical knowledge of carpentry is needed. The question we address here is how the original ceiling was built in detail in order to gain knowledge for future reconstruction of the entire part. How the reconstruction in subsequent stages could be made of prefabricated elements as distinct from the original was also studied.

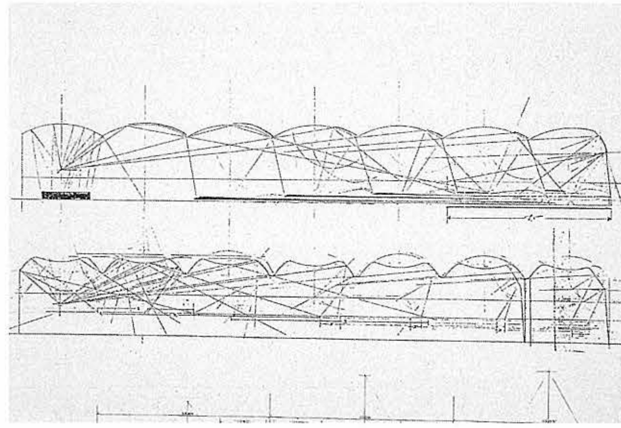

Fig. 5. The undulating ceiling repeats a geometric shape evolved from the shape of a barrel vault. AAF.

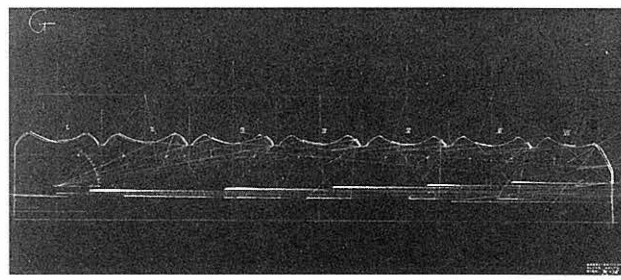

Fig. 6. Aalto's acoustic diagrams have been widely published. AAF.

This research aimed at making a reconstruction of a piece of the original ceiling from 1935. The research was carried out in co-operation with Heinola Institute, a school of fine carpentry. Solutions were found to the most important practical questions. The result of the research was mounted in the auditorium June 8th 1998. In any event, at present no proper circumstances exist to exhibit a wooden model. The high degree of humidity will provoke twists.

## Material

A Company called Oy Parkettityö Ab built the original ceiling. The carpenters Antrei and Aaro Pyykönen, father and son, came from Sortavala. They had a name for good craftsmanship as boatmakers. Aalto for his part understood the inherent potential of timber as material. Supposedly the undulating ceiling was built following the principle of a flush joint boat.

The original drawings show how the undulating ceiling repeats a geometric shape evolved from the shape of a barrel vault. Aalto stated that the room has homogenous good acoustics because of the wavy form of the ceiling. Any point in the lecture hall (at a certain normal height) should be as useful as any other to send and receive voices.

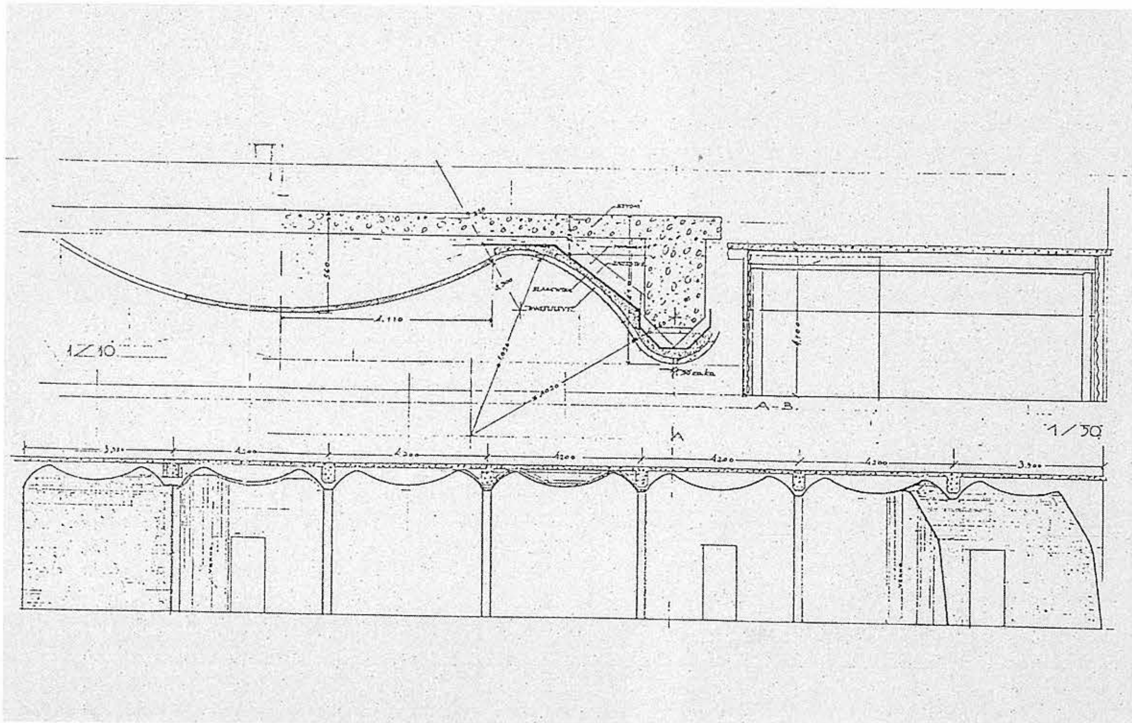

Fig. 7. Original working drawings by Alvar Aalto. AAF.

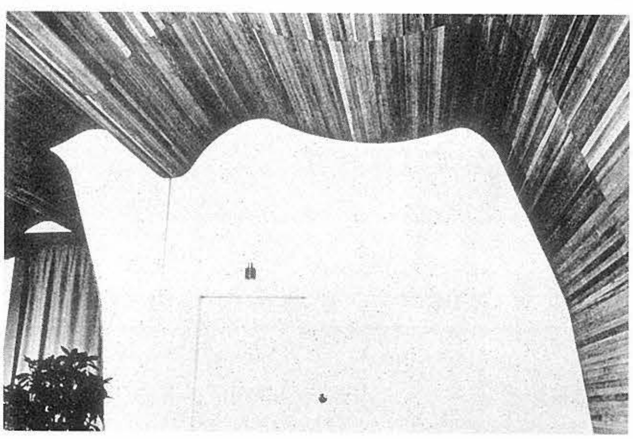

Fig. 8. Original ceiling photographed in 1935 showing the lively surface. Aalto considered it important to use wood in its natural form with no treatments. He used five to six different types of wood in the interiors of Viipuri Library. AAF.

Mr. Gardberg had studied the relation between Aalto's dimensioned section in scale 1:10 and old photographs. He noticed three differences: the panel ended approximately 30 cm higher above the door to the hall than shown in the drawing; the panel was in horizontal position just by the inner wall mounted directly to a beam; there was a space between each lamina (not only where an accordian door had been placed to be able to form "club rooms" out of the room). Mr Gardberg corrected the mentioned section to correspond the implemented ceiling.

Aalto's drawings did not show in detail how the ceiling was built. The solutions were deduced, bearing in mind the construction methods of the 1930's, in cooperation with the carpenters from Heinola-Instituutti and the present author.

The material was knot-free redwood from Karelia. Both sapwood and heartwood were used, creating a lively surface.

Some strips were sawn rounded and others were sawn straight. It was claimed that Aalto always left one rectangular piece where the geometry of the form changes. In the prototype a saw with a blade radius of 190 mm was used for the stripes of the smallest curves. The rest of the stripes excluding the few rectangular ones were planed slightly obliquely. This way the strips fitted well to both concave and convex forms.

The original treatmet of the surface is not known. In his article in Arkkitehti magazine Aalto described the colorworld of the building by saying that the color comes from the used materials themselves. Otherwise he had used white and black color. It was only later that they started to add white paint to the lacquer used in furniture of Artek. The prototype was treated with a mixture of linseed oil and natural vax. That is to say with materials that were known in the 1930's. The prototype will become yellowish little by little.

## Methods

The size of the prototype was limited to approximately 10 sqm. Its place by the window was chosen in order to achieve good coverage of the design problems. The sequence of the ceiling follows the bearing structure. Both ends of the ceiling deviate from the repeated rhythm. The prototype reaches one

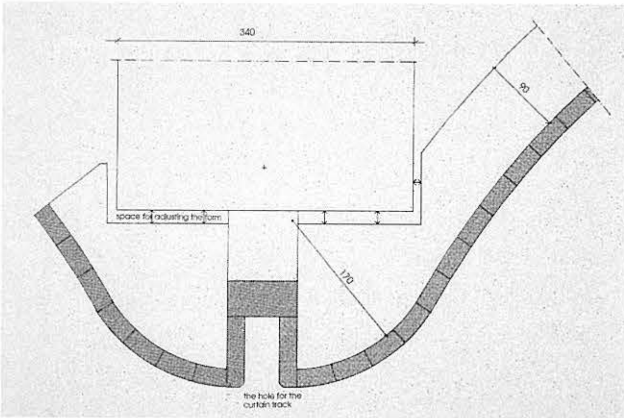


Fig. 9. A detail drawing showing the space between the laminas. The space helped to adjust the strict geometry to the intermediate floor, VKRY, architect M. Heikinheimo.

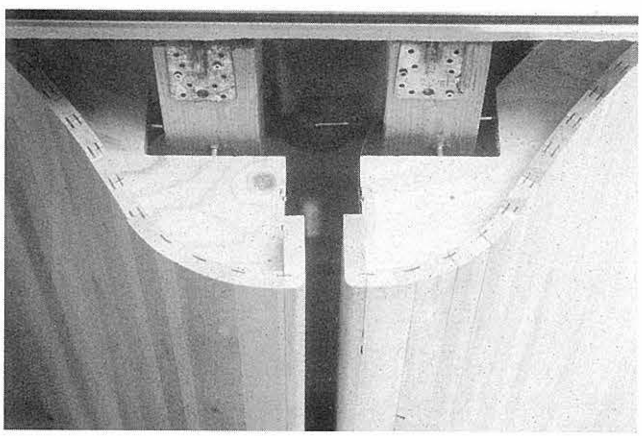

Fig. 10. As a compromise a groove was sawed to the strips and they were jointed to the frame with clips. Photo M. Heikinheimo.

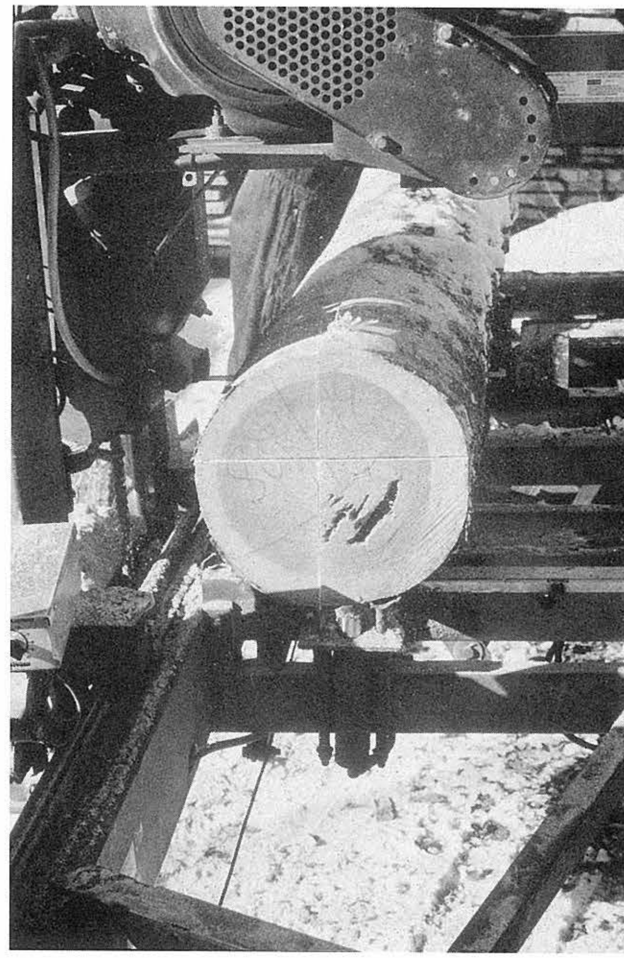

Fig. 11. Quarter sawing was used to achieve sticks that don't twist naturally. Photo Pekka Blomster.

interval plus a beginning of the following sequences on both sides.

The wood for the prototype was bought from Lappland. It is the same kind of wood than in Carelia: it has been growing slowly so that the annular rings are narrow.

Quarter sawing was used to achieve sticks that don't twist naturally. The section of a planed stick was approximately 45mm x 20mm.

In 1930's electric planers became common, which must have made the amount of work more reasonable in this case. No glue was used in the prototype, which was based on the supposition that there also was no glue in the original. The strips were jointed originally by secret nailing. The carpenters refused from nailing. As a compromise a groove was sawed to the strips and they were jointed to the frame with clips. The joint is not as spotlike as it was originally. The carpenters were afraid of the present humid conditions in the building. As a result the new structure differs from the original in details. Furthermore hidden wedges were driven sparsely.

When further information was needed, photos were used as a source. The form of some edges was judged from refraction of light: if it was smooth the form had to be rounded and vice versa strong light contrast meant sharp edges. The wooden ceiling has been fitted with the columns so that details curve gracefully and the edges are sharp; there is nothing forced here.

The carpenters had to reconsider the methods they normally use. Although contemporary machinery is basically the same as in 1930's, some work methods had to be changed. Today the carpenters are used to making a zigzag seam, which of course is stronger than a straight one. In this case the zigzag pattern was not acceptable nor was the edge. The seam had to be straight. Nowadays the carpenters are taught to bevel the edges of strips in order to make the result look better as the slopes in reality never are on the same level. They have no trust in a good result. This had to be forgotten also.

There were two kinds of strips. The rounded ones were planed manually. The edges of the other strips were worked with mitre plane. In this manner the same form would fit well one way round to the convex forms and the other way round to the concave ones.

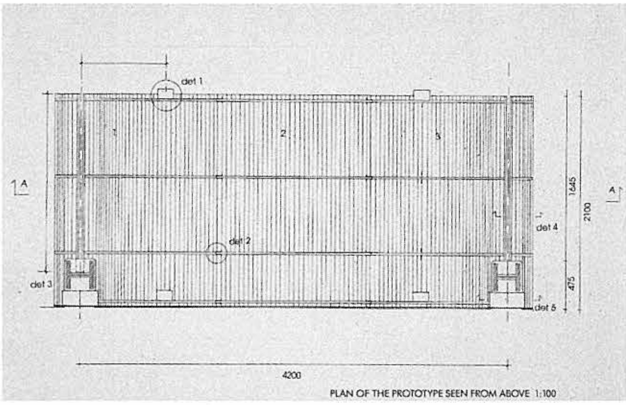


Fig.12. A plan of the prototype, VKRY, architect M. Heikinheimo.

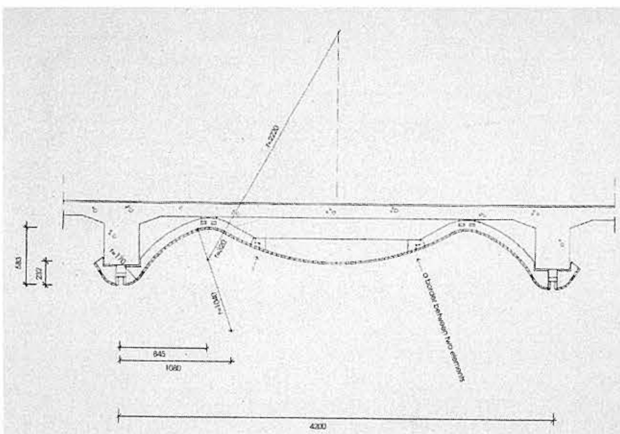


Fig. 13. A section of the prototype, VKRY, architect M. Heikinheimo.

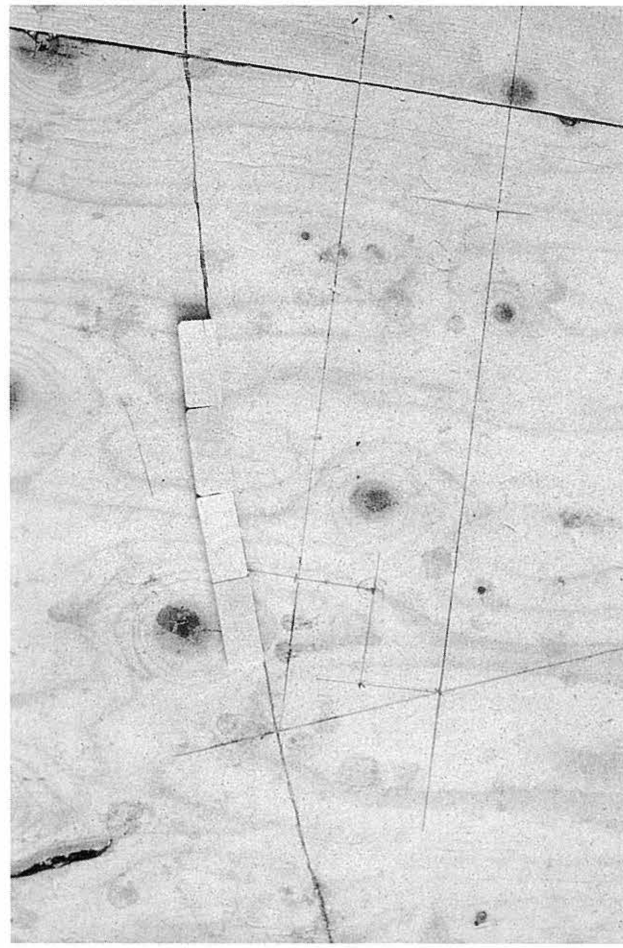

Fig 14. The same form was made to fit one way round to the convex forms and the other way round to the concave ones. Photo Pekka Blomster.

Mr. Pekka Blomster, master carpenter, created a computer model to calculate the amount of material needed. The height of the frame was 70 mm and it was made of plywood. The model was mounted by the help of chemical anchors because of the bad condition of the intermediate floor.
Making partial models in natural scale solved difficult details. Some parts had to be made several times. The most tricky part of the prototype was the interface with the column and the wooden edges. Doubts were expressed beforehand about the aesthetics: it was feared that the result would be too fine. However, the "coarse" nature of the original ceiling was achieved. As long as the wood material was of uniform quality the general impression remained as hoped: "coarse" but uniform.

Fig 15. The prototype was mounted in to the intermediate floor in the Heinola Institute. The column was also simulated with a wooden one. Photo M. Heikinheimo.

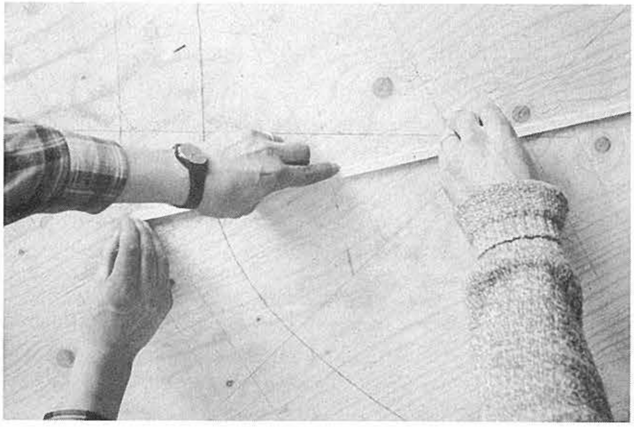

Fig. 16. The students of carpentry started to make the model by drawing the form on the floor on a scale 1:1. Photo Pekka Blomster.

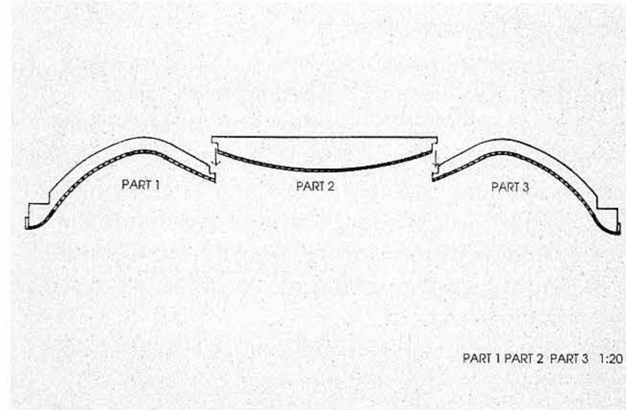


Fig. 17. In contrast to the original the aim was to study how the ceiling could be made out of elements. VKRY, architect M. Heikinheimo.

Fig 18. The prototype is being mounted. Photo Marianna Heikinheimo.

## Results

The original realization in 1935 was not documented in architectural drawings. In contrast to the original the aim was to study how the ceiling could be made out of elements. The prototype was limited to a piece 12 sqm in area and two stucco clad steel columns. It covered a good range of design problems. The structure that has now been produced, is the best record of the research project documenting all details in a scale 1:1. It is still being exhibited in Viipuri. It is important to conserve the prototype because it is a model for future carpenters.

Details were solved through discussion, comparison and partial models. Now we know what kind of wood material and sawing methods were used. Form that follows a strict geometry was adjusted to an intermediate floor with poor dimensional. Details such as the form of edges around the columns was deduced from photos and tried in partial models. System to put up the whole ceiling of prefabricated elements was invented. This is an advantage for maintenance especially if something (e.g. water tubes) goes wrong above the ceiling.

Some details, like the position of the recessed white cover board by the window, should be further considered at site. Alternatives concerning nailing of the stripes as well as the suspension to the intermediate floor should also be studied further.

## General Comments

Aalto had made experiments with timber furniture since 1928. The form of the ceiling in Viipuri is familiar with the one of Paimio chair. In both cases, Paimio Sanatorium and Viipuri Library, the "wooden" scale is intimate and the sense of material is strong. Aalto himself wrote about cosyness refering to the lecture hall of Viipuri Library. Wood in both interiors is an opposite to the rationalistic architecture. It is an element of drama.

Pine starts becoming red in the age of 70 years. It is common knowledge that there are only few everlasting forests left e.g. in Finland. In this context Aalto's ceiling expresses certain optimism towards the posibilities of an industrial society.

The present ceiling dates from 1960. It recalls the original form but is not exactly the same. The type and quality of the wood is not even close to the original. In 1960 it was impossible for the Russian architects in charge to ask for Aalto's drawings for political reasons.

The parts had to be made in Finland and only transported to Russia. This led to a prefab solution.

## Conclusion

In this project we did not only gain knowledge about the ceiling but also a pedagogical experience. The young carpenters had to reconsider the working methods they are used to. Architects´ work is often very conceptual. Working together with craftsmen one can achieve a better sense of material, which is rarely done in the building process of today. Aalto did it in a true Bauhaus spirit as a workshop and we followed his example.


## Acknowledgements

I want to thank Ms. Aino Niskanen for her comments on the content, Ms. Elisabeth Heap-Talvela for help with language, Mr.Sverker Gardberg for opening up the question, Mr. Pekka Blomster for patience and richly contributing to the project, hardworking students of Heinola Institute for their participation and Ms. Heidi Majander for constant help.


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# Wood and Acoustics in the Scandinavian Concert Halls of the Modern Movement

The extension of **wooden surfaces** in the **architecture** of the **Modern Movement** was in some degree inspired by the new **acoustical** science. However, the posibilities of controling the **sound and reverberation** in rooms through the practical design of room shape and materials were still to be examined in practice.
The **scandinavian concert halls** of the Modern Movement were covered with wooden lining and were the results of collaborations between musicians presenting the intuition of sound and music, architects presenting the feeling of form and material and the new generation of engineers presenting the new and still uncertain acoustical science.

*by Bo Mortensen*

## Introduction

The wooden surfaces and the impression of good acoustics have in many peoples consciousness been strongly connected through the past century. We are often met with a demand for wooden lining in the concert halls, but how does it actually work—is it that good—or has it more become a symbol for the classical concert hall?
Those matters will be discussed primary using the Scandinavian concert halls of the Modern Movement as a starting point.

## Architectural consequences of new acoustical ideas

The modern Concert Hall of the twenties and thirties was strongly influenced by new and widely different acoustical theories about ideal roomshapes and use of materials in concert halls.
The acoustical science had just been esthablised at the start of the century primary through the work of W.C. Sabine, a young American scientist who defined the reverberation concept and found the connection between reverberation time, the room volume and the nature of the materials used in the room (the reverberation time is the number of seconds it takes for a loud tone to decay to inaudibility after being stopped). The concert hall was still designed with the classical, rectangular shoe box shape. The dominating materials used in the famous classical music halls, like Grosser Musikvereinsaal in Vienna, were solid or heavy materials such as plaster on brick or plaster on wood lath–seldom wood except for the floors.
Later in the early days of the Modern Movement the acoustical science had to provide a logical basis for the design of concert halls. The American F.R. Watson proposed in 1923 a consistent and rather bizarre alternative to Sabine's reverberation time as design criteria [1]. He proposed that the concert hall should be designed with outdoor acoustics. In principle he used the popular outdoor bandstand as inspiration and starting point and placed them into rooms with very low reverberation time. The result was a number of in acoustical respect fairly unexciting halls. Their sound-absorptive carpets, extensive drapery, and large upholstred seats provided ideal sound clarity for drama, lectures and, by the thirties, the new sound film cinemas.
The halls designed as indoor bandstands became the model for a lot of North American concert halls. Meanwhile European designers adopted the viewpoint that all wall and ceiling surfaces should usefully reinforce the direct sound by reflection. In the twenties and thirties they extended the use of geometric principles to determine the entire shape of the hall in plan and section from the pattern of sound as it spreads out in the auditorium toward the rear of the hall. We could call these auditoriums "The directed sound auditoriums" or "The gramophone horn-like auditoriums"—comparing the grammophone-horn with the fan-shaped plan or profile of the concert hall.
The arrival of the Modern Movement in architecture meant the end of all the decorative mouldings, the statues in niches and coffered ceilings of the classical music halls. These architectural tendencies suits well into the simple geometric way of making the roomacoustical design of halls. But at the same time the smooth surfaces meant that there was a simple acoustical need of breaking up the room shape to avoid flutter echos between parallel walls. Later we learned that the decorated surfaces tend to create highly diffuse acoustic conditions, which are regarded by some to be a hallmark of the best acoustics.

### Salle Pleyel, Paris

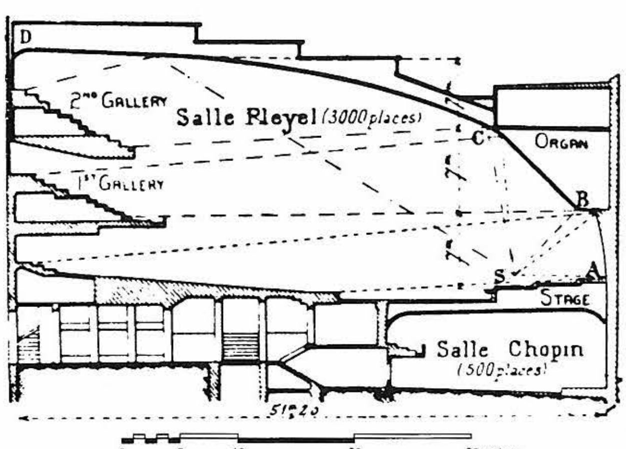
The European-theory or -school was first expressed through the building of The Salle Pleyel in Paris in 1927. The Frenchman that became famous for the very different design was the piano manufacturer Gustave Lyon.

The design was based on the idea that the reflected sound most usefully reinforces the direct sound if the time gap between their arrivals is imperceptible. Otherwise, he correctly assumed, that the reflected sound will blur the clarity and even cause an echo. From those ideas the plan and the section was drawn, so that the sound was directed toward the rear of the hall. The long section clearly shows the logic of the design. Each section of the ceiling directs early reflections onto separate sections of audience.

The hall was a notorious disappointment—the sound was reflected so effectively to the rear by the walls and ceiling that the musicians could not hear each others. Besides the musicians were disturbed by a strong echo of the ceiling and the rear wall. When this was reduced by covering the rear wall with sound absorbent material, it was found that the parabolic shape of the hall worked equilly well in reverse, so that the noise from the audience was focused on the platform so the musicians could barely hear each others. Music played in the hall had a remarkble clarity and strength, but also a caracteristic monophonic sound, both because of the strong ceiling reflections.

The Salle Pleyel was damaged by fire already in 1928 and the rebuilding included some improvements. Since that several other attemts have been made to improve the acoustics, and all the changes have caused visible modifications, mainly because the original smooth surfaces need to be more sound-spreading or-diffusing.

The principles of Gustave Lyon were used by Le Corbusier in his famous project to Debating Chamber in his Salle des Nations from 1927. Le Corbusier wrote the following about his inspiration "The Salle Pleyel"[2]:




The Salle Pleyel. Long section.

*"Here today is the Salle Pleyel, it is the truth, the truth of reality, the functioning truth, as opposed to the fake truth of the Institute, and the Institute is bent before this new irrefutable truth. There is the historical value of the Salle Pleyel: with neither ambiguity nor limitation, it is true, true as the aircraft that flies and the fish that swims"*

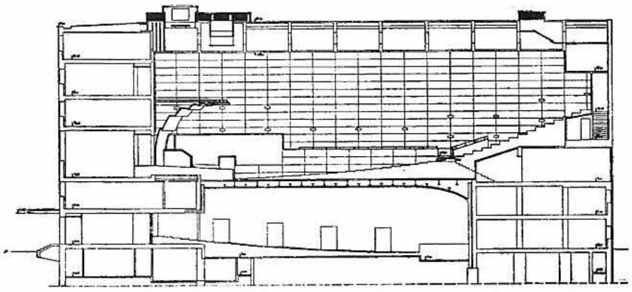
## The wooden concert halls in Scandinavia

When we look at the Scandinavian Concert Halls of the Modern Movement, we have at least three very interesting examples where the wooden surfaces dominate both visually and acoustically.

### Helsingborg Koncerthus

In 1926 the Swedish architect Sven Markelius won the competition for a new concert hall in Helsingborg in Sweden. Sven Markelius who was a close friend and college of Alvar Aalto, went in the summers of the late twenties to several European countries, among them France where he experienced The Salle Pleyel. Markelius later managed to get Gustave Lyon involved in the acoustical design of the new concert hall of Helsingborg.

In some very interesting alternations of the project from the competition in 1926 until the finished project for the hall, not only the exterior changed from classicism to modernism, also the interieur of the hall changed from a classical shoe box shaped concert hall into a modern directed sound auditorium. The Concert Hall now represents a contrast to the $18^{th}$ Century classical music hall. No decoration to disturb the musical experience. The function is the music and the acoustics. What gives the Concert Hall its caracter is now the use of materials and the dominating platform reflector made of concrete and designed by Gustave Lyon. The fact that Gustave Lyon only recommended a single reflector placed over the platform could indicate that he had learned from the mistakes in Salle Pleyel where the amount of directed sound had become too excessive or, he had correctly realised that the need for early directed sound would be less pronounced in a smaller hall. Comparing some watercolors of the interior of the hall from 1926–29 and the finished hall there also seems to have occured a remarkable change in the use of materials from plaster to wood [3]. The walls in the hall are now entirely covered with wooden panels of mahogany and ebenholz. The radical changes of the hall occurs almost at the same time that Markelius held a famous lecture for his colleges in Åbo in Finland. In this lecture he actually used the acoustics of the concert hall as an example of the new rational relationship between function and form: *"The more precise the objective starting points can be—as an example I here think of the practical and theoretical experiences quite recently obtained within the roomacoustical field—the more absurd it seems that for instance a concert hall is designed from a*



Helsingborg Concert Hall, 1932. Long section.

*decorative main idea. The congeniality between form and content has for all times been the characteristics of great architecture".*

The radical changes of the project in Helsingborg happened at the same time that similar changes happened to Alvar Aaltos project to his Finnish Theatre in Åbo [4]. However, the shift of material from plaster to wood had no similarity in Aalto's project, and the general use of wooden lining on the side walls could be seen either as an attempt to make the whole room look or act like a wooden instrument or as a well-meant attempt to control the acoustics—the reverberation time. For the musical experience we prefer an almost equal reverberation time at all frequencies and therefore we need to use a composition of materials that together absorbs the sound equally at all frequencies. Knowing that the chairs, the audience and the celotex on the rear wall absorb the sound at the mid and high frequencies and the ceiling of plaster almost nothing, we need a lining on the side walls to absorb the low frequencies, so that the reverberation time gets balanced.

Meanwhile the reverberation time of the concert hall have not been well balanced [5]. The amount of high frequency absorbtion is to high (the reverberation time is low) and if the side walls had been made of concrete this frequency imbalance would have been more serious (the reverberation time at low frequencies would have been even higher than was the case).

**Experiences from Salle Pleyel** were of course used in connection with some of the choices and detailing of materials in Helsingborg. For instance it was now known that to avoid an echo on the platform, the rear wall needs to be sound absorbent. The rear wall in Helsingborg was therefore covered with sound absorbtive celotex and canvas. The same effect could have been obtained with the use of perforated wooden panels, so why use a textile in a wooden hall? The answer seems to be that the practical use of perforated panels as sound absorptive materials was not fully developed at the time.

Today the needs for light fixtures and other technical installations dominates the platform and the wall above the platform reflector, which could have been a minor problem if the original project for an organ placed over the platform reflector had been realised [6].

## Göteborg Koncerthus

Placing an organ on top of a platform reflector was actually realised in the most beautiful concert hall of the modern movement— the Göteborg Koncerthus. The Swedish architect Nils Einar Eriksson was in 1931, after a second price in the competition, commissioned to draw the new building. Through the evaluation of the 44 proposals that were handed in for the competition it was clear that most of them used the princibles of the Salle Pleyel—The Directed Sound Auditorium, as inspiration. Only a few had considered that the reflector arrangements needed in a smaller hall was less compared with what was needed in a large hall like Salle Pleyel [7].

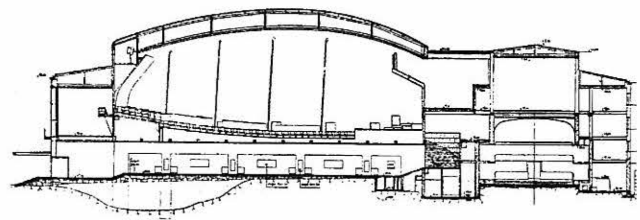
The concert hall of Nils Einar Eriksson is a very fine acoustical combination of roomshape and material considerations, or between the ideas of Gustave Lyon and the theories of W.C. Sabine.

In plan the roomshape is a modification of the fan shaped hall. Nils Einar Eriksson himself called the building "a crab in a rectangle" [8]. The long section shows the inspiration from Salle Pleyel and how the platform reflector and the rear wall reflector shall supply the audience with early sound reflections. The cross section with slightly inwards tilted walls is similar to that of the concert hall in Helsingborg.

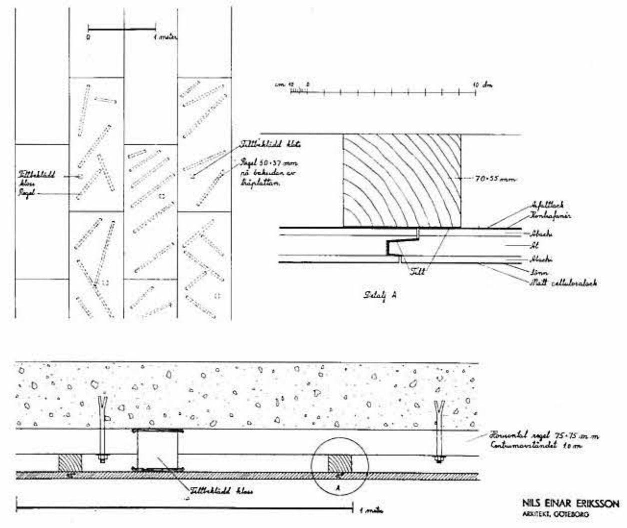
It is one of the few halls in the world that is finished entirely in wood. The warm colour of the light maple veneer, the lighting, the intimate contact between the audience and the stage, and the adequate reverberation time makes the hall a remarkeble experience for all who enters it.

Remembering the intensions to combine the right materials to obtain almost the same reverberation time at all frequencies, it seems strange that it should be possible in a hall with so much wooden lining. One would expect that such large areas of wood panels with cavity behind would cause to much bass absorption and consequently to little low frequency reverberation.

Nils Einar Eriksson used prof. Henrik Kreuger as acoustician—but much of the acoustical design was inspired by the Swedish musician and conducter Alfred Berg. It was actually his thoughts about the acoustical qualities of wood that made the hall an acoustical succes. He recommended wooden lining because wood of all materials should give an even absorption/reflection at all frequencies. Alfred Berg also meant that the wooden lining, through resonanse, would reinforce the sound. The



The Göteborg Concert Hall, 1935. Long section.

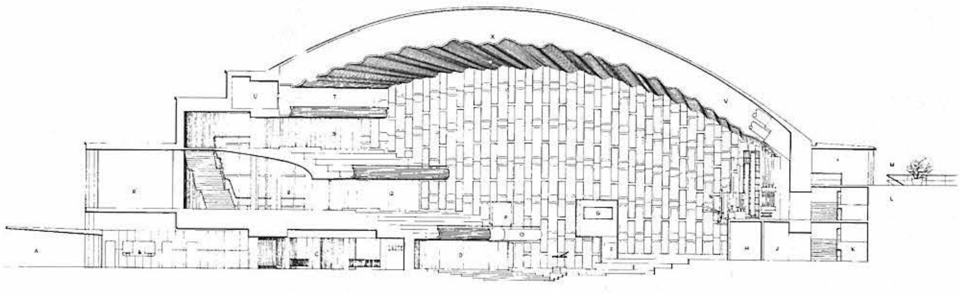



The Göteborg Concert Hall. Wooden lining. Construction.

last-mentioned is indeed the most commen misunderstanding when it comes to wood and acoustics. That the concert hall should act as a violin. Wood does not reinforce the sound. But returning to the former reason of recommending wood, we come to something rather interesting: the principles of the wooden lining in the concert hall.
To reduce the sound absorption of the panels at the low frequency and through that allow the large area of wood in the hall, the panels need to be stiff and well fastened to the concrete. The panels are about 20 mm thick, heavily braced behind by some diagonal mounted wooden stiffeners located differently on each sheet. The whole construction is securely held in place by heavy frames onto the concrete. The construction is more stiff than normal wooden lining and therefore it is not as absorbent. If we look at the reverberation time we actually see that the construction works. We have still got a good long reverberation time at low frequencies which means a good warm sound for the musical performance [9].
The original platform reflector or canopy was enlarged and reshaped in 1985 but new acoustical evaluations speaks for an alternation back to the original shape. What seems more critical from an architectural point of view is the possible acoustical arrangements at the caracteristic rear wall to eliminate the concave mirror-effect of the wall resulting in focusing echoes on the platform.

## The Danish Radio Concert Hall

The last example to be described here is The Danish Radio Concert Hall in Copenhagen. The hall is actually a large broadcasting studio for symfonic music but the hall is also used as a concert hall.
The hall is placed in a large broadcasting complex and the whole complex is one of the most distinguished examples of the architecture of the Modern Movement in Denmark. Besides it is probably the building with the most extensive use of wooden lining in Denmark. Not only is the concert hall finished entirely in wood but all the broadcastning studios were originally made with wooden panels, partly sound reflecting smooth panels and partly sound absorptive perforated panels.
The Danish architect Vilhelm Lauritzen worked with the project for a period of over 10 years from 1934 until the opening in 1945. His inspiration was also the directed sound auditorium like Salle Pleyel. Comparing the plans, the fanshape of the hall in Copenhagen is even more distinct than the hall in Paris.
As Sven Markelius collaborated with the musician and piano manufacturer Gustave Lyon, and Nils Einar Eriksson found a great inspiration in the ideas of the musician Alfred Berg, also Vilhelm Lauritzen was in a dialog with a musician through the development of the project of the new concert hall in Copenhagen. The musician was the almost seventy years old singer and conductor Emil Holm [10]. He was very sceptical of the whole idea of building a fan shaped hall. He wanted a rectangular hall or at least a modification of the project so that the side walls at the platform became allmost parallel. Today we know that his proposals would have caused better conditions for the musicians on the platform, but we still don't know if he had a special intuition for the acoustics or if he was just a reactionary man who prefered the classical shoe box shaped hall of the 18th Century.
**Already early in the design phase** in 1934 there were discussions of the possibilities of moderating the fan shape with some large reflectors on the platform side walls. Later in 1951, when the musicians had experienced the problem of hearing themselves in the hall, some unsuccesful attempts were made with side wall reflectors around the platform. In 1989 similar reflectors were actually included in a stage renovation.
If we compare the reverberation time of the hall with that of the Göteborg Konserthus we experience that they are totally different. In The Danish Radio Concert Hall the reverberation time is short at the low frequencies and long at the high frequencies [11] and in Göteborg Koncerthus it is the opposite. The difference at the high frequencies is primarily caused by the differences in the seating upholstering while the main difference at the low-frequencies can be explained by differencies in the wooden lining. In The Danish Radio Concert hall the wooden panels on the side walls are 16 mm maple and oregon pine veneer mounted with different airspace behind. The construction is resonant and therefore sound absorbtive to the bass tones, unlike the side walls in Göteborg.
The ceiling is a suspended 60 mm waveformed concrete shell with wood strips. The waveform is an attempt to eliminate the parabolic shape of the ceiling—and could be seen as a struggle between the adopted idea of the directed sound auditorium and a new knowlegde concerning the need of diffuse reflections. The acoustician W.L. Jordan feared a problem with low-frequency standing waves between the ceiling and the floor and put 250 Helmholz resonators into the ceiling construction [12]. Each



The Danish Radio Concert Hall, 1945. Long section.

resonator consisted of a hole in the concrete with a closed box behind. The construction was similar to that of the old Vitruvian vases but the intension was the opposite—to absorb, not to reinforce. All the boxes have now been removed apparently without acoustical problems.

As opposed to the other halls mentioned in this paper, the use of wooden panels in the Danish Radio Concert Hall is not limited to the smooth and unperforated panels. To eliminate annoying reflections from the concave rear walls the panels in this area are perforated and there is mineral wool in the cavity behind. During the period of realisation the use of acoustical materials in the Danish Radio Concert Hall and the broadcasting studios was a subject to many experiments.

New theories of sound absorbent materials were tested in practice and every studio was tuned to the desired reverberation time with the use of up to 10 differently panel systems in the same studio. In one of the studios there was even the possibility of varying the reverbation time by opening and closing some wooden blinds with mineral wool behind. The experiments with sound absorbent wooden panels resulted in a visual variation of the rooms determind by the function of each room. Unfortunately almost all the rooms have now been changed into modern broadcastning studios where the natural acoustics have minor importance and the main demand is a low reverberation time and the use of carpets and mineral wool absorbers have become the most frequently used materials.

## Sound absorbent wooden surfaces

The wooden surfaces described in connection with the Concert Halls of the Modern Movement are mostly the smooth, unperforated panels mounted with cavity behind. Those surfaces primary absorb the low frequency and are in acoustical terms described as panel absorbers. Besides we have two other types of acoustical surfaces or sound absorbers—the porous absorbers, as textiles and mineral wool, and the resonator panels, as the perforated surface with cavity behind.

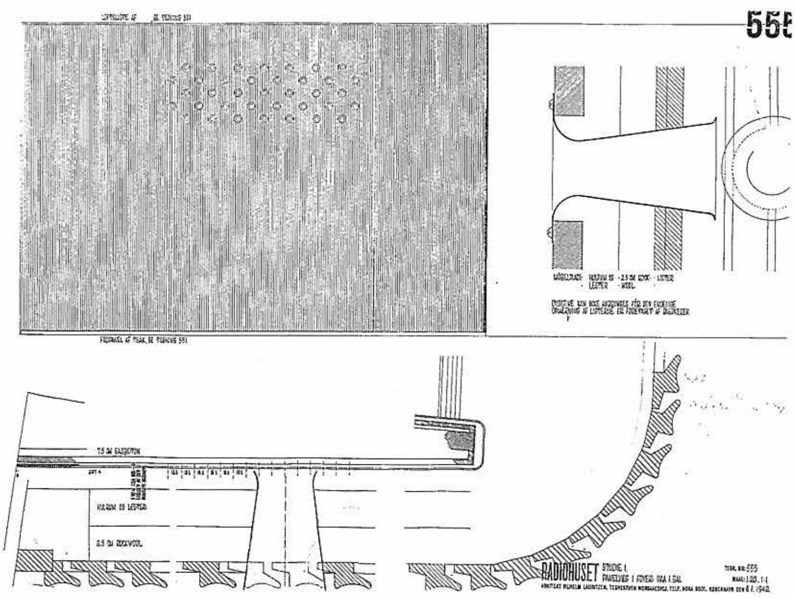
One of the early porous acoustical products was the wood wool cement (Heraklith) which of cause is made partly of wood. The material was introduced in the late twenties and has actually kept its position as a simple and honest sound absorbent product ever since.

At the start of the Modern Movement experiments with sound absorbent materials mainly in the US lead to the establishment of The Acoustical Materials Association in 1933 [13].

Besides different porous, acoustical plaster products made on asbestos, pumice stone etc. the most common porous material was a product called Celotex. The Celotex products consisted of a soft cellulose fibre board, some perforated homogeneous products and some with af harder perforated front board. Without a hard surface it worked as a porous absorber. The explanation why it was provided with holes appears from the application for a patent [14]. Here it its erroneous described that the approaching soundwave will be reflected several times in the holes and therefore reduce or absorb the sound energy. With the perforated hard surface, which made the product repainteble and more robust, the celotex worked as a resonator panel.

**The theories of resonator panels** were shown in scientific articles through the early thirties and were brought into practice through the late thirties. One of the first rooms arranged with the use of perforated wooden panels in Denmark was a lecture room at The Technical University of Denmark. The arrangement was quite sophisticated with the whole rear wall covered by a lining with large holes and variable empty cavity and therefore variable resonans frequency. The absorption of each hole was tuned to a specific tone with the low-frequency absorbers at the lower part of the wall and the higher frequency-absorbers at the upper part of the wall.

The early experiments with perforated panels shows a lot of very interesting details for instance double layer panels and panels with different materials behind. Through the period from the fifties up to the eighties we accepted the mineral wool as the ultimate material behind soundabsorbent perforated panels and when the alternative acoustic tissue materials showed up in the mid-eighties they where represented as new discoveries. However, the early experiments included very positive results with perforated wooden panels with different types of paper glued on the back.



The Danish Radio Concert Hall. The Copenhagen Panel – early proposal.

In my further studies the use of sound absorbent materials in Denmark will be registred. Some of the early examples of the use of perforated wooden lining have been picked up through the current research and in spite of the present fire demands, building materials industry etc. they will because of their beauty and their acoustical qualities permanently be an inspiration for architects and acousticians.

## Final remarks

The extension of wooden surfaces in the architecture of the Modern Movement was in some degree related to the new acoustical science. The practical posibilities of controling the sound and reverberation in even large rooms, through the use of for instance perforated wooden panels, resulted in new possibilities of functional room designs for meeting-halls, auditoriums, classrooms etc.

Concerning the unperforated coverings of the Scandinavian concert halls it seems as if some of the isolated acoustical reasons of using wood was overestimated or even a result of misunderstandings. The concert halls of the Modern Movement were the results of collaborations between musicians presenting the intuition of sound and music, architects presenting the feeling of form and material and the new powerful generation of engineers presenting a new an still uncertain science.

The normal use of thin wooden lining causes low frequency absorption and a lower reverberation time in the bass. The effect of this is a lack of acoustical warmth. But we experience the wood as a visuel warm surface. So to improve the acoustics and to get a better harmony of perception in the concert hall, we ought to use thick wooden lining or wood securely cemented to the solid construction behind.

Meanwhile the groving popularity of the wooden halls tells us that, when it comes to music and concert hall experiences, we can't just isolate the perception of sound. The experience of music in the concerthall is today more that ever before an experience for all our senses. We can't measure those things, but it is obvious that the surfaces and materials in a hall gives us some important associations, brings us into a certain mood and influence our perception of the music produced in a hall.

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# Architectural Principles in Wood Functionalism in Finland

Wood constructions were a part of Functionalism. Functionalist buildings constructed in wood were carried out in Finland from the very beginning of Functionalism. The influence that Functionalism had on wood constructions is illustrated by examples of building types like fair pavilions, sports facilities and small commercial buildings. Examples given are wooden buildings designed by architects and vernacular Wood Functionalism, sometimes called Folk Functionalism.
Of the wood structural systems, post and beam construction and timber frame construction made it possible to express most of the the formal ideals of Functionalism. Of the principles of Functionalism, the free facade, geometric forms and the strip window could be easily carried out in wood construction.
Simple geometric volumes were typical and the most common roof shapes in Finnish Wood Functionalism were the false flat roof and the shed roof. Exterior finish was mainly done by rendering or horizontal lap siding.

*by Jarmo Saari*

## Introduction

The main point in this short presentation is to study how the formal ideals of Functionalism were put into practise in wood construction in Finland and what kind of restrictions and benefits wood structural systems put on the realization of Functionalist principles. Thus an alternative for the title above could be *how the architectural principles of Functionalism were carried out in wooden buildings.*

It is been said that the development of iron concrete structures made the form language of Functionalism possible.[1] A deeper study soon reveals that during the Functionalist period several materials and various structural systems were used. Many buildings were a kind of hybrid, constructed using several materials and structural means. For example, the load bearing construction of The Schroeder House designed by G. T. Rietweldt (1924) is formed of concrete, brick, steel and wood parts.[2] So all the major materials were used for structural purposes.

It is been presumed sometimes that wooden Functionalist buildings were just imitating stone (concrete or brick) buildings, especially when wooden buildings were rendered.[3] After studying Wood Functionalism I have come to the conclusion that this kind of argument does not give a correct view of Wood Functionalism.

I concentrate on the formal vocabulary of Functionalism and exclude plans and social aspects, although they did play an essential role in Functionalism. The main themes in my presentation concern the volume and the roof shape, the structural systems and window openings and the materials and methods used to finish exterior wall surfaces. I'll illustrate these subjects with examples which represent building types which were usually constructed of wood, excluding small houses. This means fair pavilions, sports facilities and small commercial buildings like small shops and cafés.

## Volume and roof shape

Simplified geometric, often almost cubic, building volumes were typical of Functionalism.

An essential factor that gives character to the building volume, besides the form of the plan, is the roof shape. In Functionalism the most used roof shape was the flat roof. It can be derived from the roof terrace, which was one of Le Corbusier's five theses of new architecture. The aim of simplifying geometric volume and the roof terrace were the main reasons why the flat roof became one of the formal ideals and one of the most visible elements in Functionalism. It can even be said that a volume with a flat roof (or an impression of a flat roof) is often the main reason for classifying the building as a representative of Functionalism. Especially in Finnish vernacular Functionalism, there are many examples where the roof shape is the only feature that gives the effect of Functionalism.

The aim of simplifying geometric volumes was also a typical feature in Wood Functionalism. The roof terrace and the real flat roof with an inside drainage system were, however, rather unusual in Wood Functionalism. The roof terraces that were carried out

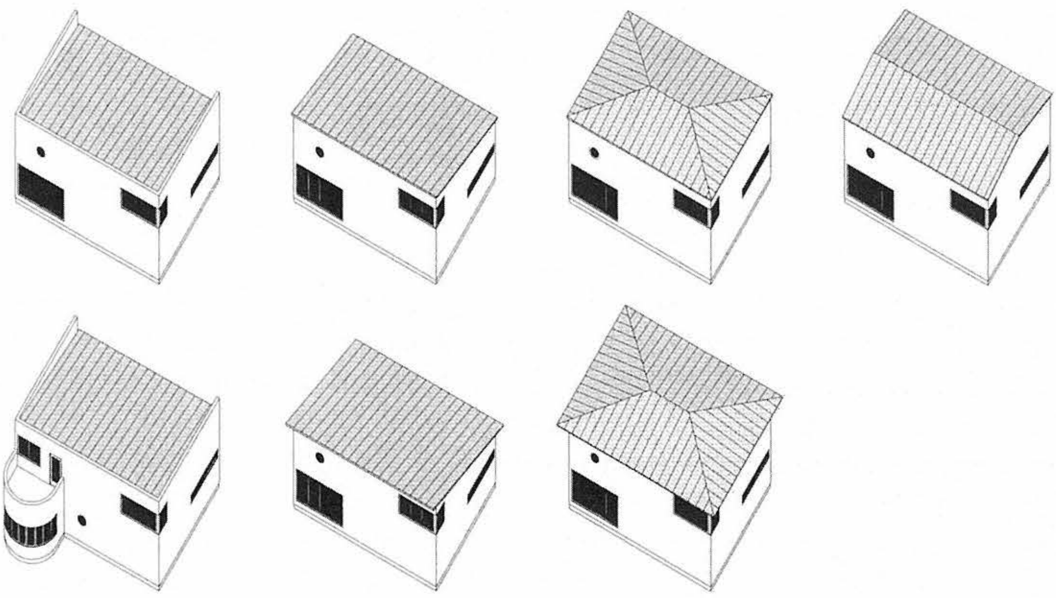

Fig. 1. Roof shapes typical of Finnish Wood Functionalism. From left: false flat roof, shed roof, hip roof and saddle roof. Fictional building volume. Drawn by author.

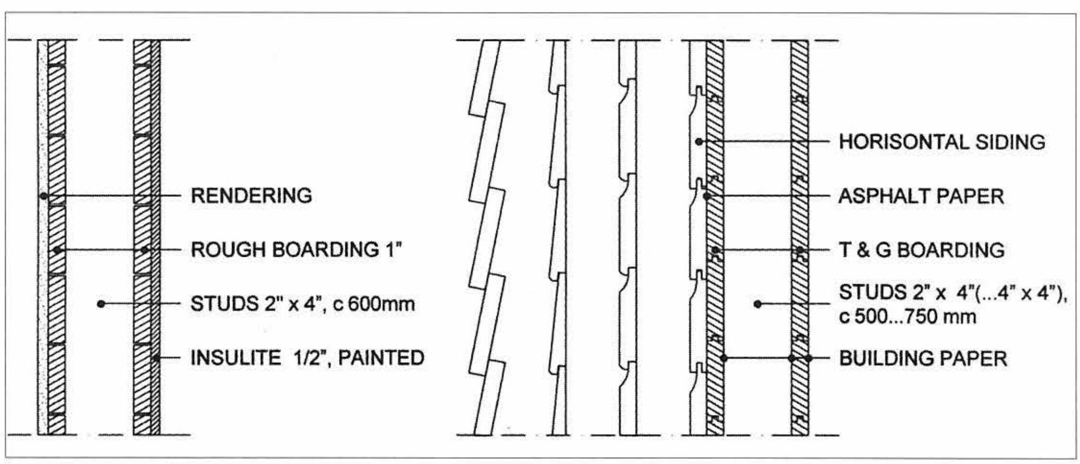


Fig. 2. Examples of timber frame wall. On the left rendered wall and on the right typical horizontal sidings. Left one was used in Drug Store in Lauritsala designed by the architect Erkki Huttunen. Sources: Left one: Arkkitehti 1935 and Archives of Finnish Museum of Architecture. Right one: W. Keinänen: Puumiehen Rakennusoppi, Porvoo 1925. Vertical sections, scale 1:10. Redrawn by author.

in wooden buildings were usually rather small and modest. Instead of this, there were several kinds of roof shapes which imitated the flat roof.

One of the most typical approaches that gave almost the same impression was the so called false flat roof. Actually it was a shed roof that was masked to look like a flat roof from three sides of the building and only the backyard facade reveals the real roof shape. This solution was used very often, not only in Finnish Wood Functionalism, but in Finnish Functionalism in general designed both by architects and local builders. *See figure 1.*

The normal shed roof was also rather common especially in small houses and weekend villas but also in small commercial buildings. In some cases the hip roof and the saddle roof were used too. Whatever the roof shape was, it was usually very low and the eaves were generally rather short or there were no eaves at all. For example, a low hip roof without eaves, which was quite typical in small houses, gave the effect of a flat roof.

## Structural systems

The wood structural systems applied in Functionalism were mainly the timber frame construction and the post and beam construction. In some cases, mostly in small houses and in vernacular constructions, the traditional log frame or the vertical plank structure (common in Sweden) were used. Most of the wood structural systems, excluding the post and beam construction, were based on load bearing walls. This seems to be in conflict with the principles of Functionalism. Free plan and free facade were seen

to be possible presuming that the walls have no load bearing function.
The first buildings in Finland where the timber frame construction was used were built at the turn of the century. In spite of this, it did not become general until the thirties, and the log frame was the most common system up to the World War II. However, in Wood Functionalism the timber frame construction soon became the most applied structural system especially in small houses, and other smaller constructions.
The timber frame construction was very much the same as the American balloon frame with 2" x 4" studs usually about 600–750 mm on centre. The system was particularly applied by Finnish architects, and it was very suitable for use together with new building panels like insulite and other wood-based products. *See figure 2.*
The timber frame construction can be seen as a kind of parallel to the demand for structural rationalism, especially when compared with the log frame. Even if the walls worked as a load-bearing structure, the frame construction made it possible to carry out most of the motifs and formal ideals of Functionalism.
Bigger wooden buildings with wide spans, like fair pavilions or sports facilities, were generally constructed using post and beam structure. Otherwise it was not very common. In post and beam structure, the walls were normally made in the same way as in timber frame construction.
Besides these systems already mentioned, rarely used other alternatives were the vertical plank construction and the traditional log frame. The log frame was, with some exceptions, covered with weatherboarding, and it was mainly used in vernacular Wood Functionalism.

## Window openings

The free facade was one of the basic principles of Functionalism. One result of this was the desire for asymmetrically composed window openings. The horizontal window band was one of the most characteristic motifs. In addition the corner window, the round window, with its origin in machine romanticism and ocean liners, and glazed walls were also typical. It is been said that the free facade and the strip window were consequences of Le Corbusier's interest for technical possibilities of iron concrete structures.[4] All the above-mentioned window types were also used in Wood Functionalism, especially in timber frame systems. As a matter of fact, strip windows were technically much easier to carry out in timber frame walls than in concrete or masonry walls. The load-bearing studs of frame walls were so thin (about 2") that they were easily faded out between window frames both in strip windows and in glazed walls. In this respect log frame and vertical plank construction set much greater technical limitations on the expression of Functionalist window ideals.
The window openings in vernacular Functionalism quite often had a character untypical of Functionalism. It was often symmetrical and the window openings were composed in very much the same way as in log buidings, in spite of the timber frame walls.

## Exterior wall materials

The most common material used in exterior wall finishing was rendering, usually white or light-coloured. It was also very common in Finnish Wood Functionalism. Rendered wooden buildings had already been built before the Functionalist period, so it was no kind of new solution.

Rendered exterior wall gave the effect of a smooth and simple wall surface that was an aim in Functionalism in general. It can be asked if rendered wooden buildings are imitating stone buildings and is it, because of this, a dishonest solution and thus against the principles of Functionalism. Still, it can be asked how rendered brick, concrete or steel buildings were more honest. In all these cases the real construction and the real material are in the same way concealed under the rendering. I am more inclined to think that the point was an abstract and immaterial pure wall surface that was a typical goal of Functionalism generally, and that the argument that the rendered wooden building is an imitation of a rendered stone building is only one side of the truth. In addition, technical reasons for rendering have been mentioned both to improve the air-tightness to give better thermal insulation (especially in walls where the only insulation was air space)[5] and to impove fire resistance [6].

The exterior wall in rendered wooden buildings usually had a normal timber frame and as a base under the rendering there was generally boarding but in some cases even wood fibre panels (insulite) were used. *See figure 2.*

Besides rendering, wood sidings were naturally very common in wood construction. In wood sidings there can be seen the same desire for the simple and smooth exterior surface that could be achieved by rendering. As a means of achieving a simple wall surface, sidings were usually done without cornerboards, and framing boards around window openings were normally turned with the edge outside so that they looked as narrow as possible. Horizontal sidings emphasising the horizontality of the volume, in same way as strip windows, were a little bit more popular than vertical sidings, especially among architects. The most common horizontal siding was the lap siding (bevel siding). *See figure 2.*

In vertical sidings designed by architects channel groove boards were usual. This can be explained also as an aim of a simple surface. *See figure 9.* On the other hand, in vernacular Wood Functionalism, both board and batten and board and board sidings were rather common. Both gave a rather clumsy impression to the facades. In addition to this corner boards and broad framing boards around window openings were used quite often.

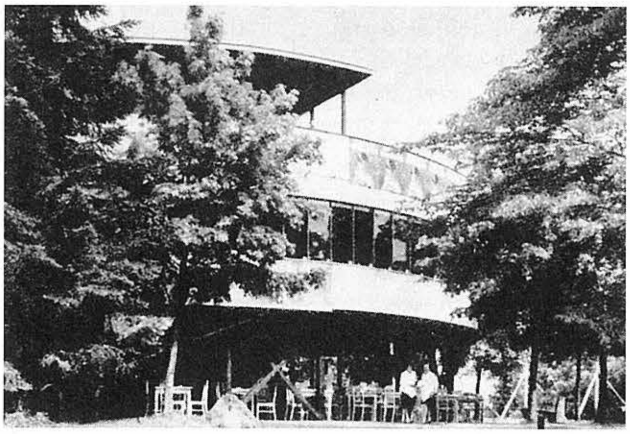

Fig. 3. The restaurant building at the Turku Fair 1929.

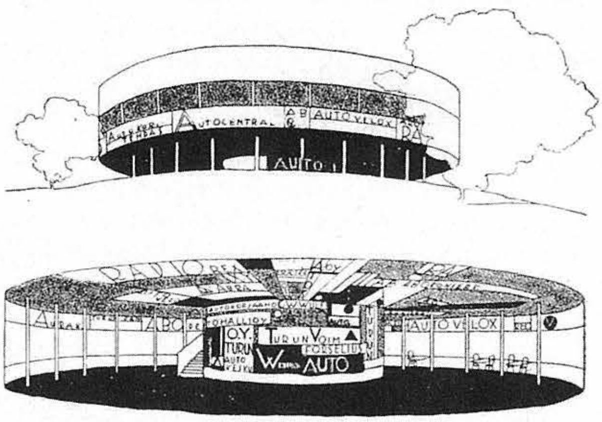


Fig. 4. The restaurant building at the Turku Fair 1929.

Besides board sidings, wood-based panel sheathings were also used in some cases. The most common products were various woodfibre boards. They were used mainly in temporary buildings like fair pavilions but also in small houses and weekend villas. Even porous woodfibre boards were applied as such in exterior walls. Quite soon it was found out that it was not a very long-lasting solution.[7] Woodfibre boards were, however, very common as an inside sheathing. Plywood panels were also mainly used inside, but there is still at least one case where plywood was applied as an external cladding. This was the Finnish Pavilion at the Antwerp World Fair of 1930, designed by the architect Erik Bryggman. *See figure 5.*

In the same way that the colour of the render was usually white, so the wood sidings were generally painted with white or light colours. In weekend villas, saunas and so on, dark preservatives were also used.

## Building types / examples

Small houses and weekend villas were the most common wooden building types. As was mentioned above, small houses are left outside this treatise and the purpose is to give a short review of other building types which were usually constructed of wood.

## Fair pavilions and exhibition buildings

Fair pavilions represent a building type which is characterised by temporary, fast and easy assembly and inexpensive structures. These are some reasons why wood was used as a building material. In spite of these limitations, fair pavilions and exhibition buildings have quite often offered an opportunity for architectural experimentation.

The Turku Fair was held in June 1929 and the pavilions were designed by the architects Alvar Aalto and Erik Bryggman. The Turku Fair has been seen as a manifesto of Functionalism and the pavilions were the first Functionalist buildings in Finland.[8]

The main building material was wood. Many of the pavilions, kiosks and other buildings had a simple timber frame construction and the external wall material was mostly paperboard (Enso-kartonki). One of the most interesting buildings was the restaurant designed by Erik Bryggman. It was round in form, elevated on wood columns and there was a roof terrace. The facade was white with a long window band. So, most of the features which were typical of Functionalism are visible in the restaurant building. *See figures 3 and 4.*

The Finnish Pavilion at the Antwerp World Fair in 1930, designed by the architect Erik Bryggman. It was perhaps the only building with plywood as an exterior wall material. It had a timber frame construction with 2½" x 4" (4" x 4" on corners), c. 1500 mm. The exterior wall material was 18 mm thick birch veneer plywood (panel size 1.5 x 3 m). The inside of the walls was covered with 5 mm thick paperboard. The pavilion was composed of simple geometric volumes. It had a flat roof, but an outside drainage system. *See figure 5.*

The Finnish Pavilion at the Brussels World's Exhibition in 1935, designed by the architects Aarne Hytönen and Risto-Veikko Luukkonen. The pavilion had the form of a parabola with a low wing and a shed roof. The exterior walls had a timber frame construction and were rendered outside. There was criticism that, instead of rendering, Finland should have used wood more visibly.[9] *See figure 6.*

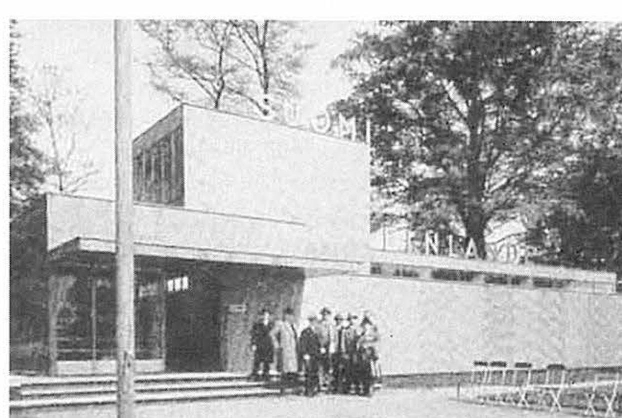

Fig. 5. The Finnish Pavilion at the Antwerp World Fair 1930.

Fig. 6. The Finnish Pavilion at the Brussels World's Exhibition 1935

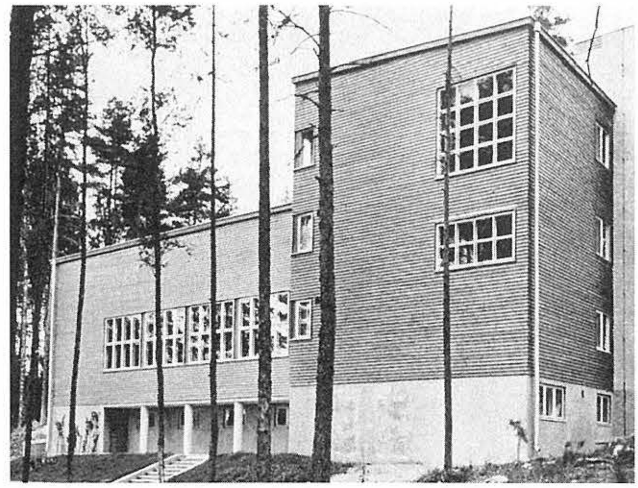

Fig. 8. Pajulahti Sports Hall, 1938.

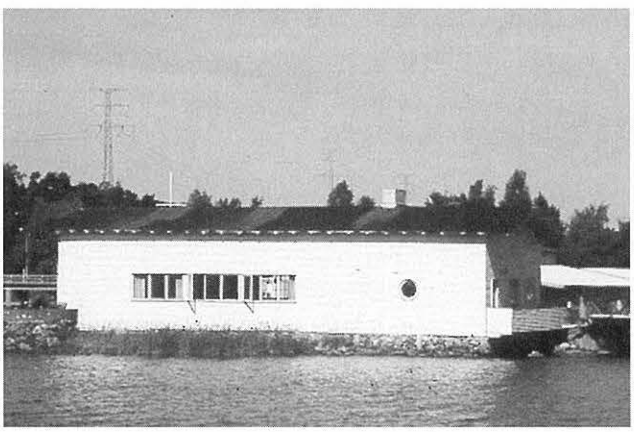

Fig. 7. Canoe Sheds in Helsinki, 1932.

## Sports facilities

Canoe Sheds in Helsinki (built in 1932), designed by the architect Pauli E. Blomstedt, represent a kind of modest Functionalism. The saddle roof and quite long eaves give a traditional character to the building volumes. In spite of that, the window openings (strip window and a round window), simple detailing and horizontal siding without cornerboards can be seen as consequences of the influence of Functionalism. *See figure 7.*

Pajulahti Sports Hall in Nastola (built 1936–37), was designed by the architect Eero Vaskinen. The gymnasium had a post and beam structure and a low saddle roof. Otherwise the walls were of timber frame construction and the roof shape was a low shed roof. All the roofs were carried out without visible eaves. Horizontal lap siding (bevel siding) without cornerboards, large windows and corner windows were typical features of Finnish Wood Functionalism. The building has been totally demolished by reconstruction in the fifties. *See figure 8.*

Helsinki Olympic Stadium was built in the mid thirties and designed by the architects Yrjö Lindegren and Toivo Jäntti. It is considered to be one of the most outstanding examples of concrete architecture in

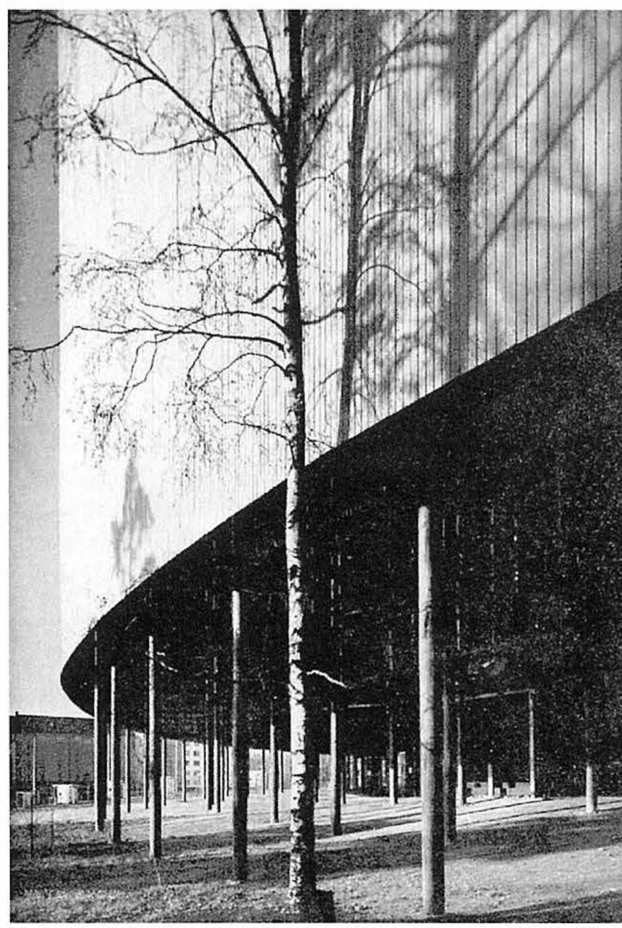

Fig. 9. Helsinki Olympic Stadium, 1939.

Finland.[10] In preparation for the 1940 Olympic Games (which were cancelled because of the War) large extension was built at the end of the thirties. The extension of the stadium was mainly built of wood and it was much bigger than the original concrete core. The simple, smooth and curving surface of the exterior was created with vertical channel groove siding. The extension was totally rebuilt for the 1952 Olympic Games. *See figure 9.*

Café and Office building of the Rowing Stadium in Helsinki (1939), designed by the architect Hilding

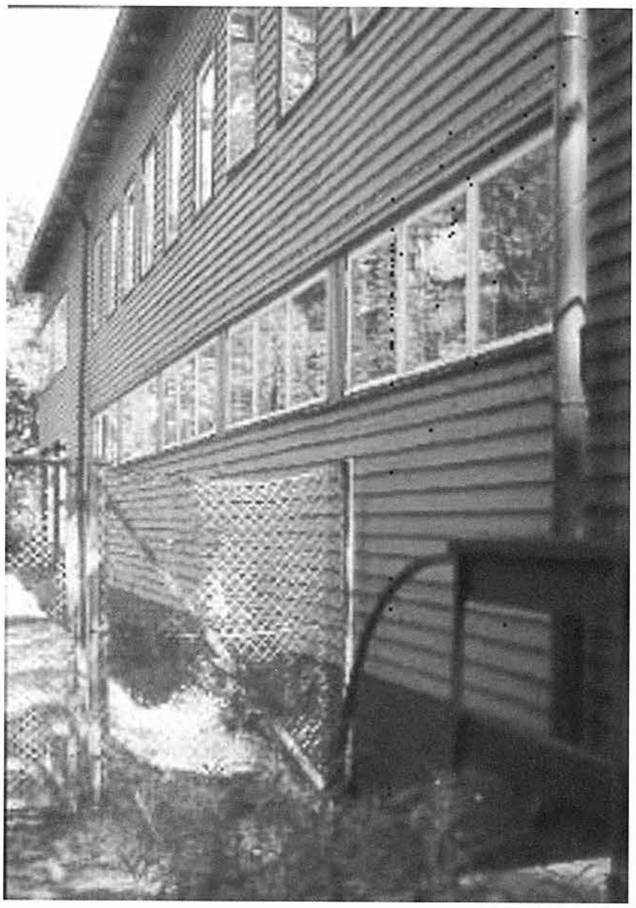

Fig. 10. Café and office building of the Rowung Stadium in Helsinki, 1939.

Fig. 11. Café and office building of the Rowung Stadium in Helsinki, window detail.

Ekelund. The building has a post and beam structure and a low saddle roof. Otherwise the walls had a timber frame construction. Typical features are the horizontal lap siding without cornerboards and strip windows. Framing boards around the window openings were turned with the edge outside. *See figures 10 and 11.*

## Commercial building

Café Saaristomaja in Helsinki (built 1931), was designed by the architect Ragnar Ypyä. The timber frame construction made it possible to use a long window band which turns round the corner. The shed roof and horizontal lap siding without corner boards emphasises the horizontality and simplicity of the building. The advertisementmast and signs were typical motifs and elements of Functionalism in general. *See figure 12.*

Drug Store in Lauritsala (built 1935), designed by the architect Erkki Huttunen, is one of the small masterpieces of Finnish Functionalism. It is a typical example of a rendered wooden building and of a false flat roof. The structural system was a timber frame, *see figure 2*. The original character of the building was lost through extensions and alterations in the fifties. *See figure 13.*

Shop Niinisalo in Karkkila (built 1938), designed by a local builder, Johan Karlsson. This small commercial building is an example of modest vernacular architecture. Characteristic features of Finnish Wood Functionalism are the false flat roof and the horizontal lap siding without corner boards. On the other hand, the symmetric window opening on the main facade and the framing boards around the windows are reminders of traditional construction. These kinds of unfunctionalist motifs were quite typical in vernacular Wood Functionalism. *See figure 14.*

Youth Hostel Ukonlinna in Imatra (built 1939) is another example of vernacular Wood Functionalism. The simple volumes with the false flat roof give an

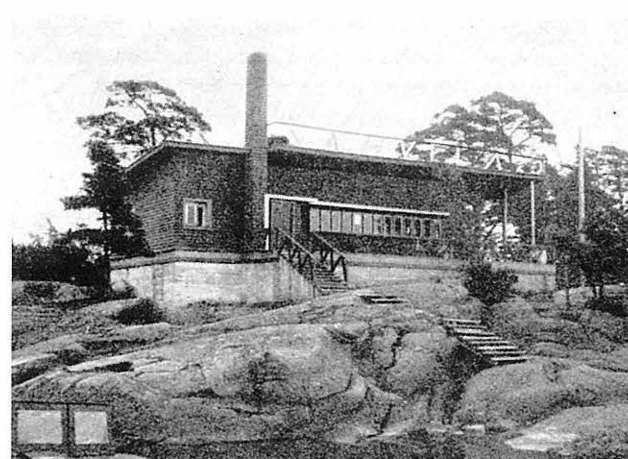

Fig. 12. Café Saaristomaja in Helsinki, 1931.

Fig. 13. Drug Store in Lauritsala, 1935.


Fig. 14. Shop Niinisalo in Karkkila, 1938.

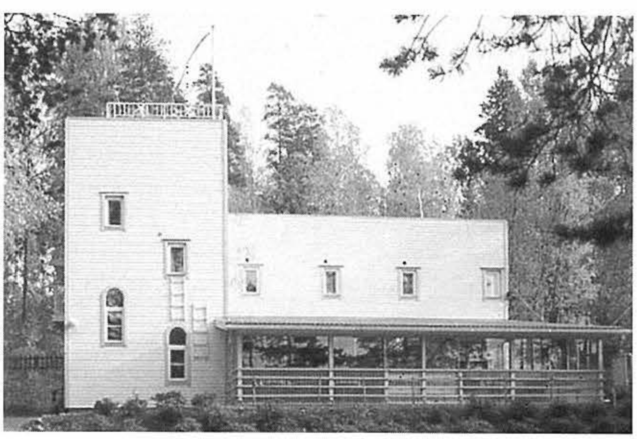

Fig. 15. Youth Hostel Ukonlinna in Imatra, 1939.

impression of Functionalism—there is even a roof terrace on top of the tower—but on the other hand the arched windows and clumsy details in terms of Functionalism create a conflicting and also a slightly funny appearence. Some alterations have been done during renovation at the beginning of the nineties. *See figure 15.*

## Conclusions

Wood Functionalism appeared immediately, both in Finland and elsewhere, in the first phase of Functionalism. This shows that Functionalism cannot be considered as a "style" of just one material (concrete).

Simple geometric volumes were also typical of Wood Functionalism and the most common roof shapes were the false flat roof and the shed roof.

Of the wood structural systems, the timber frame was the most common and besides, with the post and beam system, it was rather suitable for expressing most of the ideals of Functionalism. Although timber frame construction is based on loadbearing walls, there are technical possibilities for free facades and window openings typical of Functionalism. The strip window, for example, could be put in practice much more easily in a timber frame wall than in a masonry or concrete wall. Although timber frame construction was not very avant-garde its easy and simple assembly meant that it was still quite rational, especially in comparision with other wood structural systems.

Finnish architects were quite skilful in exploiting timber frame construction. They experimented, without great prejudices, with new materials, such as woodfibre panels as an exterior finish or as a base for rendering. Unfortunately, some solutions proved not to be durable in the technical sense.

The most typical exterior finish in Functionalism was rendering. It was also extremely popular in Wood Functionalism in Finland. Of the wood sheathings, horizontal sidings were a slightly more used than vertical sidings, especially in buildings designed by architects. In vernacular Wood Functionalism horizontal and vertical sidings seem to have been almost equally common.

There were no special limitations, when using wood as a construction material, that would have prevented the basic formal ideals of Functionalism from being realised. Principles typical of Functionalism such as technical rationalism, simple geometric and cubist form language, free facades, plain simple wall surfaces and strip windows, all found to a certain extent their realisation in wood constructions, especially in frame construction.

On the other hand, there were features, particularly in vernacular Wood Functionalism but also in some cases designed by architects, which were unfamiliar to Functionalism. These can be seen, for example, in the symmetry and the way to arrange window openings that was sometimes very much like that in log construction. Quite often the simple flat-roof-like volume is the only factor where the influence of Functionalism is visible. Somehow it seems that all the possibilities for expressing Functionalist ideals with wood were still not realized.

**Keywords**
Functionalism, wood functionalism, post and beam, timber frame, false flat roof, shed roof, rendering, wood sidings

**Notes**

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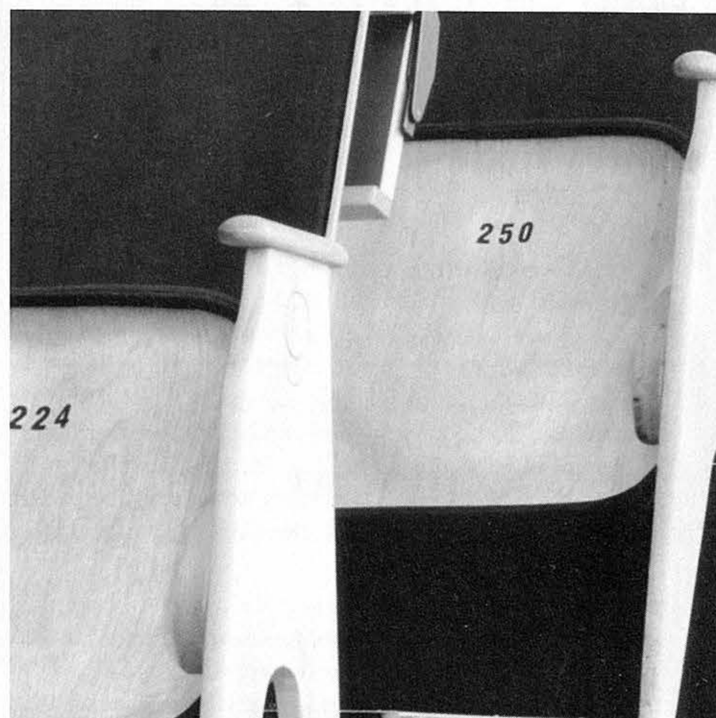
7, 10, 11, 14, 15. Jarmo Saari

# Articles



# Wide-spanned Wood Structures in the Modern Movement in Germany and Austria

No other than Walter Gropius, the founder of the Bauhaus, published a proclamation for the economic and modern use of the material wood in construction work. This article was published in the magazine Holzbau shortly after World War I in 1920.
"Numberless hands are ready to build; but by what means? They cannot disengage themselves from the old construction practices of stone and iron. They wait and complain that the material for construction is missing. How can they be helped? Only if we forget a lot of which was once possible and now is utopia, if we eliminate old prejudices without any pedantic fear, if we knock over the inopportune barriers of construction supervising resolutely, and if we face the problem of materials where it is only solvable: in the usage of wood. Wood is available in sufficient quantities and independent from coal and industry. Wood is a marvelous designable material. In its kind, it corresponds exactly corresponds to the primitive state of our lives which has to be build up again. Wood is the original material of mankind. [...] We have to experience, to discover, and to design wood again in a different way; out of its own spirit and without any imitations of old forms which do not correspond to our needs anymore. Wood is the material of the present [...]."

*by Berthold Burkhardt, Tatjana Gieschenhagen*

**It is a fact that Gropius** did prefer other materials to wood in his constructions. The Faguswerk in Alfeld/Germany (1911–1922) is rather an exception in his work; its various truss and north-light girders in the assembling halls and in the five-storey warehouse are built in the traditional framework construction. In this proclamation he rather called for new ways of construction using the materials which were known up to then together with newly developed ones and their possible combinations.

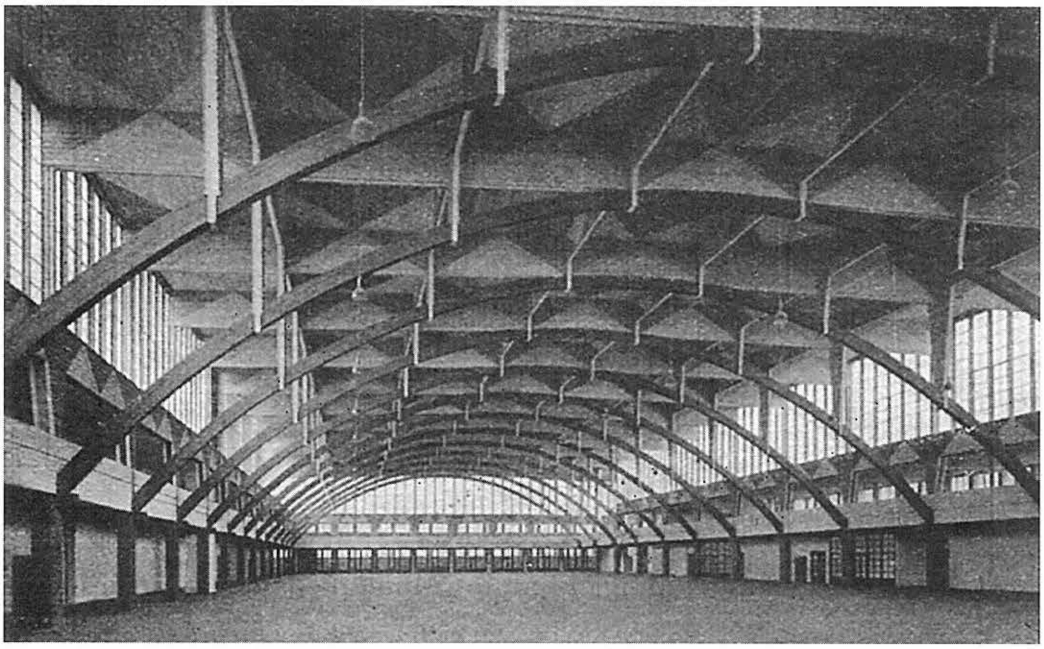
By the end of 19th Century saddle-, arched-, and domed roofs and bridges were hardly built with wood anymore. The steel construction solved problems concerning long spans with facility and almost displaced the wood construction that only were used for agricultural, temporary and residential buildings.

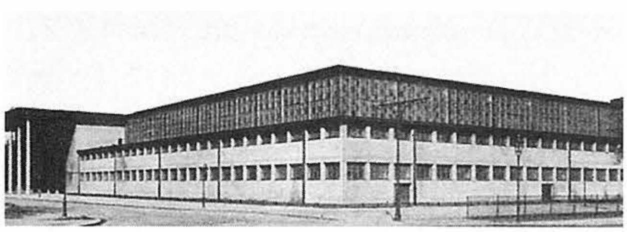
The main reasons for the decline of wood construction were the following: First, it had to enter into competition with the new steel and steel concrete constructions. Second, it was supposed that wood had a lesser service life, third, the problems with fire protection, and fourth, the weak organization of the wood-manufacturing industry. Another reason was the migration of trained workers and carpenters from wood manufacturing enterprises who were now needed for the rising building technologies to setup scaffoldings, framework for steel constructions and concret forms.

Carpentries and constructions firms with carpenter departments in Germany (for instance Hetzer in Weimar, Kübler in Stuttgart, Tuchscherer in Breslau) saw the need for innovations. To compete successfully with the steel and steel concrete constructions it was necessary to design a fast and simple and therefore cheaper production of wooden girder systems which requested less material. The former wooden girder systems, which in many cases were statically under-determined, had to be replaced by simple, statically determined or by underdetermined but easily calculable load-bearing structures (continuous beams, two-hinged-arches).

The pre-requisite for the development of "the new methods of wood construction" at the beginning of the 20th Century was the timber engineering. The introduction of the scientific basis of statics and strength theory of the traditional wood construction resulted in a revival of the almost forgotten material wood. Because of experiences with steel construction and the scientific basis in engineering solid wall and framework constructions could successfully be transferred into timber construction.

Solid-web girders were moulded out of wood lamellas, boards, and plants, or squared timbers. These trusses were connected with nails, nogs, screws,





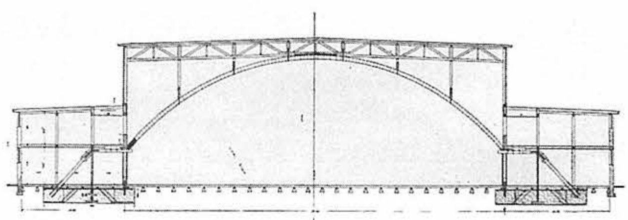


Fig. 1-3. Messehof in Breslau, 1924. Design by Max Berg. Solid-web girders construction manufactured by the firm Tuchscherer Inc.. Parabolic two-hinged arches with a span of 37.60 m.

steel bolts, and/or glues in order to receive an homogeneous compound structures of the most possible economic cross-section (most of the time rectangular or I-shape).
Otto Hetzer (1846–1911) from Weimar/ Germany was the first one to apply for the patent of laminated timber constructions. He successfully manufactured wooden girders with I-cross section for the first time. The bridge-builder Wiebeking began to work with laminated wood in 1809. The profile girders which were manufactured by Hetzer were made out of strip timbers which were combined under high pressure with a water-proof glue. This method which can be seen as the predecessor of today's Glulam enlarged the possibilities of formfinding for girder, arched, and frame constructions. To put the timbers into statically optimized form they were pressed in moist condition under very high pressure.
The idea to build arched constructions with planks and boards was not new. Because of the lack of long building timber the Frenchman Philibert de l'Orme (1515–1577) had the brilliant idea to connect various

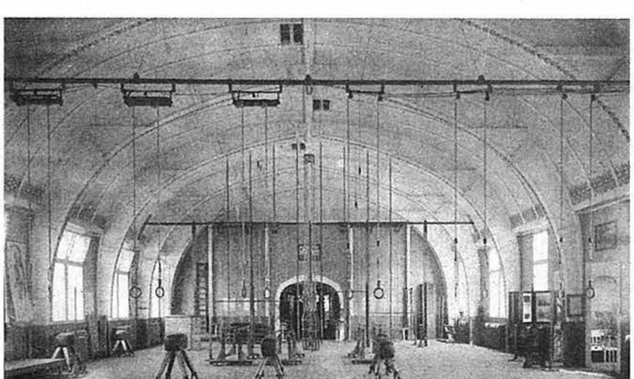


Fig. 4. Transportable gymnasium. Laminated timber construction; manufactured by the firm Christoph and Unrnack in Niesky (Saxonia)/ Germany; two-hinged arches with a span of approx. 8 meters.

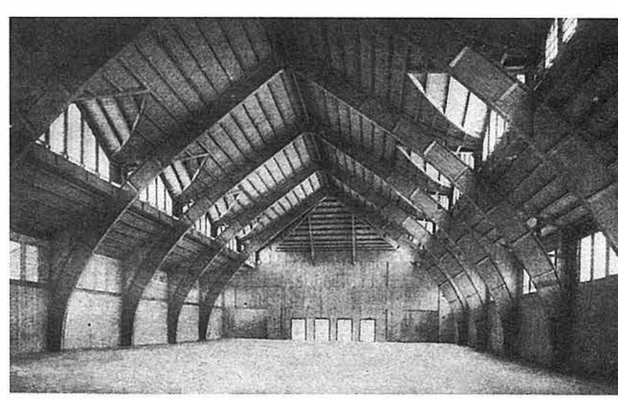


Fig. 5. Gymnasium at the International Building Trade Fair in Leibzig/ Germany, 1913. Laminated timber construction. Manufactured by the firm Hetzer from Weimar/ Germany. Three-hinged arches with a span of 25.00 m.

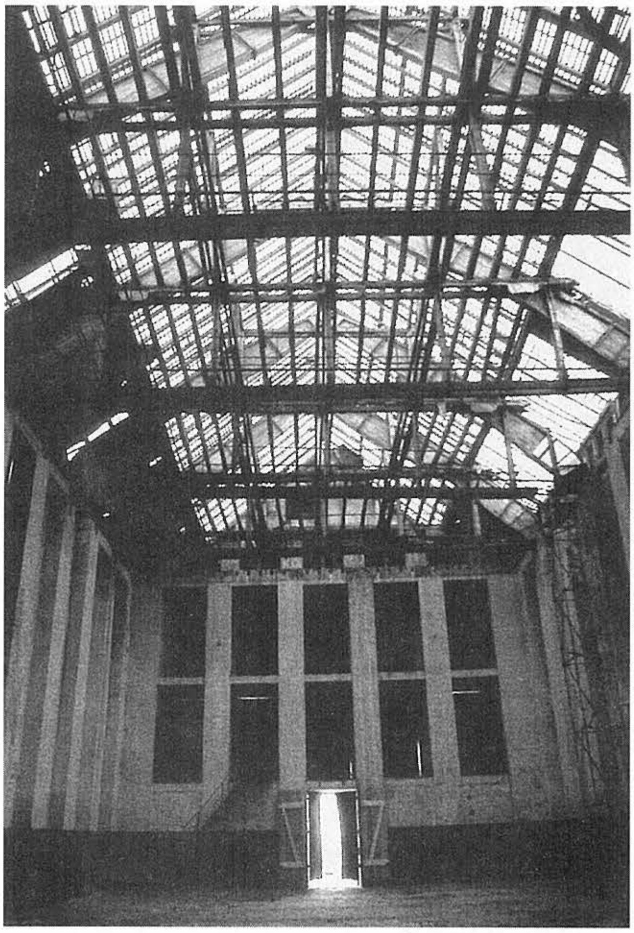
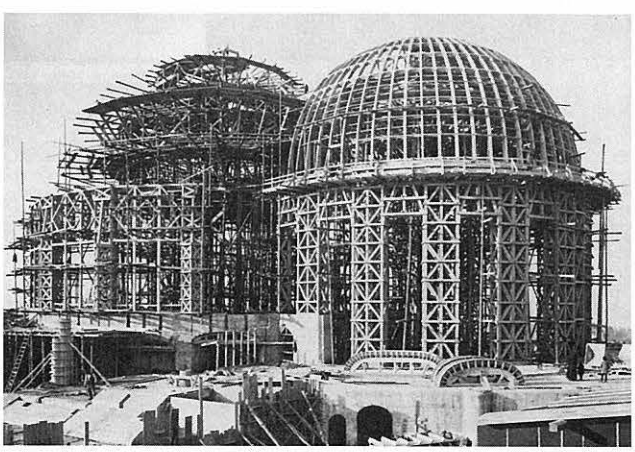


Fig. 6 and 7. Roof truss above the festival hall of the educational establishment Jaques-Dalcroze by Heinrich Tessenow in Hellerau near Dresden/ Germany in 1911. The rafters of the collar beam roof are made out of curved glued trusses.



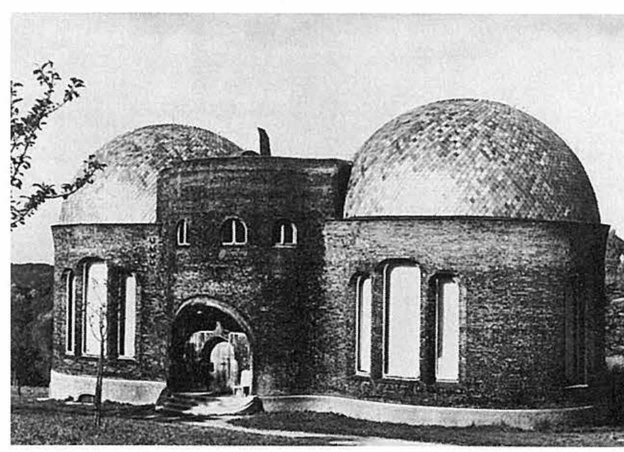


Fig. 8 and 9. The first Goetheanum of the Anthroposofic Society in Dornach/ Switzerland; built by Rudolf Steiner in 1914. The building which consisted wholly of wood was reconstructed with concrete after a fire in 1922.

short, edgewise, crossed butted boards with wood nogs in order to build a solid-web girder in the middle of the 16th Century. This method was forgotten for a long time until it was used again at the beginning of the 19th Century; presumingly by the salt-works constructor F. A. Senff. Senff built various roofs made out of massive framework and sometimes multi-storey masonry constructions with a span between 10 and 14 meters. They were extraordinary low-cost constructions because the were built with short pieces of boards, sometimes demolition materials.

One of the most remarkable buildings with dome-shaped roofs is the first Goetheanum in Dornach/ Switzerland; built by Rudolf Steiner in 1914. It is a manifesto of artistic, philosophic, and technical unity which associated Steiner with the architects of the modern movement like Bruno Taut, Erich Mendelsohn or Hermann Finsterlin.

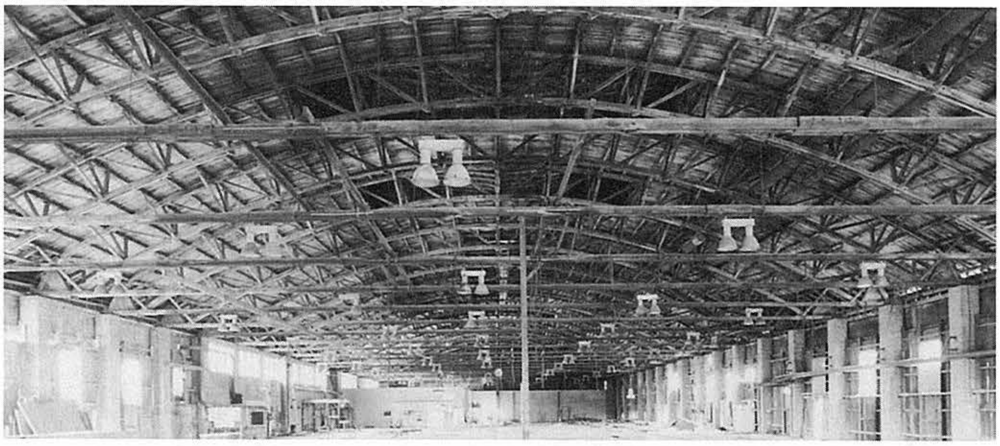


Fig. 10. Planer-hall in Magdeburg/ Germany; built by the firm Karl Kübler Inc. from Stuttgart in 1923. Two-hinged frames with a tie-member with a span of 33.40 m.

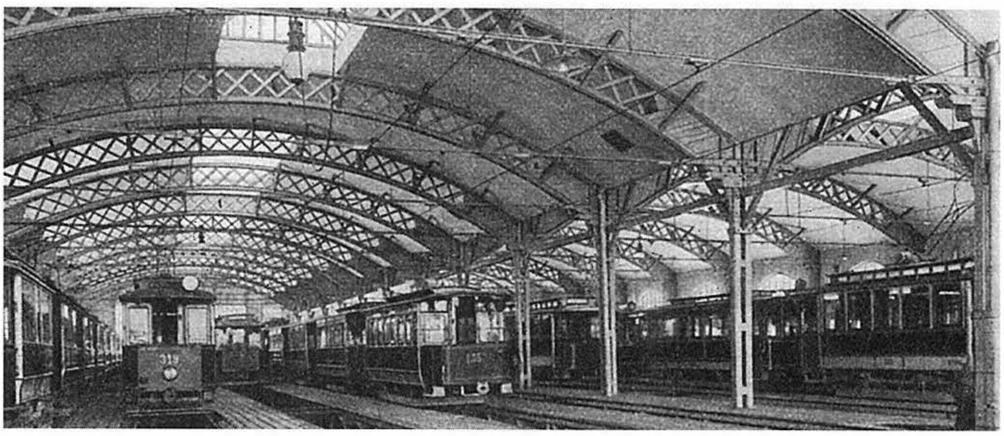
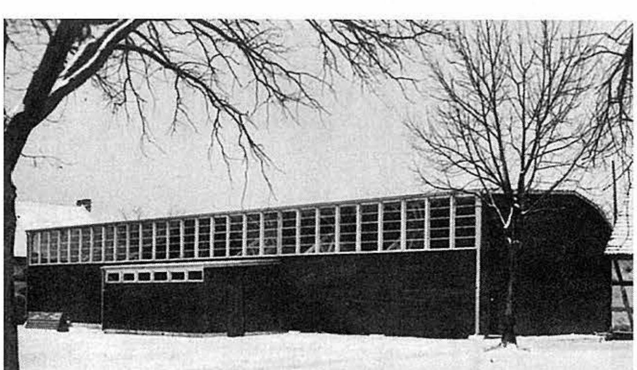


Fig. 11. Tram-hall in Vienna/ Austria. Latticed girders with wood beams. Manufactured by the firm Stephansdan Inc. from Düsseldorf/ Germany and Vienna/ Austria. Two-hinged arches with an iron tie-member. Span 40.00 m. Year of construction about 1915.

To cover long spans it was necessary to split up curved girders in trussed arches in order to minimize their weight. At the planer-hall in Magdeburg/ Germany, manufactured by the firm Kübler from Stuttgart/ Germany in 1923, the bottom and top flanges were built shear resistant out of flat laying planks.

In the end of 19th Century, the architect Stephan from Düsseldorf/ Germany managed to build beams which were resistant to bending, end of 19th Century. He designed curved lattice girders of which parallel running booms were joined by simple latticed bars. Other truss-manufactures developed this idea and designed long-span trussed arches for halls with or without tie-members.

Certainly the development of the wood bridge construction in the 19th Century helped to design the arched trusses; especially for the positioning of web-members. The American bridge-constructors



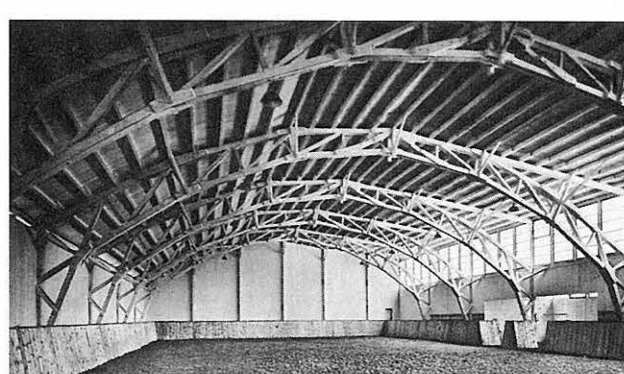
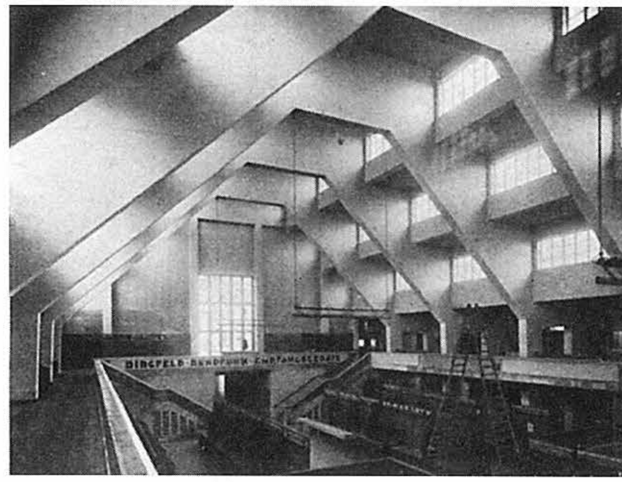
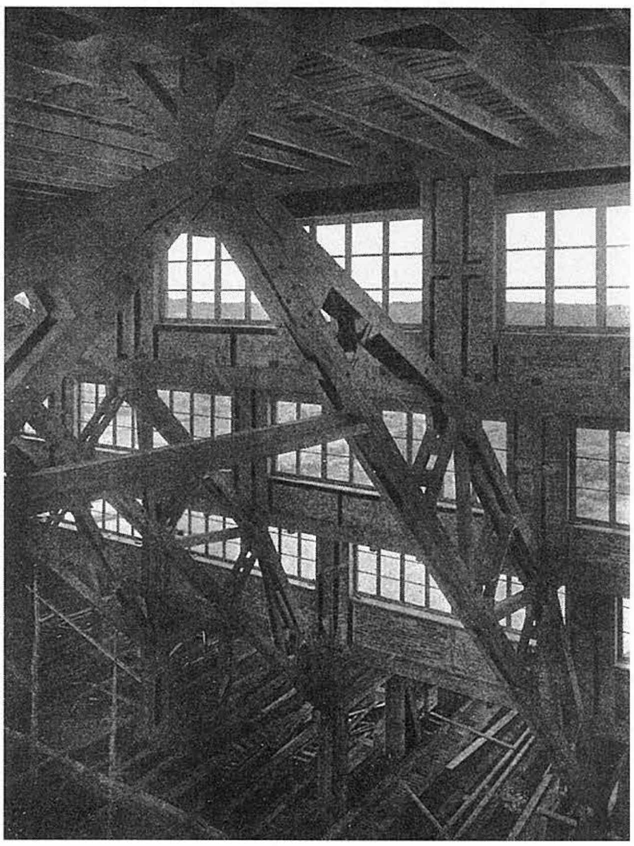


Fig. 12 and 13. Indoor Riding School der Deutschen Reitschule, Düppel near Berlin 1929 – Designed by Fred Forbat, trussed arches by Mathias Weiß, München and Berlin, span 23.00 meter.





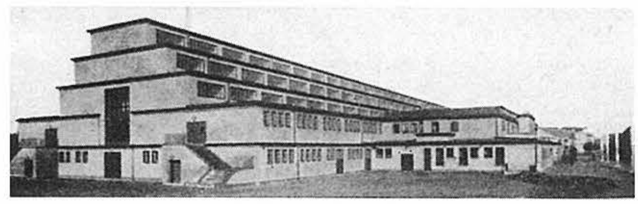


Fig. 14 to 17. Building of the Radio Industry in Berlin/Germany. Design by the architect Heinrich Straumer, 1925. Three-span hall construction by the firm Karl Tuchscherer Inc. from Breslau. The middle span as framework construction consists of the three-hinged arches with a span of 22 meters, which were lined afterwards for reasons of design and fire protection.

Howe and Long designed latticed girders. They already applied for patents for these systems about 1840.

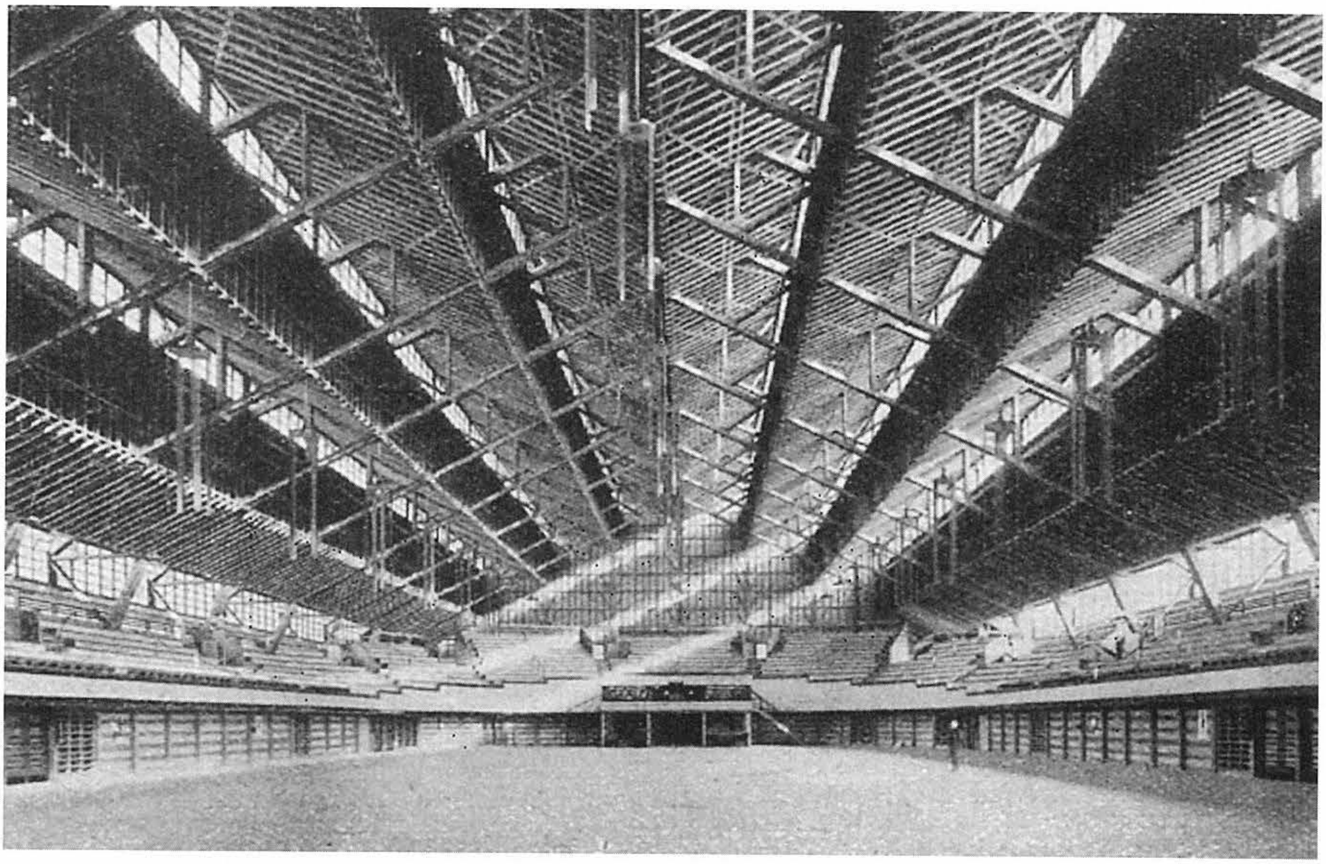
Numerous firms applied for patents for the new timber assembling technologies which made it possible to join simple wooden bars without a lot of effort of work and material. From then on it was possible to build wide-spanned framework constructions with joints which even could resist high forces and to split up boom sections in various single bars. They could be manufactured mechanically for different kinds of framework systems.

Another kind of curved girder is the parabolic arched girder of which forms were designed to join the axis of the top flange with the thrust line of the girder under permanent load. The bottom flange works as tie-member. With this kind of loading the infilling stays without unit stress. Only in case of an one-side loading by wind or snow the web-members are charged alternatively with tension or pressure.

Not always clients and architects choose a visible construction and a clear structure as an inside element of design.

Wood constructions consisting of framework girders or beams seemed like concrete constructions of the 20s and 30s because the were plastered and lined with boards. This was used many times for market halls or swimming pools. These claddings enlarge the fire protection but have architectonic reasons in the first place.

Analogous to the interior the exterior of wooden halls of this time are designed architectonically; just like



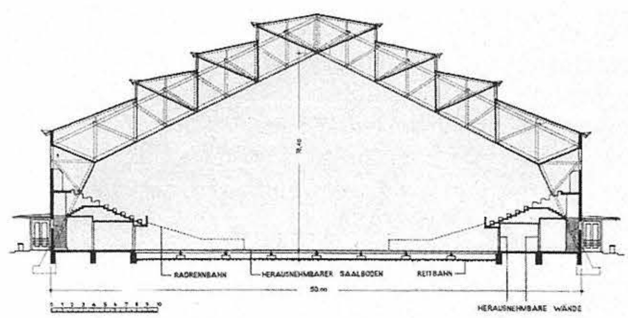


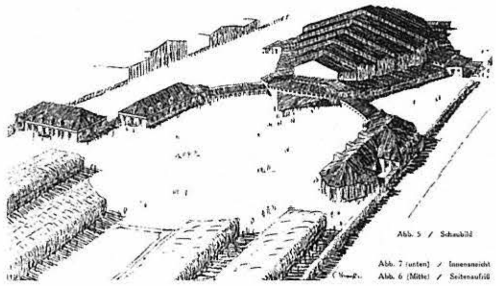

Fig. 18 to 20. Sport arena in Stuttgart/ Germany, 1925-1926. Design by Hugo Keuerleber. Framework by the firm Karl Kübler Inc. from Stuttgart/ Germany. Three-hinged frames with a span of 50.00 m.

stepping buildings where the underneath construction is hardly visible. But the functional reason was the need for exposure with day-light at deep halls with large spans. They are a special type of shed roofs which were developed for industrial buildings at first.

Wide-span wood constructions for temporary exhibition halls had a special market nearly without competition. Movable bolts were designed for the joint of these temporary girder structures. The standardized constructions, for instance by the tent construction firm Stromeyer and Co. in Konstanz/ Germany, were usually covered with cotton canopies. For exhibition and event purposes the halls received individual facades consisting of a wood truss which also was lined with fabric. In the first two decades of the last century the design of the facades varied from middle-age castle romanticism to clear forms of modern industrial buildings. Further developed wood halls of this kind were used in a large scale in competition to the steel construction for airship and aircraft hangars.

While the hitherto mentioned methods of wood constructions for roofs and halls were built by lining and stacking (trusses, purlins, rafters) the roof construction by Fritz Zollinger from Merseburg / Germany (1880-1911) represented a closed unit (two-dimensional surface structure). He already ran first tests with a new and highly standardized roof constructions in 1904. In 1910 he applied for a patent for his idea to join rhombus connectings of short boards and planks lamellas to three-dimensional frameworks. The lamellas were manufactured mechanically in large quantities. Therefore one could start with the erection of the roof truss without any devices.

Barrel roof or pointed vaults were mainly used for hall constructions. The Zollinger system was distributed rapidly all over the planet. It was used for



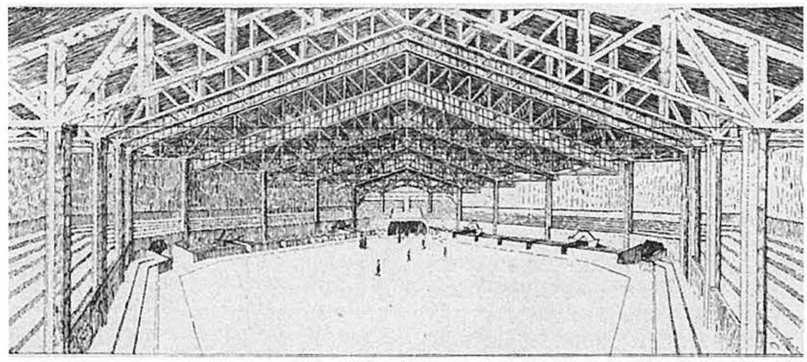


Fig. 21 and 22. First design of exhibition hall "Stadt und Land" in Magdeburg/ Germanyby Bruno Taut and Carl Kraft in 1921. Staggerd wood girders made out of benched girders.

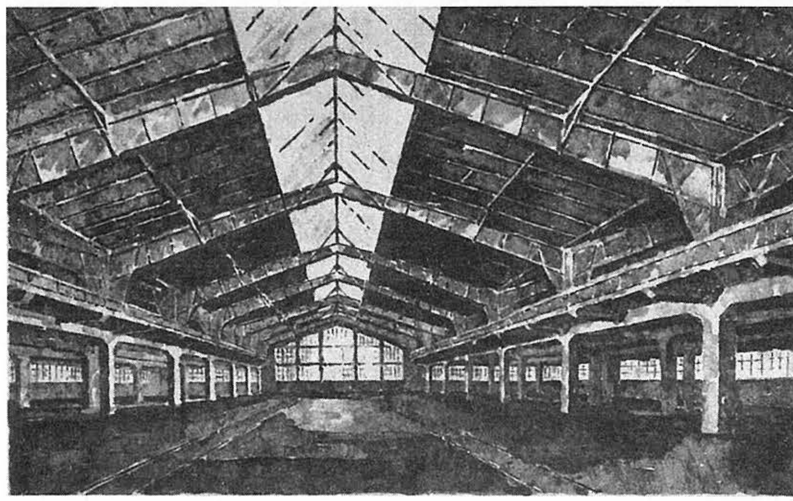


Fig. 23. Production hall for the tobacco factory Liebhold in Heidelberg/ Germany by Pflaumer and Moosbugger, ca. 1923. Three-hinged frames made out of wood solid-web frames, span 50.00 m, 70.00 m long.

residential and sacral buildings up to station-, exhibition- and industrial halls. This method which originally came from wood construction was then transferred into steel construction in the 30s. This system which once was very successful lost its influence after World War II.

Today one can see a timid renaissance. The main problems of calculation of the "weak" statically undetermined systems and the possibilities of absolute proofing are now solved. It can be supposed that roofs with great spans built with relatively thin pieces of boards would not be allowed nowadays. An example of such a construction is like the Convention Hall in Houston/ USA with a capacity of 20,000 spectators and a span of more than 40.00 meters.

The new ways of building with the traditional material wood quite met the architect's approvals during the modern age. Design, industrial manufacturing, and the low costs of production met the architect's demands.

The modern wooden girders were already manufactured in the great central workshops of the wood manufacturing enterprises. Then they were

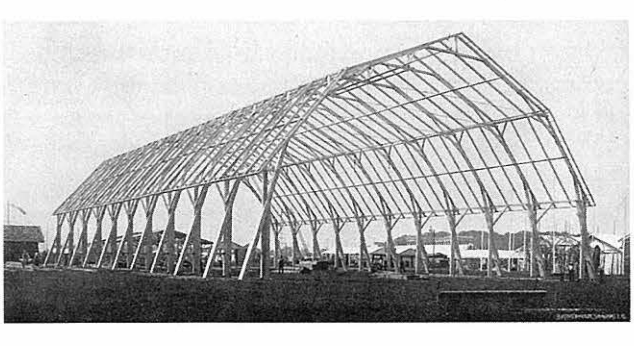


Fig. 24 and 25. Temporary system halls made out of wood trusses with fabric coating. Individual porches consisting of painted wood trusses and fabric lining.
Westdeutsche Kochkunstausstellung in Köln 1906.

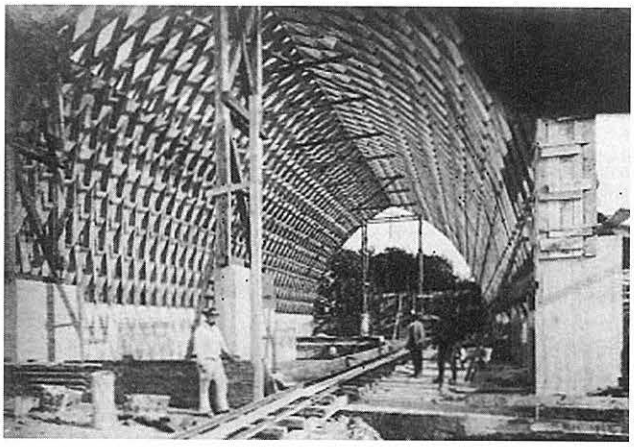


Fig. 26 . Barn building at the estate Garkau by Hugo Häring with a Zollinger construction, 1924/25.

transported to the construction site and erected by local workers under the supervision of selected and trained carpenter foremen.
Carl Kersten wrote in his "Lehrbuch des tragenden Holzbaus" in 1927:

> *"The necessity and workability of a wooden roof or hall girder which applied to modern age point of views mainly depends on the fulfillment of the following demands:*
>
> *1. To cut the working costs and the need of wood in the most possible way the sawn only has to be used in sizes which can be delivered and manufactured by the local sawmills.*
>
> *2. To reduce the problems with dem trimming the connection of the single bars has to be carried out simply and with care. Carpenter and engineer work has to complement each other.*
>
> *3. Before usage it has to be tested properly if the timbers are usable for meant purpose [...]; only skilled workers can used for the erection.*
>
> *4. If possible great girders have to be taken apart into small parts to make the girder pieces transportable and easy to move [...]"*

To conclude, the technical aspects like material, manufacturing, and installation are more often described than the architechnological design. Timber engineering not only includes technology but also the complete planing and organization; also without consideration of architects. Besides others, the main reason that some of the mentioned halls and roofs do not belong to the classic modern age or its predecessors is the lack of consideration of the development and achievement of modernity in the field of structural engineering and technology.

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*Translation into English: Tobias Burkhardt, Bremen*


Fig. 27. Design of a confirmation hall for the cemetery South-East in Magdeburg by Bruno Taut, 1922. The Zollinger roof was supposed to cover an oval and circular ground plan.

# Zollinger wooden constructions in Denmark and southern Sweden

In 1927 a new wooden construction was presented in "Kritisk Revy", a cultural magazine edited by Poul Henningsen, also known as PH the lightmaker. The engineer Eli Unmack wrote how new ways to calculate construction lines made wood "totally equal to iron and reinforced concrete". Minimal use of the material could be achieved by the use of prefabricated standardised units which, according to Unmack, even gave the Zollinger wooden lamella a leading position.
In Denmark and southern Sweden the system was thus in the late twenties and in the thirties applied as a construction system particularly for barn constructions, for instance Høvdinggaard in Denmark. Nevertheless, its most significant expression was probably the slender roof of the Nørrebro Station in Copenhagen designed by an architect called KT Seest for The City Train of the capital.
Later a steel construction, based on a similar system and developed by Junker in Dessau, also became a widely used roofing system in Denmark. Also this system was used for various types of buildings such as hangars, assembly halls and sport arenas. A beautiful example is the badminton hall of Gentofte, a municipality close to Copenhagen, which was designed by Arne Jacobsen in the thirties.

*Text by Ola Wedebrunn*

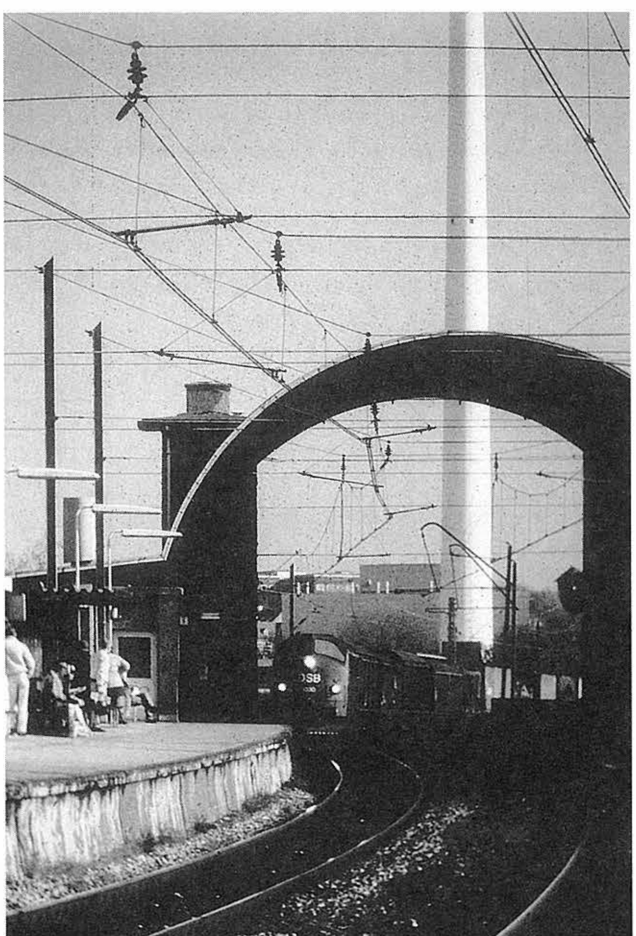


Fig. 1. As a spider a carpenter climbs the wooden net of the Zollinger construction at the barn by Høvdingsgaard in southern Zealand.

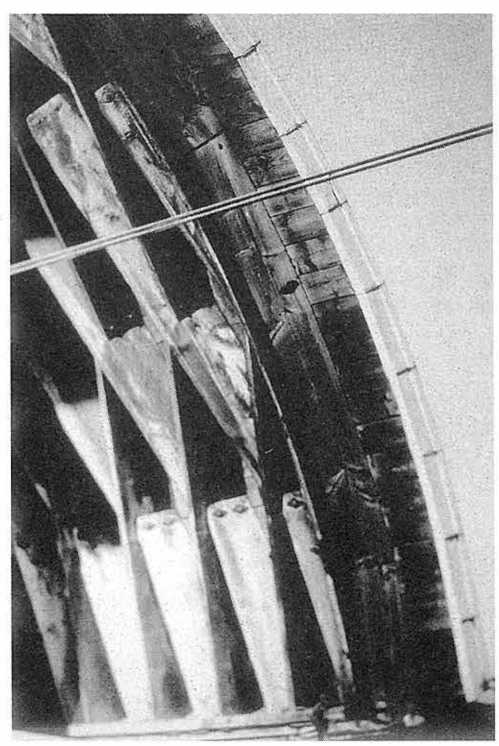


Fig. 2. Nørrebro Station designed by KT Seest with Zollinger wooden construction, covered with asphalt roof paper and the façade clad by green-coloured plaster.

# West Coast Regionalism

## An Overview of the Development of Wood Modernism in British Columbia

British Columbia's Lower Mainland region in and around Vancouver has a remarkable collection of wooden houses from the modern era. From the late 1930s to the mid 1960s, young architects launched their careers by designing modest, yet daring, houses for their young clients and their spectacular sites in the region. The buildings reflected the local materials and mild climate and took advantage of the experimental potential—and economy—inherent in local timber. This paper charts the development of West Coast wooden modernism from both an architectural and technological perspective, focussing on the evolution of the post and beam construction and its wide proliferation.

*by Donald Luxton*

### Introduction

> *British Columbia living is of a different kind... a Far West quality related to the entirely different geography and climate of this province.*
>
> ***Western Homes and Living**, August/September 1950, page 9.*

Wood has always been the favoured building material on Canada's west coast. From early times, when Native Indians developed a sophisticated wooden architecture, the abundant forests were harvested to provide shelter. With European settlement came a new way of building, based on traditional styles of architecture, but adapted for construction entirely in wood. Early colonial structures, such as fur-trading forts, mimicked European models, substituting wooden elements for masonry originals. The colonization of British Columbia began in earnest with the Gold Rush of the mid 1850s, but the local economy, based on resource extraction, remained unstable. Explosive growth from 1908 until 1913 was precipitated by a Western boom in mining, an expanding lumber industry, and optimism about the opening of the Panama Canal. This short-lived boom was followed by decades of decline, with the Great Depression brackeffed by two World Wars. The once sleepy coastal region grew explosively, with the development of large tracts of new housing based on a suburban model. Many new families from widely varied backgrounds moved 'to the coast,' either seeking new opportunities or retiring to a milder climate. Fuelling this migration was a rapidly expanding economy based on resource development. Returning veterans, a pent-up demand for cheap housing, the baby boom, ready availability of automobiles, and new consumer confidence all contributed to unprecedented growth.

The new residents shared a willingness to break with tradition, resulting in an unusually wide acceptance of contemporary styles of architecture. This was fertile ground for experimentation in design, and the quality of this new housing stock was surprisingly high. This new modernism was based on the use of natural materials, and sensitive integration with spectacular sites.

> *In the domestic field, British Columbia leads the other provinces.... They have proved to their clients present and future, by outward and inward visible signs, that the modern house is the only house for a modern family in British Columbia. Nowhere else in Canada has that proof been given.'*
>
> ***RAIC Journal**, #24, June 1947*

For approximately twenty five years, from 1945 to 1970, British Columbia was one of the centres of modernism in North America, and produced some of the greatest Canadian buildings of the time. The wide acceptance of modernism during this period resulted in a rich legacy of exceptional buildings, many now been acclaimed as masterpieces of design. This was fertile ground for experimentation, and contemporary West Coast architecture was recognized for its innovation, the use of natural materials, and the sensitive integration with spectacular sites. This elegant modernist vocabulary was ultimately distilled into a simplified vernacular, that was an intelligent response to the necessity of housing a rapidly growing population.

### Origins of the style

Many of the theories driving the development of the West Coast Style developed as part of the International Style, that originated in Europe following the mass destruction of traditional buildings and institutions in the First World War. North America, suffused with confidence after the war, and having escaped destruction on home soil, continued to build through the 1920s in a myriad of traditional period revival styles, with little reference to modernist theory. The situation changed with the Great Crash of 1929, when a new, grim economic reality set in. A crisis in public confidence triggered an exploration for new ways to build, with technology seen as a potential savior. International Style buildings embraced the progress of modern technology, and for the first time acknowledged a relationship with automobiles. Parallel to the theoretical development of this new modernism was the influence of the populist Art Deco movement, which started more as a system of ornamentation, but opened new possibilities in the move away from traditionalism. Ultimately North America embraced a blend of both styles in the Streamline Moderne (often called at the time modernistic), an architecture of geometry and volumetric expression. By the 1930s, the influence of the new modernism had reached British Columbia, especially Vancouver.

The impetus for this blossoming of modern design was concentrated in the hands of a few exceptional individuals, who formulated their own brilliant regional interpretations of the new modern idiom. These designers bravely introduced these new forms to British Columbia, influenced both by the International Style and by the domestic Bay Region Style of San Francisco, with its emphasis on natural materials. There was a conscious attempt to respond to local topography and climatic conditions, and an influx of extremely talented European designers, who moved here directly after the War, brought a fresh approach to regional design. This group of leading-edge designers, unquestionably the most talented in Canada at the time, were later referred to by Arthur Erickson as 'The Vancouver School.'

**Local designers** were strongly influenced both by the aesthetics of traditional Japanese architecture, and by the work of American architect Frank Lloyd Wright, often shamelessly imitating or adapting his designs. The Japanese influence was partly derived through the influence of Wright, and also through a recognition that the West Coast was no longer just an outpost of European culture, but was also part of the vast Pacific Rim. Wright's work was especially influential, both through his original influence on the International Style architects of Europe (his early work, published in Germany in 1910, was a touchstone of the style) and through his later residential work, beginning with a startling series of modernistic houses in the 1930s such as *Fallingwater*, and his later geometric and low cost housing models. His 'organic' architecture blended simple methods of structural framing and the use of natural materials with a formal, Japanese-inspired discipline and open floor plans. Wright's flowing use of space and inventive sculptural forms ultimately was more appealing to West Coast sensibilities than the hard edges of the International Style. This local wooden adaptation of the International Style came to be known as the West Coast Style. Whereas the International Style was primarily an aesthetic of steel and glass, the West Coast Style generally employed wooden post and beam structures, which allowed greater freedom in positioning of windows and partitions than standard stud construction.

Of these designers, possibly the greatest innovator was Charles Edward (Ned) Pratt, who maintained that 'these houses represent untiring efforts on the part of the architects to persuade the client into the contemporary frame of mind.' Pratt's interest was in the use of a strongly-expressed structure as an ordering element, which allowed the wall to be filled with modular windows and panels. Along with his associate Robert Alexander Dean Berwick, Pratt helped to revitalize the established firm of Sharp and Thompson after becoming partners in 1945, turning it into the leading exponent of the modern style in Canada. Their firm, Sharp & Thompson, Berwick, Pratt, acted as a training ground and launching pad for many of the most talented of the new generation of apprentice architects, including Ron Thom and Fred Thorton Hollingsworth. The internationally recognized career of Arthur Erickson was based to a large extent on his bold and contemporary residential designs. His work is not characterized by consistency of style but rather by a search for dramatic effects, and suggests an eclecticism based on the variety of global experience rather than a tightly defined doctrine. Erickson has described architecture as a hybrid discipline, that draws on all cultural experience, making the architect a social alchemist that transforms human aspirations into habitable space. Other notable proponents of the new modernism included Duncan McNab, CBK Van Norman, Peter Thornton, Harold Semmens, Douglas Simpson, Roy Jessiman and Donald Manning, who each made their individual contributions to the development of the West Coast Style.

**Peter Thornton, Ned Pratt, Robert Berwick and CBK Van Norman** all began their experimentation with modernism in the 1930s. Although Van Norman's commercial and institutional commissions were more daring, his residential work was based loosely on a 'Cape Cod cottage' style, that reflected a modernist sensibility but used historical details to promote an image of traditional domesticity. His best houses of this period freely combined American Colonial elements grafted onto modernistic forms. Without breaking free of tradition, he employed the clean line aesthetic that would pave the way for the introduction of the modern styles.

Thornton, Pratt and Berwick were more radical in their approach to housing, and fought with the Canada Mortgage and Housing Corporation for the approval of mortgages for houses with flat roofs; at the time the CMHC vetted all designs for which a mortgage was required, and had ruled that flat roofs, although safe, were not aesthetic. Thornton circumvented this by building his mother's West Vancouver house without a mortgage. This simple unornamented cubic form was well ahead of its time, and set a precedent for many to follow. Berwick's own house, built in West Vancouver in 1940, was more traditional in form, with low gable roofs and wood siding. The cellular massing, use of wood and stone, and the relationship with natural landscaping all point to a less intrusive style, based on vernacular cottages found throughout the region.

Local artist and teacher Bertram Charles Binning was also a pioneer builder of a flat-roofed house. Binning and Fred Amess led the 'Art in Living Group,' which encouraged discussion of the problems inherent in Vancouver's rapid expansion, and the importance of small house design. Pratt and Berwick were the associated architects for this striking building, designed and built in 1941–1942, and recently described as Canada's first modern house by the Historic Sites and Monuments Board of Canada. Throughout his career Binning showed a consistent interest in all facets of design, including his collaboration on the ornamentation of Thompson, Berwick & Pratt's landmark BC Electric Building, 1955-1957. Binning has now been recognized as one of the pioneering spirits of the modern movement on the West Coast. Binning helped to spread the style to British Columbia by inviting leading architects to lecture in Vancouver, among them the noted German architect Richard Neutra, who had settled in California, and visited Vancouver regularly in the 1940s and 1950s. Neutra demonstrated the possibility of a regional west coast expression, and spoke of the mysteries and realities of sites, and of houses that responded to local climate and light through the use of extended planes and surfaces, and reflections from glass and water.

**These ambitious modern buildings** were constructed in accordance with high-minded social ideas and ideals—this was to be the beginning of a new, modern way of life. The new School of Architecture opened at the University of British Columbia in 1946, with Fred Lasserre as first Director. A number of notable exhibitions promoting modern design were held at both the Vancouver Art Gallery and the Community Arts Council, most notably the latter's 'Design for Living' held in the Fall of 1949.

Ned Pratt was very interested in the provision of reasonably-designed low-cost housing. He introduced, and developed, the idea of post-and-beam construction, and experimented with a variety of ways in which to use it. Pratt accepted the industrial standards of construction, recognizing that it was less expensive to build in a modular fashion. The post-and-beam system employed larger scale lumber posts (generally 4"x4", 3"x8" or 4"x6") spaced from 4' to 12' apart, bridged by beams which supported the roof. The spaces between the beams were filled with wood and glass panels providing a rhythmic patterning of solids and voids. Interior partitions could be placed anywhere within this structural framework. The house was seen as a series of spatial experiences, with open rooms flowing freely together, and revealed at different levels in a intimate relationship with the surrounding landscape. Floors became floating platforms, which could be placed at varying heights. Post and beam construction was also much easier to adapt to difficult terrain than traditional architectural forms, requiring only footings rather than foundation walls; in some cases buildings were suspended or cantilevered over impossibly rocky sites.

**As plywood and other products** were available in 4 foot by 8 foot dimensions, this became the unit of design for his simple open plan houses. Pratt embraced the use of plywood, which afforded flexibility at an affordable cost. He worked closely with Bill Mar, head of research at the lumber company MacMillan Bloedel, to develop the experimental 'Silverwall' system of prefabricated plywood wall panels that could be used as infill cladding in post-and-beam structures. The first house that Pratt designed with a prefabricated panel cladding system was the Ritchie Residence, built in North Vancouver in 1950. The client, Emmett Ritchie, was no stranger to the industry; Pratt had previously designed an extravagant house in West Vancouver for his relative, lumber magnate William Brooks. Each exterior panel consisted of two sheets of plywood with insulation sandwiched between. It was a very economical form of construction, the cost for the building and the lot being about $10,000.

As this regional adaptation began to mature, certain common characteristics emerged. These local designs favoured open floor plans with extensive glazing and skylights, exposed timber structural members, and the extensive use of wood finishes, often stained rather than painted. Interior and exterior spaces were visually and physically integrated, and the final effect often relied heavily on the use of native trees and landscaping. Roofs were generally flat, but sometimes canted or lifted to allow banks of clerestory windows, which then illuminated the undersides of roof planes. The use of flat (or nearly flat) roofs also allowed the use of tar and gravel roofing, which mitigated against the steeply rising cost of cedar shingles. In sloping areas, the prime location was considered to be on the south (or lower) side of the street, allowing the parking and entry to face the road, while the open living areas faced, in privacy, towards the view. Pratt cited five specific local characteristics that determined the form of the new residential architecture in British Columbia:

1. **Rainfall:** Generous roof overhangs, especially on the east and north facades, protected windows and walls against rain and allowed outdoor access, and were more easily achievable with a flat roof. Pratt recommended 8 foot ceilings with 4 to 5 foot overhangs. On the south facade they also helped control the summer sun, while allowing for passive solar heating in winter, indicating an early awareness of energy conservation.
2. **Sunshine:** The extensive use of glazing was a fundamental feature, as it allowed the visual integration of the house into its surrounding landscape. Glass windows were beaded into

structural wood members, a form of construction that developed due to a shortage of steel during the war. The amount of glass was not necessarily increased, rather it was concentrated into wide areas facing the view and light, with blank walls where privacy was required.

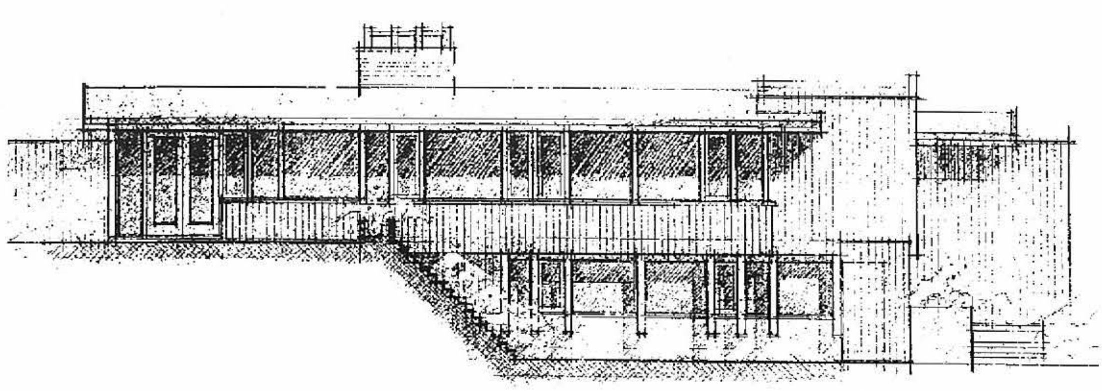
3. **View and Aspect:** As many of the building sites in the Lower Mainland have substantial views, the location of the house was considered critical. The facade that faced the street was considered unimportant and was often a blank wall, whereas those walls facing the view were mostly glazed. Privacy was the main consideration.
4. **Exterior Treatment:** Wood was the preferred cladding, as masonry was considered too expensive for most houses. Natural unpainted cedar boards or fir drop siding were recommended. Often the same materials would be used for both interior and exterior treatments, sometimes running through glass walls to blur the distinction between inside and outside and to extend the planes of the house.
5. **Plan:** The lack of interior partitions responded to a desire for openness, the freedom afforded by a flat roof, and the use of radiant heating in the floor slabs. Custom designed furniture was often built in, eliminating the need to integrate different styles and types of fittings. Cupboards were placed on castors to allow them to act as movable screens.

Other architects immediately grasped the potential of this new, simpler way to build. Ron Thom's own house, built in North Vancouver in 1952, was an amazing example of ingenuity and inventiveness. Two weeks after the slab was poured, the house was ready to be furnished. The walls and ceilings were assembled from prefabricated insulated panels, clad inside and out with plywood. These panels were 2 1/8" thick; a 1 1/2" frame was clad on the outside with 3/8" plywood, and on the interior with 1/4" ply; an aluminum sheet moisture barrier was bonded between the layers, and fibreglass insulation sandwiched between. The rigidity of these "stressed skin" panels allowed them to act as both structure and finish. Although the costs were slightly higher than those associated with a standard house ($8.50 per square foot instead of $8.00), Thom confidently predicted that the costs would reduce substantially with mass-production.

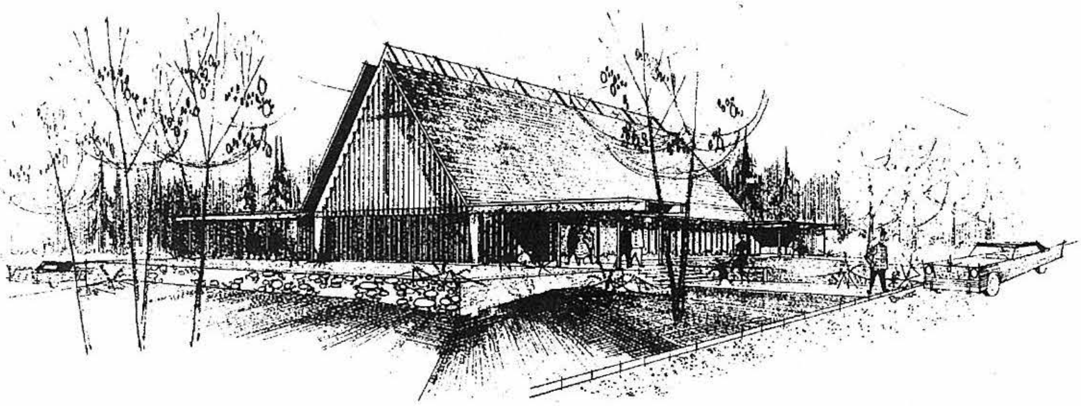
Much of the sheer inventiveness of the new modernism was based on a pervasive search for cheaper and easier ways to build. While they were both working for Thompson, Berwick & Pratt, Fred Hollingsworth and Ron Thom drove by a lumber yard, which had stacks of reject wood veneer doors on sale. Thom immediately grasped their potential as a modular building element, and began work on schemes that would incorporate them within a post-and-beam framework.

**Many of the sites available** for residential development on the mountain slopes were rocky and irregular, but provided spectacular views of the ocean or native forests. These sites demanded a sensitive response from these talented designers. In many cases these sites were considered 'unbuildable,' and demanded inventive new forms just to allow construction. This led to a new fascination with complicated geometric form and open-plan layouts, with rooms used for more than one purpose. Indigenous materials, such as heavy timber posts and beams, were used. Natural light was seen as one of the strongest form-givers for the new style, and extensive areas of glass were used both for view windows and skylights. The climate here is the most benign in Canada, and Eastern architects were jealous of the freedom to ignore the climatic restraints that they faced; the West Coast was seen as a land of opportunity, reflected in relaxed lifestyles and contemporary architectural expression.

Although it was being seen widely in residential designs, modernism was not restricted to houses. The modern idiom lent itself to a more informal and



Odlum Residence, West Vancouver. Thompson, Berwick & Pratt, Architects; Ron Thom, Designer, 1963 (Extant) [West Vancouver Municipal Plans]



St. David's United Church, West Vancouver. G.W. Peck; Thompson, Berwick & Pratt, Consulting Architects, 1958 (Extant) [West Vancouver Municipal Plans]

accessible venue for worship. Beginning in the 1950s, modern churches favoured an expressionistic aesthetic, with the roof becoming the dominant design feature. Structural design was derived from the solution of technical problems, especially the construction of large open span spaces conducive to revised liturgical procedures. Curiously these so-called structural necessities resulted in highly dramatic and emotive buildings, as evocative and mysterious as any traditional architectural forms. In retrospect, this indicated a movement away from a purely 'modern' sensibility, and provides a conscious return to formal, historicist tendencies.

Berwick was instrumental in setting a new direction for schools built after the war; on one trip to the interior of BC, Berwick brought back thirty new school commissions. He was committed to the concept of a modern design philosophy that stressed the egalitarian, rather than academic, nature of education; he promoted an appearance that was domestic in scale for the greater comfort of children, and convinced the Ministry of the wisdom of building for future expansion. Due to post-war population growth, these schools had to be constructed quickly, under stringent financial constraints. Located on large sites and built mostly of wood, these postwar schools provide a legacy of a time when fundamental new ideas provided the impetus for a new direction in architecture.

The emergence of this new architecture was watched with interest by the Massey Foundation, which sponsored every two years from 1953 to 1969 a series of design awards which recognized excellence of design and innovation in technology. British Columbia was always heavily represented in the awards. West Coast residences were considered exemplary because of their specific regional adaptation, absent in the other parts of the country.

In 1952 the Porter House in West Vancouver, by John Porter, and Ron Thom's Copp House in Vancouver both won Silver Medals. West Vancouver buildings won a disproportionate number of Massey Medals, considering the small size of the community. In 1964 alone, 8 West Vancouver buildings were placed among the 94 finalists, and won 4 of the 18 Massey medals for that year. In the period until 1971 Vancouver designers received a total of 31 Massey awards, as well as many other awards of design recognition.

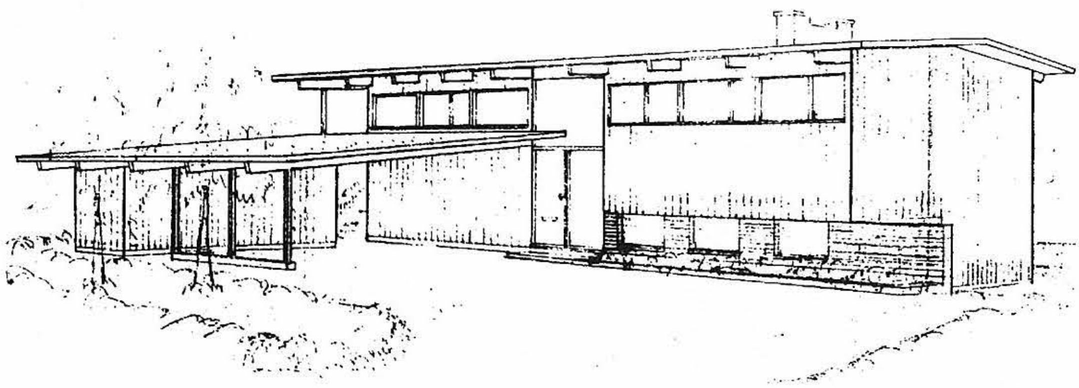
## British Columbia living

### 'Residential design philosophy of the 50s and 60s'

*The prevailing design philosophy of architecturally designed family homes in the 1950s to 60s was largely predicated by the disciplines of function and affordability. Not only did the house have to perform efficiently as a shelter in which to raise a family but it also had to be built within a very restricted budget.*

*The typical clients were a couple with a family on the way, both products of the depression and frugal war years, intent on obtaining maximum utility and livability from their restricted resources. Pretense or show was certainly not a high priority. The status symbol of the time was more likely having a large family than creating a showplace.*

*Convenience was essential. An efficient kitchen layout related closely to a dining table to accommodate the whole family was paramount. The bedrooms were sized to accommodate the bed(s), closet, dresser, and perhaps a desk top but no more. A second bathroom or a potential finished bathroom was considered pretty well essential. The one luxury was a fireplace which was the focus of the conversation circle in the living room—Family rooms and T.V. came later. The*



McBride Residence, West Vancouver. Donald M. Manning, Architect, 1960 (Extant) [West Vancouver Municipal Plans]

*outdoor patio or sundeck, preferably adjacent to the kitchen, was greatly appreciated as a bonus.*

*The form of the house besides being compact and cost efficient was to a large extent determined by topography and lifestyle. Typical basements were passé—giving way to two-level benchcuts, split levels or more expansive single-levels on floating foundation slabs. The expansive view was exploited by horizontal strip windows, sun controlled by wide low pitched eaves which in turn were often continued inward to form low-pitch loft ceilings on the upper floor levels.*

*Local building and landscape materials also characterized the architecture of the time. Rough cedar was inexpensive—particularly when stained and placed vertically. Rough broken site rock was frequently used for base walls. Beam and plank roof construction was cost effective. Indigenous conifer trees were retained and traditional lawns were complemented with local vine maples, salal, sword ferns, etc. All contributed to the expression of West Coast architecture.*

*The result was an honest reflection of the circumstances and the values of the people of the time.*

*Donald M Manning, 1993*

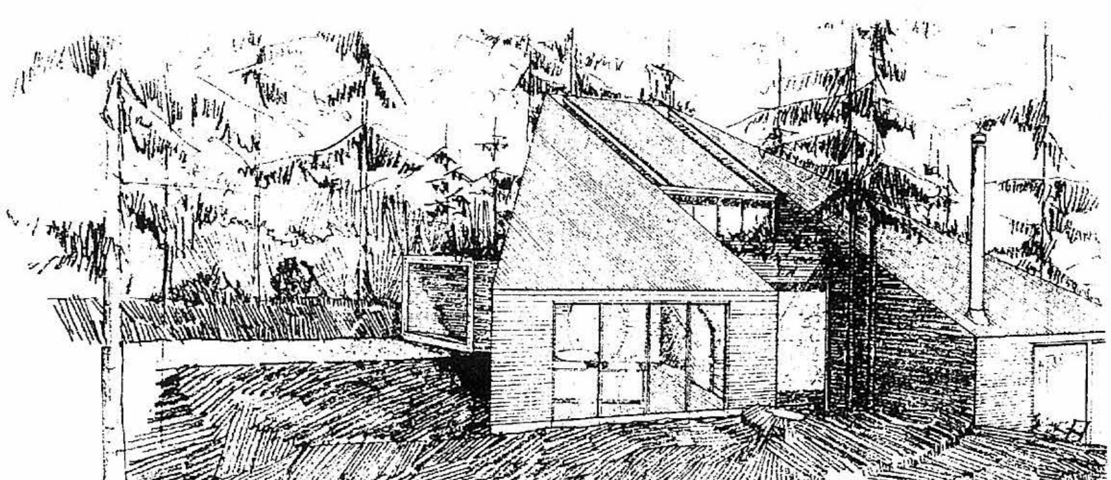
As the West Coast Style became more established, it appeared in simpler, less uncompromising versions, often designed by builders rather than architects. The polemical forms of modern architecture were softened and adapted for more general acceptance, through a blending with a more traditional domestic idiom.

One of the more distinctive characteristics of the postwar development was the opening of large tracts of land for suburban housing. These large tracts involved the construction of hundreds of individual buildings, often in repetitive plans with minor variations. These suburban developments were enormously popular, as they provided affordable housing for a rapidly expanding population. Part of this housing phenomenon was the rise of a number of design-build firms that promoted the new design philosophy. Although the houses produced by these firms were not always as sophisticated, some compare favourably with the best examples of the high-style architect designed buildings, and they often achieve a level of competence that is enviable. This regional style was identified in contemporary magazines, most especially *Western Homes & Living*, which commenced publication in 1950. West Coast homes were also heavily represented in *Canadian Homes & Gardens*.

These vernacular buildings are most often characterized by the use of a visible roof; if a flat roof was considered too radical, then a shed ('monocline') or low gable would be used. Contrasting wall materials and textures, such as wood, brick and stone, and irregular windows, were used to heighten visual interest. A garage or open carport was usually attached to one side, and exterior decks and terraces extended the available living area. Access to outdoor decks was provided through a 'French door,' as sliding glass doors were not yet available; these decks also provided easy access for cleaning the outsides of windows. Windows were almost invariably wooden sash casement, often used in clerestory bands, allowing light and ventilation but ensuring privacy, especially on facades that faced towards the street. Chimneys were often high slab-like structures of either stone or brick, that provided vertical emphasis, usually as a cross-axis to the main direction of the house. Kitchens were smaller, but featured built-in appliances and an adjacent 'family room' for children to play in. Master bedrooms featured ensuite bathrooms, and wall-to-wall carpets were installed in

The Segal Residence, North Vancouver, under construction. Designed and built by the Lewis Construction Company, 1957 (Demolished) [Courtesy Mary Segal]

the living room, dining room, halls and stairs. Plumbing fixtures were available in decorator pastel shades. Most were one storey in height, except for Split-Level or Ranch houses, in which the entrance area (with a 'cathedral ceiling') would lead down to the living area or up to the bedroom wing, usually with a downstairs or ground level 'rumpus-' or 'recreation room' with a fireplace for family play and entertaining.
Contractors also often acted as developers at this time, assembling sites and offering standard building plans. The most successful of the local design-build firms was the prolific Lewis Construction Company, which constructed hundreds of individual houses. Headed by Bob Lewis, their earlier buildings were mostly simple post and beam structures, a simple and attractive framing system that was, at the time, the easiest and least expensive way to build. Lewis homes were regularly published and recognized. The Penny House, located at 2745 Skilift Place (demolished in 1993) was chosen as the Chatelaine Magazine House of the year. In 1961 810 Margaree Place, built in six weeks at a cost of $6.50 per square foot, received the same honour. Other successful builders included Barraclough Homes, Gilbert Bradner, N.W. Hullah Ltd., Schumak & Riehl, Ted Poskitt, and Alex Browning, who spearheaded the 'Parade of Homes' showcase in 1956.



The Harbrink Residence, West Vancouver. Georg Koslowski, Architect, 1973 (extant)

## Later development: the West Coast vernacular

As the modern idiom became acceptable, it began to adapt to changing sensibilities and lifestyles. There was an increasing reliance on geometric manipulations and dramatic sloped roof forms. Many of these houses owe a debt to the work of Charles Moore, especially his Sea Ranch Condominium vacation houses (Sonoma County California; Moore, Lyndon, Turnbull, Whittaker architects, 1963–1965), which employed sloping roofs and natural wood siding on irregularly grouped structures set into a wild and untouched landscape.

Typically these vernacular houses were built on dramatic sloping lots, and often employed dramatic diagonals either in the roof line or through stepped massing following a steep slope. Unfinished vertical or diagonal cedar siding was often used, and allowed to weather naturally.

By the late 1960s, designers such as Kenneth Charow, inspired by the work of Charles Moore in California, brought to fruition an adaptation of this the regional style, which is referred to as the West Coast Vernacular.

## The preservation of modern heritage: a challenge

As local conditions changed, architecture developed in other directions. The early 1980s saw a revival in both authentic and invented 'heritage,' and the influence of post-modernism was pervasive. Stucco was adopted as the favoured cladding material, ultimately supplanting wood in most applications.

Many of these modern landmark wooden buildings are at risk for a number of reasons: rapidly increasing land value, lack of understanding of their significance, lack of maintenance, and inappropriate alterations have all taken their toll.

The value of these buildings lies not just in their age, but in what they represent through their design philosophy of an earlier era. Socially, historically and architecturally these buildings are of value in defining the development of our modern age.

Recently, and to an increasing extent, early modernist principles, with their emphasis on functionalism, simplicity and flexible planning are being re-examined as a source of design inspiration, and the West Coast Style continues to exert considerable influence on the architecture of today. It is now timely to reassess the development and impact of this regional West Coast architecture which flourished during the postwar period.

The municipalities in the Vancouver region have been very progressive in their understanding of the value of these buildings It is hoped that through increased awareness, there will be renewed interest in their preservation for future generations.

# Paradox of Modernity

## Why K. Knutsen's cottage in Portør is out of tradition

Together with Arne Korsmo (1900–1968), Knut Knutsen (1903–1969) is one of the pioneer of Modernism within Nordic Countries. Despite his fame and his important role in improving the use of *Wood in Modern Norwegian Architecture* (a sort of organic presence within the pragmatic Nordic Spirit), his own *Cottage at Portor*, a small place along the South East cost of Oslo Fjord, is one of the most innovative and revolutionary construction of post war years in Norway. Reading the lay-out of the plan, the absolutely *innovative typography* of it and unconventional use of wood, this small cottage shows Knutsen ability to go *over tradition*, without "crying" but with an intense masterpiece of quite and "natural" architecture.

*by Gennaro Postiglione*

### Built form and cultural values

Studies which examine the forms and uses of a domestic interior in primitive architecture, utilising archeology, anthropology and behavioral analyses, single out a number of factors which contribute to determining the architectural work. Climate and topography represent the specific and unalterable geographic qualities of a place, and exercise a remarkable influence over primitive settlements in that the constructed form is greatly conditioned by its surroundings. Accessible materials, level of technology possessed and economic resources constitute the changeable aspects of this, and time can make them independent from the place in terms of the evolution that a culture can have, with respect to knowledge and economy. And finally, social activities and customs single out the cultural aspects which are, like the previous ones, dependent on both place and time.

The result is a very ecological piece of architecture. Financial resources are scant as is technical knowledge and this makes necessary for the constructors/inhabitants to integrate into the environmental system in which they settle with great caution and respect, taking advantage of all its physical potential. The materials are local and the technologies are those which, in economic terms, best combine the characteristics of the site with available resources and knowledge, upholding the theory of an existing macro echo-system in which everything is relative and each gesture is integrated, triggering off a chain or other events.

In the course of time, man has instead developed a self-awareness and has thus been able to free himself from conforming slavishly to such a system. Taking advantage of accumulated knowledge and riches, he has been able to intervene and modify, to his liking, those invariant factors which were the basis of organising a construction in primitive settlements.

As a consequence, cultural aspects have not just got the upper hand over organisation and the use of space, but have transformed the links between the other factors involved in creating an abode, upsetting formal balance. The unconditional exploitation of resources has gradually come about and this in turn has led to the breakdown of man-nature relations, forcing man to totally reconsider disposition since he is now aware that the fate of the Earth system undeniably involves his fate also.

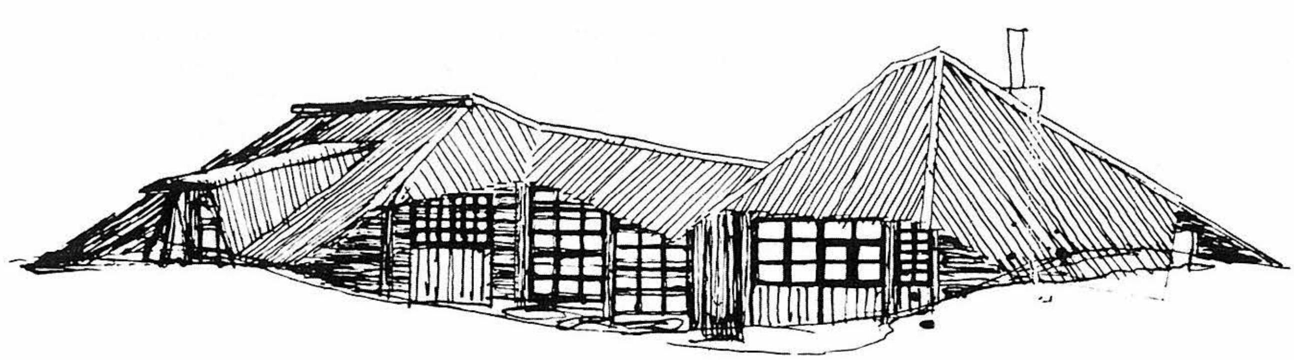


Fig. 1a. Roof sketch.

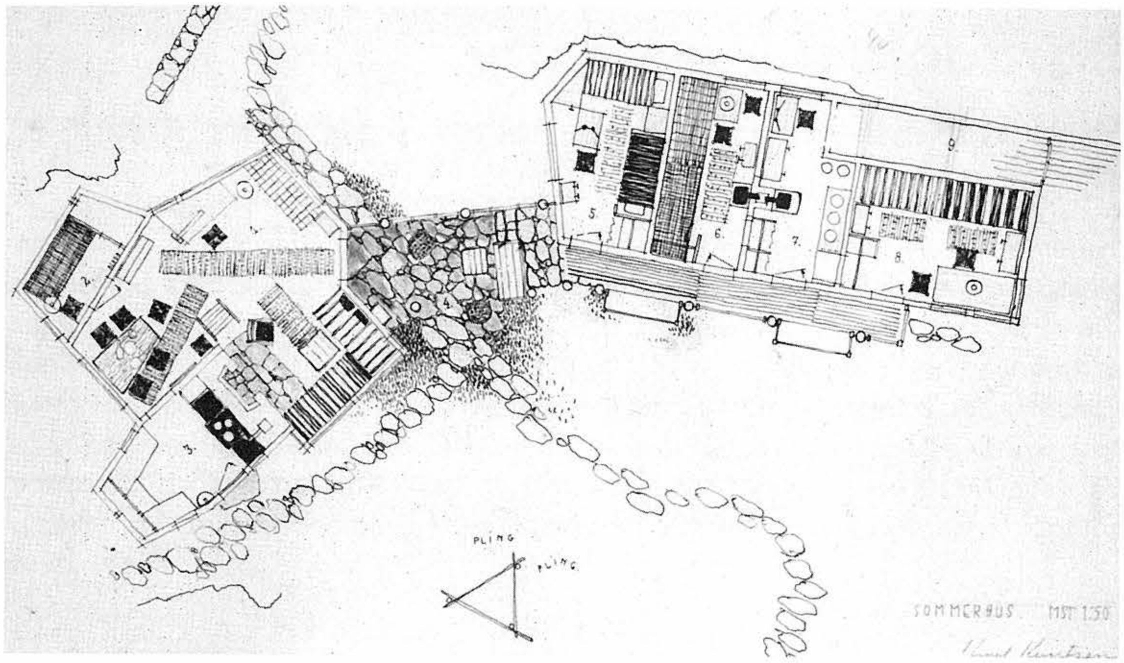


Fig. 1b. Plan with the furniture.

## Modernity vs Tradition

In architecture, the term *tradition* is often used as the opposite of *modern*: hence forms of expression aimed at representing the permanence of the values of the past are defined as traditional, while those aimed at a substantial renewal of the principles of built form are defined as modern.

And yet the term *tradition* derives from *traditio*, which means "handing down", "teaching", or "narration" and which—especially in the sense of "handing down"—implies the passage of a series of cultural data from one generation to the next through a process of *conservation and innovation* in which, in different ways, the various possibilities of the inclusion of the past in the present are achieved. The element of "movement" which is inherent in the concept of tradition means that we must immediately throw out the preconception that the term means something stable and remote, something far-off in time, fixed and therefore already "past". Being a continually changing and evolving cultural *humus*, on the other hand, implies that the principles that pervade the traditional roots of a country remain alive in the present, and that looking at this accumulation of the genetic data of one's own culture does not involve a retrograde restoration of phenomena whose creative force has faded, which have had their day: it means, rather, planning the future on the basis of complex and profound knowledge.

Thus, by contrast, the concept of "revolution" becomes the key to the understanding of the role of tradition: by revolution, in fact, we mean the upheavals that radically alter the development of the history of a given aspect of society.

In architecture, the presence of tradition can involve a whole range of aspects, and it is precisely the choice to set aside some of them in favour of others that it can construct the revolutionary moments mentioned above: the modification of the roles of the data belonging to tradition produces events that are, to a greater or lesser extent, innovative.

The fact that an architectonic object belongs to the system of consolidated and recognised values can be seen mainly in the construction features and in the specific technological scope, that is in the use and the manipulation of building materials right up to the definition of the details produced by craftsmen. In this sense the language expressed by the wise use of these technical notions becomes a form of architecture and of its single components, usually offering itself as an irreplaceable repertoire of formal outcomes with which to underline some meanings of the construction.

One of the main reasons that drives architecture to look to tradition is the knowledge and the interpretation of functions that have given rise over time to typological frameworks and forms of the inhabited shell linked to their use and to the system of their "staging". The typological system, in its most advanced meaning, has managed to reconstruct the relationship between the form of space, the use made of it and the psychological influences that man—the final protagonist of these areas—undergoes and suggests to his fellows. By extension, this concept also influences the way in which the architectonic object relates to its surrounding, to the place in which it is located, which brings about attitudes and consolidated possibilities on the basis of influences formed over time in the relationship between architecture and nature, between the interpretation of the place and the construction of the sense of the city. On the basis of these considerations, we should reconsider the supposed contrast between modern and traditional—an opposition that critics have also

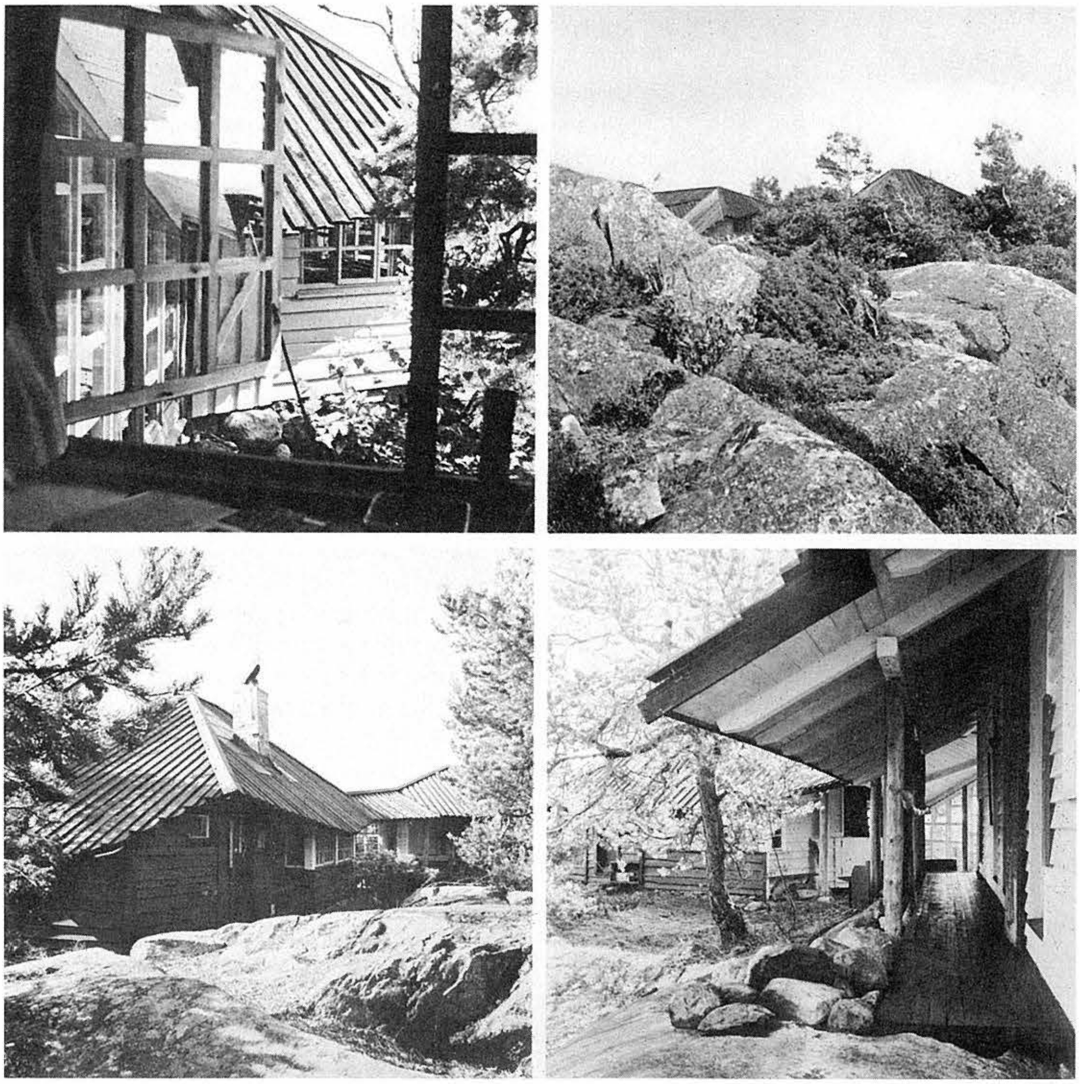


Fig. 2. Views of the exterior.

seen in the works of Korsmo and Knutsen, two Norwegian masters of Modern Movement: Korsmo, the constructor and refined originator of fragments of language that clearly exemplify all the tensions expressed by the "modernist" wing, actually bases his works on a careful—and very personal—reinterpretation of inhabited structures and spatial arrangements that derive directly from the most deeply-rooted aspects of the Nordic tradition. On the other hand Knutsen, too often labelled as the highest expression of the traditional romantic culture, although using technologies and materials known to the building capacities of his people, reinterprets the organisation of the interior space of architecture, and above all redefines, in an organic, integral manner, the relationship between artifice and nature, between nature planned by man and "natural" landscape.

## Knut Knutsen's cottage in Portør

Set deep among the rocks, almost invisible, the Knutsen cottage in Portør can only be reached by those who know the place. In addition to the difficulty of finding transport to reach the peninsula on which the house stands, there is also the fact that there are no modifications of the site to guide the visitor. A few "reconnaissance marks", handed down orally, are the only trace that allows us to discover it, a place "known" to a select few. A bridge formed of a simple wooden plank and a small hut for the WC reassure me that I have come to the right place.

The first impression is of the appropriateness of the house to the site: planned to be used only during the summer months, it seems to seek shelter from the wind between the rocks, but without defacing or upsetting the natural landscape, which is very picturesque and much loved by the local people for the uniquely gentle passage from land to sea.

The layout is strongly influenced by and adapts to the orography of the site, separating the two functional areas (living/sleeping) into which the house is divided in order to follow the lay of the land: the element that unites the two parts (the veranda) thus becomes the fulcrum of the house, the hinge between the two living areas and the filter between the natural landscape and the artificial landscape, between the interior and the exterior. The veranda, in fact, opens towards the natural landscape, offering a fine view: sheltered from the wind and furnished with a few permanent

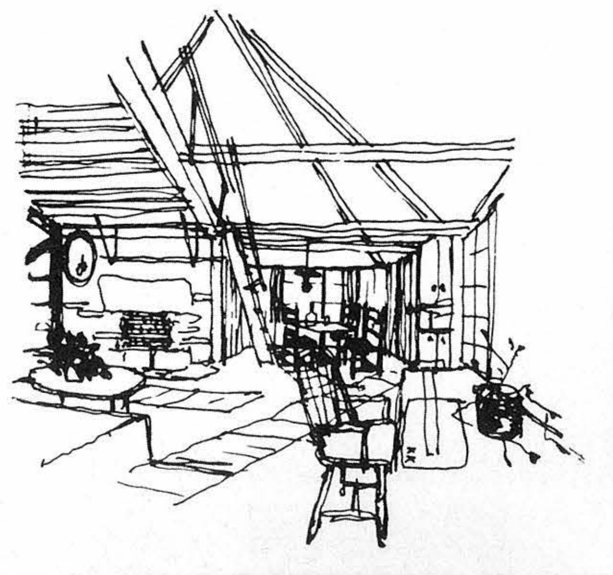


Fig. 3. Sketch of the living room (stue).

fixtures, it makes for a comfortable and pleasant pause. It is here that the entrance to the house is situated, or rather the double entrance: to the living area, characterised by a very compact polygonal plan, and to the sleeping area, characterised by a longitudinal development with a long pergola-gallery that leads to the various bedrooms. One almost has the sensation that the two "bodies" were separated following tellurian movements of the land, and that the veranda area was generated as a result of these movements.

The use of divided lines that characterises that external perimeter of the house simulates and stimulates perceptively the sense of the rotation and movement of the various parts. The construction is of traditional type, and uses the natural presence of the rocks as its foundation, while the constructive typology, linked to the technology of wood, is only apparently in keeping with local building methods. The roof, formed of layers, is reminiscent of the helmets of Oriental warriors, especially if we observe the west side, where the contrast between the building and the height of the rocks is greatest: here the top of the roof, with the small windows of the bedrooms and the colour-play of the various shades of the wood, gives the form a dynamic appearance, to the extent that it seems on the point of rising through the trees.

The interior of the living-room develops around a wooden staircase that links the ground-floor area with the attic: in a sketch of the plan we can see how Knutsen's initial idea was to have a continuous space with two levels, in which the staircase plays a fundamental compositive and distributive role. However, the only trace of this idea is the presence of the staircase, since the space under the roof was never recovered for use as a living-area. The living-room is organised as a single, continuous space in wood, where only the stone block of the fireplace, imposing in its physicality, separates the sitting area from the dining area. Apart from this, our gaze seems to be projected towards the outside, always in perspectives that are never closed, due to the way in which the architect has designed the corners, which are all obtuse (the only right-angle corners are "annulled" by the presence of the windows). This gives the space a continuous sense of openness, since there are no categorical closures of perspective; it also gives the composition a dynamic sense, characterised by a powerful centrifugal force.

Although there are no permanent physical divisions of the space, we can sense Knutsen's desire to distinguish between the various areas, giving each single place, or even each single point, different qualities and potential uses. Small details reveal the architect's sensibility in designing a space in which every corner should be lived in, which is consequently full of variety. The functions are transformed into activities, which in turn become "significant places", fashioned within the single space with consummate mastery. This attitude is rooted in the tradition of Norwegian house design, where the domestic space, the house, is understood as a great tool necessary to build the psycho-physical well-being of each of the inhabitants.

**The main area of the living-room** is flanked by the two small areas that house the bathroom, the kitchen and the storeroom, which seem almost to be juxtapositions onto the main volume of the house, elements of completion which are necessary but not indispensable. In order to reach the sleeping area from the veranda, we have to climb a few steps, made necessary by the different levels of the rocks on the site of the building, which are absorbed within the general composition in order to highlight the entrance to the more private part of the house. A further filter that helps to extend the "threshold" between the veranda and the sleeping area is formed of the gallery leading to the bedrooms, marking the confine between inside and outside. The gallery gives shelter and protection, but also allows contact with the open air, thus underlining the desire for symbiosis between natural and constructed elements, an ancient theme of architecture which is also found, though in different forms, in the Mediterranean tradition. The rooms are essential in their simplicity, and convey the sense of evolution undergone by the house: this part, in fact, has been extended in length over the years to meet the changing requirements of the inhabitants, exactly as if it were a living organism.

Everything seems natural and organic, and the irregular, though rigorous geometry of the composition hides the "secret" of the search for appropriate form (appropriate to the aims, the places, and the meanings), according to methods and typologies that tradition hands down and modifies, perfecting them through tiny variations.

The summer house in Portør was built in 1949 and it is considered by critics to be Knutsen's masterpiece. In reality, it represents only a part of the architect's desire to experiment with materials, technologies and languages. If we glance through his works, we notice that in the constant rigour of his attitude towards construction he is not afraid to experiment with the stimuli from the culture—in the widest sense of the term—of his time. The small holiday house, considered almost as a tribute to the heavy weight of the Nordic tradition, contains the essence of the most important stimuli for a part of his research, both in terms of the relationship with the past and of the desire for innovation. Here the principles, especially the formal principles, of the Norwegian house are not treated as unchangeable: both the volumes and the internal space, as well as the relationship with the site, prove to be a free re-reading of the principles—and not the products—of the model of the Nordic home; the only direct contact is found in the material—wood—used, however, in a different way.

**The house is thus much more modern** and revolutionary than it actually appears to be: the spatial arrangement of the traditional house is not reproduced in a servile manner, and compared to the more introverted layout of the *stue* (4), Knutsen's house is arranged with a series of spaces in sequence—some open and some closed—linked in a direct manner and mediated only by the formal characteristics of the encasement, by the light from the outside and by the shape of the roof. In particular, the paths unwind freely creating original, unprecedented possibilities of distribution. The house also relates to the surrounding nature, gathering in its meanings and making them its own, thus renouncing the imposition of an abstract scheme able to give order—and therefore a rule—to nature itself: nature, in fact, suggests new modes of aggregation that alter any pre-constituted typology. Thus the house loses the severity of the more regular layout of farms and rural houses, and becomes the interpretation of the logic underlying the lay of the land. The house is wholly organic, in the sense that like a natural organism it seeks its own identity by exploiting as far as possible the traces already present on the site. Knutsen's work, therefore, does not represent the traditional art of building, but re-proposes in a simple, natural way some of the archaic attitudes of the people who, in their time, had produced such models. He does not imitate the forms or patterns of tradition, but sets out—in a traditional way—to "feel" the relationship with nature and with the history of man; an attitude which, if we like, is the main characteristic of the Nordic spirit, and which leads the architect to construct new forms and contents that are, however, perfectly in line with the experience of the past. In some of Knutsen's writings we can also see a clear eulogy of the individual—the absolute opposite of any form of standardisation—which in this case, too, corresponds to a typical feature of the Nordic spirit, contradicted only in practice by an excessive repetition of forms and patterns of building due to the purity and reproducibility of the compositional choices made over time.

*Translation by Sara Marinelli*

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4. In Norwegian *stue* means living-room; the simplest traditional dwelling, in which the house is formed of only one room. It is also possible to use the word *stue* to refer to a house in general. As in English and other Germanic languages, Norwegian has two words to define the place where we live: *hus* and *hjem*, corresponding to the English *house* and *home*. *Hus* is used to identify the abstract three-dimensional phenomenon of the construction and has a prevalently objective character, as it does not establish any relation with the inhabitants. *Hjem*, on the other hand, not only defines the physical phenomenon, referring in particular to the inside, but is also related to the psychological aspect of living, assuming a prevalently subjective value and establishing a strong emotional and affective relation with the inhabitants. See: Berg A,, "Norske gardstun", Oslo, 1968; Bugge G., Norberg-Schulz C., "Stav og laft", Oslo, 1969; Christiansen A.L., "Den Norske biggeskikken", Oslo, 1986; Rybczynski W., "Home. A Short History of an Idea", Harmondsworth 1987.

# From Corner-Timbered Log Wall to Light-Frame Structures

## Finnish Wood Structures In The Early 1900s

The Garden City movement and the idealism of living in detached one-family houses at the beginning of the 1900s created a new market for wood as a building material. Wood was an inexpensive raw material in Finland but there was, however, a need to develop new low-cost constructions for the needs of the middle and working classes: the traditional hewn corner-timbered log technique was labour-intensive as well as wasteful as far as material consumption was concerned. Public interest within the construction industry focused on rationalising the use of wood as a building material in the 1910s and 1920s. For this purpose structures based on the use of sawn timber were developed. The air-insulated stud frame was on trial mainly in the second decade of the 20th century. Different horizontal and vertical wooden structures made of solid timber were tested especially at the turn of 1920. In the early 1920s the light stud frame insulated with filling material proved to be the most cost-efficient and warmest structure and soon this construction established itself as the primary alternative for the corner-timbered log house. Thus modern constructions can be said to have originated in Finnish wood architecture before modernism, that is functionalism.

*by Timo Jeskanen*

**Wood as a building material**
When people want to build an inexpensive wooden house that can be lived in throughout the year, the frame is erected using 2" x 4–6"studs and filling the space between the studs with insulating material. A hundred years ago the structure was, however, unknown in our country and very rare before the 1920s. In this article I will discuss the factors that lead to the popularity of this kind of a light frame structure.

With the urbanisation wood was becoming a secondary material at the turn of the 20th century. It was considered a fire risk and a material prone to dry rot. Furthermore the buildings grew in size which structurally favoured stone.[1]

Wood was, however, superior to brick—not to mention natural stone or iron—when material and labour costs were considered. Thus wood was the main building material in small towns and the countryside in spite of the esteem that stone houses enjoyed. Wood was also used in the outskirts of towns when people could not afford stone. It was a natural material in warehouses, shelters and provisional buildings. In some building types, such as pavilions in parks, casinos and summer houses, wood was even regarded as an essential part of their character.

In the 19th century practically all wooden houses with fireplaces and stoves were built out of logs hewed by hand. New wood structures were experimented on mainly in summer restaurants and theatres as well as provisional buildings, such as exhibition pavilions. For example the pavilion for the first Finnish industrial fair in 1876—designed by Theodor Höijer—was erected in Kaivopuisto in Helsinki with a massive timber-framed structure. The square central hall measured almost 40 metres on each side and a lantern with a diameter of 24 metres towered above it.[2] It would have been quite an effort to hew this provisional building, comprising altogether thousands of square metres, of logs in the traditional way.

Permanent public and commercial buildings intended for use even in the winter were more and more often built out of stone, but even when wood was used, the traditional log frame was relied on. Good examples of this are the railway stations. Before 1920 they were built of wood with a few exceptions. Using type plans in the projects of the State Railways became systematic as early as the 1870s but this did not lead to any constructional innovations, instead it was recommended that the stations should be built of hand-hewed logs even as late as in the 1930s.[3]

**The log wall** was long in use also in schools. Particularly country schools were built traditionally using the local workforce. Also cooperative shops relied on the corner-timbered log wall. In a model work description made by Elias Paalanen in 1916 the walls were advised to be built of hewed six-inch logs. If old and dry wood was available, the logs could be erected vertically. Cold stores could be built using a timber frame, but if logs could be purchased for a reasonable price and a strong store was desired, the corner-timbered log wall was the right choice.[4]

For a long time the use of wood was developed mainly in building residential buildings. The urbanisation that started at the end of the 19th century gave rise to a controversial anti-urbanisation movement already at the turn of the century. This would prove decisive for wood being used as a building material. With this I refer to the Garden City movement and single-family housing as ideals in Finland. Fire regulations restricted the number of storeys in wooden buildings to two but they were, nevertheless, well suited for suburban building.

At first the Garden City movement only affected the upper and middle classes. But already in the 1910s the detached one-family house or houses for three or four families at the most became the form of housing sought after also by the working class. This gave rise to a demand for inexpensive types of houses. Wood was the cheapest building material and at this point an interest in developing new wooden structures developed.

**The traditional corner-timbered log wall** was hewed of logs by hand into a six-inch wall which was generally lined with paper on both sides and boarded from the outside. It was by no means considered a bad construction, but the motivation for finding new constructions was economical. When construction increasingly became a business together with the industrialisation and urbanisation, consumption of material and amount of labour needed became decisive factors.

The turn of 1910 was a time of strong economical growth. The prices of properties and flats as well as rents rose rapidly and thus the demand for cost-efficiency was emphasised in construction. The growth levelled out as early as 1913 and began to decline gradually until the World War caused a sharp fall in demand. A ten-year depression began and it was only in 1925 when the housing production in towns and cities rose to the level of 1912.[5] During the period of shortage and rationing that came with the World War minimising building costs became even more important than earlier.

Before Finland gained its independence in 1917, the society took almost no part in the housing production. Instead, after the war, when the shortage of housing was great and the private construction business was still in depression, municipalities and non-profit housing estates commissioned a remarkable part of the building projects. The state also played an important part as financier. When building on a large scale, the work was rationalised and thus there was a good opportunity for cost savings. Prominent developers of wooden structures were also industrial enterprises that had houses built for their workers to ensure the hiring of skilled labour.

In the construction circles the general attention was focused on rationalism from the early 1910s to the economic upswing that started in the mid 1920s. In Finland modern rationalism in the building sector can be said to have evolved before functionalism, the so called modern style.

Lowering the building costs was striven at in many ways. In the early decades of the 20th century wooden structures with lower material costs and more economic techniques were developed. In addition to that general interest focused on standardising both building parts and the design of buildings for mass production. The goal was also to develop systematic management on the building sites. In my article I will concentrate on the first and the most central area, that is, load-bearing structures.

## New construction systems

In developing wood structures rationalising was sought with structural systems that were based on machine dressing. Since the 1870s as steam saws became more common, sawn goods were utilised not only in sheathing but in load-bearing structures as well. When a log is sawn instead of hewed, both time and wood is saved. Furthermore, it is more economical to saw the log so that the cross-section is rectangular and then erect the frame so that the greater measure of the cut surface is parallel to the greatest load. By using spars, planks and studs optimally dimensioned with regard to the forces impacting the structures, the total amount of wood material needed can be minimised.

As late as the early 1900s five to six-inch wood was generally used for frame structures. In Gustaf Asp's guide on wood structures, which was published in 1903, the smallest cutting dimension in the joist table is 10 x 20 cm and the biggest 24 x 33 cm. Corresponding dimensions for rafters were 10x 10 cm and 15 x 15 cm.[6] From these dimensions the sizes of timber diminished as thinner structures became more common also in building the wall frames. The condition for using studs and boards was the change in jointing technique: the thin wooden material was not suitable for notching, instead nails had to be used for fastening.

The light frame structure made of sawn timber with a rectangular cross section and erected using nails was not a self-evident aim whose becoming more common was hindered only by practical reasons such as lack of skill. On the contrary, the light frame structure was long regarded with suspicion and it was considered to be suitable only for building summer houses, just like the timber framework of the 19th century.

## Solid vertical and horizontal timber walls

Before the light frame structure I will deal with two other types of constructions that were noteworthy alternatives in the 1910–1920s; that is, horizontal and vertical structures built of solid wood.

Building walls out of sawn timber was not unknown in the 1800s. It was, for example, taught right from the beginning at so called industrial schools where building engineers were educated.[7] The use of sawn logs and especially wall material thinner than logs was, however, uncommon at the beginning of the century. According to M. Edvin Udd, building

EXTERIOR WALL:

COVERING BATTEN
VERTICAL BOARD
TARRED PAPERBOARD
SAWN TO LOG
5 ½ " X 6-9"
PAPERBOARD

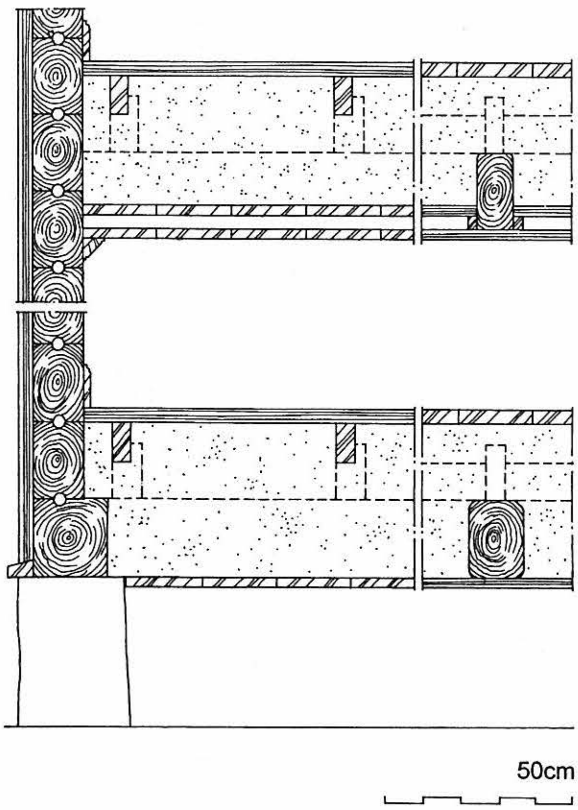


Figure 1. Joint of exterior wall to floor and intermediate floor structures in an two-storey house built in Tampere 1920-21. Vertical section 1/20.

COVERING BATTEN
VERTICAL BOARD
TARRED PAPERBOARD
VERTICAL FRAME 4" X 5" +
HORIZONTAL TIMBER 4"

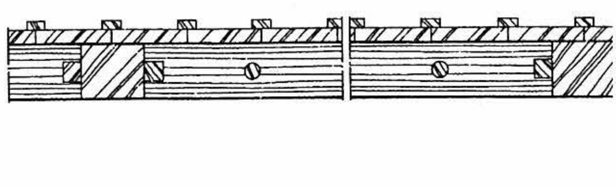

Figure 2. Exterior wall structure developed for the Puu-Käpylä area in Helsinki. Horizontal section 1/20.

engineer, five to six-inch logs were 50 per cent more expensive when sawn instead of hand-hewed in 1915.[8] During the World War the price of labour went up and so did the price of sawn timber. No cost savings could be made until the whole construction business was rationalised.

In Tampere in 1920–1921 the non-profit building council had residential houses built out of logs that were ready sawn on four sides. (Fig. 1) These logs were almost 15 cm thick in the exterior walls and 11.5 cm in the partition walls. On the building site the outer angle of the upper surface was bevelled to direct the rainwater away. In addition a semicircular hole was planed in the middle of the gaps between the blocks into which a rope twined of fibre was placed. The walls were further chinked in the ordinary way on both sides after which they were papered and finished with vertical panelling on the outside.[9]

The best known example of rationalised building of solid wood is the residential area of Puu-Käpylä (Wood-Käpylä) in Helsinki which was built in the early 1920s. (Fig. 2) In Käpylä the builders decided to use 10-cm horizontal logs which were eased between vertical studs. At the ends of the logs there were grooves which supported themselves on the tongues of the vertical frame and the wall surfaces between the windows were fastened to each other with flat iron. The surfaces that were attached with wooden pegs were furthermore chinked and sheathed in the same way as in Tampere.[10]

The argument that using sawn timber cost less was justified by claiming that since the input needed from the carpenters was smaller, more low-cost unskilled workmen could be used. Erecting the houses was fast and during a period of high interest rates the savings in building time were important. Furthermore, boards, firewood and saw dust were obtained as side-products when sawing logs. Both in Tampere and Helsinki centralised site management, standardised wood products, windows and doors purchased in big lots were used.

In Helsinki remarkable savings were made but not in Tampere. The main reason for this was thought to be

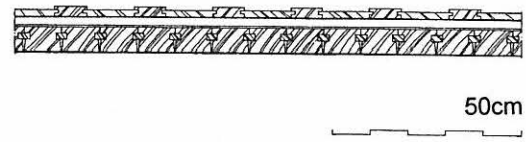


Figure 3. Structure of exterior wall in Varjakka, Oulunsalo, early 1920s. Horizontal section 1/20.

the inefficient organisation, but also the technical solutions used were thought to be relevant. For example the wall structure used in Tampere was nearly as thick as in the traditional corner-timbered log wall and thus did not save raw material to a great extent.

However dry the timber used for hewing the traditional log wall, the gaps between the blocks always yield owing to the weight from above and consequently the whole structure settles. On the other hand, the compression strength of wood is multiple in the direction of the grain compared to the cross-directional strength. Thus building walls of adjoining vertical timber was experimented on as early as the 19th century. The vertical structure was particularly practical when extending an old settled log frame, since then building a uniform ceiling and roof extending over the whole building was not problematic.

**Even if a vertical log wall** does not sink, it is still important that the timber used is dry, as the overhead weight does not compress the structure as in the corner-timbered log wall. If the wood shrinks considerably, the fillings drop from the seams and the wall is no longer airtight. Joinery shops sold dried timber but good logs were also available from torn-down houses; these logs were then sawn into the correct dimensions.

It seems that the vertical log wall was at its height of popularity around 1910 when the structure was used eg in the garden cities, such as Kulosaari, surrounding Helsinki. Vertical logs were used by architects as well as building engineers in the countryside.

Since the building did not settle when erected of vertical logs, it could be finished very quickly. The amount of timber needed was, however, almost as large as when the traditional corner-timbered structure was used. Consequently, at the turn of the 1920s trials were made using thinner planks for the vertical structure. The tongued and grooved vertical plank structure had been developed in Sweden at the end of the 1800s and it was still much used in the country as late as after World War II. In Finland the structure became known at the beginning of the 1900s but it was only twenty years later that it was experimented on.

One of the architects recommending the vertical plank structure was Harald Andersin who designed several buildings for the needs of the sawmill community in Varjakka in Oulunsalo in the early 1920s. In Varjakka the production facilities themselves had a framework but all other buildings had plank walls: the offices, residential buildings with their partition walls, outhouses and even the hose tower of the fire station.[11] (Fig. 3)

The wood was sawn and dried before building. Planks joined with loose tongues and grooves measured 2 1/2 x 4 inches and they were put together into finished elements horizontally. The roof trusses were assembled similarly. Horizontal binders were installed above and below the windows. The wall elements were erected on a sill and were joined from the top with horizontal runners. The floor joists were joined in grooves made beforehand. After this building paper was used for lining, the roof was made and the doors and windows with glasses installed were put in place. The exterior was finished with horizontal battens, tarred paperboard and tongued and grooved vertical panelling. The lining paper in the interior walls was wallpapered.[12]

The houses with solid plank walls did not always prove to be inexpensive because special sawn goods was costly. The City of Tampere had both four- and sixteen-family houses built in 1918–1919; the houses were made of 3 x 8- to 9-inch tongued and grooved vertical planks but no considerable cost saving was achieved. Additionally the houses were criticised for being draughty because the joints of the relatively wide planks opened up on drying so that the chinking material came out. Thus the City of Tampere gave up using vertical plank walls altogether.[13]

All in all the structure remained uncommon. It became current again only at the beginning of the 1940s after the so called Winter War against the Soviet Union when Sweden donated more than 2000 prefabricated houses. These vertical plank wall houses were erected in 75 different municipalities in Finland.[14]

## Massive timber-framed structures

In the 19th century framework buildings were generally made of spars that had a square cross-section and a thickness of five to six inches. The structure was reinforced with diagonal braces and the joints were made by notching and pegging and using steel fastening. Also nails were used, the longest of which measured up to 30 cm. Generally the frame was panelled but the spaces between the posts could also be laid of bricks in the Central European fashion.

In Finland the massive timber frame was mainly used in cold buildings such as stores and warehouses. In residential buildings it was rare since it was considered unsatisfactory in terms of insulation. A brick wall conducted heat too well and in the boarded structure air leaks spoiled the insulation. In summer houses the framework structure was becoming more common as late as the early 20th century. It was soon, however, replaced by a new wall structure entirely built of light sawn timber.

## Light stud frame

The American wooden frame made of studs and boards, the balloon frame, was developed in Chicago in the 1930s. In Finland the steam saws, machine-made nails and asphalt paperboard gave the conditions for adapting a similar structure as early as the 1880s and 1890s but the balloon frame became known very slowly.

In Central Europe building was based on a strong craftsman tradition and the materials used was stone for the most part; thus the American invention was not revolutionary there. The Swedes, on the other hand, relied on the vertical plank construction and thus information about the new frame innovation could not be had from there either even if the Finns followed the Swedish building practices very carefully. In Sweden the balloon frame seems to have awoken greater interest as late as the 1920s.[15]

Consequently the balloon frame from Chicago was still an oddity as late as the turn of the 20th century even if much was written about building in America in professional journals—even about how to build the foundations for skyscrapers. The balloon frame could in passing be mentioned in articles on building in America but its special characteristics remained rather obscure.

Some houses with a balloon frame were probably built already in the late 1800s when the emigrants returning from America brought back their experience to Finland. The structure became more widely known in the building trade as late as around 1907–1908. At the turn of 1910 houses with balloon frames were built for instance in the suburbs around Helsinki. The primary aim for using the new structure was saving costs but also innovative industrialists commissioned buildings. Using the new wall type was also justified with the argument that it was more suitable for building villas with more complex plans than the log wall.[16]

**The platform frame** was developed in the United States in the 1870s and 1880s. The idea was that when building a multi-storey house, the vertical studs of the frame would not have to be continued which required much work, but instead the structure of each storey was made separately. The sawn timber was delivered to the building site pre-cut into the right lengths. In Finland the timber was instead cut on the site. The platform frame became the focus of interest as late as in the 1990s when the building regulations allowed the building of multi-storey wooden houses.

The first houses with a stud frame were often built in the American style without wall insulation. Thus the thermal insulation was based on the air trapped between the airtight surfaces. The frame was made rigid with diagonal braces or boarding. To keep the house warm in winter, it was soon found necessary to fill the space between the studs with insulating material. The most common material was peat, moss, wood shavings and saw dust to which lime was added against pests. The coarser wood shavings stuffed into the wall were better than saw dust in the sense that they were not as prone to sinking and causing a draught for instance below the windows. It was advised to mix in pieces of glass and juniper needles against mice. In this type of wall a diagonal boarding was better than the braces as reinforcement since the latter made it difficult to add more insulation after the old material had sunk.

**Light-frame houses** were often clad with paperboard and wooden boards on both sides, but to minimise the fire risk, the surface could be plastered or, in some cases, made of gypsum board. Using gypsum board also speeded up the building process.[17] In 1931 the production of porous fibreboard was begun in Finland; these boards could also be used to make the structure rigid. Plywood, however, was an expensive material for the interiors and was usually not used for cladding the walls.

In principle it is simpler to construct a house of sawn timber than hew a corner-timbered log wall and finish the surfaces with an axe; for making strong joints and rigid structures new skills were, however, needed. The small sinking of a corner in a log house was not serious and the seams could be refilled but a badly built and draughty board wall is cold and its repair difficult and time-consuming.

In books on construction technology from the 1910s building a light frame of studs is hardly described at all.[18] Thus it is no wonder that mistakes were made on the building sites. Enso Ltd, which marketed sawn goods and paperboard as a construction material, realised in the early 1920s that it was necessary to develop detailed work instructions for the light frame. (Fig. 4) In these instructions nearly the whole structure was instructed to be built of 2 x 4-inch timber. There was an insulation in the floor and the ceiling but the insulation in the exterior walls was instead based on the air between the paperboard installed on both sides of the studs. The paperboard formed a continuous insulating layer also in the floors and ceilings.

The distance between the studs was 70 cm, half of the width of the paperboard strip and the construction was made rigid with diagonal braces. The space between the posts was divided into sections with a height of one metre at the most. These sections were made, on one hand, to fasten the paperboard and, on the other hand, to prevent the cooling circulation of air. It was suggested that the exterior should be clad with vertical panelling as soon as each paperboard strip was fastened to prevent damage

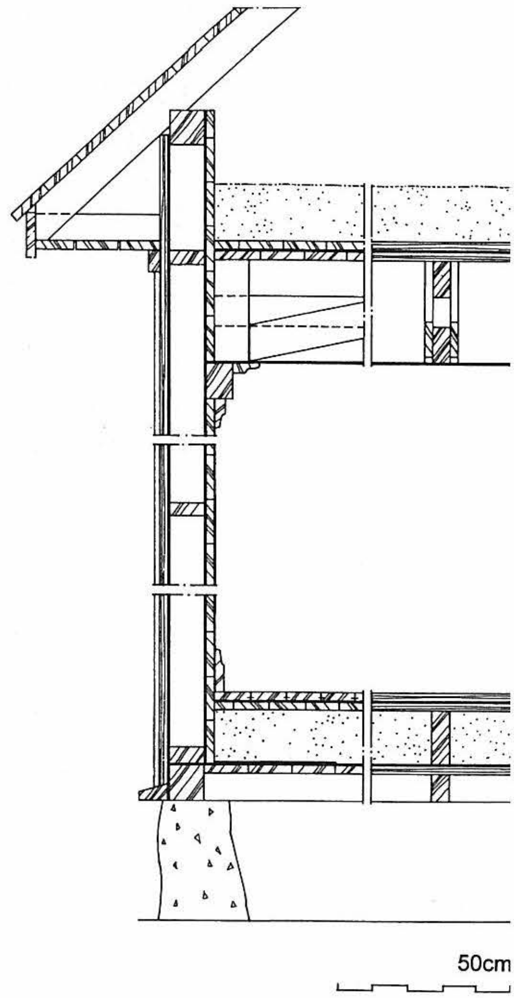


Figure 4. Structure developed by Enso Ltd in 1921. Vertical section 1/20.

caused by possible rain. The interior as well as the partition walls were sheathed on both sides with one-inch boards and finished with building paper and wallpaper. To improve the sound insulation, using a filling material was recommended in the partition walls.[19]

Enso Ltd published its work description and the construction plans in the Arkkitehti (The Architect) journal in 1921. The construction technique has been described as such in Väinö Keinänen's Puumiehen rakennusoppi (A Carpenter's Building Guide) in 1925. Keinänen claimed, however, that a double board wall was not sufficient as such but that asphalt paperboard and a tongued and grooved panelling should at least be added to the exterior. Another alternative was to plaster the walls on both sides.[20]

The debate and comparison of the corner-timbered log wall, the vertical plank structures and the stud frames was most heated at the turn of the 1920s. The corner-timbered structure generally proved to be more expensive than the stud frames and the solid plank structures remained less used because of the demanding building technique.[21] The air-insulated stud frame was considered not only cold but also a fire risk. Additionally its structural durability was doubted: if the foundation was not properly made, the frame sunk, the paperboards were torn and the air leakage spoiled the thermal insulation completely.[22]

Instead, the filled stud frame began to become more common during the 1920s. The faith in the structure was also strengthened partly by the research made on the insulation efficiency of different wall structures at Trondheim University of Technology[23] and the Swedish Academy of Engineering[24] in the early 1920s. This research was followed with interest also in Finland. In both investigations the filled light-frame wall proved to be the best.

In the 1920s houses with insulated walls were built by many towns and cities as well as some non-profit housing estates, housing cooperatives and industrial enterprises. Furthermore, the odd one-family house of the same type were built in smaller communities. The buildings were generally wood-panelled one-storey houses but occasionally the walls could be plastered.[25]

In the countryside there were neither need nor conditions to use anything else than logs for building. Forests surrounded the farms and the time spent on building did not have the same relevance as in towns and cities. The carpenters were generally not skilled professionals and thus the knowledge of new ways of building spread slowly. In the building guides meant for country people building stud frames was not taught properly before Heikki Siikonen's Pienviljelijän rakennusoppi (Building Guide for Small Farmers) was published in 1933. Before that the solid log wall was presented as the only reliable structure. The hewed corner-timbered log wall remained competitive as late as in the period of reconstruction after the Second World War.

**Keywords**
Stud frame, wooden structures, rationalism

**Notes**

1 Unless otherwise mentioned, the text is based on: Jeskanen Timo *Kansanomaisuus ja rationalismi. Näkökohtia Suomen puuarkkitehtuuriin 1900–1925. Esimerkkinä Oiva kallion kesähuvila Villa Oivala.* Teknillinen korkeakoulu, arkkitehtiosaston tutkimuksia 14/1998. (*Vernacularism and Rationalism. Aspects on Finnish Wooden Architecture 1900–1925 with Oiva Kallio's Summer House Villa Oivala as an Example.* Helsinki University of Technology, Studies from the Department of Architecture 14/1998. English abstract available.)

2 Viljo 1985, p 117-119.

3 Valanto Sirkka *Suomen rautatieasemat vuosina 1857–1920.* Museoviraston rakennushistorian osasto, julkaisu n:o 11. Helsinki, 1982, p 10; Valanto Sirkka *Rautateiden arkkitehtuuri. Asemarakennuksia 1857–1941.* Helsinki 1984, p 30; Hellström Thure *Huonerakennukset.* Valtionrautatiet 1912–1937. II osa. Toinen painos. Helsinki 1937, p 374.

4 Paalanen Elias *Liiketalopiirustuksia osuuskaupoille 1916*, work description pp 1,4-5.

5 Kuusi Eino *Rakennustoiminta ja asuntopulan vaiheet Suomen kaupungeissa vuosina 1912–1925.* Sosialinen Aikakauskirja 11/1926, Helsinki, p 706.

6 Asp G.E. *Huonerakenteiden-oppi. Toinen vihko: Puurakenteita.* Turku 1903, pp 21,38.

7 *Suomen teollisuushallituksen tiedonantoja. Kolmas vihko* 1887, p 51.

8 Udd M. Edvin *Ehdotus normaalimääräyksiksi puutavaroille.* Rakennustaito 1/1916, Helsinki, p 10.

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10 Toivonen Akseli *Osakeyhtiö Helsingin Kansanasuntojen rakennustoiminta.* Rakennustaito 1/1921, pp 7-8.

11 Hirviniemi Helena *Oulunsalon Varjakka – rakennushistoria, käyttö ja kunnostus.* Master's Thesis in Architecture, University of Oulu, Faculty of Technology, 1995, pp 27,87.

12 Andersin Harald *Pienempien asuntotyyppien standardisoiminen.* Arkkitehti 2/1921, pp 8,11.

3 Strömmer Bertel *Tampereen kunnallinen rakennustoiminta asuntopulan lieventämiseksi.* Rakennustaito 3-4/1920, pp 24-26; Murros Eetu *Tampereella käytettyjä puurakennustapoja.* Rakennustaito 9-10/1922, pp 111-112; Keinänen W. *Puumiehen rakennusoppi. Lyhyt oppikirja rakennusopissa ammattikouluja sekä itseopiskelua varten.* Porvoo 1925, p 79.

14 Englund Kaj *Ruotsin lahjatalot.* Arkkitehti 2/1941, pp 20-21; Pajamies Lauri *Ruotsin lahjatalot. Tyypit 1 ja 4.* Arkkitehti 2/1941, pp 22-23 and Appendix, p 7; Orola U. – Peltonen J. *Ruotsin lahjatalot. Tyypit 2 ja 3.* Arkkitehti 2/1941, p 24; Helamaa Erkki *40-luku. Korsujen ja jälleenrakentamisen vuosikymmen.* Helsinki 1983, pp 67-71.

15 See eg B. Borgström: *Amerikanska bostäder. Reseberättelse.* Arkitektur 8/1920, Stockholm, pp 108-111 or Hans O. Elliot: *Reseberättelser. V. Studieresa till Nord-Amerika och Canada.* Byggmästaren 1923, Stockholm, p 65.

16 See eg *Nya villor.* Arkkitehti 4/1909, p 77.

17 See Lindahl Karl *Två Grankulla-Villor.* Arkkitehti 1/1910, p 13.

18 For example G.E. Asp does not mention the structure at all in *Teknillinen käsikirja* (1914, 1920) when writing about the work of carpenters and joiners and it is neither dealt with in Akseli W. Malm's guide *Huonerakennuksien työnjohto* (1919).

19 *Enson kartonki rakennusaineena.* Arkkitehti 6/1921, pp 1-5,8-9.

20 Keinänen 1925, p 81.

21 Kuusi Eino *Asuntojen tuotanto Suomen kaupungeissa vuosina 1912–22 ja toimenpiteitä sen elvyttämiseksi.* Tiedonantoja. Sosialiministeriön julkaisemia XVIII. Helsinki, pp 55-58.

22 For instance the state did not grant loans for air-insulated houses. The reason was not the insufficiency of the thermal insulation but there were doubts whether structure would last the required 50 years. Kuusi Eino *Yleishyödyllisen rakennustoiminnan tukeminen. Valtion asuntopoliittista toimintaa varten vuoden 1920 ylimääräiseen rahasääntöön otetun määrärahan käyttäminen.* Tiedonantoja. Sosiaaliministeriön ja sosiaalihallituksen julkaisemia XII. Helsinki 1921, p 12; Kuusi 1923, pp 49.

23 *Rakentamisen halventaminen.* Rakennustaito 8/1921, p 75; Käytännöllisiä seinärakennekokeiluja Norjassa. Rakennustaito 14-15/1921, pp 121-124 and 23/1921, pp 196-197; Åberg Urho *Norjalaiset kokeet erilaisilla seinärakenteilla.* Arkkitehti 4/1923, pp 59-60,62-64.

24 E–n A. *Byggnadstekniska undersökningar. Ingeniörsvetenskapsakademiens verksamhet på området.* Byggmästaren 1922, pp 195-196; Hj. Tallqvist: Rakennuskonstruktsionien lämmöneristyskyky. Arkkitehti 5/1926, pp 58-61,65-68 and Arkkitehti 7/1926, pp 136-140.

25 See eg Lillqvist J.W. *Yleishyödyllinen rakennustoiminta Oulussa.* Rakennustaito 4-5/1924, pp 40-41,43; Linko Sulo *Asunto-osuuskunta Omakoti r.l. Oulussa. Osuuskunnan rakennustoiminta vsta. 1921.* Rakennustaito 4-5/1924, p 44; Vikstedt Juhani *Yleishyödyllisestä rakennustoiminnasta Viipurissa.* Rakennustaito 17-18/1924, pp 184-186; Kuusi 1923, pp 49;57-58. The structure of the houses has not been described in the sources in great detail and thus in some cases frame timber more massive than studs may have been used.

## The OTAWOOD team

# Education and Research of Wood Tehchnology in Finland

The OTAWOOD team, situated in Otaniemi, is Finland's largest concentration of wood technology and timber construction knowledge, which also holds an internationally significant position.
The team includes

- VTT Building Technology/Wood Technology
- Helsinki University of Technology HUT/ Wood Technology
- Helsinki University of Technology HUT/ Structural Engineering and Building Physics
- Helsinki University of Technology HUT/ Wood Construction

The OTAWOOD team consists of 130 wood technology experts, of whom 10 are professors, 68 research scientists, 8 assistants and 44 other staff members.
The main objective of OTAWOOD is to co-ordinate and develop the education in and research of wood technology provided in Otaniemi, and to advance domestic and international co-operation. To its partners and customers, OTAWOOD offers expertise covering every stage of wood processing from forest harvesting to use in buildings. OTAWOOD has active connections with the wood industry and a wide network of international connections.

## Netlike Wooden Structures Research Project 1998–99

*by Pentti Raiski and Katariina Rautiala*

Project Management
Prof. Eero Paloheimo (HUT, Wood Constructions)

Architectural Design
POOK Architects / Pentti Raiski and Katariina Rautiala

Civil Engineering
Nuvo Engineering Ltd / Jarmo Tommola, Lauri Salokangas, Hannu Hirsi

Assistant Åke Möller

Scale Models
Heinola-Instituutti: Students of Cabinet Making

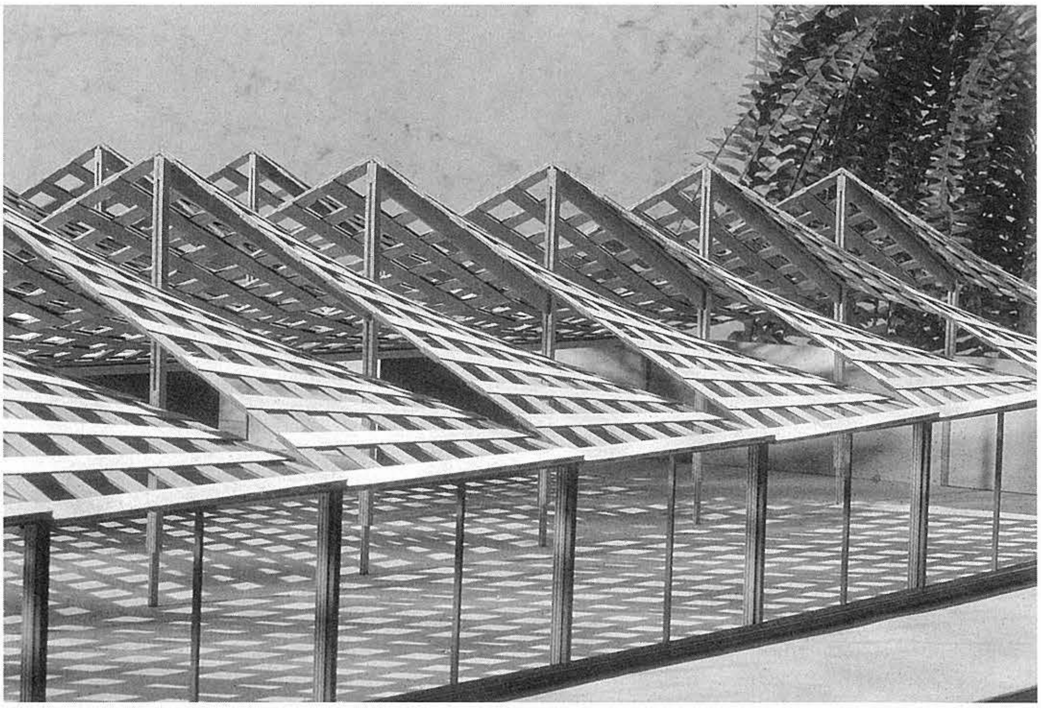
Co-operation
Puuinfo Ltd, TE-Keskus, Finnforest Ltd, Vierumäen Teollisuus Ltd

**The aim of the project** was to study, design and visualize netlike wooden structures that could be exploited by the building industry. At the same time a new wooden structure system was being developed. The system would be open and consist of design principles only, rather than fixed dimensions and measures. The research is presented through designs of six different buildings that vary from a temporary shelter to a fully covered football hall.
The buildings were designed to differ from one to another in the sense of their function, spans, wood materials and building methods: a football hall, a church, a market hall, a tower, a temporary shelter and an industrial hall. The common factor was the use of ruled surfaces. These surfaces have a great advantage for shell structures because they may be formed from straight form boards even though they are surfaces of double curvature. This type of shell structure can be built to what appears to be the ultimate in lightness of construction.

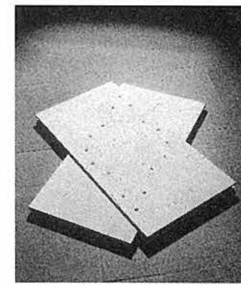
Most of the design process was carried out utilisizing 3D CAD-models, through which the shapes were studied and developed in close cooperation with civil engineers. An AutoLISP program was written to calculate these surfaces of the second order. When the desired shape was achieved a more detailed computer model was made. At the same time the stresses and the delections of the structure were being calculated. The computer model was then later used to produce drawings for large scale models. Exsamples of the joints, which were to be diffent in each of the study cases, were constructed in 1:1 scale.

### The Football Hall

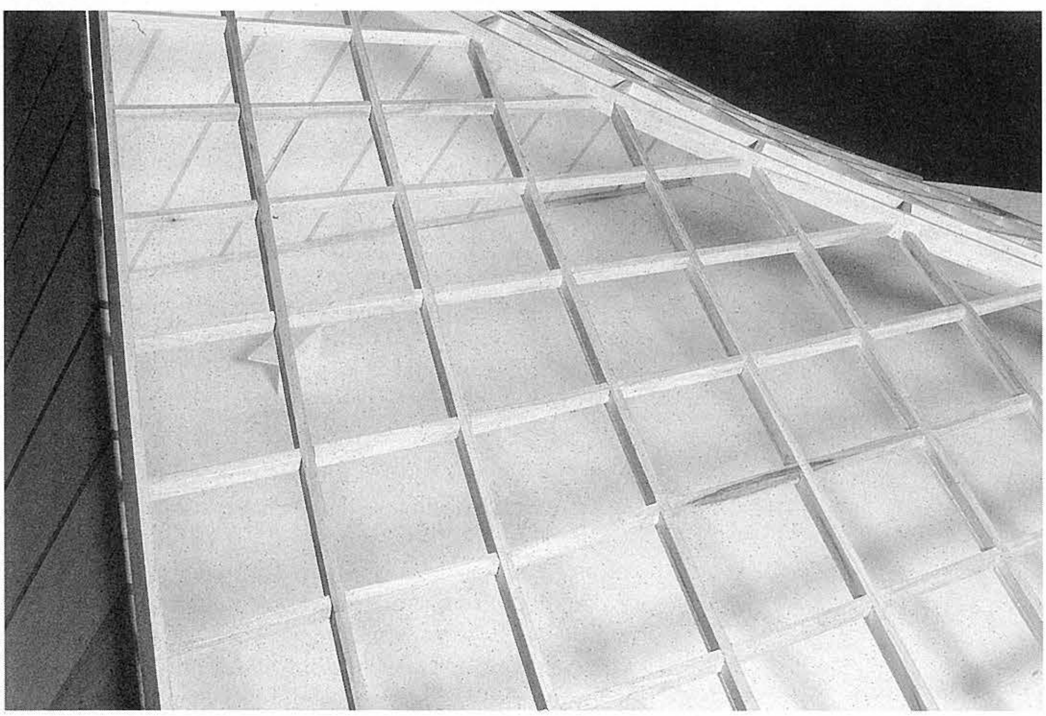
The basic dimensions are derived from the demands of a K2-type football hall (free heigh 20m in the center, 10 m on sides). The roof structure spans over the field (64m × 100m) and the stands. The structure is made of prefabricated glue laminated beams that form a reticulate shell. The form of the hall is a portion of a torus shape and therefore the only building of the serie not based on the use of a ruled surface. The joints at which several beams intersect at



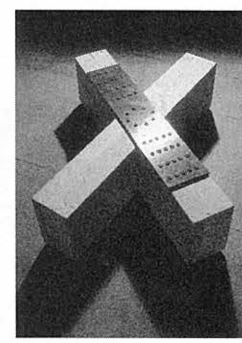
The market model. Photo: Arja Lampinen



The market joint.
Photo: Arja Lampinen



The church model. Photo: Arja Lampinen



The church joint.
Photo: Arja Lampinen

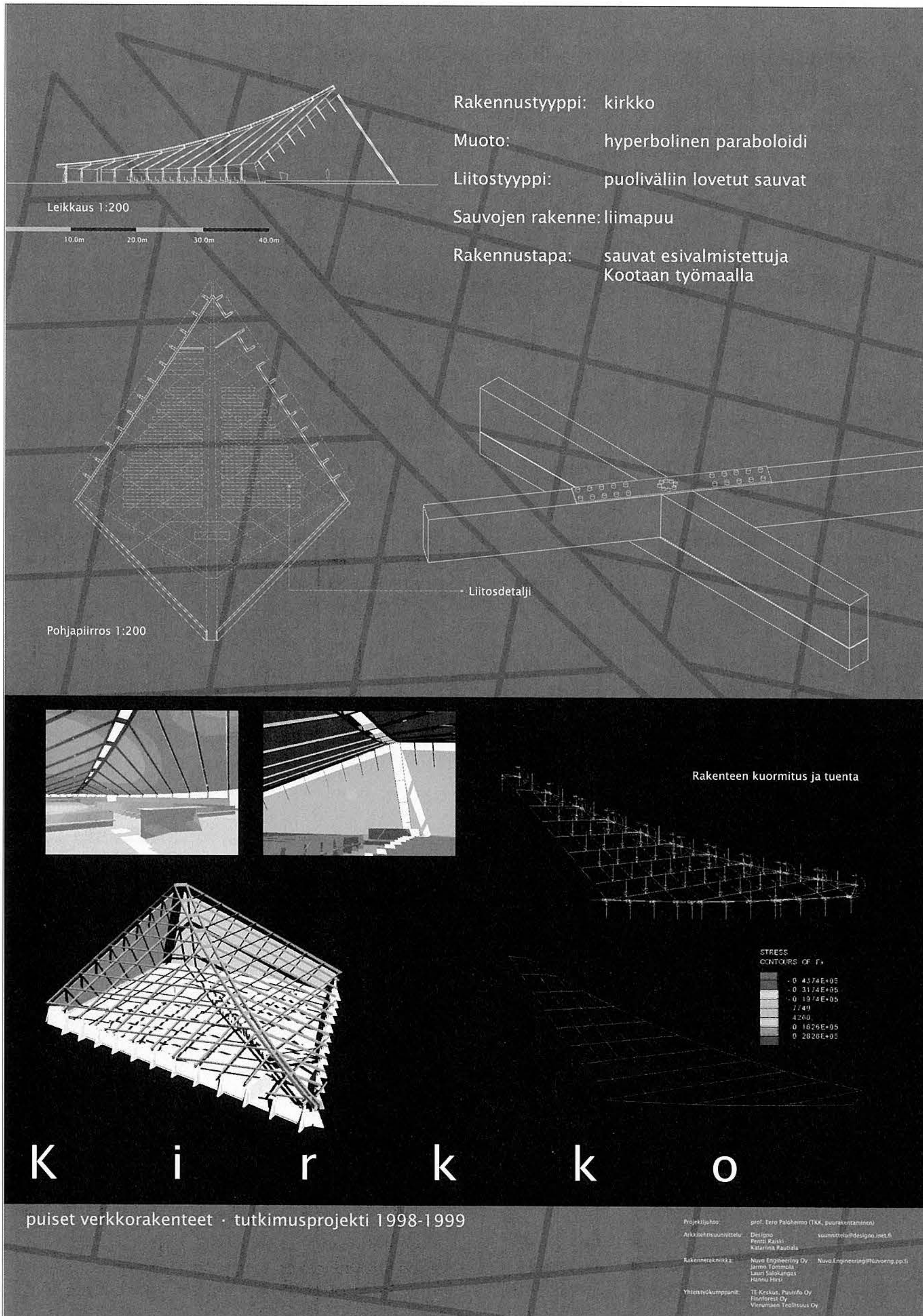
diffent angles are detailed with steel-concrete connectors.

## The Market Hall

The overall dimensions and the design were being determined by a rectangular grid which is also the structural module (14.4m × 4.8m). The roof modules that are portions of a hyperbolic paraboloid can be entirely prefabricated. The retangular units are supported by gabled rigid frames at the outside edges. The structure may be built continuously with units side by side to cover a large area. The structure consists of plywood beams which are glued together, the joint is reinforced with srews.

## The Church

The aim was to create a space that would be open, light and sacral. The gluelaminated beams are rather few and far between, and they are left partly visible to the interior. The joint of the beams is reinforced with a steel plate. The roof form is a portion of a hyperbolic paraboloid which is mirrored along the center axis of the church.


Rakennustyyppi: kirkko
Muoto: hyperbolinen paraboloidi
Liitostyyppi: puoliväliin lovetut sauvat
Sauvojen rakenne: liimapuu
Rakennustapa: sauvat esivalmistettuja
Kootaan työmaalla
Leikkaus 1:200
10.0m
20.0m
30.0m
40.0m
Liitosdetalji
Pohjapiirros 1:200
Rakenteen kuormitus ja tuenta
STRESS
CONTOURS OF Fx
K i r k k o
puiset verkkorakenteet · tutkimusprojekti 1998-1999
Projektijohto: prof. Eero Paloheimo (TKK, puurakentaminen)
Arkkitehtisuunnittelu: Designo
Pentti Raiski
Katariina Rautiala
suunnittelu@designo.inet.fi
Rakennetekniikka: Nuvo Engineering Oy
Jarmo Tommola
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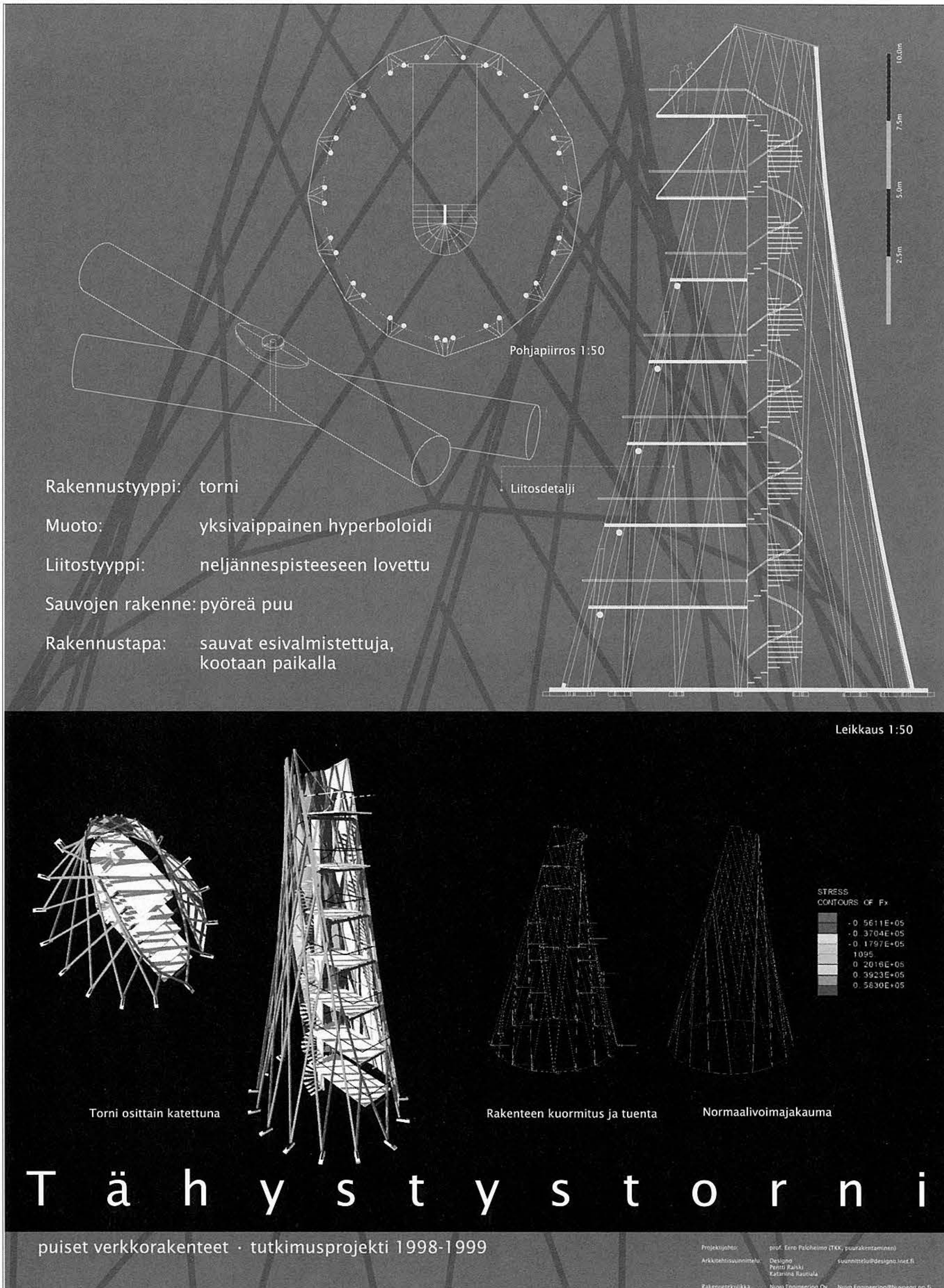
Hannu Hirsi
Nuvo.Engineering@Nuvoeng.pp.fi
Yhteistyökumppanit: TE-Keskus, Puuinfo Oy
Finnforest Oy
Vierumäen Teollisuus Oy

The church


10.0m
7.5m
5.0m
2.5m
Pohjapiirros 1:50
Liitosdetalji
Rakennustyyppi: torni
Muoto: yksivaippainen hyperboloidi
Liitostyyppi: neljännespisteeseen lovettu
Sauvojen rakenne: pyöreä puu
Rakennustapa: sauvat esivalmistettuja, kootaan paikalla
Leikkaus 1:50
STRESS
CONTOURS OF Fx
-0.5611E+05
-0.3704E+05
-0.1797E+05
1095
0.2016E+05
0.3923E+05
0.5830E+05
Torni osittain katettuna
Rakenteen kuormitus ja tuenta
Normaalivoimajakauma
T ä h y s t y s t o r n i
puiset verkkorakenteet · tutkimusprojekti 1998-1999
Projektijohto: prof. Eero Paloheimo (TKK, puurakentaminen)
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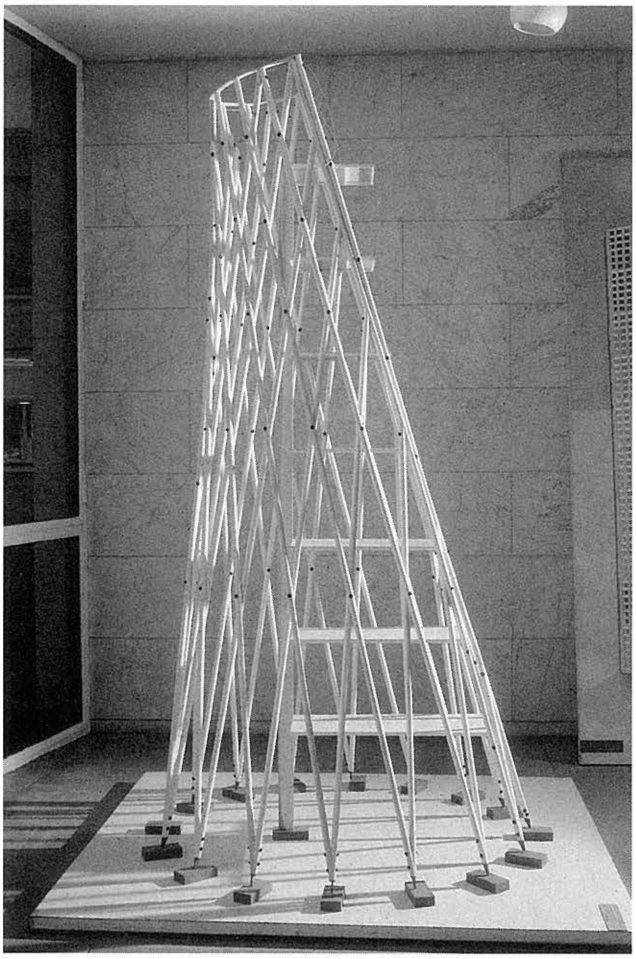
Jarmo Tommola
Lauri Salokangas
Hannu Hirsi
Yhteistyökumppanit: TE-Keskus, Puuinfo Oy
Finnforest Oy
Vierumäen Teollisuus Oy

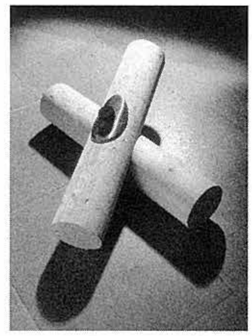
The tower



The tower model. Photo: Arja Lampinen

## The Tower

This 25 m high vertical structure is formed by two symmetrical wooden nets. Intersecting beams are bolted together, floor slabs and the staircase are



The tower joint.
Photo: Arja Lampinen

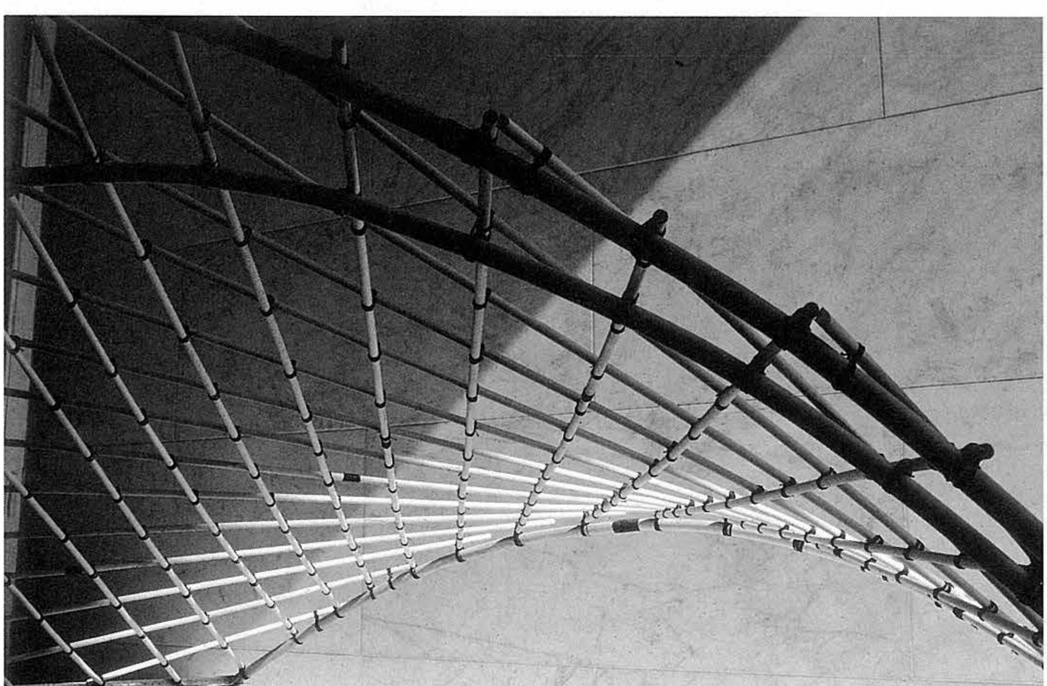
used to reinforce the structure. The shape derives from a hyperboloid of one sheet which is cut and then mirrored along the centre axis.

## The Industrial Hall

The design was based on the idea of an anonymous industrial hall. The roof , which is a portion of a hyperboloid of one sheet, would span 42 metres and no columns would be needed in the interior of the hall. The horizontal stresses of the structure are absorbed with steel tension bars. The net is dense so that sawn timber can be used to form the structure. The timbers are joined together with a steel collar.

## The Temporary Shelter

Thin trunks that could be taken directly from the woods are used for this building type. The shape originates from a hyperbolic paraboloid. The beams are joined with rubber bands, a sail fabric is placed over the structure. Paraboloidical arches are required at the front and the back of the shelter.



The temporary shelter model. Photo: Arja Lampinen

The temporary shelter joint. Photo: Arja Lampinen

## Life Cycle Assessment: Essential Instrument for Decision on Environmental Issues

*by Matti Kairi*

Wood has a positive image as a building material. It is a renewable raw material for various contructive components. This study approaches the Life Cycle Assessment (LCA) of Laminated Veneer Lumber (LVL) as a case to evaluate the wood as a raw material for building components based on environmental aspects.

LVL is an Engineered Wood Product. It has been produced first in USA and in Finland since 1970's. It is based on parallel glued wooden lamellas, which are 3 mm thick rotary peeled spruce or pine. LVL is used as a beam, header or column.

Life Cycle Assessment has been carried out for KERTO®-Laminated Veneer Lumber, which is manufactured by Finnforest Oy. The study is based on the project together with the Institute for Woodresearch University of Munich. The objective of the product-related LCA presented here was to systematically assess and evaluate the environmental effects related to the manufacture of LVL. The methodological principles for the formation of this study are based on the standards for product-related LCA, issued or about to be agreed upon in the course of the next couple of years by ISO-standards of the 14 000 series.

The energy calculation for the entire manufacturing process shows that less energy is required to manufacture LVL than the usable energy content stored in the product itself.

LVL manufacture has a negative global warming potential. Using wood as a raw material LVL is storing CO2 more than 10 times releasing during its life cycle "from the cradle to the grave".

**For further information please contact**
*Mr. Matti Kairi, Master of Science*
*Research scientist, Member of Otawood*
*Helsinki University of Technology,*
*Laboratory of Wood Technology*
*E-mail: matti.kairi@hut.fi*

## Expressions and Trends for Wooden Windows in Europe

*by Jussi Virtanen*

Wood as raw material for European windows has a long and creditable history. Through centuries wood has been the basic element of expressing local window joinery traditions by uniting regional and climate needs with visual appearance of wood. Thus window styles by which local needs has been expressed have considerably altered to various visual and construction trends in different parts of Europe to meet the needs of local community. Therefore wooden window has with some exceptions maintained a character of an unusual local product in Europe today.

However, the world of wooden windows has changed rapidly in many European countries during the last 20 years. We aim to demonstrate current expressions and trends for wooden windows in Europe by showing and describing wooden windows and their product evolution process in recent years. Reasons behind these changes will be analyzed with informative window cases from different parts of European window markets. Besides with trends we will also focus on future challenges with facts from field surveys to demonstrate directions of modern movements of wooden windows.

**For further information please contact**
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*Member of Otawood*
*Helsinki University of Technology,*
*Laboratory of Wood Technology*
*E-mail: jussi.virtanen@hut.fi*
*http://pmtpc2.hut.fi/*

# Thermotimber® – A new material for restoration

*by Pertti Nieminen*

The Finnish Thermotimber® wood treatment is a process whereby woods can be "aged" in a fraction of the time that conventional methods require.
Thermotimber® is manufactured under controlled heating conditions in temperatures at 170–230°C. The degree of heat used depends on what type of wood is being processed and what type of characteristics are desired. The process involves no chemicals or additives, whereas the only outside agent used is moisture, we can proudly claim this to be a natural product. During the Thermotimber® process, the cellular structure changes. The hemi-cellulose starts to break down and the pitch in coniferous woods evaporate.
During the Thermotimber® treatment, a light coloured wood transforms into a brownish hue, which with longer treatment can be enhanced to bring out different nuances. The weight of the material is reduced by 5% to 20% depending on species and the breaking point of the material decreases, but the stiffness of the material increases considerably, i.e. the elasticity increases. Also twisting and warping due to moisture are reduced up to 70%. As a result of the Thermotimber® treatment, the structural qualities of the processed wood is the same as "aged wood".
We believe that Thermotimber® wood treatment will give new possibilities for reconstruction of old wooden houses.

**For further information please contact**

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*Tampere University of Technology*
*Department of Civil Engineering*
*E-mail: pertti.nieminen@tut.fi*

The seminar participants on a visit to the HUT Wood laboratory.

# *Appendices*

# Programme

June 3, 1999

## Seminar day

**08.30** Registration

Opening of the Seminar
Chairman *Hubert Jan Henket*,
the Netherlands

**09.15** Beyond the Balloon Frame Engineered Wood Comes of Age in USA
M.Arch *Tomas Jester*, USA

**10.15** The Aalto Way of Using Wood
Prof. M.Arch Tore Tallqvist, Finland

**11.15** Coffee

**11.45** Modern Times for Norwegian Wood
Cand. Philol *Eirik Boe*, Norway

**12.45** Lunch

**14.00** Restoration of the Venice Pavilion
M.Arch *Panu Kaila*, Finland

**14.30** Konrad Wachsmann's Use of Log Building Traditions in Modern Architecture
Prof. Dr.-Ing. *Jos Tomlow*,
the Netherlands (Germany)

**15.00** Reconstruction of the Undulating Ceiling of Viipuri Library
M.Arch *Marianna Heikinheimo*, Finland

**15.30** Coffee

**16.00** Wood and Acoustics
Ass. Prof., MSc *Bo Mortensen*, Danmark

**16.30** Architectural Principles in Wooden Functionalism in Finland
M.Arch *Jarmo Saari*, Finland

**17.00** Conclusions

**18.00** Coctails

June 4, 1999

## Excursion Day

**Tour around Helsinki** (early bird ride)
Buildings & constructions for the Olympic Games 1940 / 1952:
Olympic Stadium, Swimming Stadium, Sporthall, Velodrome, Olympic Village, Rowing Stadium etc.

**Helsinki School of Economics**
Hugo Harmia & Woldemar Baeckmann 1948-50
Presentation of the restoration project and guided tour

**The Lasipalatsi Building** ('Glass Palace')
Niilo Kokko, Viljo Revell & Heimo Riihimäki 1936
Presentation of the restoration project and guided tour

**VTT / Woodlaboratory**
**HUT / Woodlaboratory**
Presentation of researchprojects (OTAWOOD)

**Helsinki University of Technology, Otaniemi**
Main building
Elissa and Alvar Aalto 1964

**HUT / Department of Architecture**

**Ota Hall**
Alvar Aalto 1949-54
Presentation of wooden ceiling and wooden constructions

**Otaniemi Chapel**
Kaija and Heikki Siren 1957 (rebuilt 1976)

# Resume of Authors

*Thomas C. Jester*
Architect

**Professional specialities**
Mr Jester is an architectural historian with the National Park Service Heritage Preservation Services Division since 1991. He is the author of numerous articles on preservation technology, and has developed cultural resource training seminars and workshops, including the Preserving the Recent Past Conference held in 1995. He has edited Twentieth-Century Building Materials: History and Conservation, which was published by McGraw-Hill.

**Present post**
Architectural Historian, National Park Service, Technical Preservation Services

**Education**
- B.A. American Studies,Colby College, Waterville
- M.S. Historic Preservation, University of Pennsylvania
- M.Arch. Architecture, University of Maryland

Nationality: American

*Tore Tallqvist*
Professor, Architect

**Present post**
Since 1988 Professor at Tampere University of Technology, History of Architecture
Mr Tallqvist is a member of the Finnish Association of Architects.

**Previous work**
- practising architect at the Architectoffice Alvar Aalto 1965-72, own Studio from 1972
- assosiate professor at Helsinki University of Technology, History of Architecture 1983-85
- architect of Old Porvoo 1986-88, speciality: preserving townplannig

**Education**
M.Arch, Helsinki University of Technology, Lic.Tec 1983

Nationality: Finnish

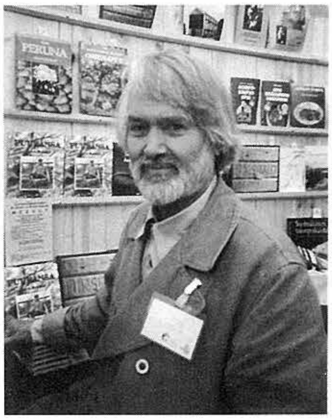
*Eirik T. Bøe*
Cand. Philol.

**Present post**
Restauration Advicer, University of Oslo,
Senior Executive Officer, Directorate of Cultural Heritage Norway (Riksantikvaren)

**Education**
- Master's Degree in Art History, University of Oslo (paper in architectural history on Villas in functionalism)
- studies in restauration of modernism, Royal Academy of fine arts in Stockholm

**Work**
Senior Executive Officer, University of Oslo, from 1995-1997, registration of 20th century architecture at the University, withemphasis on the Campus at Blindern.

Nationality: Norwegian



*Panu Kaila*
Architect

**Professional specialities**
Traditional building materials and technologies

**Present post**
Special researcher at University of Oulu and Tampere University of Technology

Nationality: Finnish

*Jos Tomlov*
Professor Dr.-Ing.

**Professional specialities**
Gaudinism, history of structural design, vaults and lightweight structures, history of the use of complex geometry in architecture, wood building traditions in Saxony, technical aspects of Modern Movement architecture

**Present post**
Since 1995 teaching Art and Architectural History in Hochschule für Technik, Wirtschaft und Sozialwesen, Zittau / Görlitz (FH) in Zittau, Saxony, Germany

**Education**
- architectural training in the Technical University of Delft, Holland, masters degree 1982
- 1982-95 in Stuttgart, Germany :scientific assistant at the Institute for lightweight structures (IL)
- directed by Frei Otto / Werner Sobek, in sub-project SFb 230 C3 "History of structural design"
- doctoral degree of Stuttgart University on the Hanging Model by Antoni Gaudi 1986

Nationality: Dutch

*Marianna Heikinheimo*
Architect

**Professional specialities**
Marianna Heikinheimo has specialized in restoration and is a member of the Finnish Association of Architects.

**Present post**
Researcher/ph.d. student at the Department of Architecture, History of Architecture, Helsinki University of Technology. Mrs Heikinheimo is also a Partner in HNP Architects.

**Former post**
Architect of The Finnish Committee for The Restoration of The Viipuri Library

**Education**
- M.Arch., Helsinki Unniversity of Technology, Department of Architecture
- M.A. in Fine Arts, Helsinki Academy of Fine Arts

Nationality: Finnish

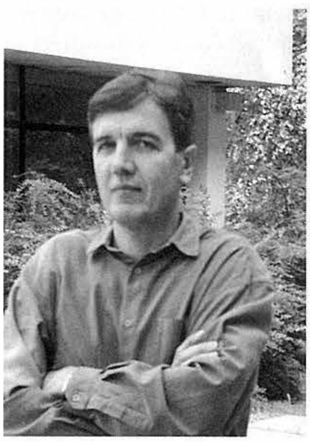
*Bo Mortensen*
Associate professor

**Professional speciality**
Building- and room acoustics mainly in theaters, concert halls.
Mr Mortenson is Manager of Bo Mortensen Akustik.

**Present post**
Associate professor in Acoustics The Royal Danish Academy of Fine Arts, School of Architecture. Part time lecture at the Danish School of Art and Design.

**Education**
- Studies at The School of Architecture, Aarhus, Denmark.
- Civil Engineer, The Technical University of Denmark
- Master's of Science in Engineering, MSc.

Nationality: Danish



*Jarmo Saari*
Architect

**Precent post**
Mr Saari works as a practising architect and is a partner in A4 Architects.
He is a member of the Finnish Association of Architects.

**Education**
- M. Arch., Helsinki University ofTechnology, Department of Architecture
- post graduate studies in Helsinki University of Technology, Department of Architecture, History of Architecture (subject of studies/research: wooden functionalism in Finland)

Nationality: Finnish

*Berthold Burkhardt*
Professor

**Professional specialities**
Mr Burkhadts area of expertise incluedes structures, concrete, steel, wood and lightweight, particularly of the Modern Movement. He is also a advisor regarding the Bauhaus building in Germany.

**Present post**
Berthold Burkhard is an architect and structural engineer and a professor at the Technical University of Braunschweig, Germany.

Nationality: German

*Donald Luxton*
Architect

**Professional specialities**
Donald Luxton has practiced in the field of heritage conservation since 1982, and has demonstrated experience in all aspects of heritage planning and heritage restoration. His reputation as a heritage consultant, designer, educator and preservation advocate has been firmly established on projects throughout British Columbia, Alberta and the Yukon.

**Present post**
Mr Luxton is a partner in Donald Luxton & Associates. Included in these past projects were heritage inventories of Vancouver (including the Heritage Interiors Project), and North and West Vancouver, where most of the modern houses in this paper are located. His published works include The Modern Architecture of North Vancouver, 1930-1965 and Lions Gate, a book about the history and construction of the Lions Gate Bridge, available this Fall.
Mr. Luxton has been active in the field of public education through the teaching of heritage conservation courses, for both general interest and university credit. His interest in the preservation of architecture has led to his involvement with a number of heritage societies.

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*Gennaro Postiglione*
Architect

**Professional specialities**
The prevalent interests for Mr Postiglione are towards Nordic Architecture, with special attention for Dwellings, Museums and The Thirties.

**Present post**
Research Professor at The Politecnico di Milano - IT -, with a PhD in Architecture of Interiors and a Master School in Industrial Design, Gennaro Postiglione was graduated as Architect in 1980 and is member both of Italian and Norwegian Architects' Association.

---

*Timo Jeskanen*
Architect

**Present post**
Mr Jeskanen has worked as part-time teacher of the history of architecture at Helsinki University of Technology 1991–1999. He is a partner in R. Teränne Ltd, Architect´ s office and a member of the Finnish Association of Architects.

**Education**
MSc in Architecture Helsinki University of Technology
Postgraduate student and researcher at Helsinki University of Technology since 1996, licentiate thesis Kansanomaisuus ja rationalismi. Näkökohtia Suomen puuarkkitehtuuriin 1900–1925. Esimerkkinä Oiva Kallion kesähuvila Villa Oivala. (Vernacularism and Rationalism. Aspects on Finnish Wooden Architecture 1900–1925 with Oiva Kallio's Summer House Villa Oivala as an Example.)

# List of Participants

| | | |
|---|---|---|
| Adlercreutz Eric | A-Konsultit Oy | Finland |
| Biro Ana Maria | MARC 99/HUT | Romania |
| Boe Eirik | University of Oslo | Norway |
| Cabral Lacerda | CENFIC | Portugal |
| Claessens Els | R.Lemaire Centre for Conservation | Belgium |
| Cronan Pat | | Ireland |
| Daniell Ruth | MARC 99/HUT | Australia |
| Englund Marjukka | HUT Dipoli | Suomi - Finland |
| Freese Simo | MARC 99/HUT | Finland |
| Gee Stephen | MARC 99 | United Kingdom |
| Graham Lee | COTAC England | United Kingdom |
| Graham Mrs | | United Kingdom |
| Grägg Ulrika | Åbo Akademi | Finland |
| Gyllenberg Petra | Åbo Akademi | Finland |
| Hammar Torun | Birgitta Holm Arkitektkontor AB | Sweden |
| Heikinheimo Marianna | Helsinki University of Technology /Dep. of Arch. | Finland |
| Henket Hubert Jan | Delft University of Technology/ Faculty of Arch. | Netherlands |
| Henket Mrs | | Netherlands |
| Hirviniemi Helena | Arktsto Helena Hirviniemi | Finland |
| Horo Anne | Student of Architecture | Finland |
| Isotupa Maria | HUT Dipoli | Finland |
| Jeskanen Timo | Ark.tsto Raimo Teränne | Finland |
| Jester Thomas | National Park Service Heritage, Preservation Services | U S A |
| Jester Mrs | | U S A |
| Juvakoski Marja | HUT Dipoli | Finland |
| Kaila Panu | Tampere University of Technology/Dep. of Arch. | Finland |
| Kairamo Maija | National Board of Antiquities | Finland |
| Karjalainen Juha | Opettajaosuuskunta Konstruktiivi | Finland |
| Kassa Armstrong | | Sweden |
| Kauto Jukka | Tampere University of Technology | Finland |
| Kjisik Hennu | Arktsto Harris & Kjisik | Finland |
| Kovács Elizabeth | Nat. Board for the Protection of Historic Monuments | Hungary |
| Kuipers Marieke | DOCOMOMO ISC/R | Netherlands |

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|---|---|---|
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# Docomomo ISC/T
# Wood and Modern Movement Seminar

## DOCOMOMO meets HUT

Helsinki University of Technology (HUT) and Lifelong Learning Institute Dipoli gave to about 80 friends of Modern Movement from 22 different countries an intriguingly modern surrounding for the Wood and Modern Movement Seminar in June 3 and 4, 1999. The seminar was held in Dipoli-building (designed by Raili and Reima Pietilä, inaugurated in September 1966). The two-day program of the 4th seminar of the Docomomo Specialist Committee on Technology consisted of a one-day seminar and one excursion day.
Programme committee of the seminar consisted of two ISC/T professionals, Mr Ola Wederbrunn (chair) and Mr Juha Lemström.
On the seminar day Ola Wedebrunn showed the DOCOMOMO database of the technology experts. Getting and gathering the information has started well and the use of this database will certainly be a very good tool for many. The database is available at www-address: www.karch.dk
The Wood and Modern Movement seminar brought us interesting expertise information in the form of presentations from eight experts and an open forum for discussions and comments. This seminar day was chaired with great skill and humour by Mr Hubert-Jan Henket.

**Other Seminar Participants additional to MoMo-friends:**
The DOCOMOMO seminar day was also included in the program of an International Continuing Education course - MARC (Modern Architecture- Restoration and Conservation and TRANSFUSION (Transfer and Diffusion of the Conservation and Restoration Training Projects). Thus Docomomo-ideals were enthusiastically received by these groups working in the restoration and conservation field, too.

TRANSFUSION is a project of transfer and dissemination of results aiming at the exchange of information and experiences, allowing an open and European space on training and qualification in the initial and continuing training.

**Partners Activities**
More than to disseminate the training products, the partners of TRANSFUSION intend to disseminate the methodological strategy of its development and synergetic relations between the products. The partners organise conferences / seminars where they present their latest methods and educational project developments on conservation and restoration.

**Partners**
CENFIC – Centro de Formação Profissional da Indústria da Construção Civil e Obras Públicas do Sul, Portugal
Contact Person: *Vitor Dias*

COTAC – Conference on Training in Architectural Conservation, England
Contact Person: *Richard Davies*

HUT – Helsinki University of Technology, Lifelong Learning Institute Dipoli, Finland
Contact Person: *Tapio Koskinen*

N.B.P.H.M. – National Board for the Protection of Historic Monuments, Hungary
Contact Person: *Elisabeth Kovacs*

D.I.P. – Dublin Institute of Technology / Faculty of Build Environment, Ireland
Contact Person: *Maurice Murphy*

More about the project:
www.dipoli.hut.fi/transfusion

## Exhibition

A special MoMo - Forum exhibition was set up in Dipoli's main lobby to present contemporary Finnish wooden architecture, wooden products as well as development and research products on wood. Special thanks belong to Finnish National Board of Antiquites, Museum of Finnish Architecture and The Finnish Timber council for their cooperation. The exhibition of Contemporary Finnish Wooden architecture was collected and skilfully set up in the lobby of Dipoli by architect Yrjö Suonto.
The most impressive object was the five large-scale models, which showed a recent project of netlike wooden structures. A team of architects had developed, under the guidance of Professor Eero Paloheimo (HUT Dept of Architecture, Otawood), several different wooden structure systems of searched wooden structures that could be exploited by the building industry.

More information about the projects:
www.vtt.fi/rte/otawood

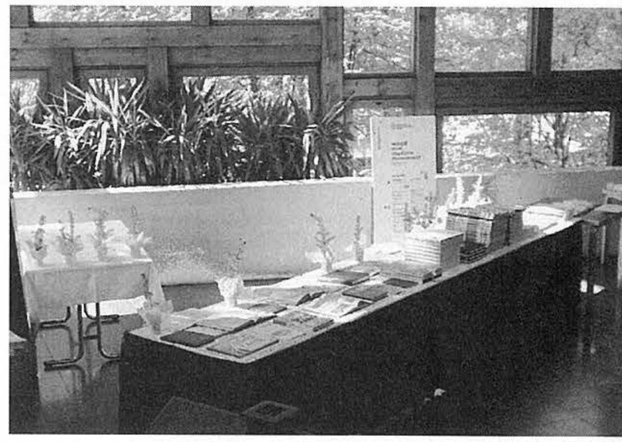



Photo: Yrjö Suonto

Photo: Yrjö Suonto

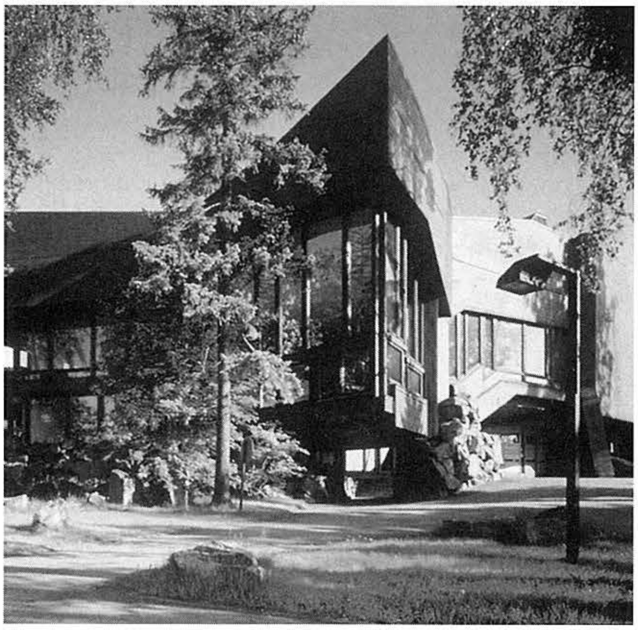
On the second day excursion the group visited the newly restored Lasipalatsi building guided by Architect Pia Ilonen.


## Acknowledgements

It was a privilege to collaborate with the worldwide DOCOMOMO organisation and to meet so much pure enthusiasm and professional work for the same target.
Special thanks to the whole organising team in Dipoli; to Ms Marjukka Englund for being our warm hostess during seminar day, to Ms Maria Isotupa for her enthusiasm and experience in coordination and to Ms Marja Juvakoski for her talent to collect the group of interesting enterprises to MoMo Forum. Special thanks also belong to Mr Panu Puukari for the graphic design for the seminar and to Ms Aino Niskanen from Architours for the guidance on the professional tour of the excursion day.
As an event the Wood and Modern Movement seminar was a great success, and fulfilled its aims as a meeting place for the participants to learn, to discuss and to share different visions and expertise on the subject. I wish that the Spirit of DOCOMOMO continues to be as alive as we felt it in Finland.



*Tarja Mäkeläinen*
*Architect, Programme Coordinator*
*Seminar organiser*
*Helsinki University of Technology*
*Lifelong Learning Institute Dipoli*

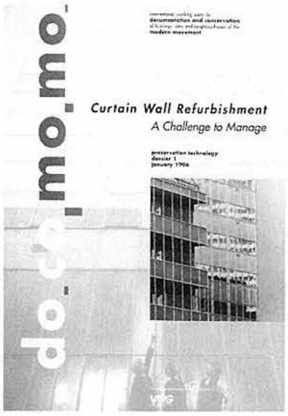


**Helsinki University of Technology, Lifelong Learning Institute Dipoli** organises courses and professional development programs in fields within the expertise of the University. The institute combines a good international network, the solid technological know-how of the university staff, and the business experience from industry to support management of technological development.
The institute has close contacts with companies and business organisations. To identify the present situation and the development needs, it continuously develops new methods, for example, to anlyse training needs or simulate business operation. Continuous research and development work enables the centre to offer the highest level of continuing education in this field in Finland.
The main tasks of Lifelong Learning Institute Dipoli are

- to organise courses, usually several weeks in duration, to broaden or deepen professional skills
- to develop teaching of latest technology, especially in areas of the University's research and, by various methods, to pass on the expertise to companies and others who need it
- to increase the opportunities to make use of the under- and postgraduate teaching of the University also in the form of continuing education for those at work and as open University teaching
- to organize research and development work to support continuing education

The conservation programme has been a course module in the TKK Dipoli since 1982. The programme was built up in allience with the Ministry of Education, The Helsinki University of Technology and the leading experts of the field. The content is made flexible enough to alter yearly according to the needs of the industry.
The course introduces the participants to an economically viable conservation that takes into consideration both the customers' needs and the historical, architectural, and sociological values of the building and environment. Sustainability in technical solutions and materials is also considered.
The participants of the continuing education at HUT Dipoli have taken part of the research and planning stages of topical conservation projects during their training.

http://www.dipoli.hut.fi

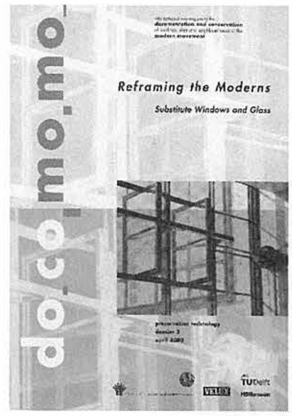



### The Fair Face of Concrete

*Conservation and Repair of Exposed Concrete*

This publication from DOCOMOMO includes papers presented at the 1997 seminar "The Fair Face of Concrete; Conservation and Repair of Exposed Concrete" held in Eindhoven. Papers by researchers and practitioners from Germany, Great Britain, France, Norway, Denmark, Switzerland, the United States and The Neatherlands are included, and many of them are case studies.

- All lectures presented at the seminar
- Additional case studies and papers
- Over 80 pages in English
- Contributions from 14 authors
- Fully illustrated, including black & white photographs, drawings and graphs
- The first comprehensive publication on the subject in Europe

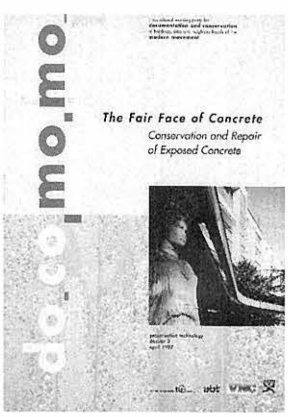



### Reframing the Moderns

*Substitute Windows and Glass*

This publication is the result of the 1998 'Reframing the Moderns' seminar held in Copenhagen. The dossier includes:

- All lectures presented at the seminar and additional case studies and papers
- Contributions from18 authors
- Over 120 pages in English
- Fully illustrated, inc. black & white photographs, drawnings and graphs
- Selected bibliography and relevant background literature on 1. Theory and Methodology, 2. Windows, 3. Glass, 4. Case Studies
- The first comprehensive publication on the subject in Europe




### Curtain Wall Refurbishment

*A Challenge to Manage*

A full report of the 1996 Curtain Wall Refurbishment seminar, with contributions by noted authors from Europe and the United States, is still available and includes

- All lectures presented at the seminar
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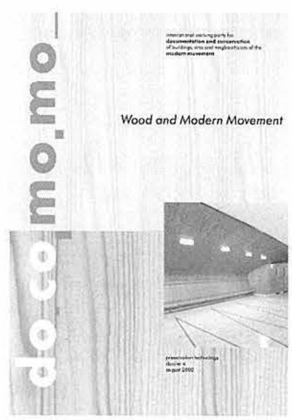


### Wood and Modern Movement

Proceedings of the DOCOMOMO ISC/T seminar 1999 'Wood and Modern Movement', held in Espoo, Finland. Papers by practising architects and engineers, researchers and specialists from Canada, Denmark, Finland, Germany, Italy, The Netherlands, Norway and The United States.

- All lectures presented at the seminar and additional articles on the subject
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The built heritage of the Modern Movement is today more at risk than that of any other period, due to its age, the functions it was designed to perform, and the present cultural climate, but most of all because the involvement of often innovative technology. New materials and construction types, and standardised building methods have been instrumental in materialising modernity in architecture. Constructions and envelopes were pushed to their physical limits, and were often designed with a limited lifespan.

DOCOMOMO International Committee of Technology aims to foster the development of appropriate techniques and methods of conservation,and to disseminate this knowledge. Yearly, international seminars on modern conservation technology are organised with the additional aim to produce a series of professional Preservation Technology Dossiers, focusing on the preservation challenges posed by such emblematic modern features as structural frames, exposed architectural concrete, glazings, steel windows, light envelopes and curtain walls.

The "Wood and Modern Movement" seminar in Finland, of which this publication is the result, has been aimed at exchange of experience and to discuss on construction, expression and restoration of wood and wooden products in Modern Movement architecture.

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