

RECENT LARGE SCALE WOODEN BUILDINGS IN FINLAND



Content

Joensuu Arena - Wooden Multipurpose Hall



Metla - Finnish Forest Research Institute

FMO Tapiola - Finnforest Modular Office



Project views - selected projects in the field of large scale wooden buildings

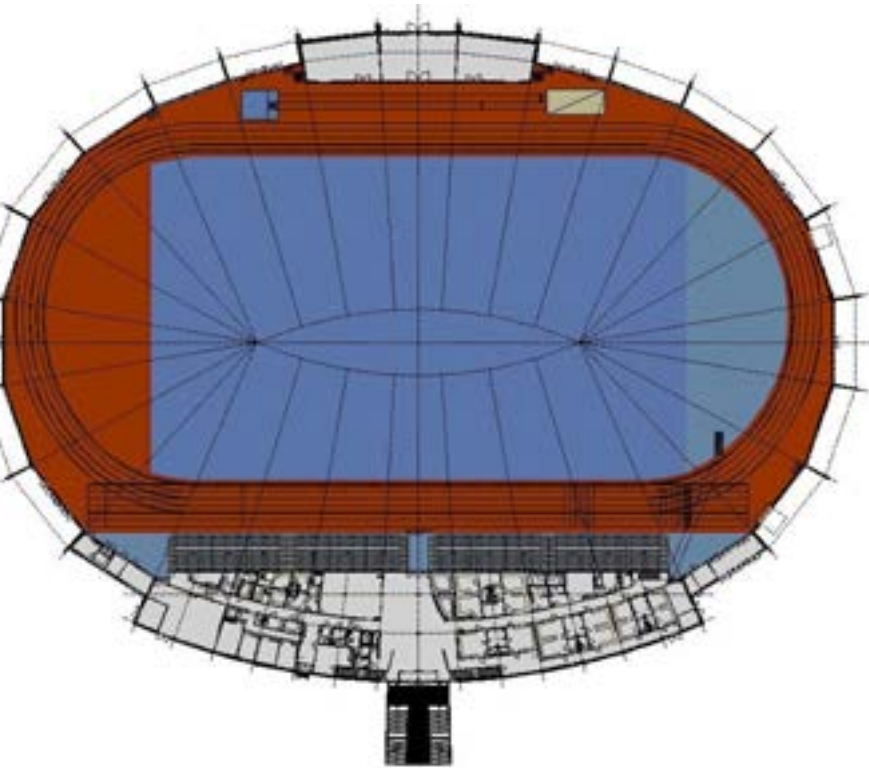


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POOK Architects' Office Ltd Finland



Joensuu Arena - Wooden Multipurpose Hall

Joensuu Arena - Wooden Multipurpose Hall



The largest wood building in Finland
Length 150 m, width 110 m, height 31 m

Area: 14.654 m²

Volume: 262.510 m³.

Multipurpose hall (sports, fairs, concerts and exhibitions)

Multipurpose premises, locker rooms and showers for athletes, office and meeting premises and an auditorium seating 2,000

Maximum capacity of people 7.000

Commissioned by the City of Joensuu

Design & Build-project

Contractor, YIT Construction Ltd

The architectural design, Proark Oy

The structural design, Finnmap Consulting Oy

The building systems design, Instakon Oy

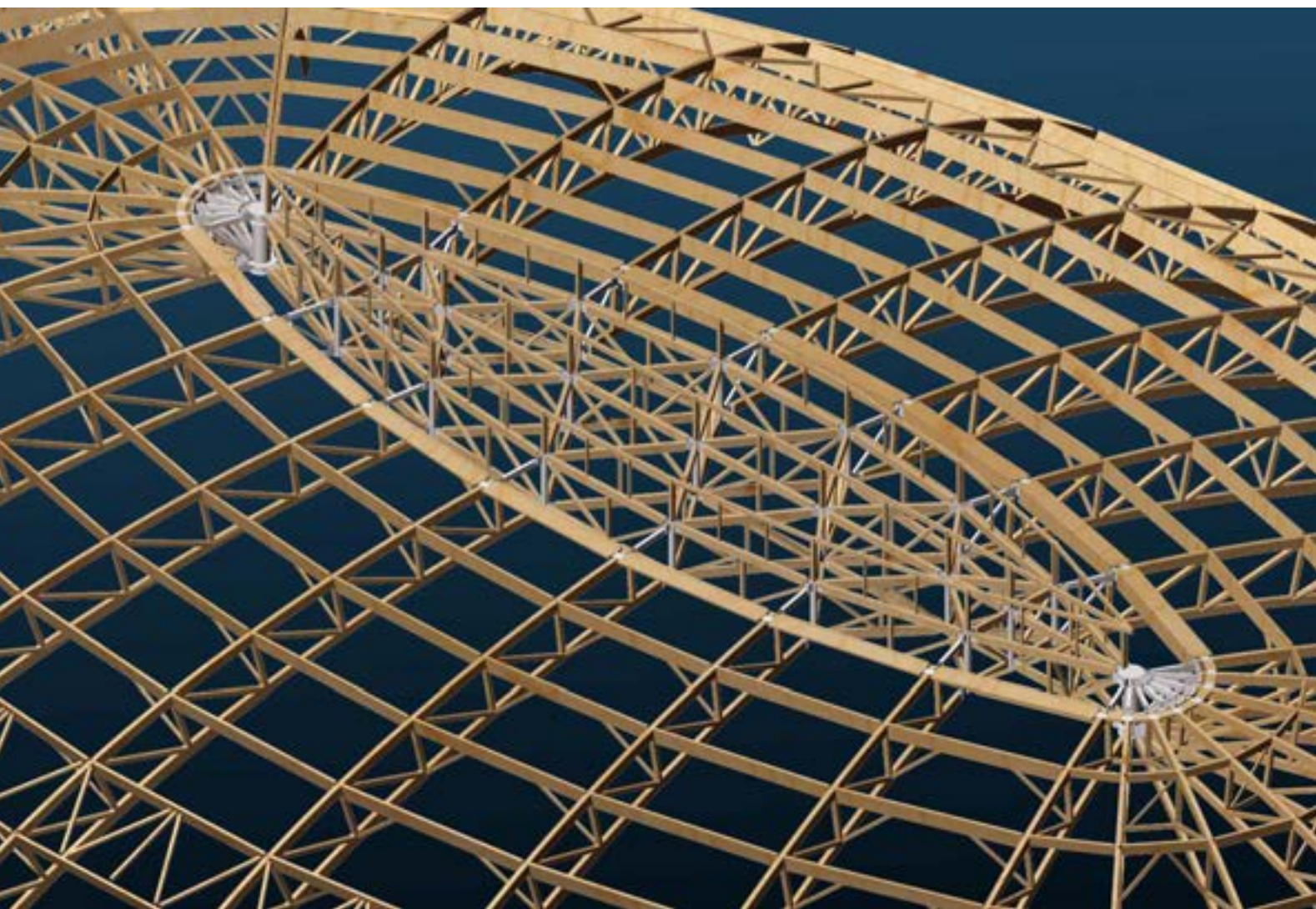
The contract price is € 10.7 million (VAT 0%)

Construction: August 2002 – January 2004

Wood structures

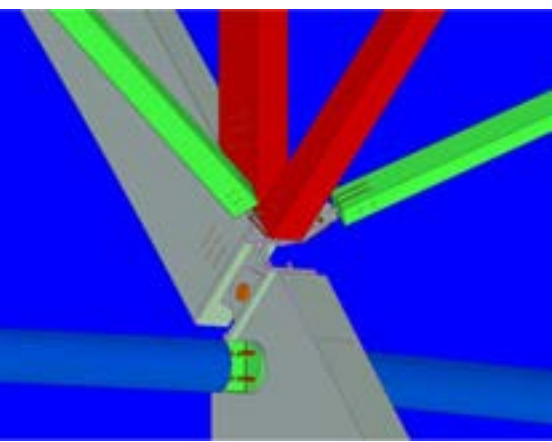
1400 m³, Space truss and diagonals
of the main arcs Kerto-LVL, Finnforest Oyj

Main arc flanges and secondary structures glued laminated timber, Late Rakenteet Oy



Cross supporting cupola

Oval-shaped base, Load bearing in both of the main axis directions, 28 separate 2-linked arcs, geometrically identical, The arc halves join in the middle in a space truss construction, Main spans 100 x 145 m



The joints

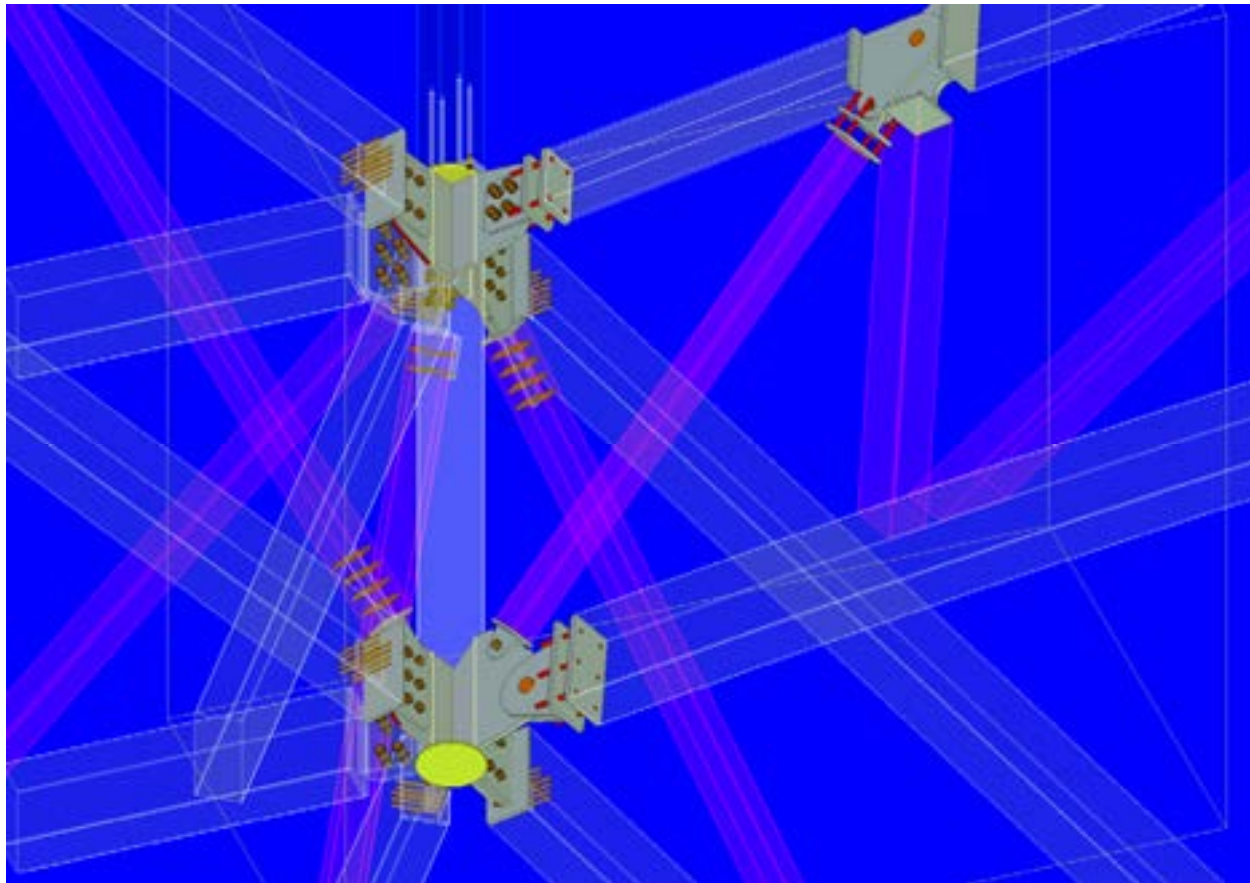
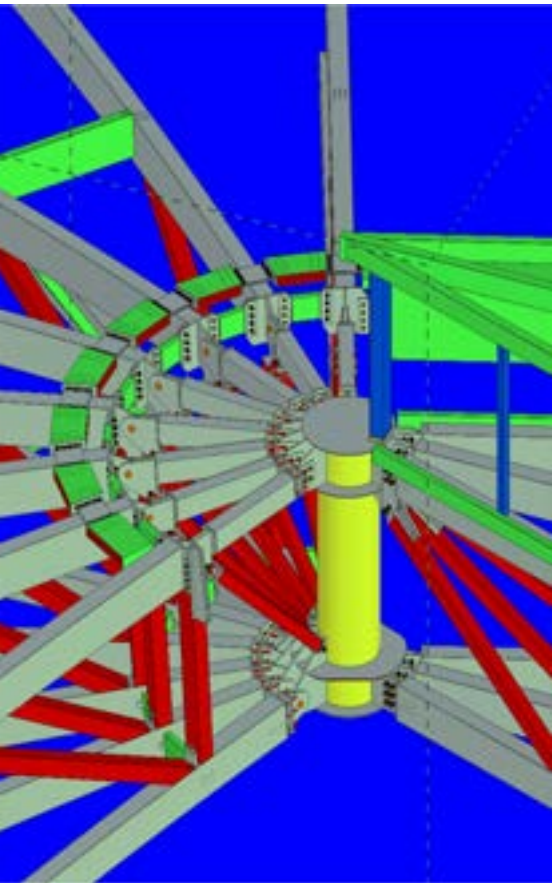
Dowel joints

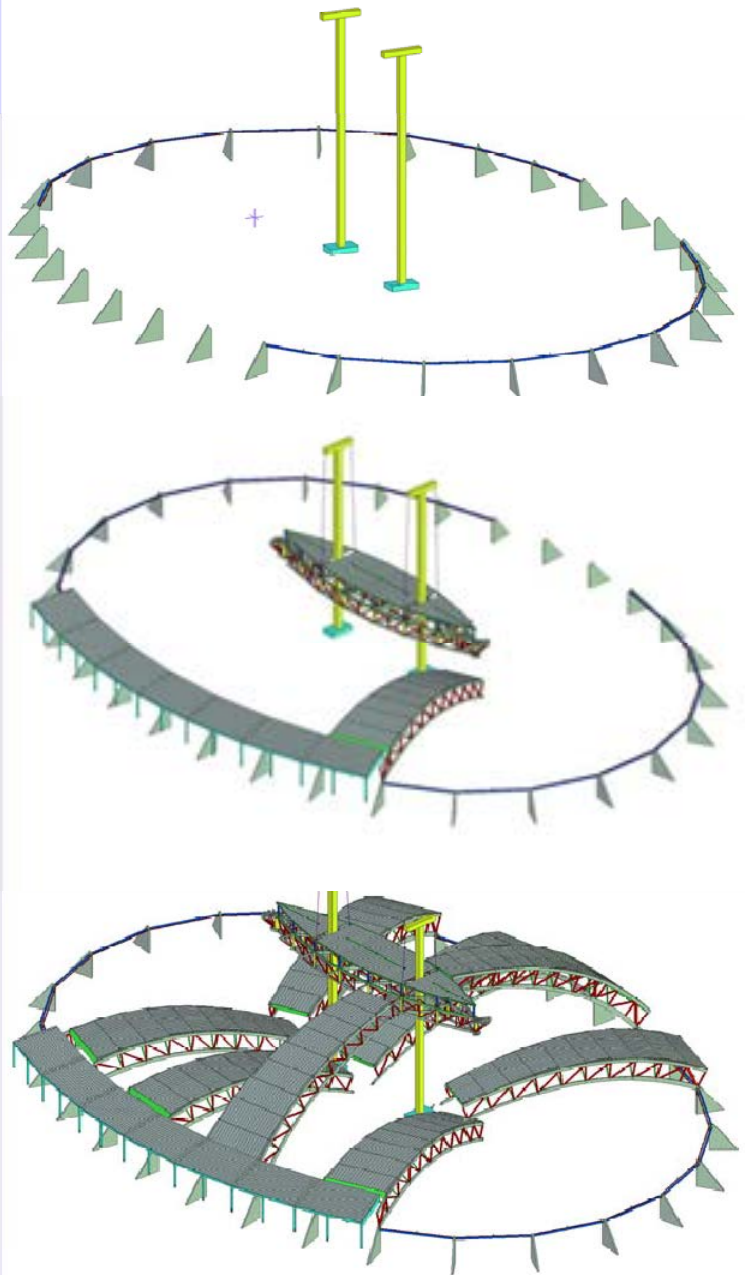
39.000 steel dowels and 4.000 bolts

Traditional steel joints between the arc blocks

150 tonnes of steel in the joints

Calculations according to the Eurocode 1-3 design rules





Implementation order

Installation of the frame of the service premises

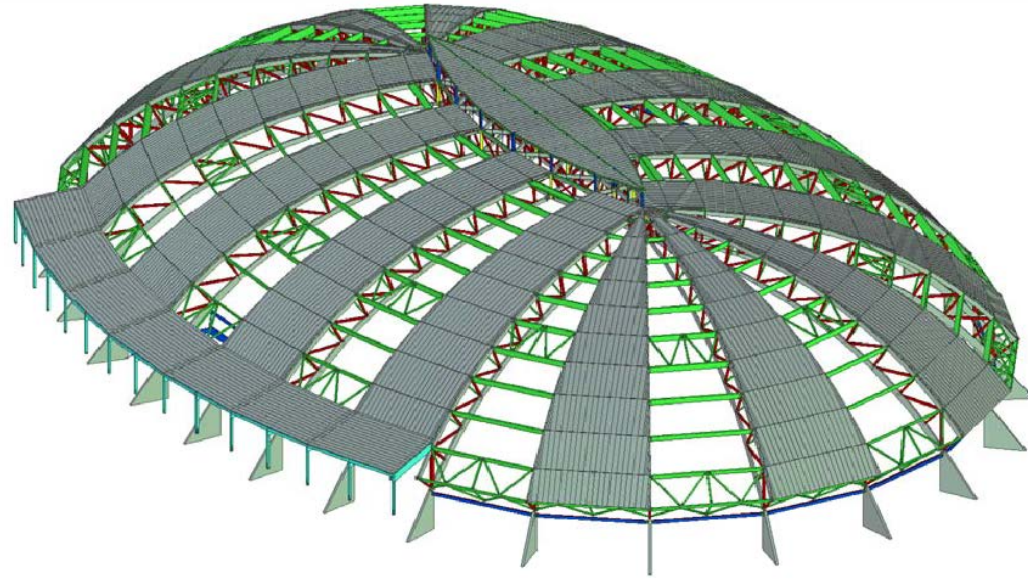
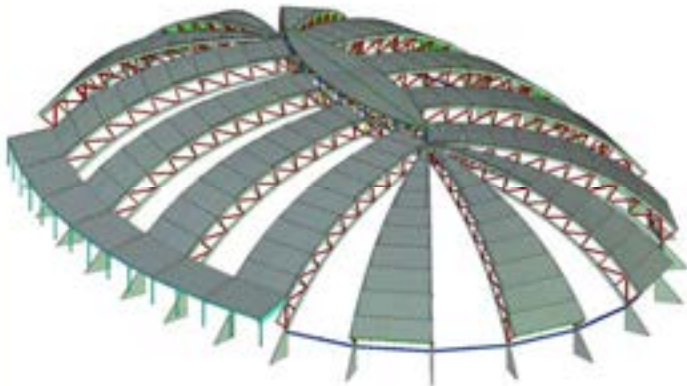
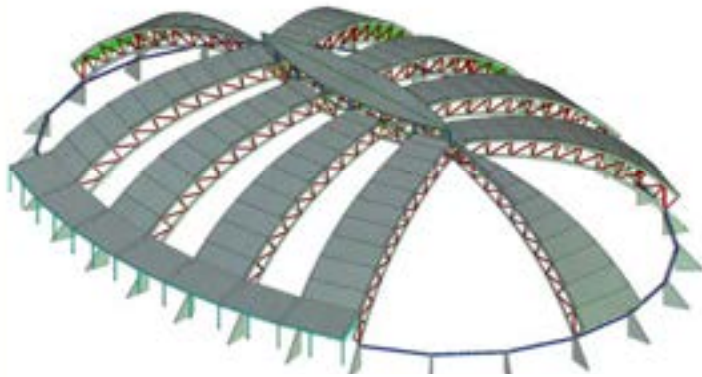
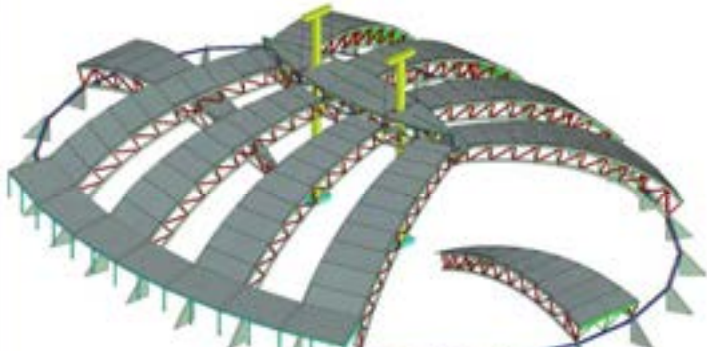
Installation of the space truss

Hoisting of the space truss

Installation of the main arcs

Hoisting of the main arcs

Installation of the purlins



Implementation order

Installation of the frame of the service premises

Installation of the space truss

Hoisting of the space truss

Installation of the main arcs

Hoisting of the main arcs

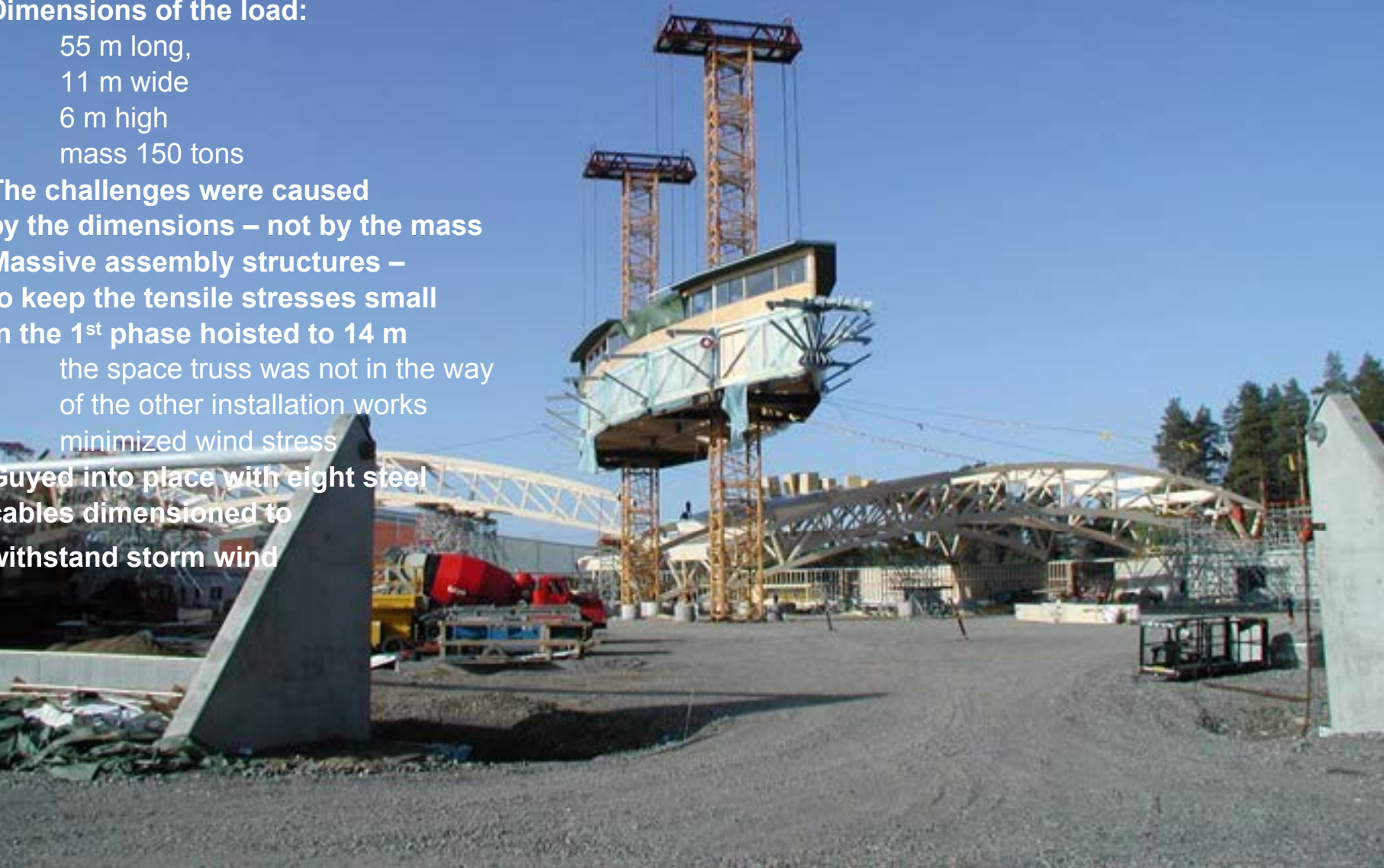
Installation of the purlins

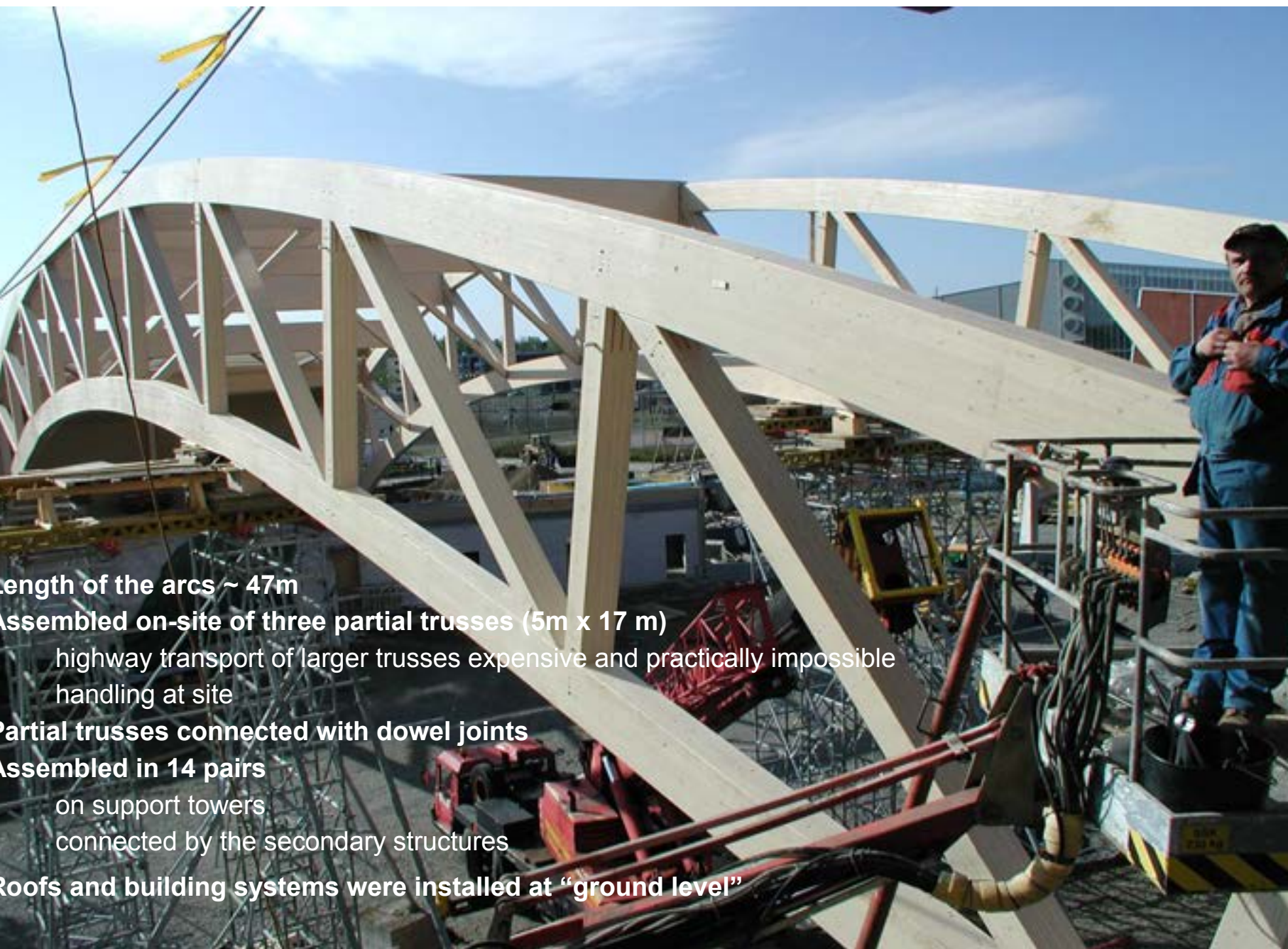
Most demanding phase during the project
hoisted onto two support towers
Four hydraulic jacks (120 tons)
Dimensions of the load:

55 m long,
11 m wide
6 m high
mass 150 tons

The challenges were caused
by the dimensions – not by the mass
Massive assembly structures –
to keep the tensile stresses small
in the 1st phase hoisted to 14 m
the space truss was not in the way
of the other installation works
minimized wind stress

slid into place with eight steel
cables dimensioned to
withstand storm wind





length of the arcs ~ 47m

Assembled on-site of three partial trusses (5m x 17 m)

highway transport of larger trusses expensive and practically impossible
handling at site

Partial trusses connected with dowel joints

Assembled in 14 pairs

on support towers
connected by the secondary structures

Roofs and building systems were installed at “ground level”



2nd phase of hoisting of the space truss

Hoisting of the main arcs with mobile cranes

- single mobile crane of about 170 tons to hoist each pair
- to keep the loads even
- two sections at a time, the loads symmetrical after attachment of cranes

“Pre-stressing” of arcs

- hydraulic jacks
- to establish stresses corresponding to the final stress, (to avoid tensile load)

Experiences - YIT, Tero Kiviniemi

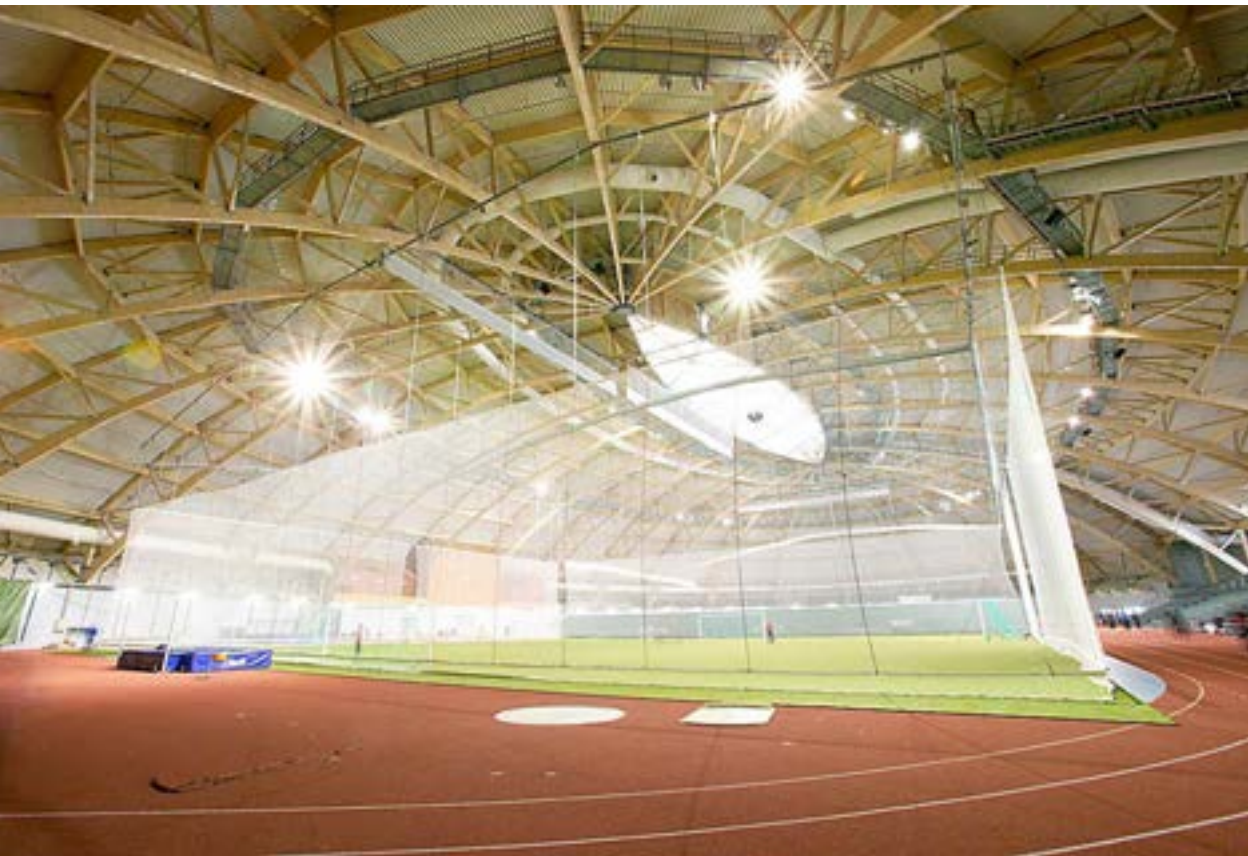
Great changes in weather conditions during installation (6 months)

- Temperatures -30°C - +30 °C
- Strong winds
- Abundant rain in August - September
- The ideal condition a dry winter with temperatures of a few degrees below zero

Procedures caused by rain

- Protection of large wood structures difficult - weather proof coating on wood and steel structures
- Joints have to be carefully protected and provided with drainage – wet joints hinder installation works
- Drying of the constructions has to be done carefully – rapid drying increases the risk of splitting
 - Cover the joints with plastic
 - Temperature 10-15 °C, RH>30%





Special Thanks and Credits of the Joensuu Arena
lecture material to:

PRO-ARK Ltd: Marjatta Hara-Pietilä
YIT Construction : Tero Kiviniemi
Finnmap Consulting Ltd
City of Joensuu: Veijo Toppinen
photographs by: Esko Jämsä, Tero Kiviniemi



FMO Tapiola Finnforest Modular Office

The investor and the owner of the building is Tapiola Group (Insurance company)

When completed, FMO was the highest wooden office building in Europe

Finnforest has been responsible for

- developing of the building
- delivering the wooden constructions, parts and facade
- the overall functioning of the construction

The main contractor was PEAB Seicon

Architectural design:
Helin & Co Architects



Background:

In the spring of 2003 Finnforest arranged a limited Nordic competition for the planning of the FMO. Altogether 8 offices from Finland, Sweden and Denmark were invited. The task was to design a wood construction office building for approximately 240 people. The winner was Helin&Co Architects, architect Pekka Helin and his team.



FMO Tapiola - Finnforest Modular Office

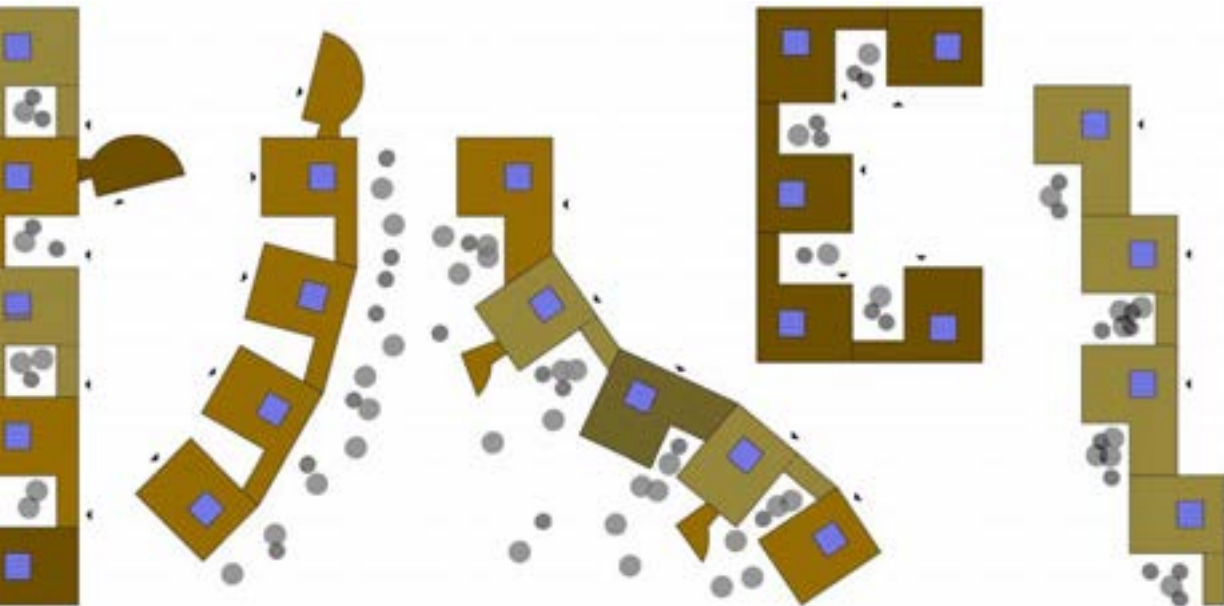
The aim:

The competition was seeking for new constructional solutions and entities for...

- intermediate floors
- external walls
- internal office partition walls
- natural ways of combining wooden constructions with other materials :
 - esthetically
 - technically
 - economically

The life-span target of the basic structures was set to a century (100 years).

Modularity means repeatable and flexible basic units, which have to be universally applicable

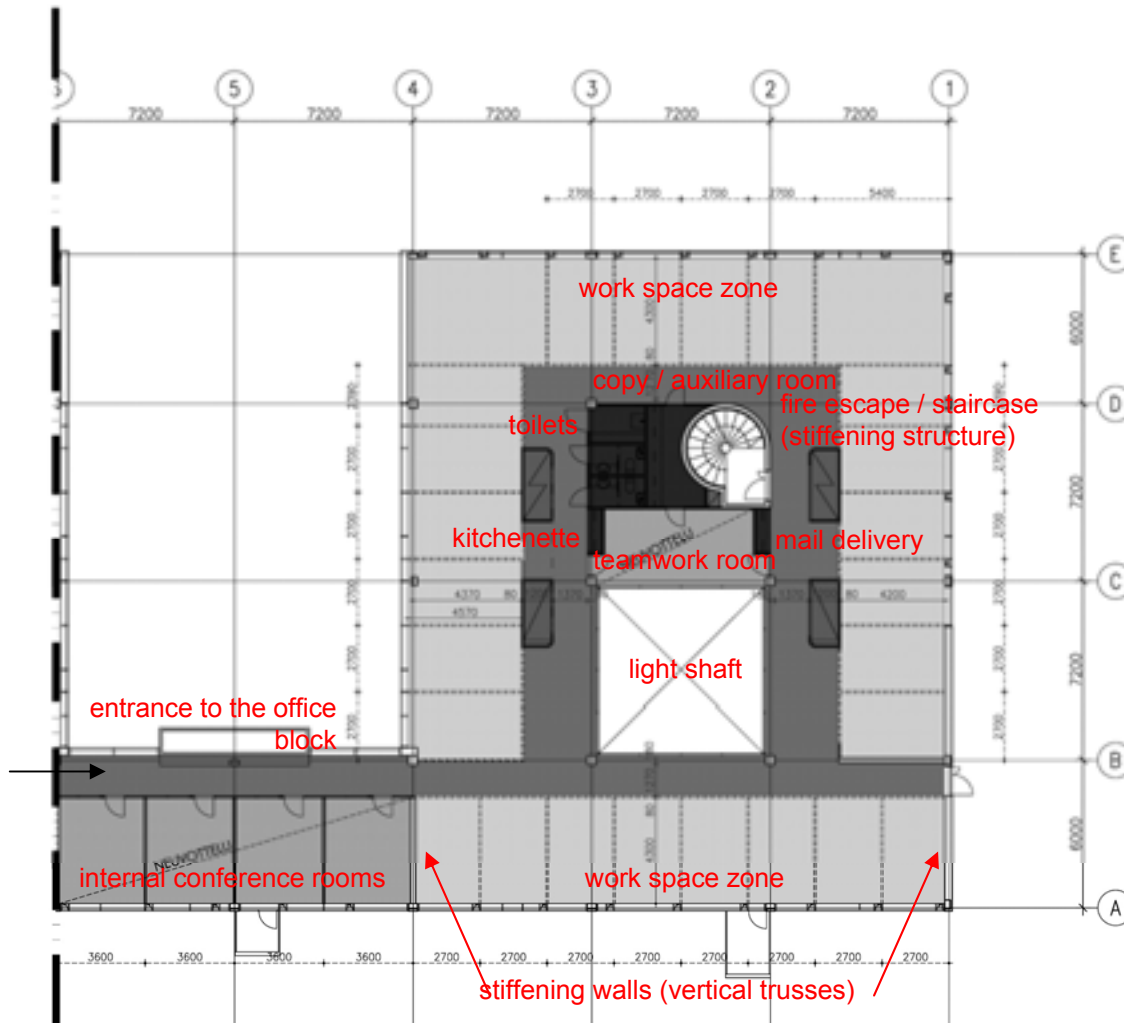


The costs of the planning and solutions of the FMO should not exceed those of similar / typical office buildings made of other materials in the same area.

images of the winning proposal by Helin & Co Architects



material by Helin & Co
Architects



THE BASIC MODULE

- Grid system : 7.2m x 7.2 m and 7.2m x 6.0m *)

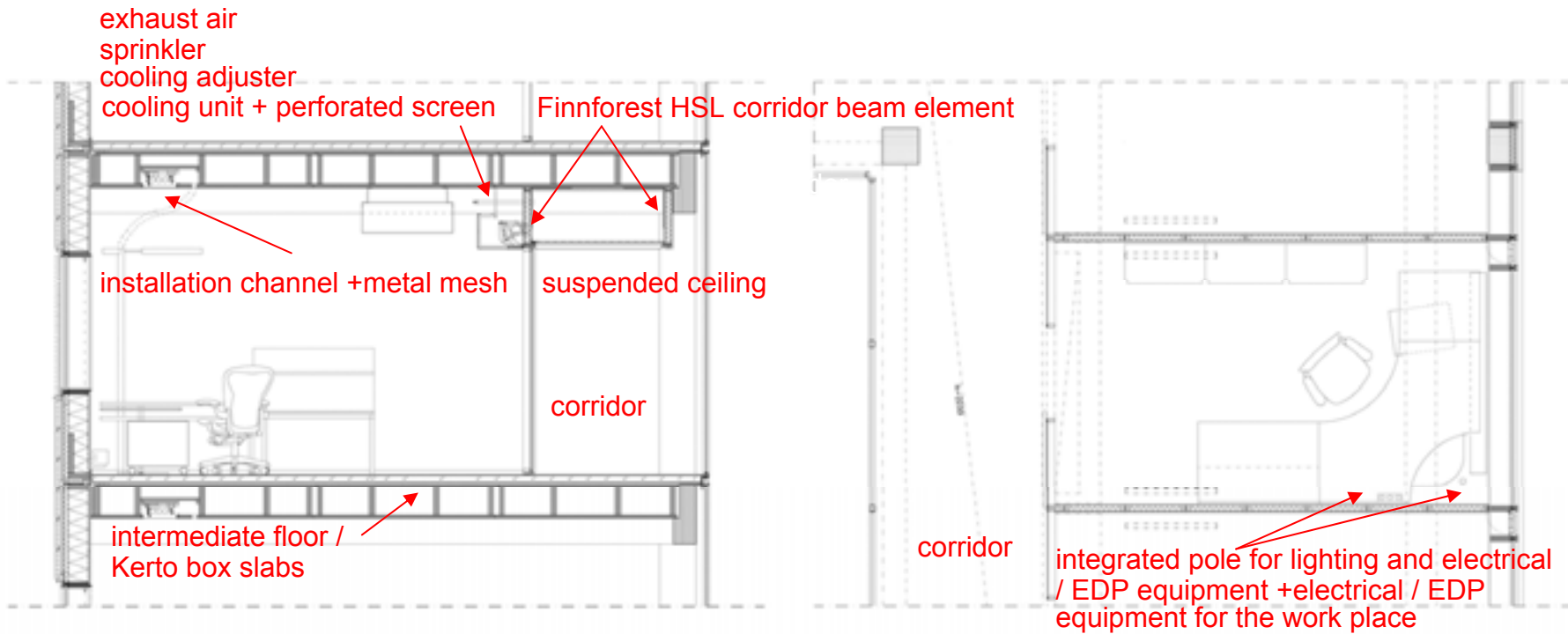
- "L" –shape ("axe")

7.2 m module produces spaces, which have a pleasant scale and are very intimate.

There are no large landscape office areas - you might better say that the spaces form a set or chain of miniature landscapes.

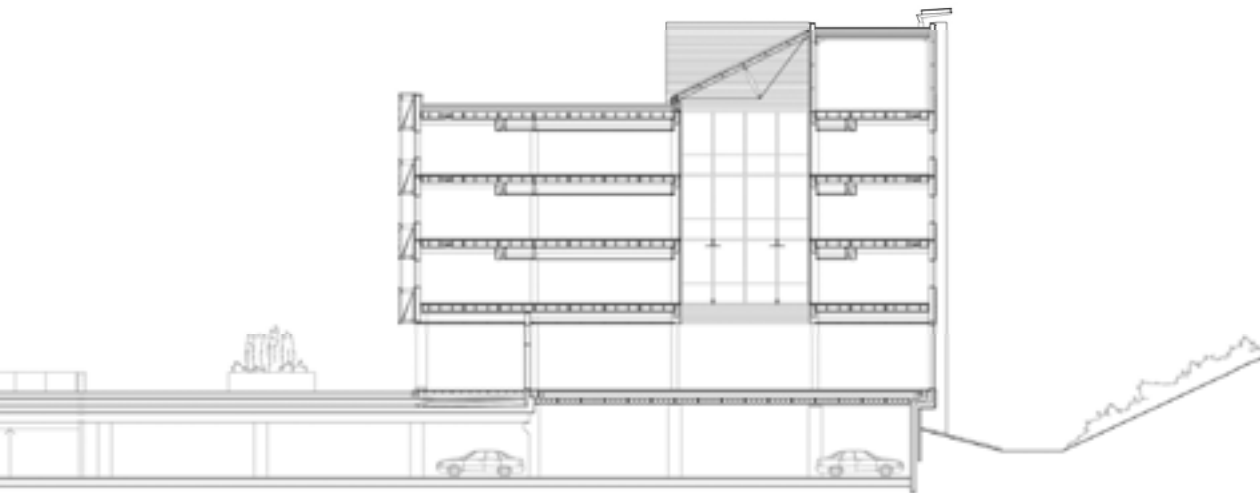
Besides extra light the light shaft provides also roominess and long vistas

Possible new rooms or future changes in the floor plan
do not require changes in the HVAC installation arrangements.



SECTION C...C

Cross section / light shafts

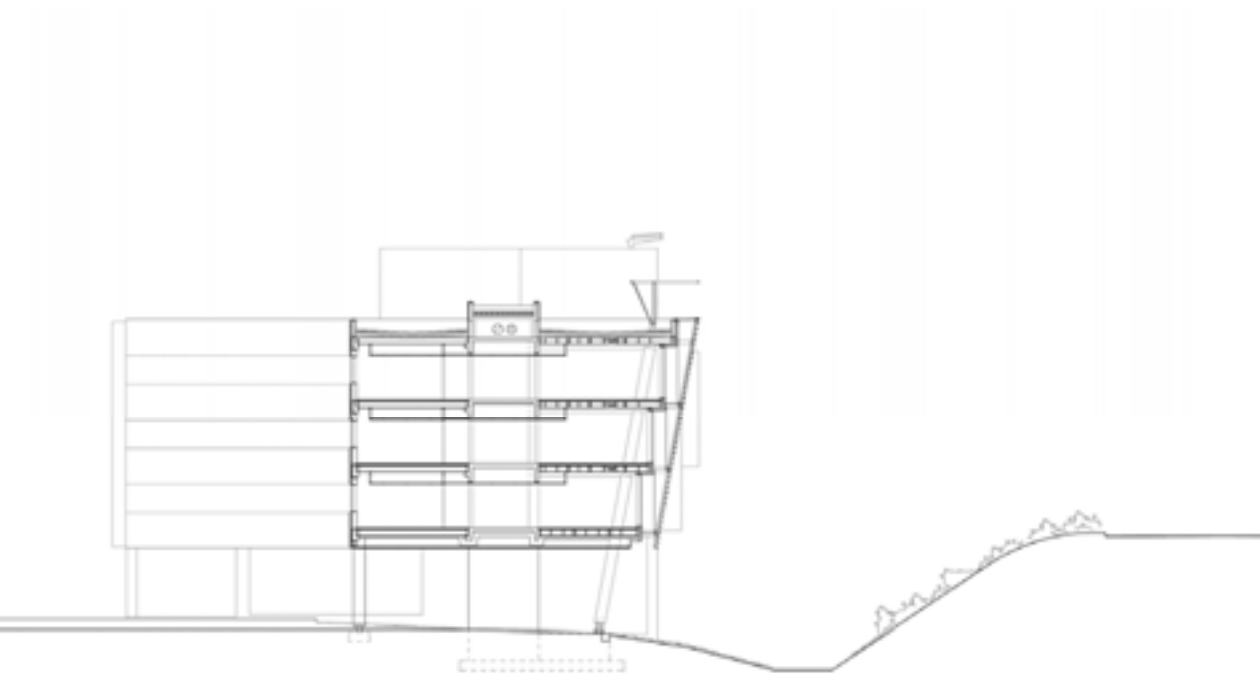


material by Helin & Co Architects

photo : Voitto Nieminen

SECTION D...D

Cross section /
"the South Spar-buoy"



material by Helin & Co Architects

photo : Voitto Nieminen

The most important wooden components are beams or boards made of glued veneer made of coniferous wood.

THE WOODEN COMPONENTS AND CONSTRUCTIONS

The skeleton and the elevations of the FMO consist of prefabricated wooden elements assembled on the site.

There were altogether 1200 wooden elements and a total of 17000 individually worked wooden parts.

One third of the total construction cost of 20 000 000 euros was formed by the wooden components and parts.

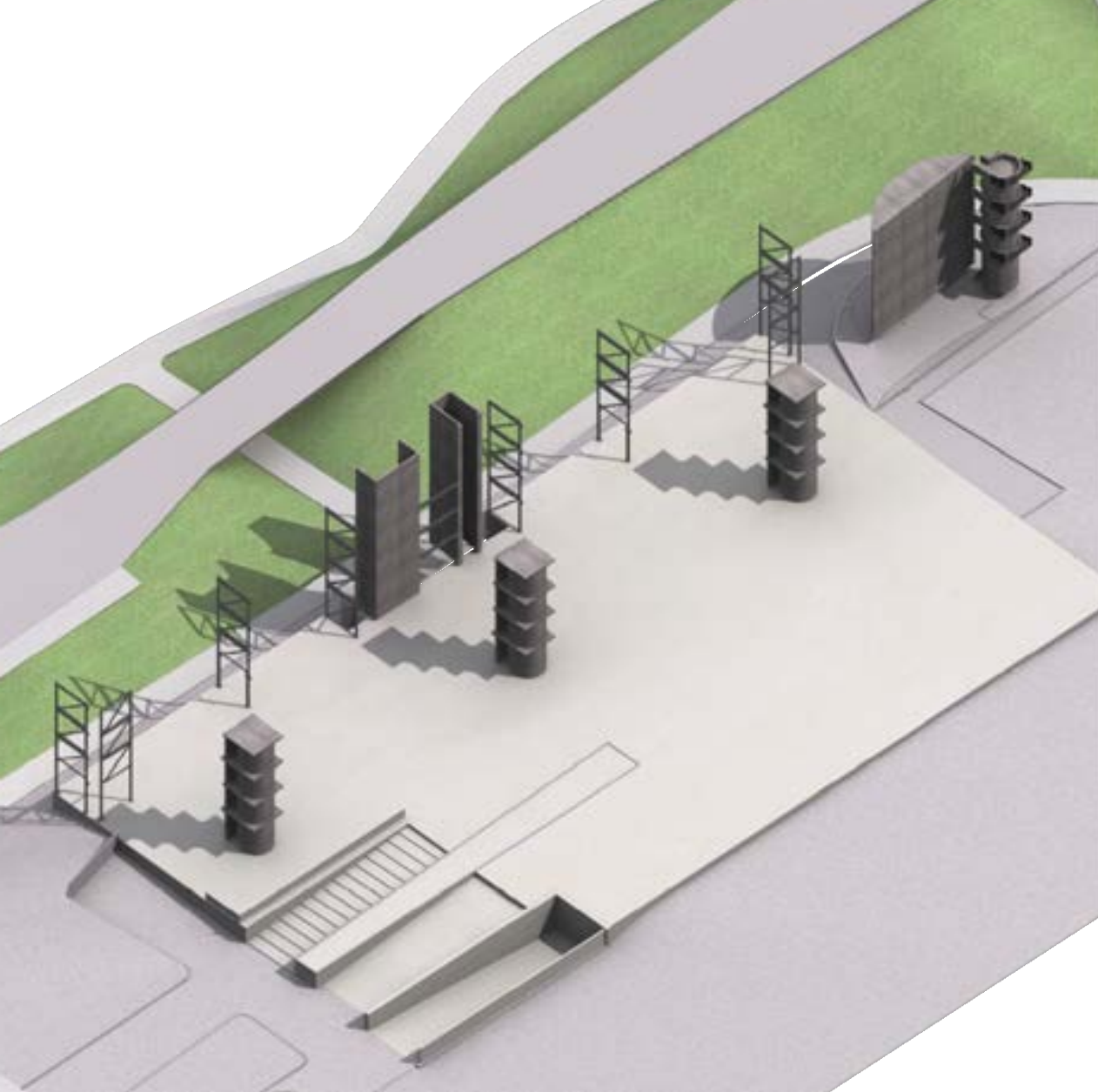


PREFABRICATION

lessens essentially the work carried out on the building site.

- 1 THE SKELETON
FINNFOREST KERTO COLUMNS AND T-BEAMS
- 2 THE INTERMEDIATE FLOOR
FINNFOREST KERTO BOX SLABS
- 3 THE FACADE
LIGHT ELEMENTS MADE OF FINNFOREST KERTO BATTENS
- 4 THE CLADDING ELEMENTS
FINNFOREST "KUNINGASPALKKI" SPLIT GLUE-LAM PANELS
- 5 THE FACADE TRELLISES
FINNFOREST THERMO-WOOD GRILLES
- 6 FINNFOREST GLUE-LAM BEAMS
- 7 FINNFOREST PANELING

material by Helin & Co Architects



THE STIFFENING OF THE SKELETON

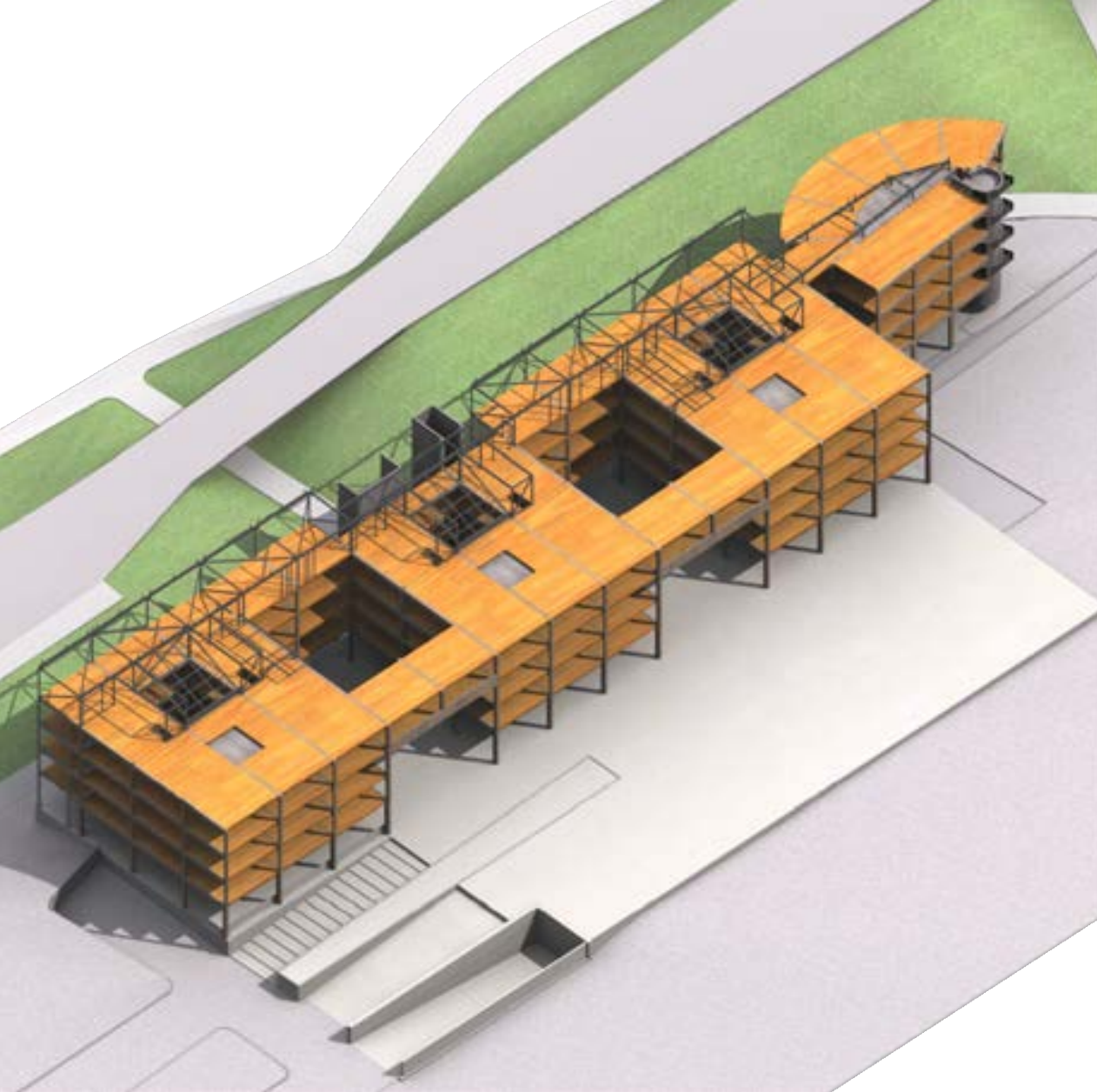
The staircases and the elevator shafts are concrete structures (cast on site).

The vertical trusses are fire-protected steel constructions.



material by Helin & Co Architects

photo : Voitto Nieminen



THE SKELETON OF THE BUILDING

The skeleton of the office part is made of Kerto.

To manufacture the column T-beams and box slabs a new Finnforest production unit was established in Ojakkala, some 40 km from Tapiola.



material by Helin & Co Architects

photo : Voitto Nieminen



A 3D architectural rendering of a building section. The structure is composed of multiple levels. A single intermediate floor is highlighted in a solid orange color, while the other floors are shown in a light gray wireframe. The building has a modern, industrial aesthetic with visible structural elements.

THE INTERMEDIATE FLOORS

There are 6000 sqm of Kerto Box Slabs in the FMO.



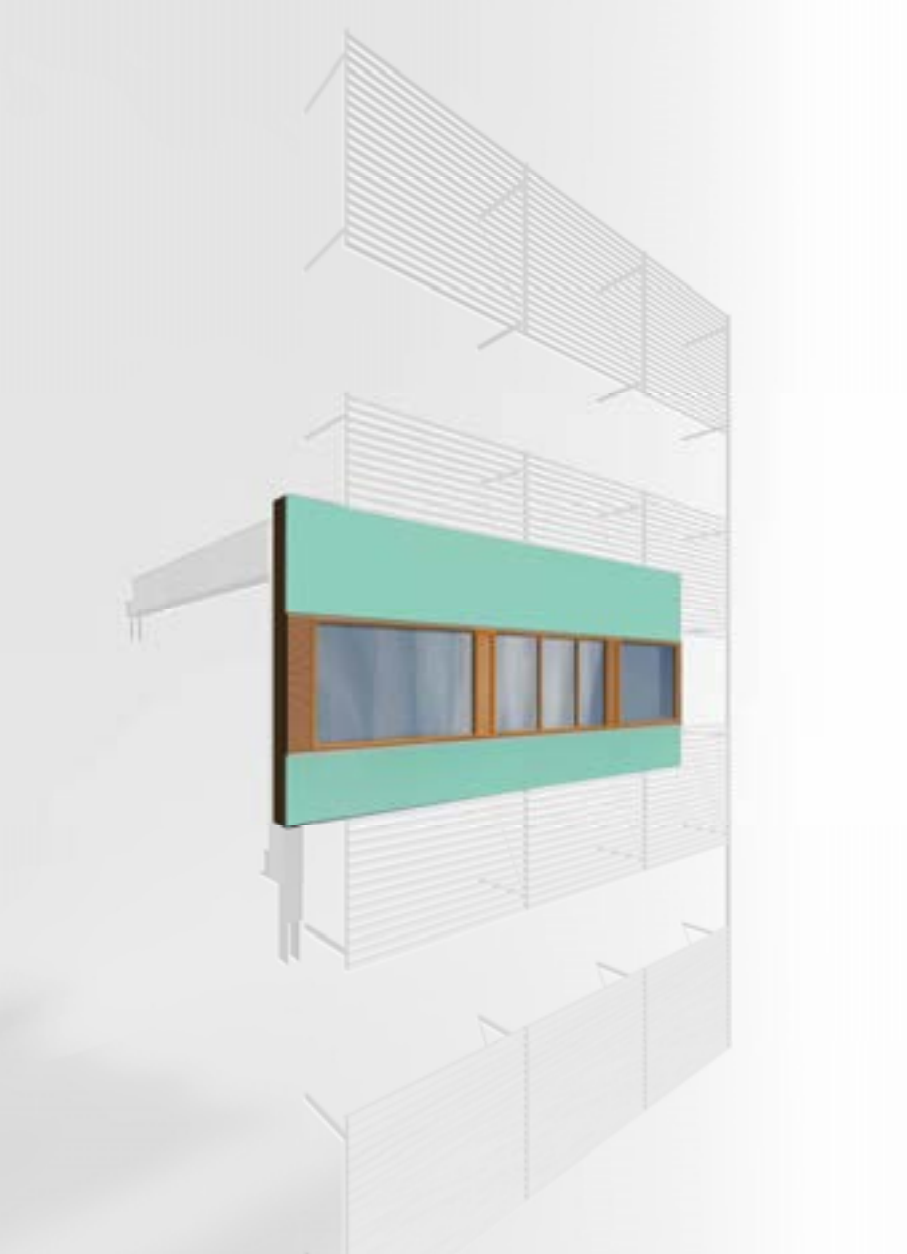
A 3D architectural rendering of a building section, similar to the one on the left. It shows a vertical column and a horizontal T-beam highlighted in a solid brown color, with the rest of the building structure in a light gray wireframe. The rendering illustrates the connection between the column and the beam.

THE COLUMNS AND THE T-BEAMS

There are 500 Kerto columns and Kerto T-beams in the FMO.

30 000 kilos of steel was used in the joint components.

The columns are single-storey columns.
The T-beams and box slabs are single-span structures.



THE FACADE ELEMENTS

A new product developed for the FMO.

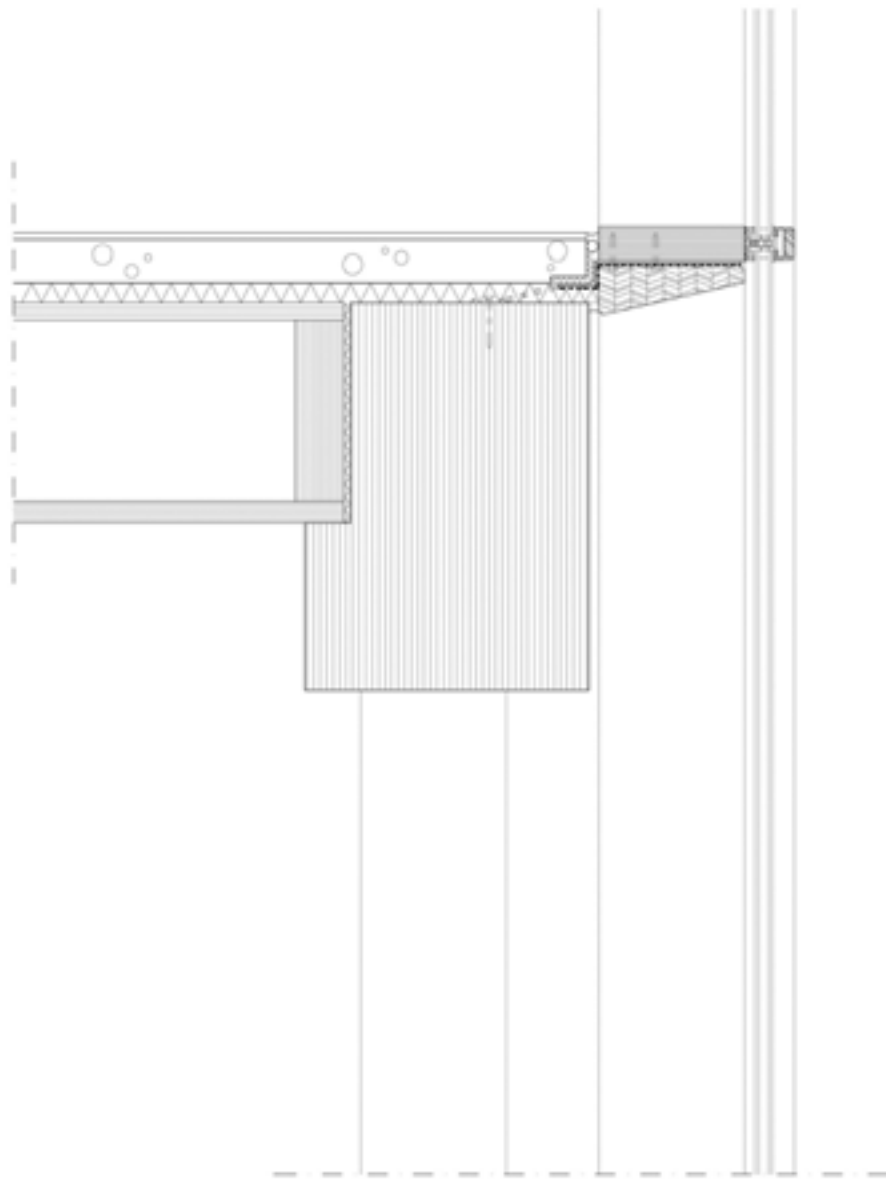
There are 218 facade elements in the FMO.

The skeleton of the element is built of 51 x 200 Kerto laticework.



material by Helin & Co Architects

photo : Voitto Nieminen



THE GLASS WALLS

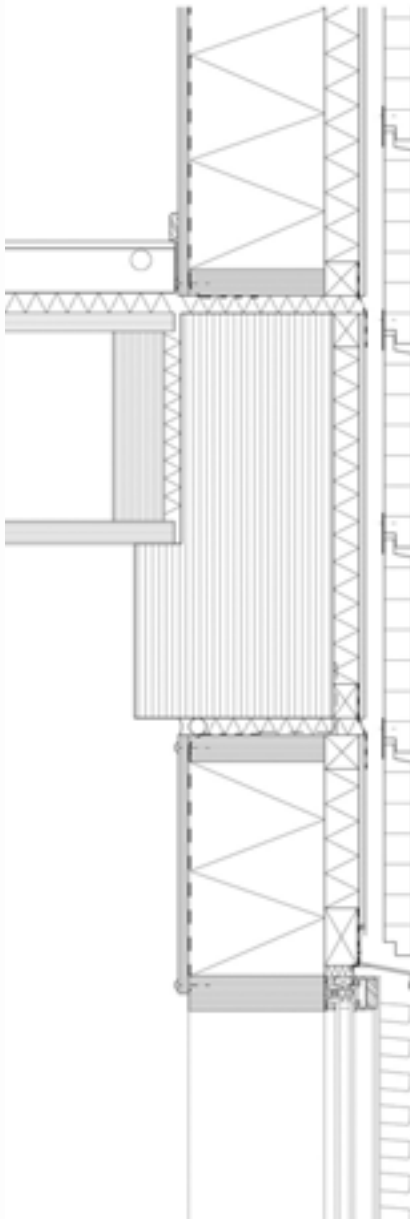
The glass walls around the inner courtyards are made following the same principles.

The frames are made of Kerto (51x200).



material by Helin & Co Architects

photo : Voitto Nieminen



THE FINNFOREST CLADDING ELEMENTS

The facades of the FMO are mostly clad with Finnforest "Kuningaspalkki" split glue-lam panels (42 x 312mm).

There is a total of 2200 sqm of split glue-lam paneling in the FMO.

The colour of the paneling is red brown. The product used is Teknos Aquagrund + Teknos Aquatop lacquer. The assumed average interval between treatments is 5 years.

The glue-lam panel is supposed not to warp.

material by Helin & Co Architects

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DES SAHARA
DES SAHARA

photo : Voitto Niemi

In the FMO project especially important aspects have naturally been

- FIRE TECHNICAL ASPECTS
- ACOUSTIC ASPECTS
- ECOLOGICAL ASPECTS

For fire technical and acoustic aspects a specialist was involved in the project team.

The new "PromisE" environmental performance indicators for the real estate and construction industry in Finland have been in use in the planning and realization of the "FMO project."



material by Helin & Co Architects

photo : Voitto Nieminen

FMO Tapiola (Real Estate Company)
Address : Tuulikuja 2, 02100 Espoo Finland
Quarter : 12017, block 3

Completed: 2005
Total gross floor area : 13 048 sqm
Permitted gross floor area 8000 sqm / used : 7998 sqm
Net floor area : 10374 sqm
Cellar floor area : 4066 sqm
Site : 7167.4 sqm
Volume : 50 420 m³

Floors : cellar + 4 office floors + air conditioning rooms in the attic

Parking : 118 parking places in the cellar + 7 places for the clients on the deck

Air raid shelter : 60 + 65 = 125 persons

Total costs : 25 000 000 €, out of which approximately 20 000 000 € comes from construction works.

Client : FMO Tapiola Real Estate Company
Investor & owner : Tapiola Group / Antti Leivo
Client / main tenant : Finnforest / Lauri Palojarvi
Developer : FMO Tapiola Real Estate Company / Hannu Ronkainen
Consultant for construction management services : CM-Urakointi Oy / Mikko Laakso, Vilppu Vesterinen, Erkki Sainio, Eero Kakkonen

INFORMATION & CREDITS



material by Helin & Co Architects

photo : Voitto Niemi



material by Helin & Co Architects

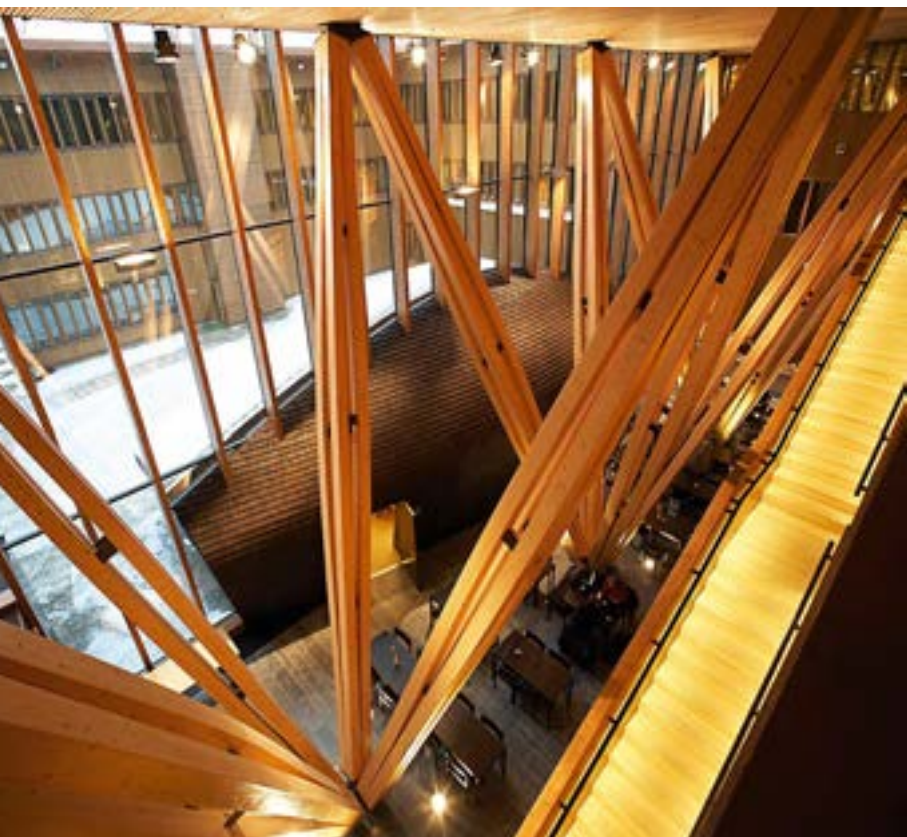
photo : Voitto Niemelä



Special Thanks and Credits of the
FMO material to:

Helin & Co Architects: Pekka Helin
and Peter Verhe

photo : Voitto Niemelä



Metla - Finnish Forest Research Institute

Investor: Senaatti-Kiinteistöt
User: Metla - Finnish Forest Research Institute

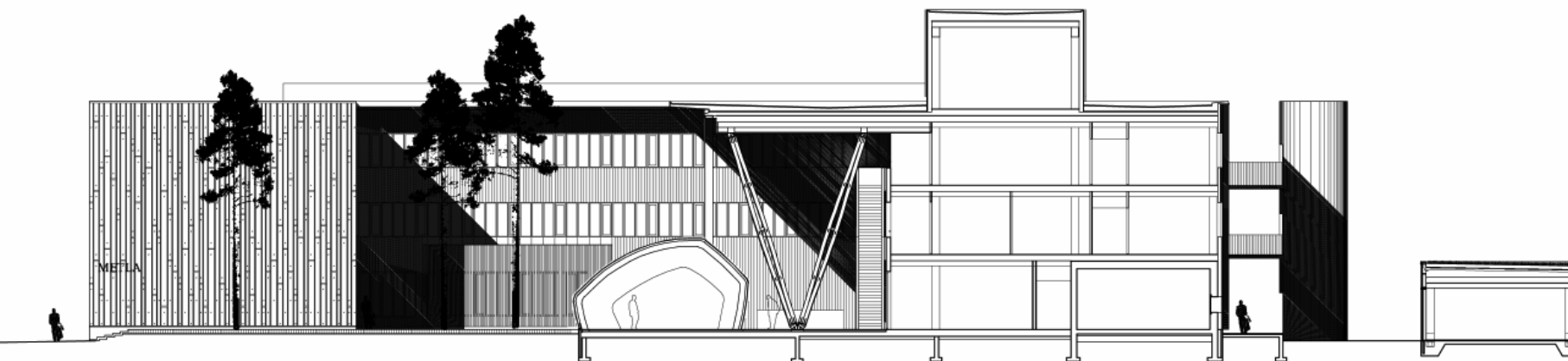
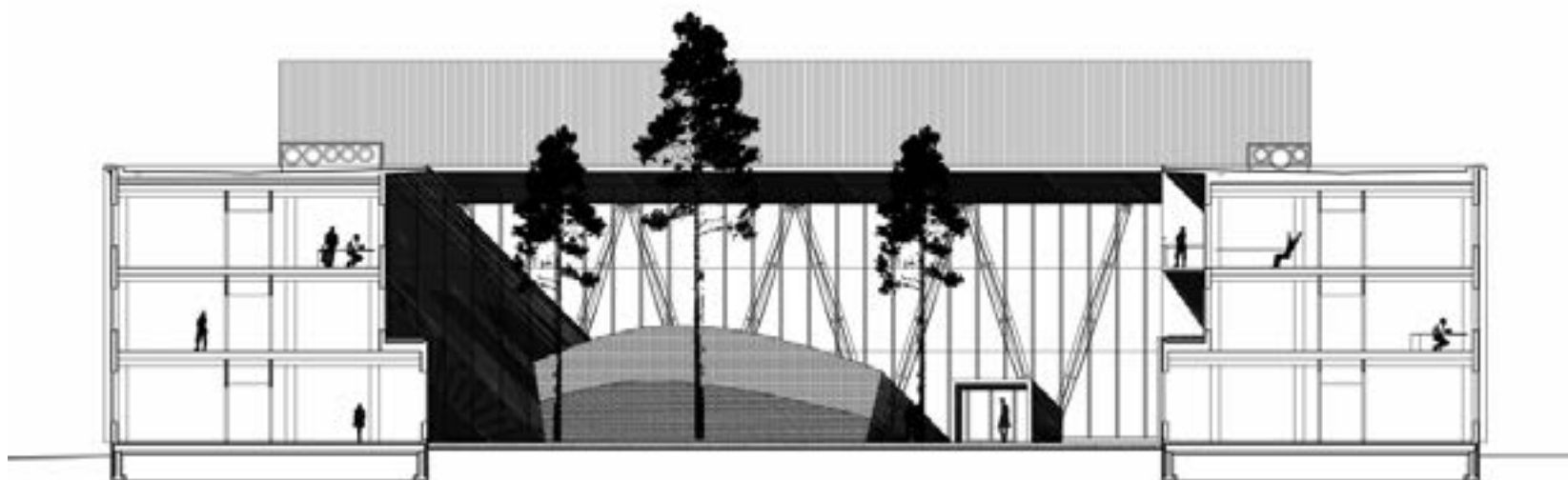
Size: 7.653 brm²,
33.151m³

Main contractor: Rakennusliike A. Taskinen
Glulam frame: Verso Wood
Glulam frame engineering: Asko Keronen
Civil Engineering: Insinööritoimisto Magnus
Malmberg Oy
Fire Safety: L2 Paloturvallisuus
Architecture: SARC Architects Ltd



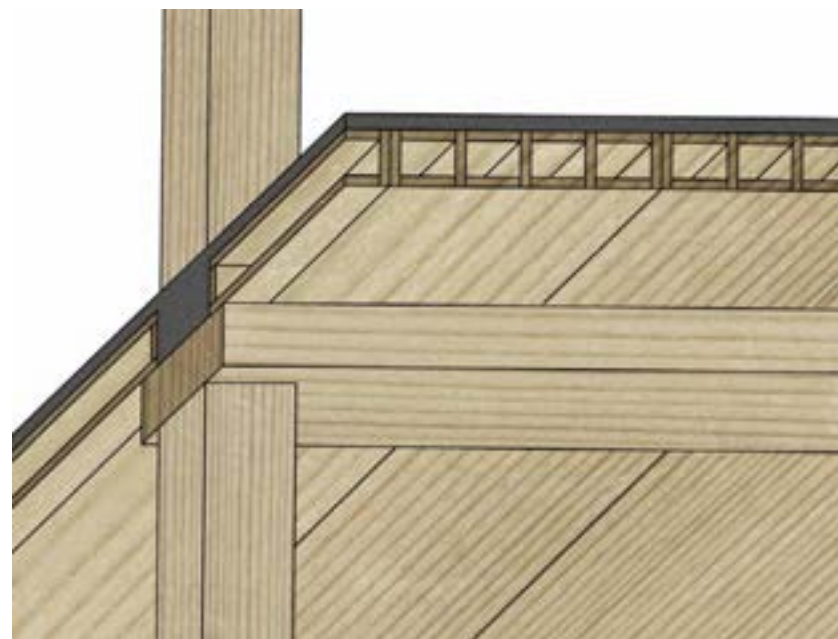








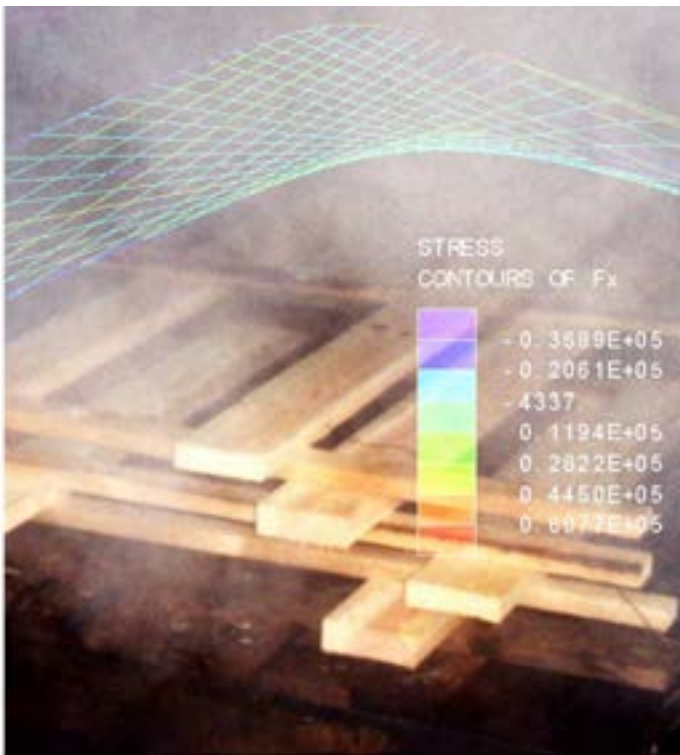








Special Thanks and Credits of Metla material to: SARC Architects
photographs: Jussi Tiainen



Netlike Wooden Structures - Development & Research

Project management: Prof. Eero Paloheimo

In co-operation with H.U.T

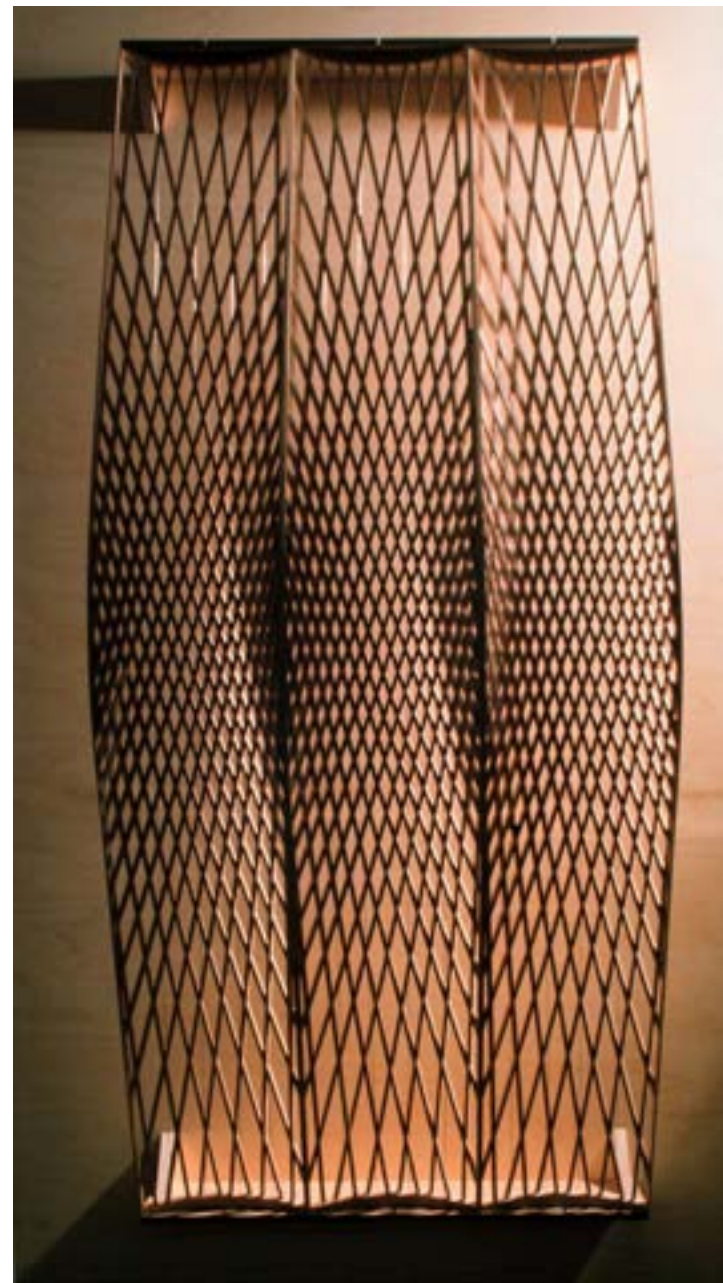
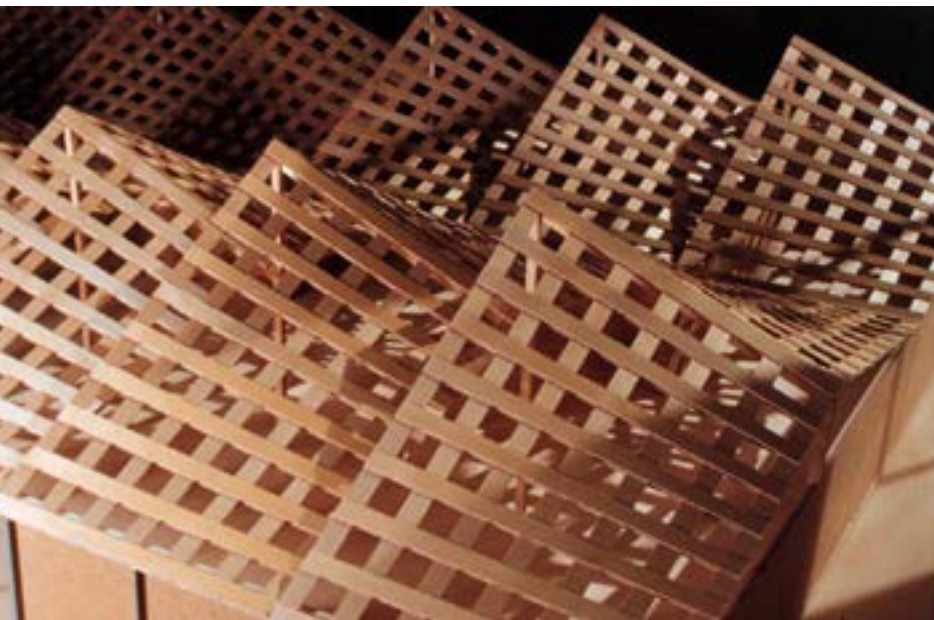
Funding: Tekes - National Technology

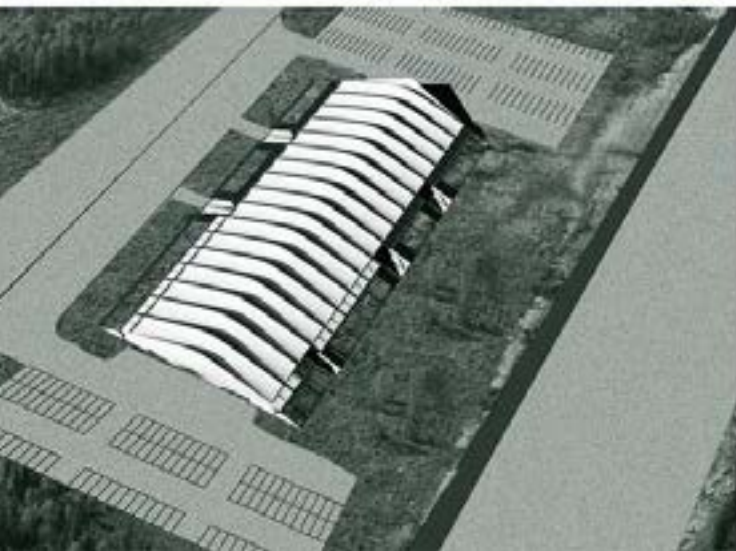
Agency

Architecture: POOK Architects' Office Ltd

Civil Engineering: Nuvo Engineering







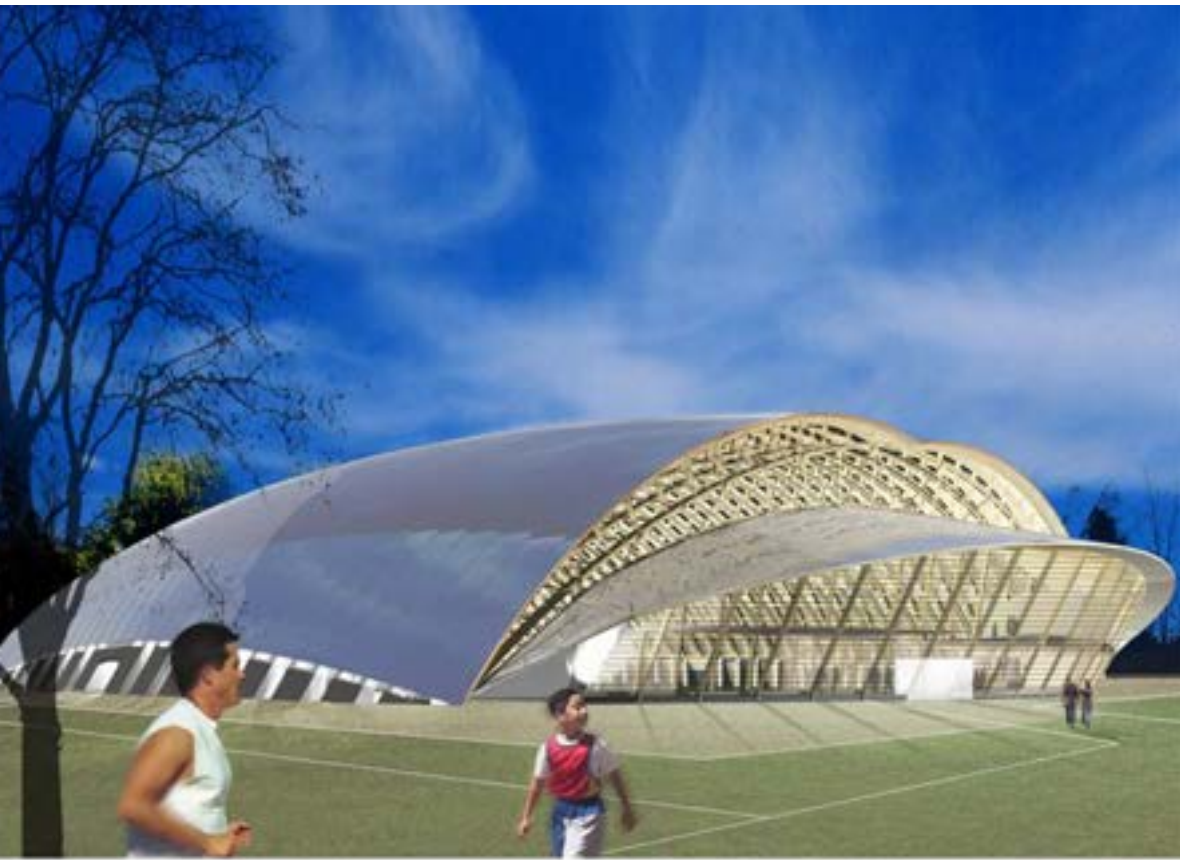
KATARIINA RAUTIALA, ARKITEHTI SAFA, POOK ARKK

Convertible Wooden Hall Construction / case car show room

Client: Moreeni HML

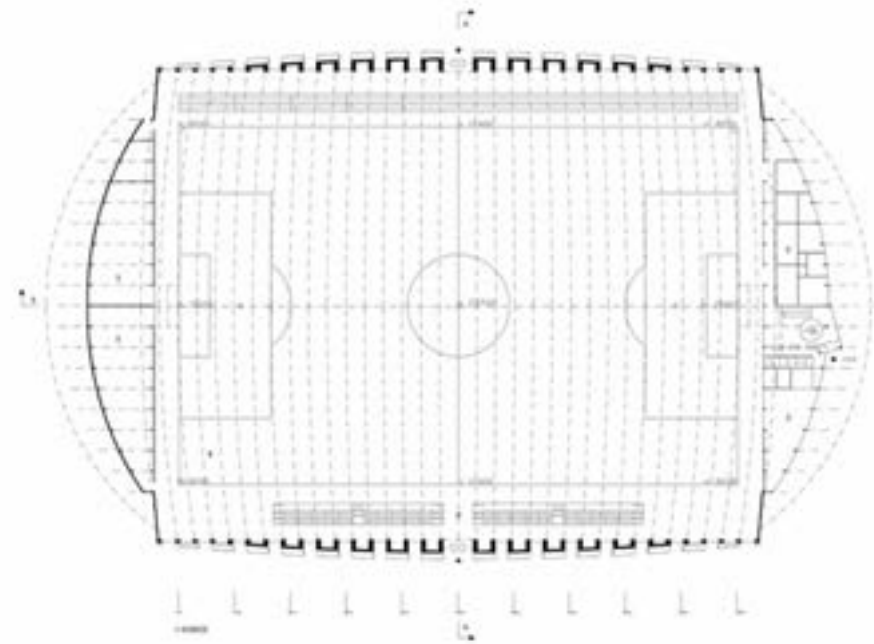
Architecture: POOK Architects' Office Ltd

Civil Engineering: Nuvo Engineering



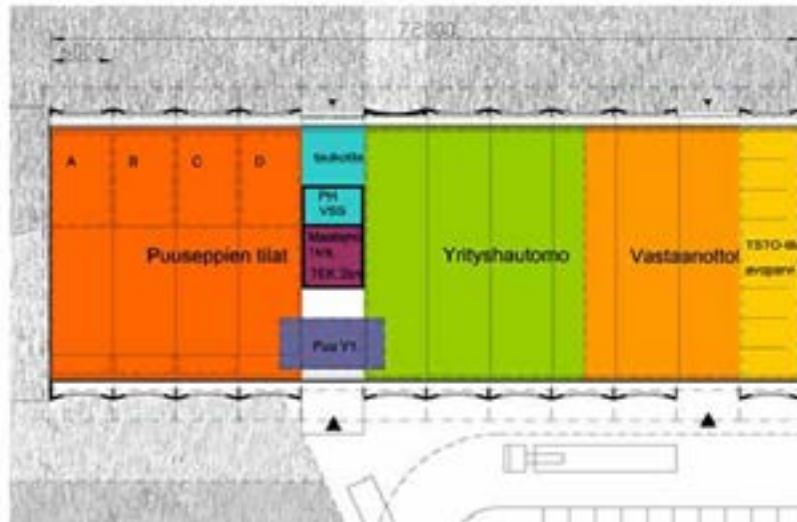
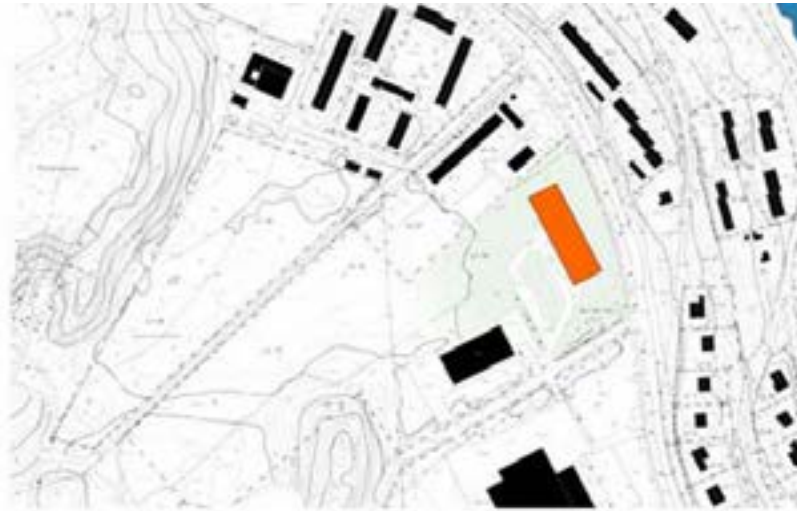
Wooden Football Hall - Level K2

Client: Skanska Etelä-Suomi
 Architecture: POOK Architects' Office Ltd
 Civil Engineering: Nuvo Engineering Ltd



Client: Skanska Etelä-Suomi
Architecture: POOK Architects' Office Ltd
Civil Engineering: Nuvo Engineering Ltd

Client: Skanska Etelä-Suomi
Architecture: POOK Architects' Office Ltd
Civil Engineering: Nuvo Engineering Ltd



Wooden Production Hall

Client: City of Kitee

Architecture: POOK Architects' Office Ltd



Thank You.