ARQUITECTURA

Tratados e historia de la construcción en Finlandia

Pannu Kaila

Desde el tronco al tablero de partículas

Los edificios más antiguos que aparecen en Finlandia son los refugios circulares formando un cono de troncos recubierto con pieles de animales. De esta manera la casa era todo tejado y la palabra que lo designaba - kota- sobrevive en el finés actual como koti, hogar.

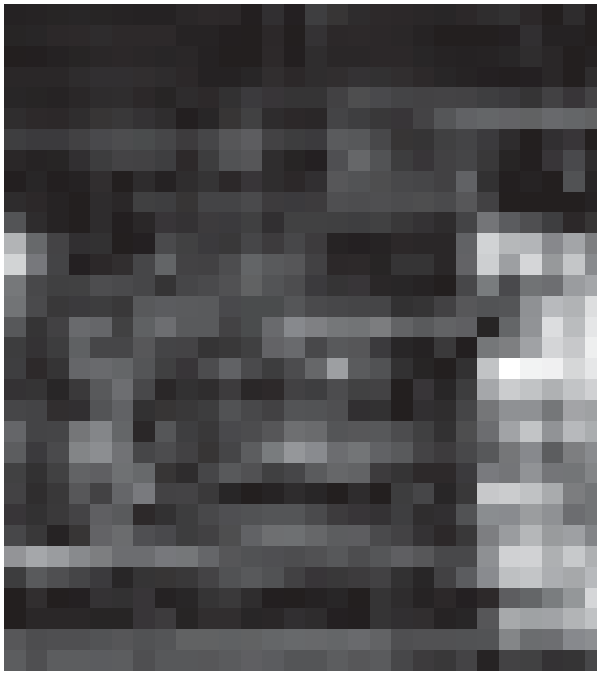
Un siguiente refugio más avanzado es un cobertizo rectangular con troncos de muros bajos (un par de hileras). La cubierta, que arrancaba casi desde el suelo, apoyaba sobre una viga maestra (hilera) que se sujetaba con pilares de troncos. El tejado se resolvía con corteza de abedul y no con paja, constituyendo el elemento dominante del edificio. En el centro de la casa estaba el hogar, la chimenea que centralizaba la vida familiar. Este tipo de refugio que es prehistórico para el resto de Europa se empleaba cuando Finlandia estaba permanentemente bajo hielo.

La casa de troncos tal como la conocemos hoy llegó a Finlandia a través de la inmigración de Suecia y Alemania y en ella tuvo importancia una herramienta especial para realizar las juntas (una especie de tenedor denominado vara) cuyo uso se extendió rápidamente por el país (nos encontramos en el siglo XII).

La evolución de la casa de troncos tiene dos etapas principales.

La tipología primitiva se mantuvo hasta el siglo XIX y consistía en espacios muy compartimentados cuyas juntas se rellenaban con musgo. Se cimentaba sobre un basamento bajo de piedra que se terraplenaba en uno o dos lados. El espacio interior, que al principio se dejaba libre hasta el tejado, se fue compartimentando y rellenando con finas capas de tierra (siglo XVII). La cubierta, de corteza

Solución de bloque-pilar



From log to chipboard

Pannu Kaila
Summarized from 'Timber Construction in Finland'
Museum of Finnish Architecture & Finnish Timber Council
From log to chipboard - The development of the finnish wooden house

The shelter and the hut-ancient wooden houses

The oldest building type known in Finland appears to have been the circular shelter presumably made of wooden spars covered with textiles or animal skins. It seems that the sloping walls of the shelter were supported by a circle of upright posts in the interior. The ancient word for such a shelter, *kota*, survives in contemporary Finnish as *koti*, or 'home'.

A slightly more advanced building type is the

de abedul, se fue cubriendo con turba o tierra vegetal y yerba. Para los edificios de gran porte (iglesias, ayuntamientos, etc.) se desarrolló el bloque-pilar. El bloque requiere seis esquinas talladas en cada hilera. Se trata de una laboriosa adaptación de las pilastras de bóveda y los contrafuertes de las iglesias y un intento de dotar a las iglesias de madera de la solemnidad de los grandes edificios de piedra.

Los primeros tratados

Durante la Ilustración la atención se dirigió a los métodos de construcción: un primer tratado se editó en Suecia en 1739 y en el periodo entre 1762 y 1775 se presentaron tres tesis doctorales sobre construcción en madera en la universidad de Turku.
Entre las primeras recomendaciones que allí aparecen están los cimientos de piedra sobreelevados al menos un pie para evitar las salpicaduras y la cámara de aire inferior ventilada. El calafateado de las juntas se recomienda que sea sobre las 4" de contacto entre hiladas, que más 1" por cada lado dan espesores de muros de 6", mientras anteriormente se empleaban de 8" y 4" de apoyo.
No se da importancia al aislamiento térmico pero sí a la estanqueidad que se recomienda solucionar con papel pegado en paredes y techos. También se recomiendan el doble cristal (el vidrio apenas había empezado a emplearse en la carpintería), especialmente en la cara norte.
Evidentemente la carpintería debe sellarse para el invierno. Se recomiendan tablas solapadas o tejas para la cubierta en vez de corteza de abedul, que además produce mucho desperdicio de material.
Las fachadas se han de ser revestidas de entablado vertical que puede sellarse por detrás con corteza de abedul y se pintara con ocre (óxido de hierro hidratado que con frecuencia va mezclado con arcilla) como medio de protección.
Los edificios de troncos alcanzaron su cenit durante el siglo XVIII, en el periodo de dominación sueca pero se veían sometidos estéticamente a los edificios de piedra en aspectos como juntas y matar esquinas.

Vivienda de loa años 20. Eliel Saarinen

Las casas de troncos en el siglo XIX

El más importante tratadista en este siglo fue sin duda C.L.Engel, quien además fue un pionero de la tecnología de la construcción. Engel demostró con la piedra y la madera unas enormes capacidades arquitectónicas. Desarrolló las, así llamadas, cerchas suecas.
Para proteger las cabezas de las vigas embebidas en muros de mampostería recomendó el empleo de la sal, método que todavía sigue en uso en forma de barras de bórax.
La casa ordinaria de troncos quedó fijada en su forma definitiva en el siglo XIX: su basamento es de piedra a menudo sobre cantos rodados, cuyo uso se hizo familiar tras las experiencias en las obras de la fortaleza de Suomenlinna, en el puerto de Helsinki.

rectangular hut, which had side-walls a couple of logs high, log gables perhaps propped by vertical timbers and a ridge roof supported by wooden pillars and provided with a smoke-hole at the top. The roof, which began almost from the ground, and probably made in Finland of split logs and birch-bark rather than straw, was the dominant element of the external shape of the building. In the centre of the floor was a long paved fireplace which formed the focus of living. This building type, too, is prehistoric in the European context; it is possible that people were living in buildings of this kind in the Mediterranean countries when Finland still lay under a covering of ice.
The log house as such is essentially a German Sweddish import. At this period the *vara*, a special fork-like jointing tool, also made its appearance. Finns were probably experienced handlers of wood even before the arrival of the strangers, so that the new buildings types and high-quality toolsspread rapidily into general use. Nevertheless, the hewing of the outside surfaces of walls, for example, which both embellishes a building and makes it more durable, became widespread in the interior of the country only in the 18th century. Linguistically, *pirtti*, a word of Slavonic origin, and the Germanic *tupa*, both terms denoting cabins or rooms, originally meant living spaces with high, joined log walls.
The development of the log house can be divided into two main phases. The earlier building type, of medieval origin, survived in the modest constructions of remote areas until the 19th century. It was characteristic to build a number of small spaces without dividing walls instead of a homogeneous building mass. The corners were often handsomely carved and keyed, and the gaps between the logs were plugged with moss. Because the insulation were built on low stone bases. The interior space, which at first rose all the way up to the roof, received a tripartite intermediate ceiling with a thin earthen filling in about the 17th century. Roofs were of birch-bark covered with turf or

El doble suelo estaba relleno con musgo o serrín.
Los muros de rollizos mecanizados se cubrían al interior con papel pegado y en el exterior con tablero de cartón embreado y tabla ya estabilizada. Las esquinas peraltadas superiores se prohibieron en las ciudades por considerarse rústicas.
En 1872 se empezó a fabricar tabla machihembrada con junta en V. Los perfiles rectos provenían de Noruega quien siempre ha sido un país pionero en industria de la madera. Para proteger las fachadas se empleaban costosas pinturas al aceite. No se permitía colocar estufas pegadas a los muros y en el interior debían rodearse con ladrillo. En orden a la seguridad frente incendios se prohibieron los edificios de dos plantas ya en 1856. Las ventanas siempre eran de doble cristal con perfiles de madera en T.

Al final del siglo pasado la construcción con madera se desarrolló enormemente gracias a las publicaciones técnicas. Los arquitectos volvieron a fijar su atención en las construcciones rurales y se empezaron a construir edificios públicos con madera, tales como iglesias, colegios o ayuntamientos.
Cuando en estos caso se empezaron a colocar huecos de fachada grandes (por ejemplo superiores a los 3m) se debió recurrir a rigidizar los muros mediante pies derechos o tirantes metálicos.
Las fendas de secado y las grietas se rellenan a los 2 o 3 años, después de le estabilización del edificio. Los diseñadores desarrollaron una junta especial para vigas horizontales compatible con sus deformaciones en el centro.
Diferentes combinaciones de tablón y tabla se experimentaron entonces en viviendas y en

Construcción ecléctica en Juvascula del siglo XIX.

construcciones ferroviarias.
En Finlandia los arquitectos dispusieron de los excelentes libros suecos hasta la aparición de un hito con el manual 'Edificios agrícolas' de Alfred Sjöström en 1891; el libro venía magníficamente ilustrado con una serie de láminas. Este libro provocó una ruptura con respecto a la arquitectura sueca. Sjöström clarifica los distintos sistemas de muros: macizos, rellenos. Pueden hacerse con tablones machihembrados, con pies derechos cuyo entre-eje se rellena con maderos dispuestos horizontalmente, con entramados más cerramientos de tabla y rellenos de serrín o de ladrillo. Introduce la diferenciación entre elementos portantes y de cerramiento, con concepciones más racionales y modernas. El siguiente libro editado en este campo fue el 'Tratado de construcción de viviendas' de Gustav Arp, escrito para escuelas de maestros constructores. Se publicó en una serie de entregas entre 1900 y 1908, dedicando el segundo volumen a las estructuras de madera.

Sistema 'balloon frame' y entramado ligero

El sistema entramado con relleno de serrín aparece por primera vez en las buhardillas

beams.
One Finnish original solution was the block-pillar structure used in certain churches, in which slender, square log pillars divide long walls. The supporting pillar is probably, rather, a laborious adaptation from the world of the vault pilasters and kontrefors of stone churches, an attempt to give wooden churches a touch of solemnity of stone structures. At the same time the problems of the reinforcement of long walls and the support of the roof structure were solved.

The developing log-house

During the period of the Enlightenment, attention began to be directed toward the building methods of log-houses. The pioneering work was printed in Sweden in 1739. In the period of 1762-1775 three doctoral theses was presented at Turku University. Among others recomendations appeared that houses should be built on a stone base: ' The base wall should be at least one foot (30 cm) high, preferably 2 or 3 feet in linving rooms, for this not only prevents the splashing of darinage water on the walls but allows a handsomer prospect. It is also healthier to live a little above ground level, when the floor, too, does not so soon rot from humours and dampness rising from the ground. A double floor was offered as an alternative to the earth-bank, whose base was made ventilable to avoid dry rot, The caulking gap between wall timbers was to be 4in (10cm), and that of the entire timber ideally 8in. In practice, however, it was considered sufficient to leave 1in wood on either side of the 4in caulking gap, so that 6in logs became more usal. No importance was attached to the thickness of the heat insulation; instead, the draughtproofing was considered of first importance, which is, of course, vital for the warmth of the room. 'Paper was also recommended for the ceiling:' Experience shows that if the ceiling is not tight, heat is lost most quickly of all by this route. 'Instead of moss which generally swarmed with mouse-nests, limed gravel was recommended as a

de Suomenlinna en 1780, caso ya mencionado por Sjöström pero el sistema americano es el que primero se da a conocer, primero en Chicago en 1832 y luego en la exposición de París de 1867. El sistema consiste en un entramado de madera aserrada de secciones pequeñas unida a través de clavos y reforzada con tablazón diagonal.

El sistema llega a Finlandia a través de emigrantes que han vivido en Norteamérica y es descrito en la revista Arkkitehti en 1909 con realizaciones hechas en Finlandia por Valter Thomé y Gustaf Strengell. En su opinión este sistema hace obsoleto la construcción tradicional maciza revestida de tabla, vestigio arcaico en el que se confunden las funciones portantes y aislantes del muro. Antes de que el 'balloon frame' se estableciera realmente en Finlandia se dio un interludio de edificios con muros de tablón machihembrado. Este tipo de edificación que empleaba piezas verticales y horizontales era frecuente en el sur de Suecia y en Finlandia se había aplicado en los edificios ferroviarios. En Tampere se desarrollaron tres grupos de vivienda con este sistema después de la Primera Guerra Mundial pero se abandonó finalmente. La realidad es que el sistema de tablones machihembrados era más caro que el de troncos. Mientras, se producía un vigoroso debate entre los técnicos sobre los relativos méritos de las casas de troncos y de tablón machihembrado. En las primeras se destaca la estanqueidad, longevidad, resistencia al fuego, robustez y su movilidad, mientras tiene como desventajas el fendado y el movimiento de la madera, el mantenimiento, el desperdicio de material, la pesadez de las piezas en su manipulación. Las segundas ofrecían como ventajas su rápida construcción, inmovilidad, ahorro de material en términos macroeconómicos, posibilidad de estandarizar tareas y ambivalencia de las caras de los muros exteriores. En los años 20 las estructuras de troncos empezaron a criticarse como pasadas de moda en términos de despilfarro de materia prima, mano de obra añadida y necesidad de estabilización final del producto.

A pesar de todo la madera

filling, 'if you have the means` , os sweet-smelling sawdust.

Glass windows also became more widespread during the 18th century. 'He who has means to procure double windows, on the north side al least, will thus wind warmth, even though the rooms will thereby become a little darker... It is obvious that window frames should be stuffed and tapered for roofing than birch-bark, which wasted timber, but the ideal was a roof, and the seeking of roof slates was also encouraged. Weather boarding or painting was not yet suggested to these writings, which were primarily directed at the improvement of folk building. Nevertheless, prominent buildings were enbellished with smooth, vertical boarding as early as the 17th century; this also aided interior warmth if a layer of birch-bark was placed under the planks. Red ochre distemper painting was recommended as a way of preserving wood in the authentic manner of the Age of Utility.

The climax of log building during the period of Swedish rule but according to all the rules of art, beautiful` among other was the imitation of the stone facade: and so the two-storey manor has short corners and smooth boarding.

The log-house in the 19th century

The most important and influential figure in Finnish building in the early 19th century was undoubtedly C.L. Engel. He was also a pioneer in building technology. Engel had a masterly grasp of wood construction, as demonstrated for example by his enormous wooden churches such as the one at Pyhäjoki, he developed better solutions, the so socalled Swedish roof truss and developping protection of the heads of wooden beams instead of embedded in plaster from rotting recommending holes filled with salt - a method that, in the form of borax rods, is still in use today.

The ordinary log-house became established in its new form in the 19th century. The Building had a high stone base, often of dressed boulders, whose use had become familiar with their use along with the rank-and-file soldiers who had worked on the building of the Suomenlinna fortress, on an island in Helsinki harbour; in the 18th century. The double floor was packed with moss or sawdust. Smooth-hewn log walls with corner joints shaped evently by the saw were covered on the inside with lining paper and on the outside with tarred cardboard and weather boarding. Overhanging crossing corners were used in rural areas, but in many towns it was forbidden by the uneconomic with space.

Industrially planed beaded and V-jointed board production began in Kotha in 1872. The plane profiles came from Norway which was for a long time the Nordic pioneer in the timber production sector. Expensive oil paint was always used to protect such surfaces. It was no longer permissible to place stoves directly against a log wall: instead, a brick fire-wall was to be found within the stove group. In order to improve fire security, two-storey wooden building and even heated attics were

seguía considerándose como el material preferido en los edificios públicos. La 'Guía de construcción de edificios ferroviarios' de 1930 aprobó el sistema de tablón y tabla ('board&plank') sólo para dependencias y oficinas1.
En la época de los '30 otros edificios públicos -escuelas, iglesias, ayuntamientos- se construían con muros macizos, siendo en las viviendas y en construcciones pequeñas donde se fue introduciendo más fácilmente el entramado ligero con muros rellenos de serrín.
Otro renacimiento destacable de las casas de troncos se produjo durante la Segunda Guerra Mundial y el periodo de austeridad subsiguiente por la ausencia de productos industriales.
Hubo de esperarse a la recuperación económica para que el 'balloon frame' se impusiera definitivamente. Aunque se reconocieran sus diferencias en términos de durabilidad, era más rápido de ejecutar y la obra se terminaba de una vez, sin necesidad de ajustes posteriores.
Durante los años '20 la madera aserrada había ya sustituido a los maderos en las viguetas y desde el siglo XVIII los manuales de construcción ya ofrecían tablas de predimensionado. Sjöström, también, sugería un método de cálculo adicional a sus tablas.
La literatura sobre arquitectura finlandesa en madera ha aumentado considerablemente en este siglo. Fundamentalmente se trata de guías para edificios rurales o agrícolas: 'Edificios para granjas pequeñas' con cuatro ediciones entre 1933-1951, 'Reparación y mantenimiento de edificios' de 1943, 'Una Guía para carpintería de armar' de 1925 destinado a sectores más profesionales, 'Una enciclopedia de construcción' de 1943, 'El arte de construir con madera' de 1946, 'Carpintería' con tres ediciones entre 1957 y 1971. Información periódica técnica fue publicada en 'Manual técnico' en los años 1914-1917 y el 'Calendario del constructor'. Las normas sobre estructuras de madera aparecieron en 1946.

Construcción de paneles y construcción con paneles

El primer tablero que apareció en el mercado fue el contrachapado que empezó a fabricarse en Finlandia en 1893 pero tardó en extenderse como material de construcción debido a su alto coste. En su lugar empezó a utilizarse el 'Ensopahvi', un cartón muy rígido de 6 mm que inicialmente se empleaba como relleno en el sistema de tablón y tabla.
La compañía Enso puso en marcha edificios experimentales en su fábrica y preparó un dossier describiendo sus estructuras y un proyecto de producción de casas de madera.
La fabricación del 'insulite', un tablero de fibras poroso comenzó en Korkeakoski por una empresa norteamericana, Masonite. Se trataba del tablero de fibras duro, cuya línea de producción entró en funcionamiento en 1937.
Muy pronto la excelencia de

forbidden in the general building regulations for towns in 1856, but in the country side building was free. Windows were doulble-glazed, generally T-framed.
At the end of the last century, the development of building in wood was influenced above all by the increasing amount of professional publications and literature. Architects began to turn their attention to the design of wooden rural buildings, and new type-plants for wooden buildings such as railway station and schools demanded new technology, which also replaced traditional methods in the building of wooden churches. In these public buildings windows often grew to more than 3m in heght, and the making of allowances for settling and the strenghening of the walls became difficult. The use of vertical timbers between the windows was proposed to help. The vertical structure had to be bonded together with iron ties because, as it dried, it no longer settled to become uniform and weathering. Opened cracks were chinked after two or three years as the building was weatherboarded. Designers also developed a special joint for horizontal beams, which could support weight at its centre and could easily be chinked afterwards. This was used, for example, in railway buildings. Various thin plank and board structures were experimented with in villa projects.
In Finland, architects studied the plentiful and excellent Swedish literture till the publication of Alfred Sjöström´s 'Agricultural buildings´ in 1891: the book was ilustrated, and was also furnished with an excellent appendix of plates. Wooden walls can also be made with tonghed-and-grooved planks; of columns, the gaps between which are filled with horizontal timbers; from framing which can be boarded, either only on the exterior or on both sides, in which case the space between the boarding is filled with sawdust, and also with framed walls and brick fillings`.

Balloon frame system
The boarded frame structure, sometimes even with a sawdust filling, appeared in attic rooms.

Librería Vaiilila. Helsinki 1992

estos paneles hizo que su empleo como refuerzo del 'balloon frame' fuera una realidad

Heikki Siikonen escribía en 1933: "Ensonite, insulite y paneles similares pueden utilizarse como cerramientos de interior, en lugar de tabla en los muros de entramado ligero. Cuando se emplean en la cara exterior hacen innecesario el arriostramiento y en la interior el papel de forro".

En un artículo titulado 'Los tableros de fibra de madera' en 1971 escribía A. Vaajoensuu: "Los ensayos de aplicación y la experiencia práctica han demostrado que los tableros de fibras duro de 3 mm ó los de fibra porosa de 12 mm, fijados a la estructura entramada refuerzan la rigidez del muro de tal manera que hacen innecesario el empleo de tabla".

El empleo de esta estructura invitaba a experimentar en la compartimentación de las cavidades como en los días pasados. Para esto se utilizó el 'Takolite', un cartón corrugado, durante los años '40 y '50, pero finalmente se abandonó el empleo de muros huecos por temor a que errores constructivos provocaran condensaciones. El cambio final del cerramiento

The new 'American building practice ` was described in *Arkkitehti* ('The architect ´) magazine from 1908 to 1909 by Gustaf Strengell. Strengell remarked how, in some areas, developtment had trod water for long periods. 'One of these is wooden architecture. For in fact how insignificant is the development of this technologies ` . In his opinion, it was only now thata there had been any development from the primitive log cabins of our pelt-clad ancestors to a rational mode of buinding in which the supporting and insulating functions of the wall were separated into their own constructional elements.

Before the balloon frame building really became established in Finland, there was an interlude of plank buildings. Vertical plank structures were common in the southern parts of Sweden, and in Finland it had been tried to railway buildings. The shortages by the First World War, turned interest toward cheap building methods. The so-called Gothenburg structure, and was presented by Birger Brunila at a housing congress in 1917. The city of Tampere, which had suffered badly in the fighting of the Civil War, boldly built two groups of houses designed by Birger Federley in 3in tongue-and-groove vertical planks in 1919, but because of the doubts of the city conditions it subsequently asked for an expert opinion form two experienced building engineers.

There was vigorous discussion of the relative merits of log buildings and plank buildings. The advantagess of the log cabin included draught-proofness, longevity, better fire-proffness, sturdiness and the posibility of being moved from one site to another. Disadvantages included splitting and moving, the care demanded in building, waste of materials, heavy handling and freight charges and the fact that 'a log wall that has been put to bed cannot then be boarded, and therefore at once made ready ` . Among the advantages of boards and plank walls were faster constructions, inmobility, 'savings in terms of the national economy, the possibility of standardisation of tasks and the fact that the wall can be made ready both internatlly and externally at the same time ` . Numerous 'economy building practices ` were presented at the same building fair, includings a planed timber structure similar to those in use today.

In the 1920s, log structures began to be criticised as old-fashioned. Nevertheless, timber was felt to be better for public buildings as the national railway system ´s ' Building guide for house-buildings ` of 1930 approved board and plank buildings only for ourthouses. Wooden buildings for the railways and other builders using sikilled labour-barracks, schools, curches - represented high-quality wood buindings. In small houses, the sawdust-filled balloon frame building gradually supplanted teh log structure during the 1930s.

A remarkable renaissance of log-building was experienced in Finland during the Second World War and the period of austerity that followed. It

de tablas + arriostramiento al de tableros se dio con la aparición del tablero aglomerado en Finlandia en 1956.
Según constata el libro de Jarle 'Unidades de precios de estructuras' de 1961 el empleo de tableros en construcción se difundía rápidamente. En efecto, en 1961 los tableros de refuerzo en muros se utilizaba en un 30% de los muros de viviendas. En 1964 era el 40 y en 1969 el 100%. La lana mineral, que se fabricaba en Finlandia desde los años '40 suplantó al serrín como aislante a la misma velocidad.
La facilidad de transporte ha sido siempre parte de la naturaleza de las casas de madera, comparada con la construcción tradicional. La costumbre se conoce, al menos desde el siglo XVI. La movilidad de las casas jugaba un papel importante en la división de las tierras, siendo relativamente frecuente que una casa se moviera hasta tres veces a lo largo de su vida. Así pues las casas prefabricadas formaron parte de la política colonial de las grandes potencias en la Europa del siglo XIX. Noruega llegó a exportar iglesias neogóticas a Madagascar.
En 1890 unas pocas empresas de carpintería comenzaron a producir pequeñas unidades construidas, saunas, baños, casitas de verano. Casas y villas fueron fabricadas en Helsinki en 1928 y Ahlström planeó una factoría a finales de los años '30. El empujón final para la prefabricación finlandesa fueron las campañas de invierno de la Guerra para realizar barracones. En la inmediata paz de 1940 la compañía Puutalo Oy se fundó con el esfuerzo de 21 empresas de la madera. Se utilizó la experiencia sueca, que había empezado a prefabricar casas desde 1930. y después de la IIª Guerra mundial se exportó

1992 Viviendas cerca de Helsinki de Esko Rautiola (ARRAKS Arquitectos)

was only after the recovery from the shortages that the balloon frame house house secured its victory. Although balloon frame buildings cannot be considered the equal of log buildings in terms of durability, the can, if properly made and faced, have many advantages. First they are cheaper. Then, their building is easier and faster. And a building is easier and faster.
As a material for joists, sawn timber replaced logs during the 1920s. Tables indicating the load-bearing capacities of timber beams and ways of calculating their dimensions had appeared in building manual as early as the 18th century. Sjöström, too, suggested a method of calculation in addition to the table.
Literature concerning Finnish wood building eas significantly added to at the beninning of the present century. In the majority were various guides intended for independent farmers, on which the most widespread was Helsinki Silkonen´s 'Building for small farmers`, 'The repair and maintanance of buildings´, 1943, A carpenter´s building guide`, 1925, 'An encyclopedia of building` in 1943, 'The art of wood building`, 1946 , 'Carpentry`, in 1951- 1971, 'The technical handbook` in 1914 and, from 1917, The builder´s calendar`. The building standards for timber structures appeared in 1946.

Building panels and panel building

The first panel material, plywood, which began to be manufactured in Finland in 1893, not become widespread as a material for building panels because the high cost. Ensopahvi, a 6mm, strong cardboard manufactured from 1916, functioned initially as packing in board and plank buildings. The Enso timber company put up experimental buildings for its factory developing structures for wooden houses. The production of porous fibre board, or insulite, began in Finland when an American-owned factory was strated at Korkeakoski in 1931; the 'masonite`, or hardboard, production line was set up in 1937. The insulite factory opened up markets for itself by holding a design competition for an insulite villa in 1932.
Very soon, the excellence of the panels as reinforcement for balloon frame buildings was realised. Heikki Silkonen wrote in *Pienviljelijän Rakennusoppi* 1933: 'Ensonite, Insulite and similar panels can be used instead of boarding for the inner surfaces of outer walls and for internal walls. When used for outer walls, no diagonal boarding is needed, or cladding felt, or lining paper for the internal walls. 'Performance experiments and practical experience have demonstrated that 3mm hardboard panels or 12mm porous fibre panels, attached to the frame structure, reinforce the wall structure, for example, quite sufficiently, sot that from the point of view of reinforcement boarding is unnecessary`.
Dense panels also invited the building of holow-framed walls generally divided into two three compartments, just as in the early days of the board house. Compartment wall were made from both the corrugated cardboard-like Takolite and from porous fibreboard. These were used mainly in the 1940s and 1950s. Neverthless, it was feared that susidence and building errors might cause airleaks, and hollow structures were abandoned.
The final shift from balloon frame houses reinforced with diagonal boarding to structures reinforced with panel was brought by chipboard, whose production began in Finland in 1956. In P.O. Jarl´s book *Rakenteiden yksikkökustannuksia* ('Unit prices of structures`), published from 1961, which gathers together various structural solutions, the triumphal march of building panels during the 1960s is evident. In 1961 the proportion of panel-reinforced walls in small houses was about 30 per cent, in 1964 40 per cent and in 1969 100 per cent, Mineral wool, which had been manufactures in Finland since the early 1940s, supplanted sawdust at about

mucho a la Unión Soviética como compensaciones de guerra.
Las típicas casas de los años '60 y '70 manifestaban, sin embargo, una cierta sospecha hacia la madera en fachadas por su necesidad de mantenimiento. Para solucionar este problema se recurrió al asbesto como material libre de mantenimiento, al ladrillo y a las planchas metálicas, pero fue finalmente el tablero de partículas el que se impuso, revestido con productos al látex.
A la manta aislante de 100-150 mm se empezó a añadir una lámina de plástico como barrera de vapor.
La industria de fabricación de viviendas de pequeña dimensión se impuso finalmente gracias a la crisis de la energía, la búsqueda de materiales respirantes, el miedo a las radiaciones de radón y el sentido ecológico de los materiales.

the same speed.
Easy of transportation has always been part of the nature of the wooden house, compared to masonry or frame-built structures. Log buildings were hwen in late winter in the forest or even on the ice, dismantled and brought into the courtyard or sold to the town. The numbering found on building timbers does not, therefore, necessarily refer to anything more than transportation during building. This Nordic custom was wondered at by travellers as early as the 16th century. The moving of buildings played a major role in divisions of lands. Materials used were corrugated iron, cart iron and wood. In the 1890s, a few carpentry factories began to produces small prefabricated cold buildings such as bathing rooms and summerhouses. Houses and villas were manufactured in 1928, in Helsinki and Jaakkima, and Ahllström planned a real factory for wooden houses at the end of the 1930s. The final impetus for the Finnish prefabricated house industry was given by the Winter War and its requiremen for barracks. During the intermediate peace of 1940, the company Puutalo Oy was founded through the joint efforts of 21 timber firms. A great deal of help was received from Sweden, where the production of prefabricated houses was already flourishing in the 1930. More than one thousand type-plans were drawn up in the first ten years. War reparations provided the basis for export to the soviet Union, which later became significatn. In 1950 Puutalo Oy had become the world´s largest exporter of prefabricated wooden buildings.
Typical of the wooden houses of the 1960s, and 1970s was a faint suspicion of wood as a material for façades - this was caused at leats in part by the problems in maintenance painting caused by latex. The abestos element panel Minerite was advertised expressly as a 'maintenance-free` solution, brich cladding became more common and sheet metal, too, made its appearance. It was obvious that 100-150mm mineral wool, with a plastic film as moisture barrier should be used as insulation. Open-seamed chipboard rolled with latex was the commonest surface material. A sloping roof was supported with lattice structures and laminated timber, too, was employed. The industrial building of small houses with their different house packages, which had begun in the 1940s, now conquered the markets. It was this situation which then ran into the energy crtisis, formaldehyde emissions, the radon problem, breathing buildings, dry rot, the removal of asbestos, natural paints, fungal damage and ecological thinking about materials.