

# trä!

A MAGAZINE ON INSPIRING ARCHITECTURE  
FROM SWEDISH WOOD » ISSUE 4 » 2023

**DOWELS AND BUTTERFLIES**  
**Designed for  
the future**

**SPACE FOR KNOWLEDGE  
AND MEETINGS  
ARCHES CREATE HEIGHT  
FOR SPORTS  
HOUSING WITH  
SOCIABLE DETAILS**

**TRÄ MEETS**  
**Karin Ohman**

**KNOWLEDGE**  
**Digital technology  
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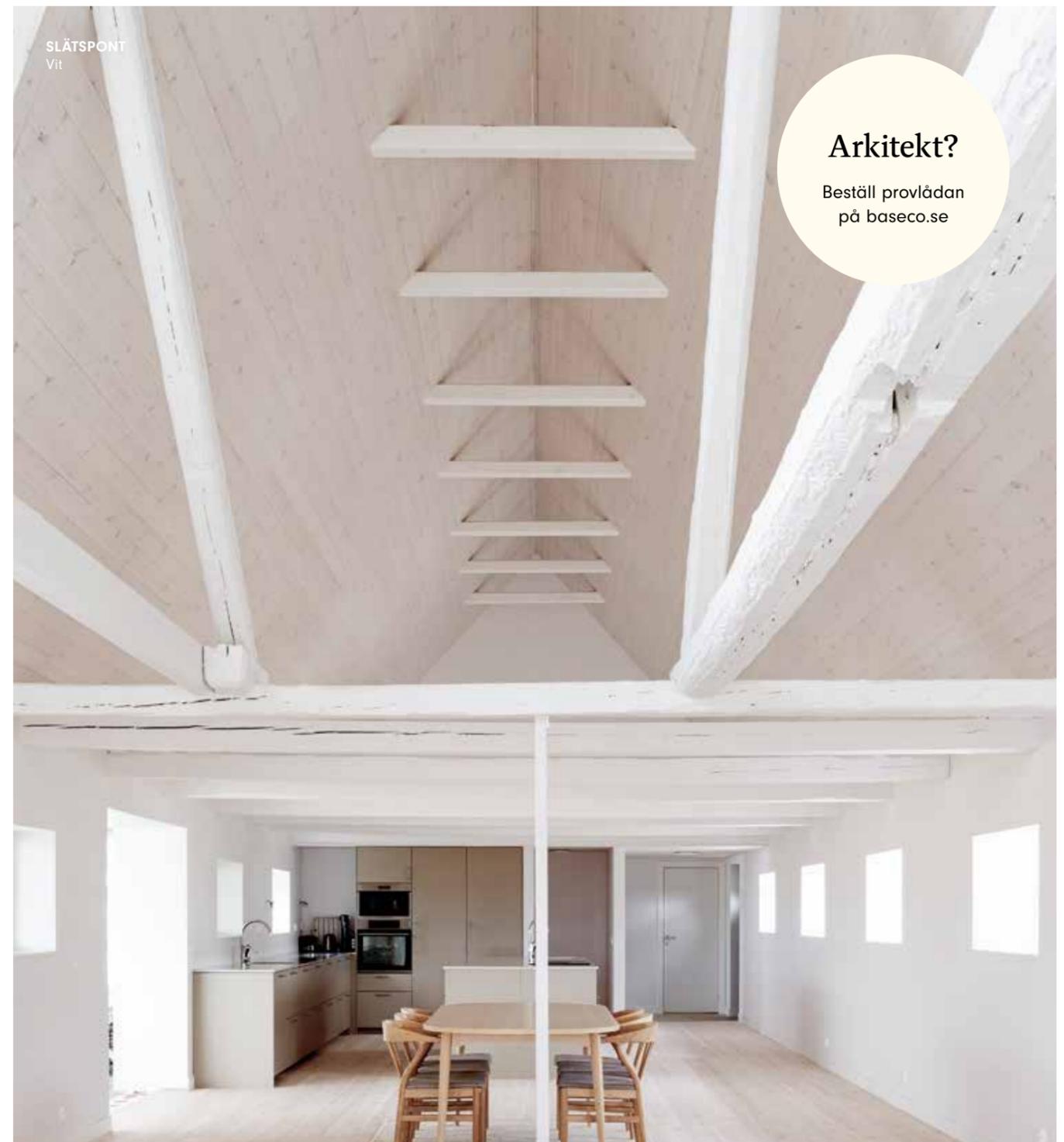
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Läs mer om Träpriset på [svensktra.se/trapriset2024](https://svensktra.se/trapriset2024) eller genom att scanna QR-koden.



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## Naturliga val.

Våra paneler är tillverkade av noga utvalda råvaror från de djupaste norrländska skogarna. I vårt sortiment finns en stor variation av paneler, från klassisk pärlspont till tidlös slätspont. Det skapar en levande känsla i ditt hem i en stil som håller över tid. Gör ett bra val på [baseco.se](https://baseco.se).

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# trä!

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A German research project has resulted in an apartment block that focuses on energy-efficient construction. Slightly thinner walls have created extra space for the residents, while careful treatment of the interior wood provides them with a comfortable indoor climate.

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Swedish Wood disseminates knowledge about wood, wood products and wood in construction, contributing towards a sustainable society and a thriving sawmill industry. We achieve this by inspiring, educating and driving technical advances.

Swedish Wood represents the Swedish sawmill industry and is part of the Swedish Forest Industries Federation. Swedish Wood represents the Swedish glulam, CLT and packaging industries, and collaborates closely with Swedish builders' merchants and wholesalers of wood products.

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Anna Ryberg Ågren Director, Swedish Wood

## Our cities need wooden housing

ONSALA, SWEDEN Having now been at Swedish Wood for a whole year, I feel fortunate to be part of an industry that is so important for the green transition and in an organisation with so many knowledgeable people.

The weak economy and the uncertain international situation are hitting the Swedish construction industry hard, particularly when it comes to housing. According to the October forecast from the Swedish National Board of Housing, Building and Planning (Boverket), the number of housing starts declined sharply this year compared with last year, and the pace is expected to dip a little further in 2024. Despite this, Swedish sawmills delivered record levels of wood products in the first half of this year, mainly due to strong exports. 2024, however, is looking more challenging.

In September, the National Institute of Economic Research forecast a deeper economic downturn, with no recovery until the second half of 2024. Nevertheless, we still need to build more housing. According to Boverket, more than 67,000 new homes are needed each year until 2030. When housebuilding picks up again, wood construction will play a key role in enabling us to accelerate the pace of climate footprint reductions. So although 2024 will be challenging, I remain optimistic about the future prospects for our industry. While we at Swedish Wood cannot influence the economy, there are many other things we can do to increase wood construction when the economy recovers, not least by promoting the possibilities of wood.

A cornerstone of this work is the Swedish Wood Award, one of the country's largest and most prestigious architectural competitions, which we organise every four years. The next iteration of the Swedish Wood Award will be in March 2024, and this time we will follow the jury's work in six filmed episodes that can be viewed at trapiset.se, starting on 15 February.

I also look forward to seeing the entries submitted to »New Eyes on Wood«, an architecture competition for students, whose winning entry will feature at the Nordbygg trade fair in April 2024. The competition aims to increase knowledge about wood and to inspire creative ways of using the material. Among other things, the entries will be evaluated on their ease of disassembly, as a means of extending the lifespan of integrated wood products.

Increasing the use of wood in construction and extending the lifespan of the integrated wood products will mean more carbon is stored in our cities than is emitted. This will make cities true carbon sinks. Happy reading!

*Anna Ryberg Ågren*  
Anna Ryberg Ågren



John Collings

## 180 metres low-key campus entrance

**OBJECT** Boola Katitjin  
**ARCHITECT** Lyons Lyons with Silver Thomas Hanley, Officer Woods, The Fulcrum Agency and Aspect Studios  
**STRUCTURAL ENGINEER** Aurecon

**MURDOCH, AUSTRALIA** Murdoch University, south of Perth, needed an additional building for student and office space. At the same time, it also wanted to create a new natural entrance to the campus from the south. The result is a 180 metre long building which, despite its size, is carefully blended into the landscape. The exposed external glulam columns combine with generous glass walls to create an airy shell, and are also repeated in the light, warm interior.

The repetitive glulam structure, in symbiosis with the ceiling beams, establishes a refined

warehouse feel – a warehouse for learning.

Located on a slope, the building visually flattens the incline towards the campus and serves as a welcoming entrance from the south. On the north side, closest to the campus, the 24-metre-long canopy creates a sheltered space that can be used for markets and other events. The gable roof is covered with solar panels that combine with the building's other low-energy systems to reduce the energy footprint by 90 percent. «

w| lyonsarch.com.au

The new building, set into the 13 metre high hillside, forms the gateway to the campus.

## Preserved barn with change of function

**ARNEX-SUR-ORBRE, SWITZERLAND**

A 19th-century farm building has been repurposed as two homes thanks to an

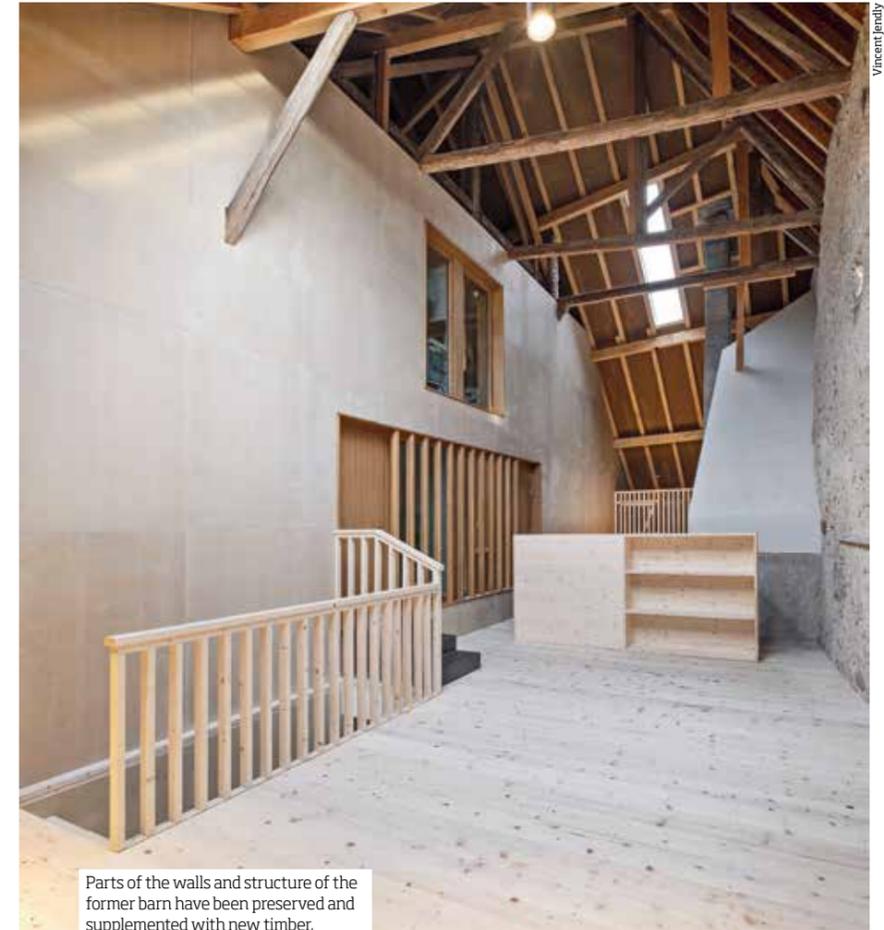
**OBJECT** Barn conversion  
**ARCHITECT** cbmm architectes  
**STRUCTURAL ENGINEER** Marc Jaunet

inserted timber frame. The older building was to be preserved as far as possible out of respect for the traditions of the time, so the thick stone exterior walls remain, as well as an irregular oak truss supporting the roof.

The interior now consists of three sections: two residential units plus a shared space in between, where older and newer parts of the structure interact and utilities are housed.

The entrance to the apartments is through the original stone arch, and just inside is a small outdoor space, from which the visitor gets a first glimpse of the new structure and the warmth of the wood in contrast to the austere stone. The homes range over three levels, served by a staircase integrated with the original beams and columns. To bring in more light, a number of windows have been cut out of the old façade, giving views onto the rear garden. «

w| cbmm.ch



Vincent Jendly

Parts of the walls and structure of the former barn have been preserved and supplemented with new timber.



Shawn Talbot

## Freestanding spiral links different levels

**KELOWNA, CANADA** The KF Centre for Excellence is a museum of historic aircraft and other industrial memorabilia, designed around the founder's wish to use wood wherever possible and make the museum feel like an aeroplane. So what could be more fitting than a freestanding spiral staircase made of CLT?

Since the spiral shape required the CLT to be both bent and twisted, the development team worked from small-scale prototypes to get the right

bending radius and thickness. The CLT elements consist of three layers of wood: two that run along the staircase in a double curvature and a layer in between that runs perpendicular to the outer layers. Notches were then cut into the upper surface to reinforce it with a wood-concrete composite. Adding such a hybrid structural system to the spiral form increases the stiffness of the staircase and makes it easier to control vibrations in the free span, eliminating the need for support columns in a design reminiscent of a stunt plane's loop the loop. «

**OBJECT** Spiral staircase  
**ARCHITECT** Meiklejohn architects  
**STRUCTURAL ENGINEER** Structure craft  
w| meiklejohn.ca

The free-standing spiral staircase is an advanced design that uses bent and twisted CLT.



The walkway winds through the treetops, offering views and close-up experiences of nature.

### Accessible route to viewpoint

**OBJECT** Nature walk  
**ARCHITECT** Effekt  
**CONSTRUCTOR** Inge Aamlid

**HAMAREN, NORWAY** Hamaren activity park in southern Norway now has a new accessible nature walk, based on a desire to give everyone, regardless of physical ability, the feeling of walking among the treetops.

The gently sloping kilometre-long walk is the first of its kind in Norway, extending through the landscape on piles, 15 metres up in the air, along lake Fyresvatn and up to the peak of Klokkehamaren.

The trail ends with a circular viewpoint offering a panoramic view of the pine forest, clear lakes and rock

formations. Using local pine has helped the walkway to blend in with the pines growing on the hillside, creating the impression that it is in symbiosis with the surrounding forest.

The structural system, jointly developed by the architects and the contractor, consists of small and straight prefabricated wooden elements that could be easily handled with small machines or by hand to protect the sensitive landscape during the construction process. «

wj effekt.dk

# Byggbeslag och Infästning för KL-trä konstruktioner



Skanna QR-koden för att komma till katalogen

Simpson Strong-Tie® erbjuder ett brett sortiment av byggbeslag och infästning för KL-trä / CLT konstruktioner. I vår senaste katalog har vi samlat teknisk information tillsammans med beräkningar och lösningar för dina projekt baserat på applikation.

Läs mer på [strongtie.se](http://strongtie.se)

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### Narrow frame creates sociable setting

**STOCKHOLM, SWEDEN** In Stockholm's new Hagastaden district, the Norra Station neighbourhood is now taking shape, with wood playing a visual role in the urban space. A restaurant, housed in a 375 square metre pavilion, opened off the new square in the spring. Its dark façade contrasts with the older surrounding buildings in stone, render and brick. Despite its lower height, the distinctive asymmetrical building draws the eye and invites

**OBJECT** Restaurang  
**ARCHITECT** Henning Larsen

you to enjoy warmth and food in a two-storey space that includes a restaurant, bar and more intimate rooms.

The light colours of the interior form an exciting counterpoint to the exterior, with the exposed timber frame of high glulam posts and beams setting the tone. The walls are lined with cork for both warmth and good acoustics, and just like wood, it is also a sustainable material. The building's rectangular shape and narrow floor-to-ceiling windows create exciting views and a varied interior. «

wj henninglarsen.com



The pale glulam columns and cork-lined walls give the restaurant a cosy feel.

# SiOO:X, nu med högsta klassens Brandskydd B



SiOO:X miljöanpassade träskydd med kiselteknologi inför en ny brandskyddsprodukt i högsta klassen B. Används på gran, furu och termoträ, och finns nu i två populära grå färgnyanser. Successivt införs alla våra tio nyanser från vitt till svart, brunt och Clear Coat (opigmenterat).

Behandlingen sker genom certifierade samarbetspartners i Sverige och runt om i Europa. Med SiOO:X Träskydd och brandskydd kombinerat i ett system, får man en högkvalitativ helhet med bättre teknisk, miljöanpassad och estetisk funktion.

Vi erbjuder standardsortiment, samt kundanpassade lösningar till ditt byggprojekt. Scanna QR koden, eller besök oss på [sioox.se](http://sioox.se) för mer information.

Välkommen med frågor!

Bild: Privat villa i Førresfjorden utanför Haugesund i Norge. Byggd i Kärnfuru och applicerad SiOO:X Träskyddande Panelfärger 02-Oyster Grey.



## Chimes and grazing animals in hymn to rural life

**VALBELEIX, FRANCE** Horizon Art Nature is an exhibition of contemporary art that is placed outdoors in the summer months to

**OBJECT** Pastoral symphony  
**ARCHITECT** Luc Doin, Quentin Bourguignon and Marin Delebecque

highlight both the landscape and the buildings of the countryside. This year's works included a micro-architecture project that combined the elegant, monolithic form of a traditional bell tower, usually placed at the centre of a village, with straw as a symbol of pasture that is rarely crossed.

The installation was made using local materials, sourced less than 25 kilometres from the site. The lower part of the wooden structure is stuffed with straw, and on top sits a traditional timber frame, sparsely covered with boards that allow light to enter in an elegant pattern. A hanging rope invites visitors to temporarily become part of the installation and country life by ringing the bells at the top of the tower. The peals then integrate with the sounds of animals grazing nearby, acting as a hymn to rural life. «

[w| horizons-sancy.com](http://www.horizons-sancy.com)



The wood and straw bell tower creates a synergy between the usually more centrally located church and unspoilt pasture.



The building is designed with sustainability in mind. The beams have only a few fixings to make the wood easier to reuse.

## Office building for frequent interaction and future reuse

**AMSTERDAM, NETHERLANDS** An industrial company's new premises in Amsterdam's port district adopted a strong focus on reusing as much of the material as possible. The compact timber structure consists of glulam posts and beams, the latter running in long lengths and deliberately having as few nodes and fixings as possible. This means less work on the wood, so it can more easily be put to a new use in the future.

From the block's large

**OBJECT** Office building  
**ARCHITECT** De Zwarte Hond  
**STRUCTURAL ENGINEER** IMD Raadgevende ingenieurs

atrium, wide central wooden stairs connect the floors, encouraging employees to meet and interact spontaneously. The façade is clad in Corten steel, giving it a warm and welcoming tone, while solar panels and heat storage make the building energy neutral. In addition, 30 percent of the façade is green, which promotes biodiversity, and rainwater is stored locally to water plants on and around the building.

The head office consists of several volumes with different functions, parts of which can easily be expanded or contracted as required. «

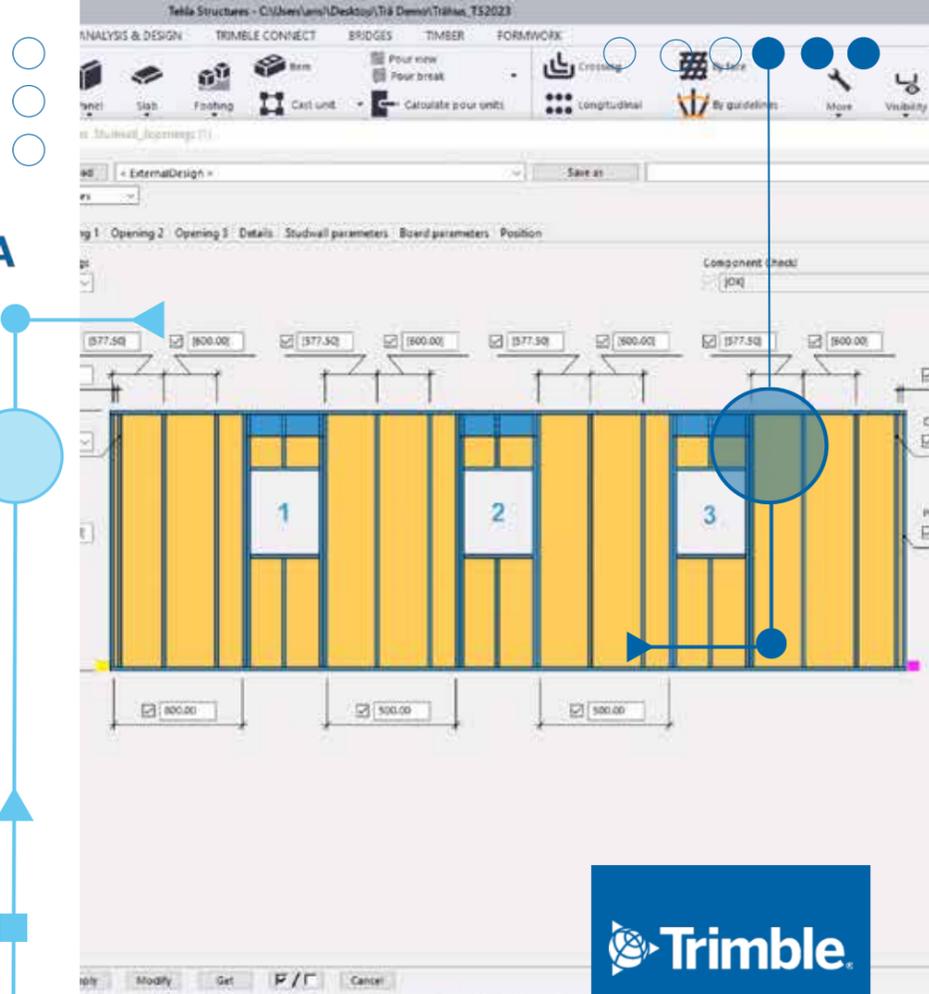
[w| dezwartehond.nl](http://www.dezwartehond.nl)

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Different dimensions and types of wood bring the interior to life. Much of the gentle light comes in from the skylights.

### Few windows for cosy insulation

**KARIYA, JAPAN** On a small, sloping plot in the centre of a residential area, a family wanted a house for two adults and two children. Other key criteria included a wood-burning stove and space for a surfboard.

To integrate the timber frame into the home while providing good insulation, the architect started with a vertical structure where two rows of 90 millimetre thick cedar posts make up the frame. The exposed roof structure further emphasises the form. The entire interior consists of exposed wood, with the different shades and types of wood intended to create a vibrant feel. The façade features a few small windows, furnished with wooden shutters that only let in light when they are open. Instead, most of the light comes from four skylights.

And what about the surfboard? Well, since the house is on stilts, the steep slope has been used to create an open space under the house where it can be stored along with garden tools. «

**OBJECT** House  
**ARCHITECT** Tomoaki Uno architects  
[www.unotomoaki.com](http://www.unotomoaki.com)

## Be guided by the project when choosing wood

**GOTHENBURG, SWEDEN** There are many reasons to build with wood, not least for the sake of the environment.

There are also many reasons for not doing so, most commonly cost.

But why design a wooden building and then build one in concrete or steel? It can't be a financial decision to spend money first on a design and then on a redesign? Yet it happens. And we want to avoid that.

This is what Wingårdh's wood strategy says: «We use wood as a frame material in all new projects. In every project we design, we try out wood as the first choice. When this proves unachievable, we try to replace as many non-renewable materials as possible with wood.»

A fairly large proportion of Wingårdh's projects are built in wood, entirely or at least in part. The success of our strategy lies in always having wood as our starting point in the early stages. We create geometries, volumes and planes that we know work with the unique properties of wood and meet the needs of the project – throughout the design process.

Does this come with a cost? Absolutely. How much depends on the requirements for the building.

We have the expertise to employ timber framing as a way to add value and capitalise on the properties of wood and to take advantage of the precision in the wood industry, using glulam, CLT, LVL and so on. And we know how to most effectively utilise the acoustic properties of wood to ensure simple and smart installation options.

Creating a timber frame building is actually easy. It's easy to make it pleasant and architecturally appealing. It's even easy to build it. But it takes detailed knowledge to make it economically viable and environmentally sound in the long run.

The two are very much linked. These days, most of us are prepared to pay a cost to save our planet. However, we differ in our willingness and ability to swallow extra costs, which is why we propose framing options based on our specific client. The right material, in the right place, at the right time – for the right customer.

In short, we choose the frame based on the specific conditions of the project and the site, and we do so at the earliest possible stage. We believe this allows for efficient design that does not need to be revisited. And so our knowledge contributes to more projects being built in wood, which ultimately reduces the impact on our planet.

**OBJECT** Pavilion  
**ARCHITECT** JK-AR  
**STRUCTURAL ENGINEER** Hwan structure  
[www.jk-ar.com](http://www.jk-ar.com)



The tree-shaped columns are a tribute to a symbolic pavilion from 1365.

### Tree shape links past and present

**JINJU, SOUTH KOREA** A new pavilion in South Korea serves as both a reminder of the past and an opportunity to introduce new technologies into the construction process. At just over six metres tall, the building consists of six tree-shaped columns, a tribute to the old Chokseok-ru pavilion, built in 1365 and one of the city's most symbolic buildings.

Instead of using nails or glue, the structure has been formed using elements of birch plywood, cut using CNC technology and augmented reality (AR). The architects see this as a way for the almost forgotten crafts of East Asia to be reborn in our time using new technologies.

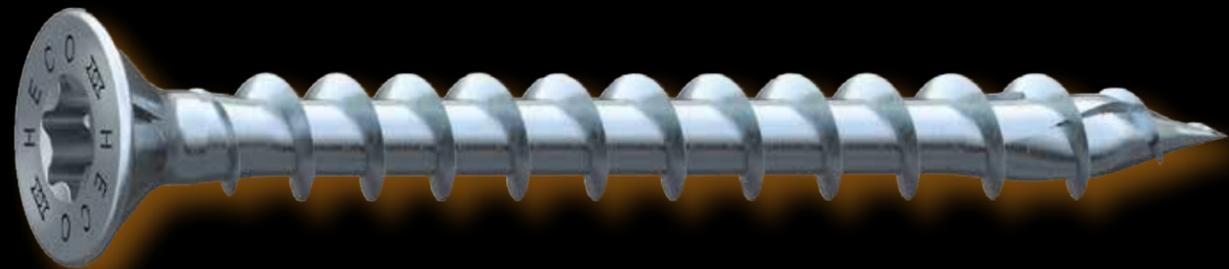
However, the pavilion will

also be a place where visitors can bask in their surroundings. The river here used to be dense with bamboo forests, and the space between the pavilion's tree-shaped columns now forms a visual pathway between two forests. Glass walls on three sides create further transparency between inside and outside. «

This is an opinion piece. The views expressed are the writer's own.

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## VOLUMES CREATE EXPERIENCES IN URBAN PARK

### PHOTOGRAPHER

Morten Aagaard  
Krogh

### OBJECT

Amager Urban Park

### ARCHITECT

Lytt architecture  
& Adept

### STRUCTURAL ENGINEER

Atkins

**COPENHAGEN, DENMARK** The 3,500 hectare Naturpark Amager in central Copenhagen attracts a large number of visitors every year. Now the park has gained five small buildings that function as different kinds of shelters and hubs. Integrated into the surrounding landscape, they aim to help create new experiences.

All the volumes have a glulam structure that has been left exposed. The large roofs form a recurring geometry, but although they are clearly visible from a distance, their charred shingle cladding allows them to blend naturally into their setting.

Although the typology is the same, the design and function of the volumes vary considerably, emphasising the landscape in different ways. For example, a shelter sitting partly on stilts overhanging the water is a key element of the park's promenade, while a three-storey tower further into the park instead showcases the view of nature and the nearby city. «

- As well as providing shelter, the buildings are also important for nature conservation as they lead visitors on the right path through the park.
- Another two more volumes are planned. The cohesive architecture will make it easy to scale up the project later if there is a need for further additions.

W | [lytt.dk](http://lytt.dk), [adept.dk](http://adept.dk)



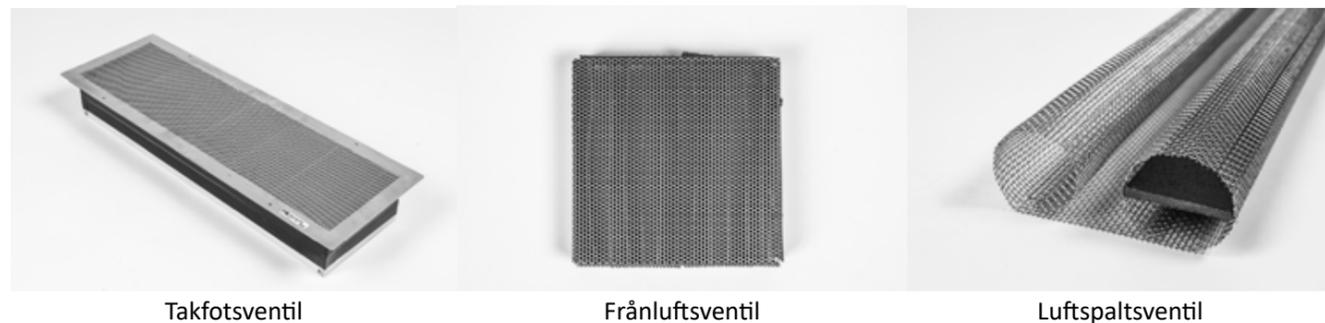
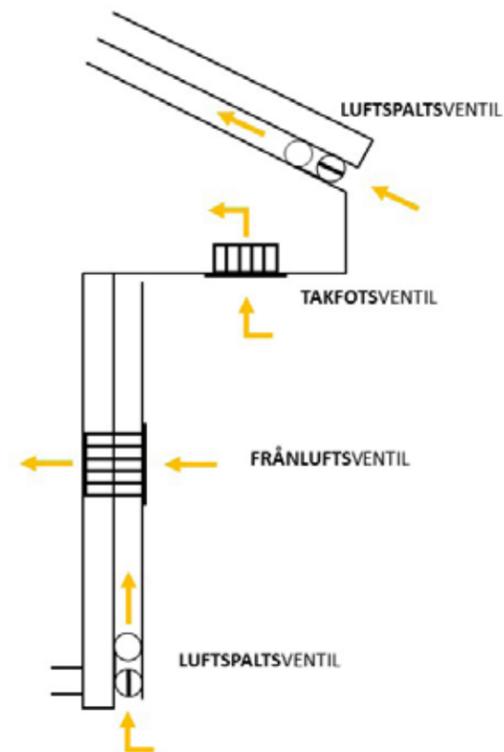
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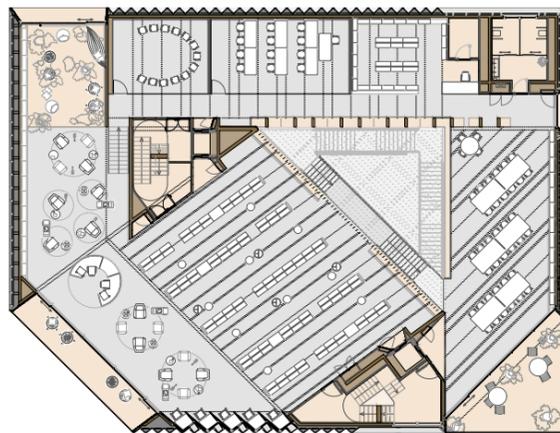


**LIBRARY  
FOR NEW  
CONTEXTS**

Barcelona's new library attracts people from near and far to enjoy its content and architecture. The stylised book design of the façade leaves no doubt about the building's function, and inside, a spiral staircase leads visitors through the open spaces, enticing them to stay longer. »

The architecture creates a continuity between book and building in this shared context.

TEXT Johanna Lundeberg PHOTO Jesús Granada



Plan, floor 3.



Cross-section.

As society evolves, so does the role of the library. Thanks to digital media, information is often available at the touch of a button, and in the public sphere, meeting places such as squares and buildings are being replaced to some extent by social media. This not unproblematic societal phenomenon formed the basis for the design of the Gabriel García Márquez Library in Barcelona.

»We started thinking about the purpose of a library in the 21st century when everything is on the internet, and from there we wanted to place the book and the building in a shared context. Our role is to enhance and intensify the architecture to make the journey to the library worthwhile. You should come here and feel you're getting something that you wouldn't have got otherwise,« says Guillermo Sevillan, architect at SUMA Arquitectura, the firm behind the library.

**HERE THE BOOKS** and the architecture speak through each other, linking to form a whole. The façade carries repetitive patterns of stylised books, shaped from fibreglass combined with thermosetting plastic, a light but strong material with a smooth surface that is also used for surfboards, among other things. The glossy white gives the books an almost sacred

appearance, stacked in neat rows next to each other and carefully opened, as if inviting visitors to another world and new chapters in their lives. The extended frame supports the books, and an inviting terrace running around the library allows visitors to seek shade or shelter beneath them.

»It's a kind of structural matrix, which we've scaled and converted into a library. For us, the most important collection in the library is its spaces. The incomparable spatial experience is why you go to the library instead of looking up information on your computer,« says Guillermo Sevillan.

The five-storey building is arranged around three CLT towers, essentially large load-bearing columns that are connected by the floors and roof trusses. An atrium in the centre not only brings the parts together visually, but is also the heart of the building in many other ways. Light flows from all directions, while the open space allows both air and heat to

circulate and provide a comfortable climate. From here, visitors are naturally drawn up through the building via the open triangular staircase, with each floor offering large, open spaces plus more secluded rooms along the edges. This is a flow without beginning and end, where the light coming in through the roof and windows makes it seem obvious where to go, with most visitors choosing the stairs over the lifts located in two of the three towers.

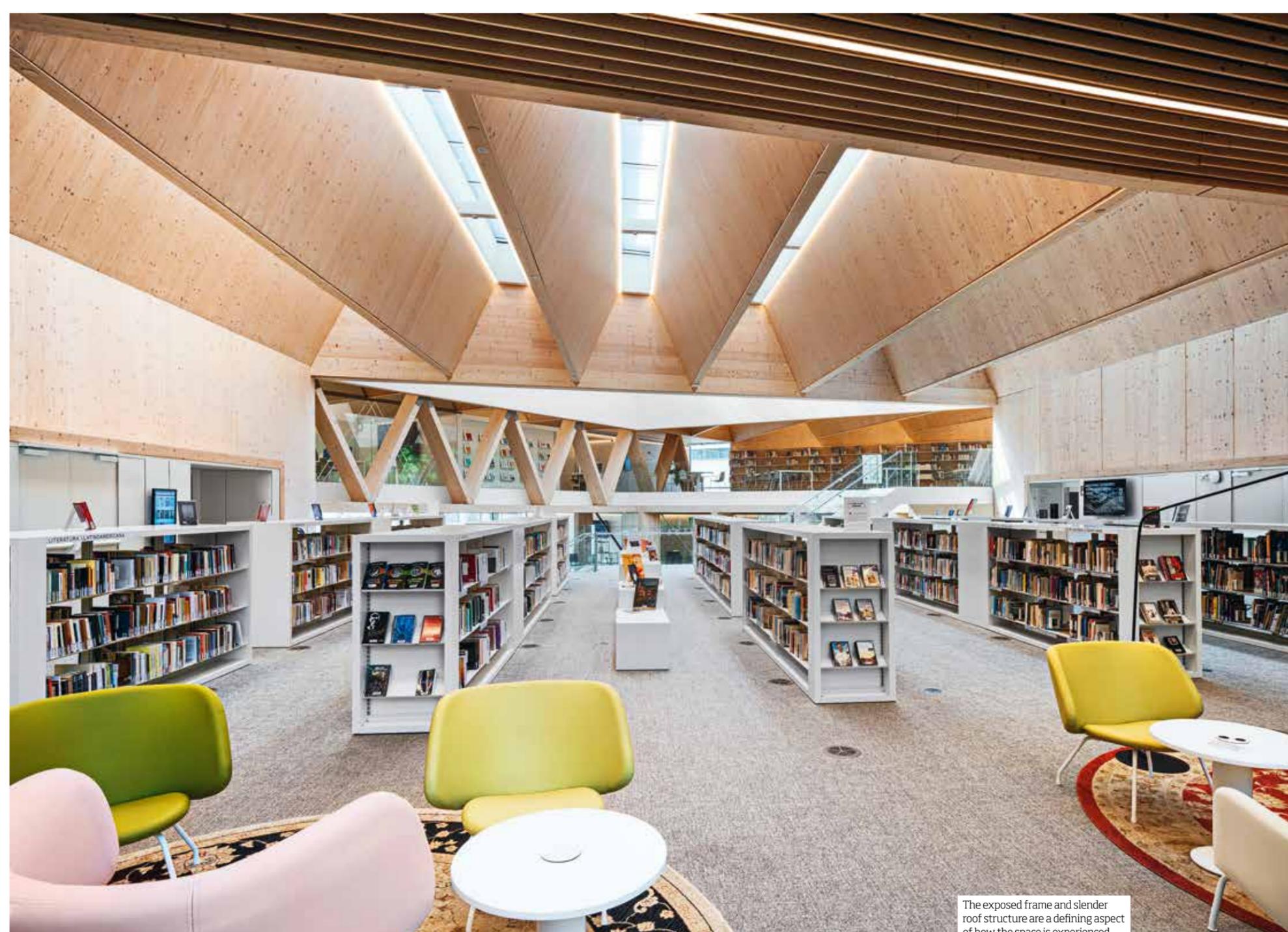
»The open staircase invites you to walk through the library and consider it as a kind of landscape where the rooms change from one corner to another. The airiness of the structure, the light moving in multiple directions and the way the windows open onto the tree-lined street make it warm and welcoming, and it's as if visitors know exactly which direction to go in,« says Guillermo Sevillan.

Alongside the book shapes, the façade is clad in a hybrid

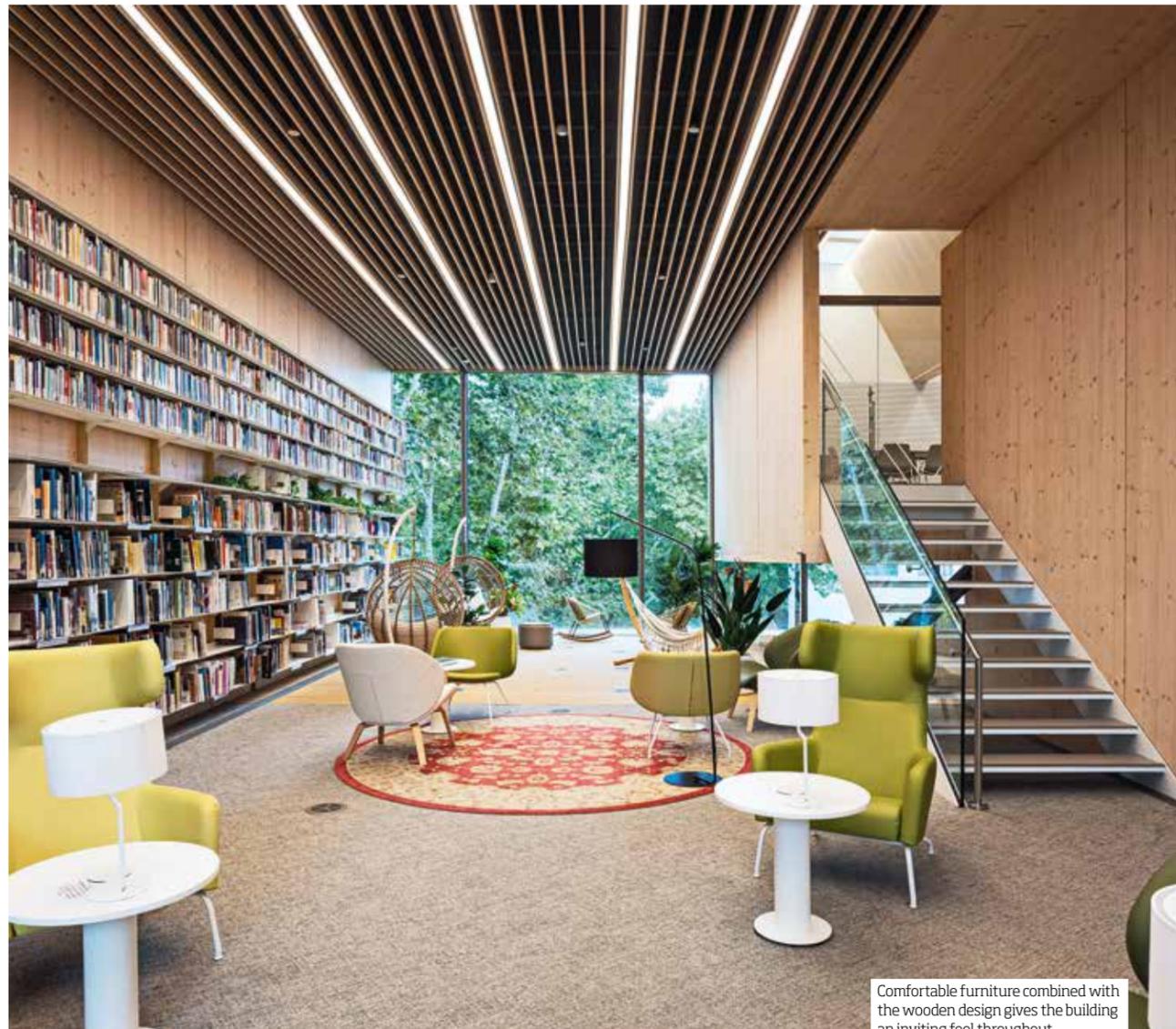
material, a mixture of glue and wood fibre that is weather-resistant and requires minimal maintenance, while the interior's CLT and glulam are prominently exposed, just with a treatment to combat fire and bleaching from sunlight. The supplementary steel reinforcements are hidden, like in a cabinet system, to give a coherent look that tricks the eye into seeing only the parts of the construction that form a three-dimensional system of different materials interacting.

»Most of the time when working with CLT, you start with sturdy elements. You make boxes, add four walls and a top and bottom, and then you have a stable structure. Here, we wanted to make it as permeable and light as possible, and that's when handling the loads gets tricky,« explains Sevillan.

For example, the truss is not presented as an independent element, since it would then need thicker dimensions. Instead, the different elements – diagonals and vertical and »



The exposed frame and slender roof structure are a defining aspect of how the space is experienced.



Comfortable furniture combined with the wooden design gives the building an inviting feel throughout.

Architect **Guillermo Sevillan**

## »EVERYTHING IS BASED AROUND A CONTINUITY OF EXPERIENCE AND SPACE«

» horizontal beams – are separated into different layers or integrated with the other architectural elements.

»So when you look at the truss, you don't see a thick, Herculean structure, just very thin elements of glulam and even thinner steel reinforcements that have no clear connection,« explains Mr Sevillan.

For structural engineer Miguel Nevado, the main challenge of the project was the movement of the wood:

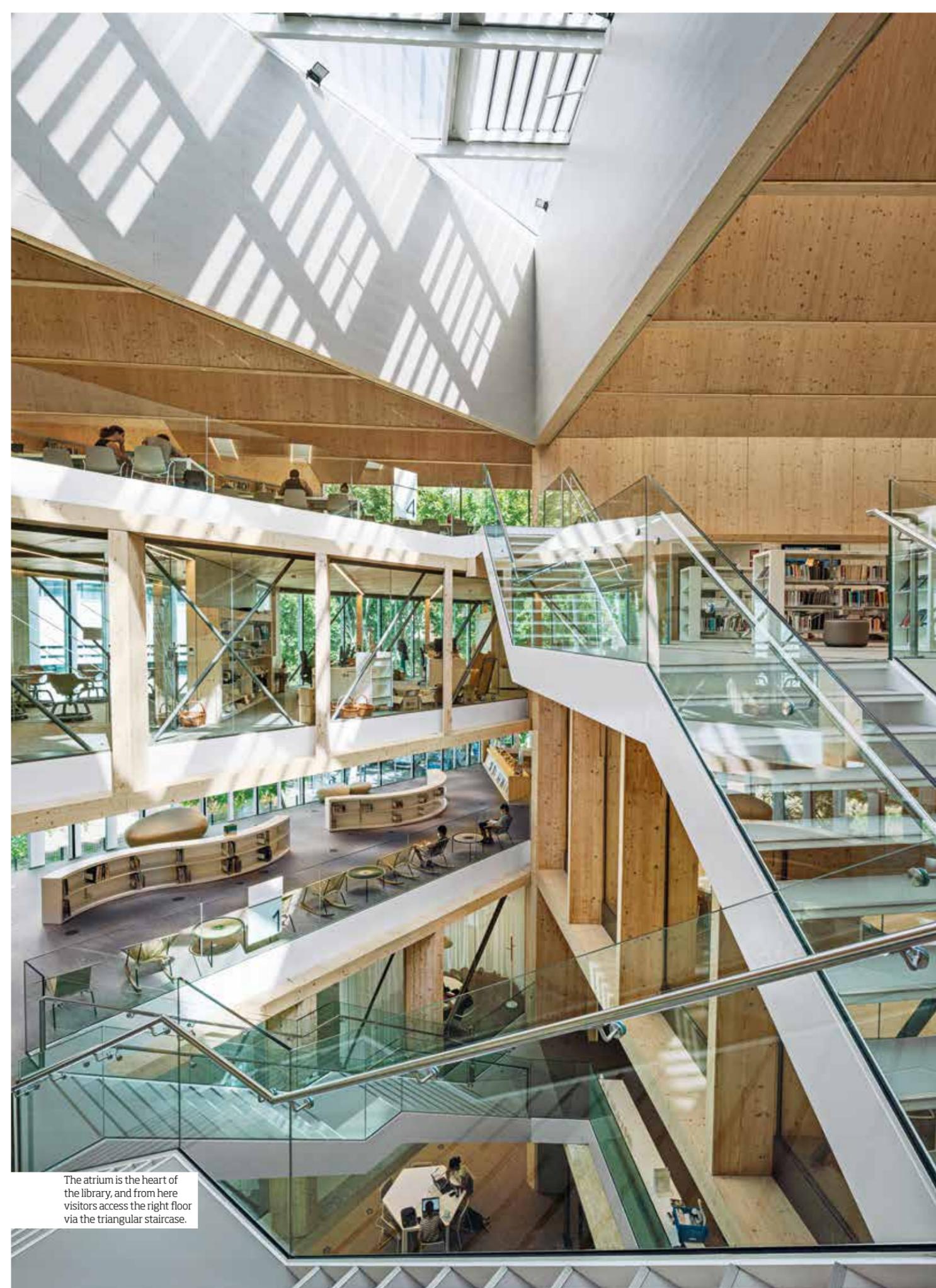
»Managing the stresses in load points comprising thin 'sheets' of CLT requires state-of-the-art methods to properly manage the joints and material proportions. There is almost no movement in steel, whereas glulam has some slight movement and CLT even more so. So here we have a variety of nodes, all with different properties,« he explains.

Throughout the project, the slender structure has been key to achieving a light and elegant feel, with the structure

not only resolving the load-bearing challenges of the building, but forming part of the whole, defining the orientation, scale and dimensions of the rooms.

»In this architectural work, the structure is the building, as there are very few architectural features that don't play a structural role. Between half and two thirds of the user's architectural experience involves the exposed structure and its surface. The lack of a clear structural typology and a clear perception of load points creates a particular spatial experience,« says Miguel Nevado.

**WHERE THEY USED** to be silent buildings with hushed visitors, libraries today also need to offer opportunities for talking and socialising. At the same time, peace and quiet must be available for those who wish to read and study, so the lack of doors between the different rooms requires an acoustic »



The atrium is the heart of the library, and from here visitors access the right floor via the triangular staircase.

# SWISSPEARL

swisspearl.com



Cembrit har bytt namn till Swisspearl i samband med att företagen gått samman. Tillsammans kan vi erbjuda ett bredare sortiment med bibehållit fokus på hållbarhet. Våra innovativa produkter kommer även fortsättningsvis att ge stort spelrum för kreativa idéer, funktionell design och konstruktion. Som en ledande leverantör av byggprodukter, lösningar och service tror vi att det alltid finns

## MORE TO CREATE.



The half-open books adorning the façade encourage reading. The openings offer views of the generous public spaces inside.

» solution. Like in a theatre, but in reverse, explains Guillermo Sevillan, because they don't want the sound to carry throughout the building. Instead, the noisier functions and meeting areas are located at the bottom and the quiet spaces, such as study areas, are at the top.

»Everything is based around a continuity of experience and space. For example, we put the children's library in a separate area so that you can read aloud to the children without disturbing other rooms.«

The carpeted floors and sound absorbers on the walls protect against reverberation and echoes, while the water fountain at the bottom of the atrium creates acoustic interference and conceals some of the sounds of conversation and so on.

»Rather than thinking of the library as a kind of sacred temple with enforced silence, we wanted to emphasise its social and cultural value and encourage people to interact with each other. It should feel a bit like a hotel lobby with soft sounds and a gentle buzz,« explains Guillermo Sevillan.

**UP TO 2,000** people visit the library daily, a number that has increased significantly since it was named Library of the Year earlier this year.

»I think the use of wood makes visitors feel more

### Gabriel García Márquez Library

BARCELONA, SPAIN

ARCHITECTS Elena Orte and Guillermo Sevillan, SUMA Arquitectura.

STRUCTURAL ENGINEER Miguel Nevad.

AREA 4,294 sqm.

COST EUR 9,3 million.

ENERGY certification LEED Gold.

[www.sumaarquitectura.eu](http://www.sumaarquitectura.eu)

comfortable, and the fact that the library has sofas, armchairs and comfortable furniture means that they spend more time in the building. They read, work on their computers... or take a nap,« notes library manager Neus Castellano Tudela.

Many people come here from other parts of the city to take advantage of the facilities, and the architecture also attracts tourists and Instagrammers.

»But the most important thing for us is the relationship that the building has formed with its neighbours – they are proud of it and feel that it's basically a people's palace for those who live in the former working-class neighbourhoods nearby,« says Guillermo Sevillan. ©



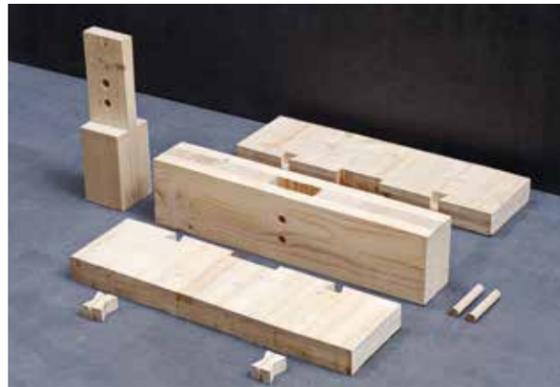


The brief was for a sustainable and flexible office with an open-plan layout at the bottom, making it easy to welcome visitors.

# Office block built to be dismantled

The Hasletre office block in the expanding Oslo neighbourhood of Hasle is built entirely of wood, with the idea that everything can be dismantled and reused. Several parts of the building are themselves also made from reused or recycled materials. »

TEXT Sara Bergqvist PHOTO Einar Aslaksen



Oslo tre



Prototype from the joinery workshop.

When Jørgen Tycho and his colleagues at Oslo tre were commissioned to design Høegh Eiendom and AF Group's new circular timber office building – now the headquarters of Save the Children Norway – they were overjoyed. The assignment was to create an innovative, boundary-breaking timber building that was demountable, economically viable and a model for the circular economy.

»This was something we'd been dreaming of for a long time. We had already designed small timber buildings with a certain degree of demountability, but never on this scale,« says Jørgen Tycho.

He and his colleagues immediately set about designing solutions that would provide the purest possible materials, so that the building could be easily dismantled and reused. Initially, this meant replacing steel joints, adhesives and silicone with wooden joints and using the principle of utilising gravity and building in layers.

However, they encountered considerable scepticism within the industry.

»They said the building would collapse, it would be too expensive and so on. We probably heard every possible version of 'it can't be done'. So we started making mockups and prototypes in our workshop with the help of our own experienced carpenters. Since it was during the pandemic and all meetings were digital, we filmed everything and then sent it to design teams and suppliers. In the end, we managed to get everyone on board,« says Jørgen.

The result is a post-and-beam structure, where the beams are driven onto the posts and secured with beech dowels.

»The dowels were dried down to 6 percent moisture content and knocked into the glulam, which had a moisture content of 12 percent. This meant the dowels were able to absorb moisture from the glulam and lock in place.

Everything is based on old techniques from the past that we've now industrialised,« he adds.

**THE LOAD-BEARING STRUCTURE** also includes prefabricated CLT roof and wall elements joined by means of wooden butterfly dowels. The fixings are part of a system designed to simplify future dismantling.

»The prefabricated elements use factory standard 3 x 15 metre products and so generate very little waste, while being efficient from a transport point of view. All in all, it's a very efficient way of building. The entire timber structure took only four and a half weeks to complete, which was about twice as fast as we had estimated. And the façade units took just two days to install. The entire above-ground structure was put up in a mere six months,« comments Jørgen.

The frame and surfaces in the building comprise several different types of wood and other natural materials. The load-bearing structure in glulam and CLT is made of spruce,



The façade is clad in wooden shingles to tie in with the area's brick façades but using modern building materials.

with beech fixings. The internal walls are clad in ash veneer and birch veneer, with acoustic inserts in spruce that is largely recycled. The façade is clad in heartwood pine shingles, and the window frames are made of acetylated wood. Apart from the stairwell, which is impregnated with a fireproofing treatment, all the other surfaces in the building are untreated.

»The insulation is wood fibre and wool. And on the floor we've laid an acoustic carpet of goat hair, which is a 100 percent biological and hygroscopic material just like wood. This means that it can help to balance the humidity in the room, resulting in a better indoor climate,« he continues.

With the exception of the external fire escape, which had to be made of steel for fire safety reasons, the building contains neither steel nor concrete above ground.

»We've now placed some green planting around the fire escape. In the long term, it'll be completely covered and look like a green wall,« says Jørgen.

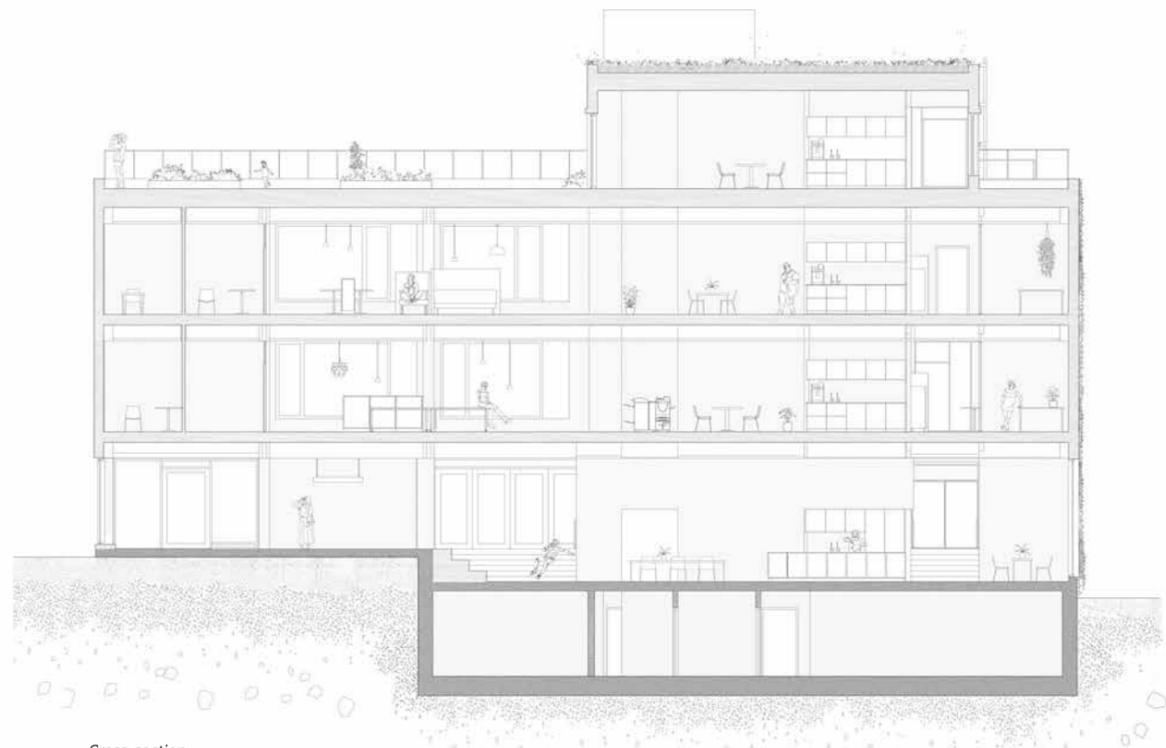
Another of the building's many green features is the roof

terrace with all its plants and the biotope roof that supports pollinating insects.

»The idea was that we would compensate for the building's footprint by moving excavated soil up to the roof. This way, we haven't stolen anything from nature, we've just moved it around. Inside, there is also plenty of planting and greenery. There is a wealth of research showing that surrounding yourself with natural materials such as wood and green plants improves quality of life, with effects including lower stress levels, less sick leave and better concentration and focus,« explains Jørgen.

He points out that building with wood also benefits the working environment during construction – and is positive for local residents.

»Working with wood is much quieter and faster. We haven't had a single complaint from the neighbours. For the construction workers, the labour is not as physically demanding and noisy, the atmosphere isn't as damp and the site also



Cross-section.

» smells good. As such, we've hardly had any sick leave at all,« he says.

Save the Children moved into the building in mid-December 2022 as the first and only tenant.

»We're so pleased. Since we signed the contract six weeks before the construction process started, we've been able to closely follow the process, learning about all the unique and innovative aspects of the building,« says Linn Huse-Amundsen, head of the People and Technology department at Save the Children Norway.

**THE NEW BUILDING** is located in the emerging district of Hasle on the outskirts of central Oslo. This former industrial area is now being developed into a vibrant neighbourhood with housing, offices and other facilities, where more than 60,000 people will be able to live and work. The building's closest neighbour is the former production facility of the Norwegian alcohol monopoly, known locally as »Vinslottet« (The Wine Palace), a typical modernist building with a brick façade and an open ground floor on concrete beams.

»Our vision was to design a building that could harmonise with and be subordinate to this existing structure. At the same time, we wanted to embrace the construction material of this century, which we believe is wood, so we clad the façade with shingles, inspired by ancient Norwegian wooden architecture such as the stave churches. This is our way of connecting with the brick façade of Vinslottet, but using a completely different material. And just like Vinslottet, we've designed the building with an open ground floor and a more enclosed feel as you get higher up,« says Jørgen Tycho.

Inside, the ambition was to create a building with plenty of light, a dense vertical core and open, flexible layouts on all floors.

Arkitekt **Jørgen Tycho**

»**WE PROBABLY HEARD EVERY POSSIBLE VERSION OF 'IT CAN'T BE DONE'.**«

»All the technical installations are routed for maximum flexibility. For example, we have a flexible utilities corridor in the centre of the building, and we use a raised floor with cavities underneath so that we can easily change everything when we want to. The interior walls are made of ash veneer panels, attached with beech plugs that are inserted with a nail gun and can easily be removed,« he adds.

**A DISMANTLING MANUAL** has been drawn up so that all the materials used in the building can ultimately be reused. By keeping them as untreated as possible and free of glue, Jørgen expects the second-hand value to be quite high.

»The BIM model we use serves as a material library, where all the collected information is held,« he says.

As well as being prepared for material reuse in the future, the building already consists of several reused components and materials. For example, all the acoustic elements, toilets and ventilation units are recycled.

»Save the Children has continued along the same lines and sent their old furniture to a 'spa' to be upgraded and used again,« says Jørgen.

However, there was no tenant in the picture when the two owners – the property companies Høegh Eiendom and AF Eiendom – began planning the building. Their focus was on creating something with a high sustainability profile.

»Sustainability is not just a part of our strategy, it is the »



The structure's post-and-beam system is based on an industrialised version of traditional wood techniques.



The premises are activity-based, and much of the old furniture has been reused.



The butterfly dowels, to the left of the window, have been kept exposed to show the construction.



Many of the fixtures and fittings are reused, including the toilets and sinks. Everything is recorded in a dismantling manual.

» strategy. In an industry that accounts for 40 percent of climate emissions, we feel compelled to act as responsibly as possible. We've long worked to minimise climate emissions and energy use in the operation of our properties. Hasletre was a great opportunity to build up our knowledge of how to develop properties that are low-emission even in the production process,« says Cato Dehli Lauritzen, head of the Oslo business area at Høegh Eiendom.

The goal was to cut carbon emissions by at least 50 percent compared to current building requirements.

»Wood was the natural choice because of its renewability, its low climate emissions and the possibility of creating a circular cycle. The idea of making a building with materials that can be dismantled and reused was conceived at an early stage. So we had all that in mind even before we chose the architect and contractor,« says Cato.

In addition to the climate benefits, he was convinced that building this way would be competitive in cost terms.

»The planning time is a little longer, but the construction phase is very fast because you can put everything together as a kit. So it becomes quite a cost-effective way to build, and there is definitely an interest out there. We've seen sustainability factors going from being on a wishlist to becoming a dealbreaker for tenants,« he reports.

Jørgen Tycho agrees.

»We're doing another building right now, based on what we've learnt here, where the contractor expects it to be three times faster than steel and concrete. And wooden buildings have become extremely popular. We're finding that virtually every wooden building is rented out even before it's finished and that those who move in are very happy. The working environment is good, sickness absence is low and people are often very proud of their wooden building.«

### Hasletre

OSLO, NORWAY

CLIENTS Høegh Eiendom and AF Eiendom.

ARCHITECTS Oslotre.

STRUCTURAL ENGINEERS Oslotre and Nystruktur.

COST NOK 118 million.

SURFACE AREA (LOA) 2,868 sqm

CERTIFICATION BREEAM-NOR Excellent

ENERGY DECLARATION Energy label Green B

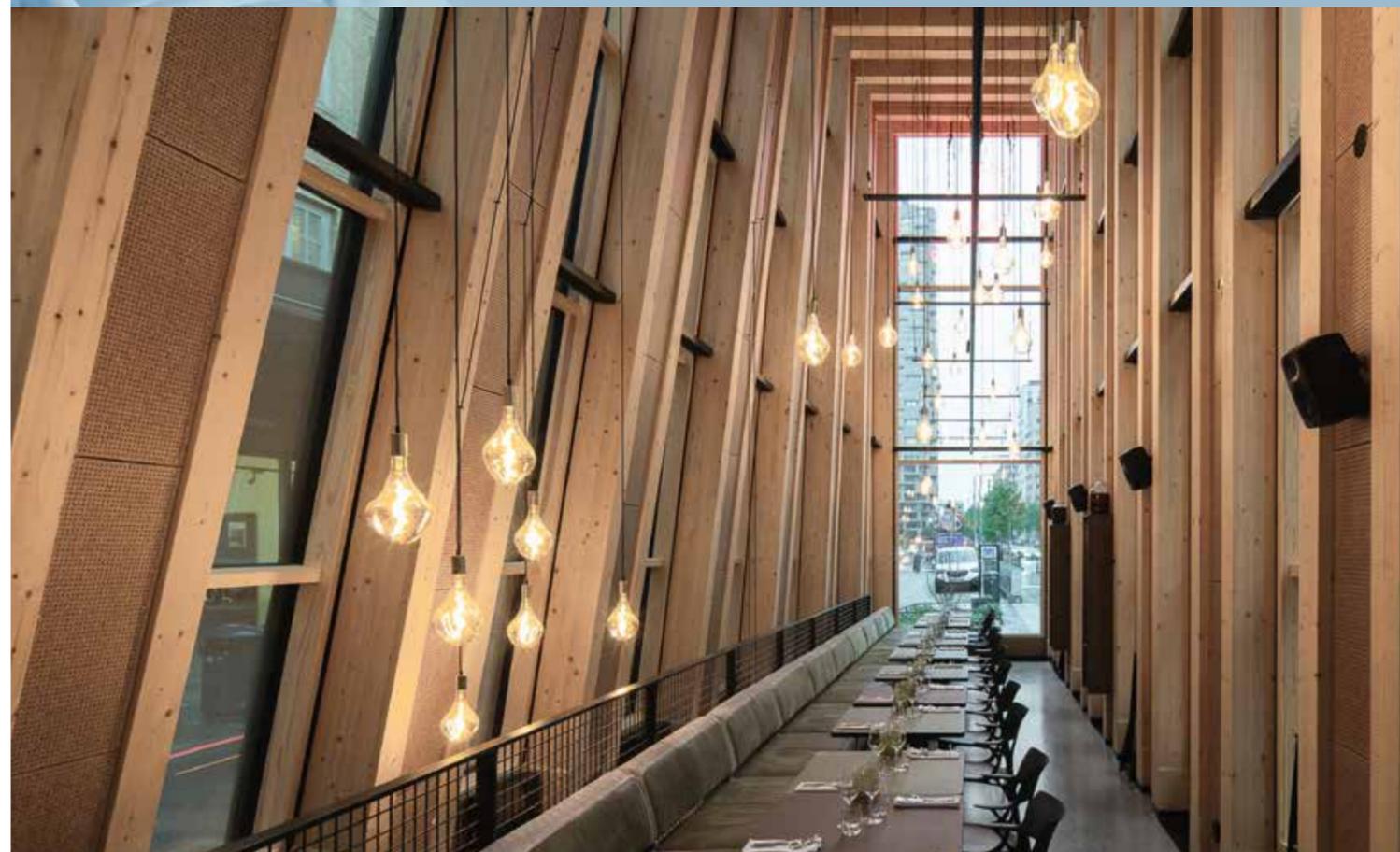
COMPARISONS Reduced greenhouse gas emissions compared to the reference building Future Built 2.0: 60 percent. Reduced use of steel compared to the reference building: 80 percent.

w| oslotre.no

This is indeed the case for Save the Children. With their former premises in an office building in the centre of Oslo due for a complete refit, meaning they needed to move, they conducted a thorough employee survey. What did they want from their premises and where did most of them live?

»What we concluded was that the office should be activity-based, sustainable, located in the centre or eastern part of Oslo and preferably on the ground floor so we could easily be visited by our volunteers and invite them to different events. We're so pleased with our new office and never thought we'd be able to have a whole block to ourselves. It feels great to be in a climate-friendly building and to be able to continue on that path in the interior as well. Around 60 percent has been carried over from our old premises, while the rest is recycled from elsewhere or bought from showrooms and suchlike. And the wood creates a warm and friendly atmosphere that makes us and our visitors feel so welcome here,« says Linn Huse-Amundsen. ☺

VI ODLAR HUS.  
VI ODLAR  
FÖRÄNDRING.



För att förverkliga framtidens hållbara samhälle behöver många starka krafter samarbeta för att skapa förändring. Vi på Holmen vill bidra till en positiv samhällsutveckling genom att låta ännu fler upptäcka och ta tillvara möjligheterna med trä. Det kan handla om allt ifrån privatpersoners egna byggprojekt, till stora kontorshus, bostadsområden och offentliga byggnader.

Vi har byggt upp en komplett, cirkulär kedja, där nyckelorden är hållbarhet och energieffektivitet. Det gäller såväl när vi vårdar, brukar och skördar skogen, som i förädlingen på våra sågverk. I koncernen ingår dessutom Martinsons, som med nytänkande byggsystem gör att vi erbjuder en helhet som framtids-säkrar levnadsmiljöerna för framtida generationer. Hela vägen från planta till färdiga byggnader. Vi odlar hus, helt enkelt. Och vi odlar förändring.

HOLMEN

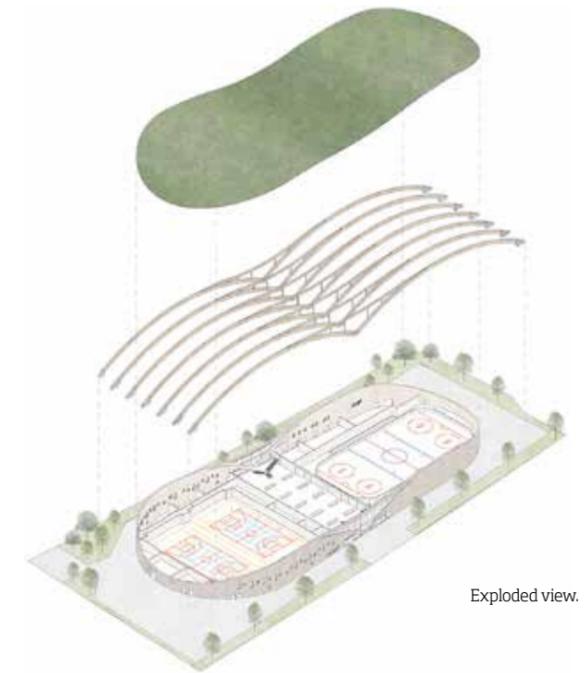
Tillsammans med

 martinsons

Restaurang Rummel på 375 kvm är belägen mellan Norra Stationsgatan och Dalagatan. Det sluttande taket är tio meter högt i ena änden och fyra meter i den andra. Fastighetsägare är Humlegården Fastigheter, arkitekter är den danska byrån Henning Larsen Architects och Martinsons Byggsystem har ansvarat för projekteringen och monteringen. Trästommen i limträ och taket i KL-trä har tillverkats i Holmens sågverk i Bygdsiljum.



The glulam arches supporting the sports hall meet in the centre of the building, where solid concrete foundations absorb the forces.



Exploded view.

## THE CITY PLAN PROMPTED THE DESIGN, WITH DOUBLE GLULAM ARCHES CREATING SPACE FOR BOTH BALLS AND PUCKS, OF THE HALL

TEXT Marit Engstedt PHOTO James Silverman

Sometimes constraints can give rise to the best solutions and a good design, as was the case with Kviberg Park's new ice rink and sports centre in Gothenburg, where glulam arches were the only way to meet the construction challenges.

When the City of Gothenburg's sports department commissioned the new sports hall, it was subject to several building restrictions. The City Plan allowed a maximum building height of 12 metres and a floorspace of 8,000 square metres. In addition, the client wanted the building to be constructed in wood, in line with the City's climate vision.

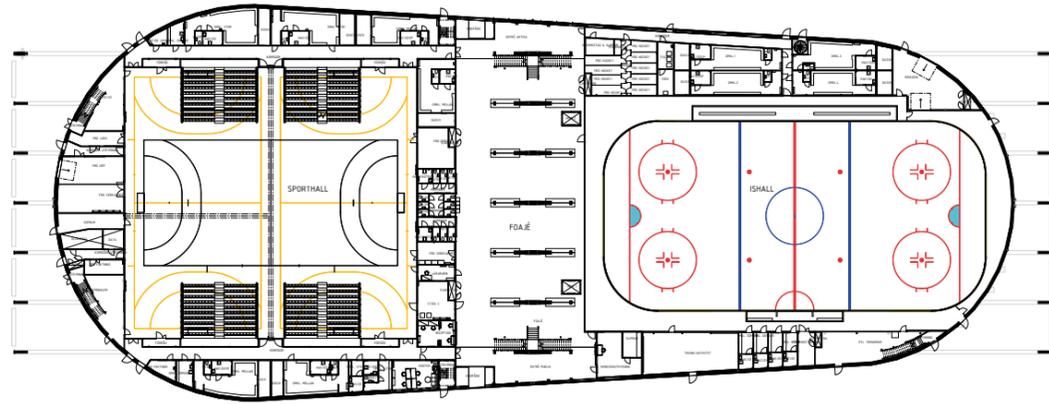
Wahlström & Steijner were the architects commissioned to design the building. They considered various combinations of straight glulam beams and trusses, but just could not find the right solution.

»We couldn't exceed the external height limit, and that meant there wasn't much clearance left inside. The only solution was to employ glulam arches,« says architect Jürgen Wahlström.

This made it possible to achieve the required ceiling height without exceeding the maximum external height. Since the building would be housing not just a hall for handball and other sports but also an ice rink, the solution was to have seven rows of two glulam arches, each 80 metres long, spanning each hall, with a triangular concrete foundation in the middle and at each end to absorb the forces from the arches.

»Turning an arch upside down between the other arches gives the building a lovely wave shape. You can see this clearly on the roof, which follows the shape created by the glulam arches,« says Jürgen.

**THE DESIGN OF** the building was also limited by the total development footprint permitted in the City Plan. The two 80 metre arches cover more than 8,000 square metres, so they had to continue outside the body of the building. The area specifications also gave rise to the oval shape. The plot was narrower at one end, so the ice rink, which required »



Plan.

» less space than the larger sports hall, was placed in the narrower section and the sports hall in the wider section. And rounding the corners brought the project just under the maximum figure, at 7,999 square metres!

»The shape of the hall has emerged from the structure and function, with the conditions and limitations actually producing a beautiful outcome.« says Jürgen Wahlström.

The centre of the building, between the two halls, houses the entrances and foyer. The sports teams enter from one of the sides, and from there they go directly to their respective halls – either to the right or left, via a row of changing rooms.

**THE SECOND ENTRANCE**, for the public, is accessed from the car park. Spectators can mingle in the spacious foyer, where the glulam arches touch down centrally on the concrete foundations that absorb the forces. Sturdy concrete benches have been placed around the foundations, where the two materials meet in an exciting juxtaposition.

»It's a great contrast. The concrete creates a

Architect **Jürgen Wahlström**

## » THE SHAPE OF THE HALL HAS EMERGED FROM THE STRUCTURE AND FUNCTION. «

counterpoint to the warm wood,« says Jürgen.

Apart from the concrete benches and foundations, the interior is clad with wood in various forms and textures. The floor is hard-wax oiled industrial parquet in ash, virtually indestructible according to Wahlström, and ideal for this public context. The walls are lined with hardwearing perforated birch plywood with sound-absorbing mineral wool behind. The panels are impregnated with a fireproofing treatment and gently white glazed to prevent yellowing.

The ceiling is made of pine laths in different dimensions, with a gap between them and mineral wool behind.

»Because the sound is broken up by the ribs and the staple fibre wadding absorbs the sound, it becomes like an acoustic wall, ensuring comfortable sound levels in the halls.

There are no or few opposing perpendicular walls and ceilings that cause sound to bounce around – everything bends and curves, which is good for the room acoustics,“ says Jürgen Wahlström.

**BEFORE REACHING LEVEL two**, via stairs or a lift, visitors pass a reception area and a counter for skate hire. This also serves as the box office for public events and concerts.

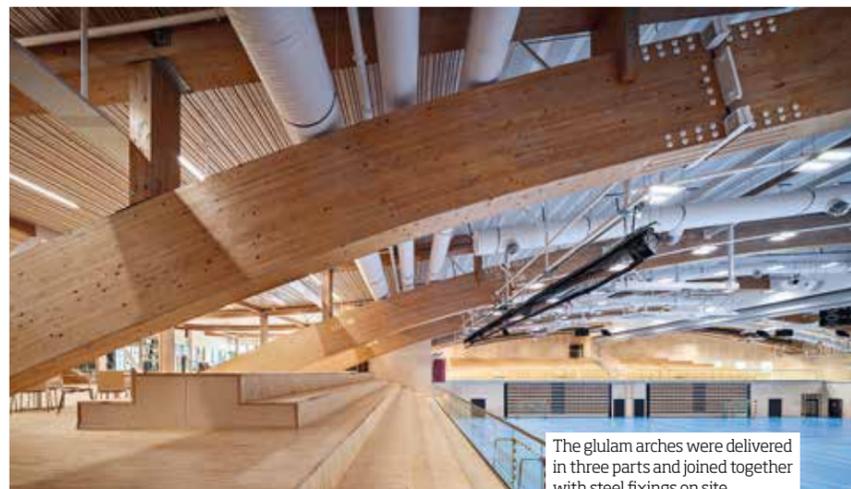
On level two, visitors will find a generous space housing a café, which then leads on to the spectator areas for the sports hall and ice rink. The wall facing the ice rink is glazed and transparent so that parents can watch their children on the ice without having to stand in the cold.

The large windows on the outer walls of the sides follow the arched shape of the building, allowing light to flood into the foyer and café, while the halls themselves are more indirectly lit.

The glazed section between the ice rink and the public spaces that wrap around the large sports hall helps to give the interior an open feel. It is possible to move freely around almost the entire building, and in terms of fire safety, this is enabled by installing sprinklers and making it a single fire compartment.

»This building appeals to all the visitor's senses. It's bright and smells of wood, which also feels warm and pleasant to the touch. And of course the wood is beautiful to look at,« Jürgen comments.

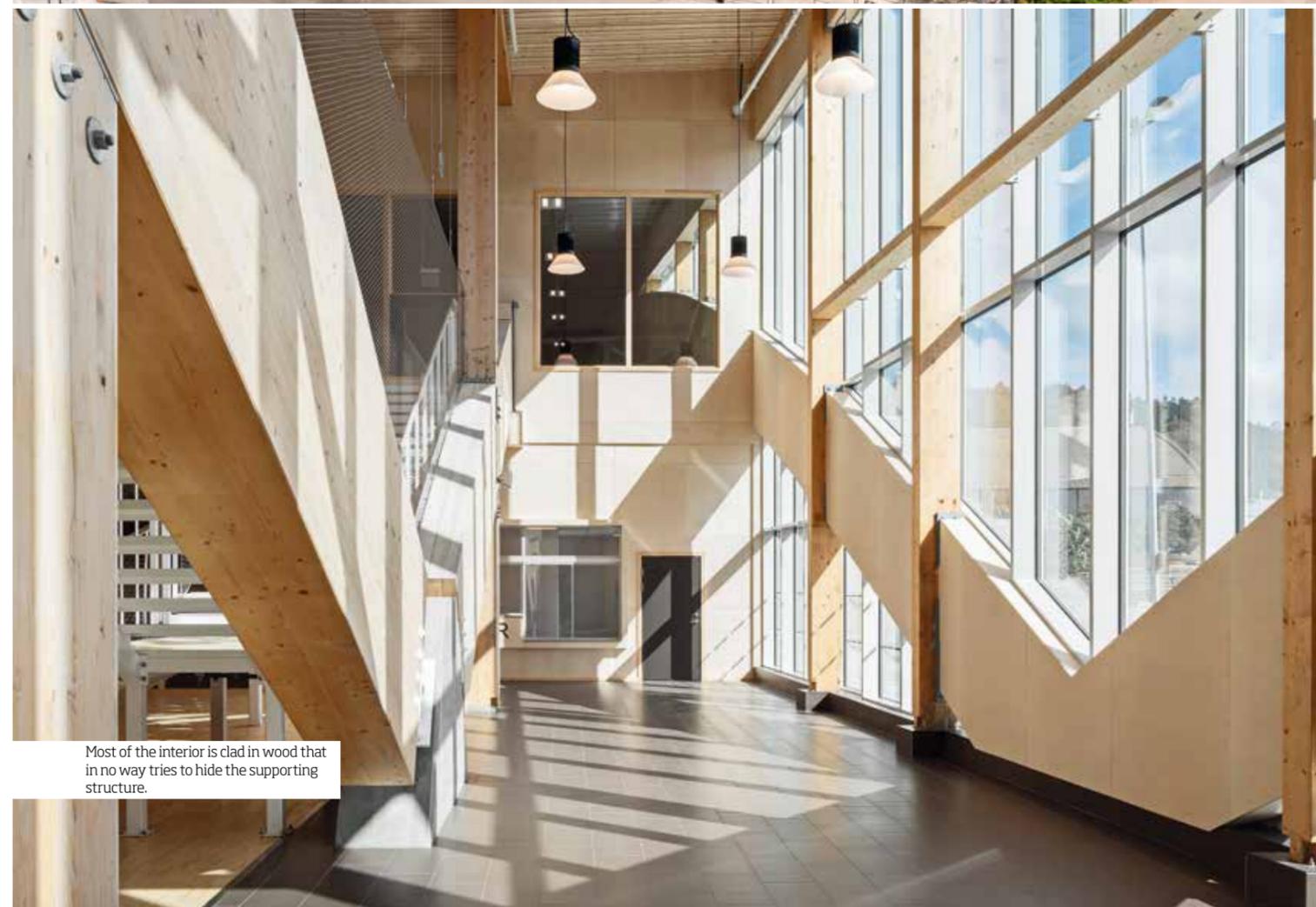
The long glulam arches in pine are 1.60 metres high and 50 centimetres wide. The tender for the glulam was won by a manufacturer from Austria that offered a good overall solution. The glulam arches were delivered »



The glulam arches were delivered in three parts and joined together with steel fixings on site.



The glulam arches extend outside the hall, with the tops clad in sheet metal so as not to exceed the floorspace limit.



Most of the interior is clad in wood that in no way tries to hide the supporting structure.



Stairs lead from the café on the upper level to the stands. The ceiling is made of pine laths.

» in three parts by lorry and joined on site with steel fixings.

The floor slab, with its embedded bracing to prevent the arches from sliding apart, and the concrete foundations were already in place, so it only took a few days to lift the arches into place, anchor them to the foundations and get the building under a roof.

The roof is made of prefabricated light-weight elements, consisting of wooden panels on the top and bottom, with mineral wool sandwiched in between.

»This is a very practical approach when working with shapes other than traditional pitched roofs. Where they span from one glulam arch to another, they can be bent to follow the shape of the arch,« says Jürgen Wahlström.

The elements are topped with an environmentally friendly sedum roof that promotes biodiversity and captures rainwater. The south-facing roof also has solar panels that power some of the building's machinery.

The façade is finished in heat-treated wood, with the heavy-duty board-on-board

cladding mounted in a sequence that creates vibrancy and a play of shadows.

**JÜRGEN WAHLSTRÖM** IS very pleased with the end result of Kviberg Park's ice rink and sports hall, and cites the working method as one of the success factors. The project worked on the basis of a construction-only contract, which meant that the architects and structural engineers were responsible for their drawings and were involved in the entire process.

»I had a very good relationship with the contractor's site managers. They often called us out to the construction site so we could solve problems together. They accepted help from us architects, and we were able to collaborate on the construction, in a constant spirit of constructive positivity,« he says.

He also noticed that the builders enjoyed working with wood and that everyone was keen to do a good job. Jürgen recalls how the process of making the grandstands turned into an artisanal endeavour that perhaps rarely occurs when working with other materials.

#### Kviberg Park GOTHENBURG, SWEDEN

ARCHITECTS Wahlström & Steijner Arkitekter.  
CLIENT City of Gothenburg Sports & Associations.  
STRUCTURAL ENGINEER COWI.  
CONSTRUCTION COST SEK 250 million.  
PROJECT COST (including developer costs) SEK 300 million.  
AREA (LOA) 11,468 sqm.  
w| wahlstrom-steijner.se

»They consist of parquet in the form of small wooden staves. The site managers called us to the site to jointly figure out the best configuration for the wooden staves and mouldings that would produce the finest finish.«

That is another advantage of working in wood, he says. Something you may not be able to fully finalise in the drawing can be worked out on site.

»It's easier with wood than with other materials,« he concludes.®



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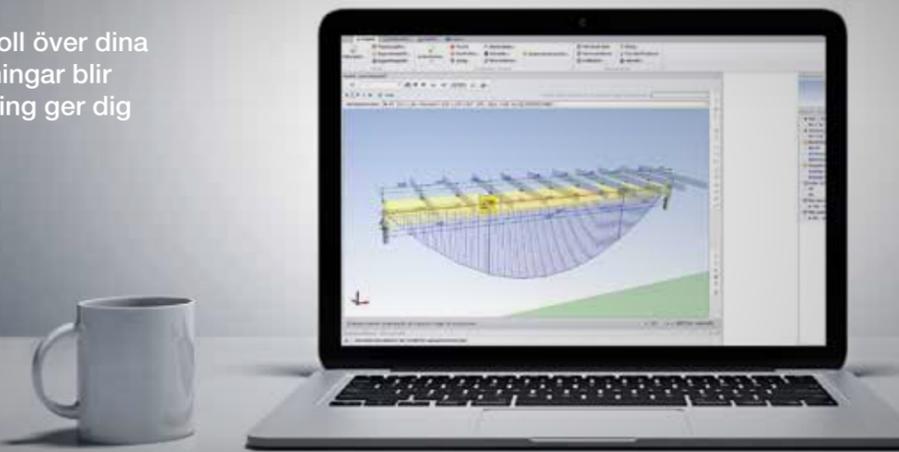
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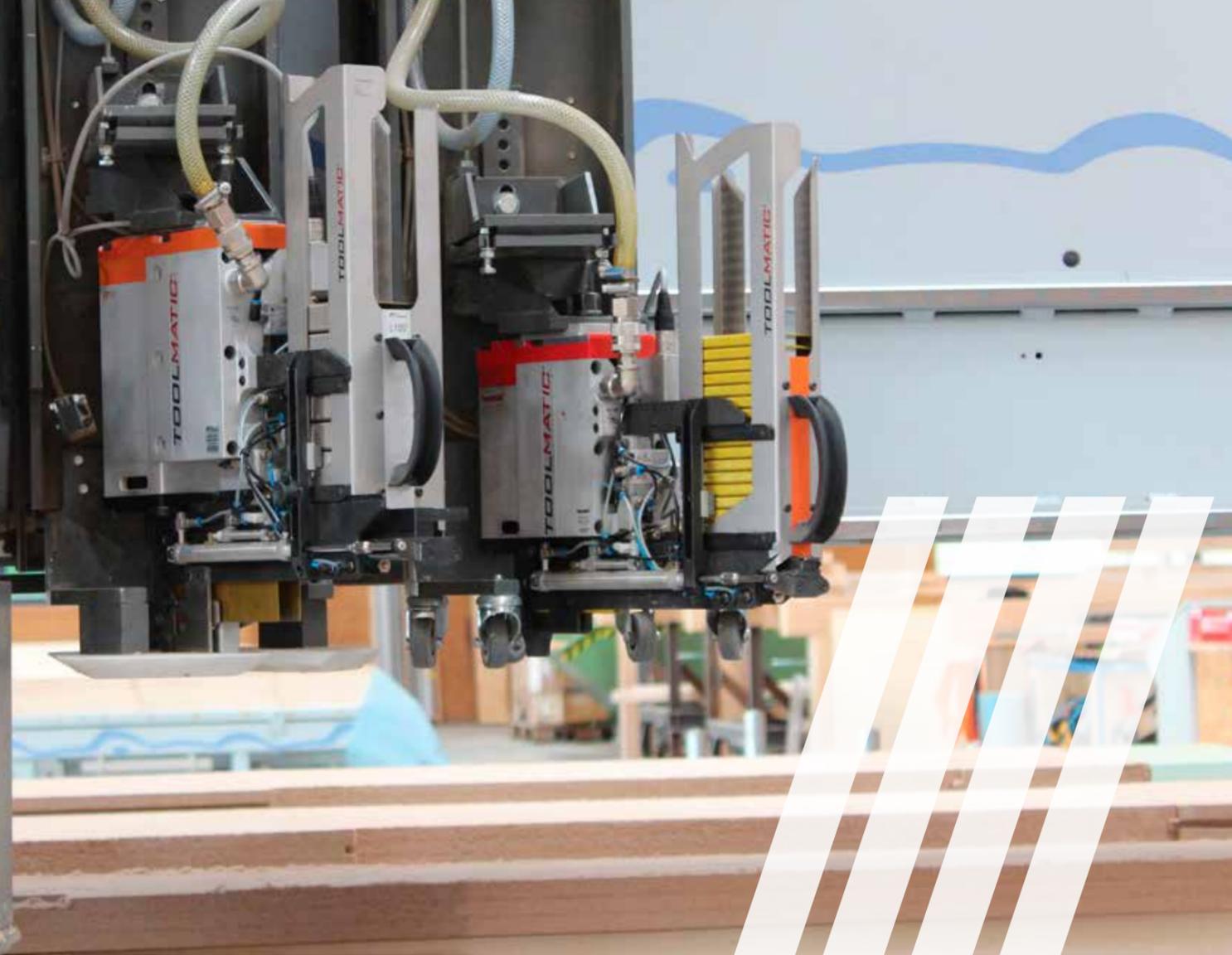


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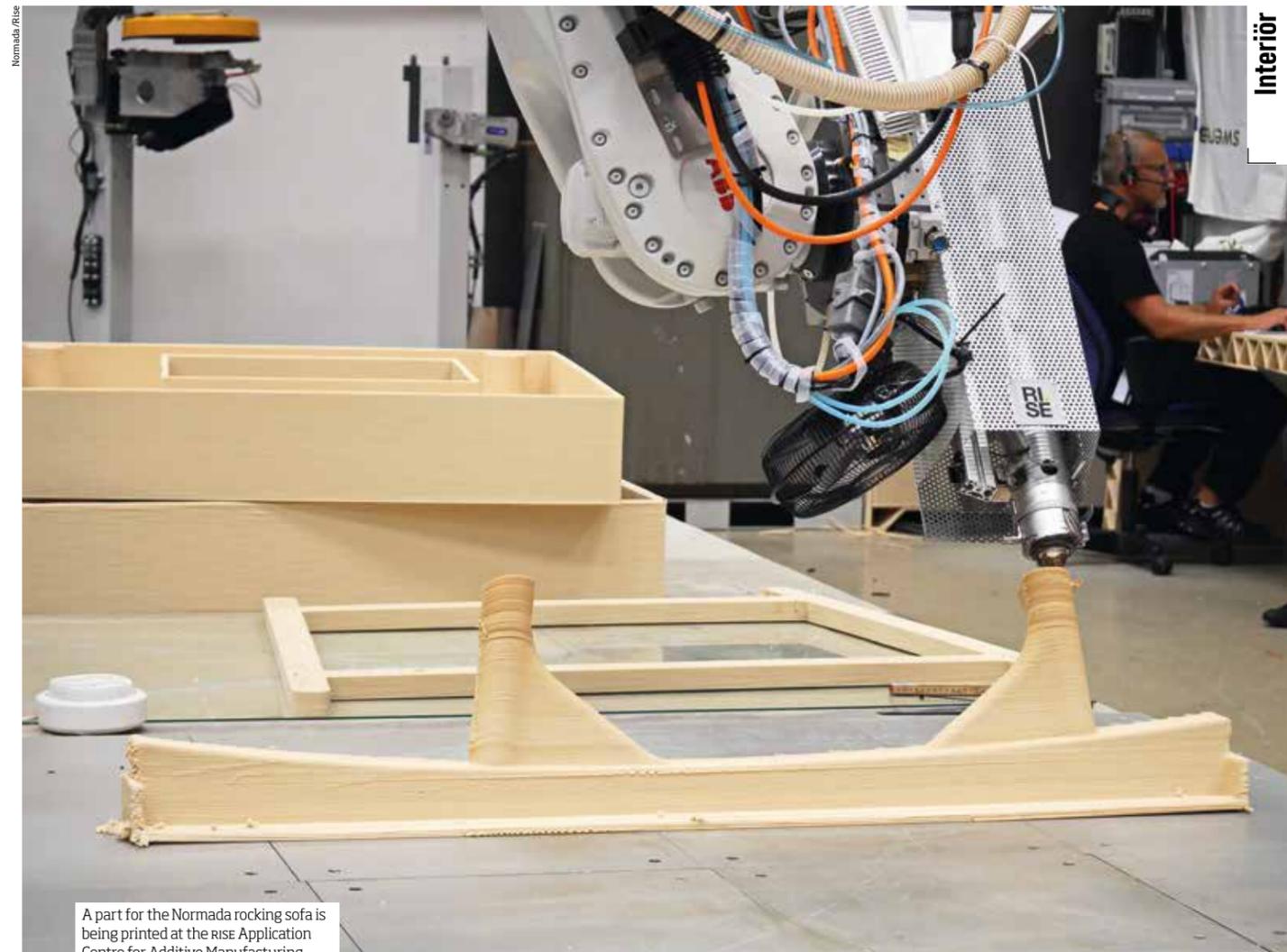
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A part for the Normada rocking sofa is being printed at the rise Application Centre for Additive Manufacturing.

## Technology and materials pave the way for circular furniture

**For many years, both architecture and furniture design have been experimenting with additive manufacturing, known more commonly as 3D printing. New aesthetic expressions are being created, and spatiality based on technological advances is being explored. But we are seeing a particularly interesting development in smaller scale products such as furniture and kayaks.**

TEXT David Valldeby

Many houses are being printed in extruded strings, usually with rounded corners, in what is called concrete but is actually more like old-school clay. But there are problems – getting a sufficiently fluid material that retains its shape both under pressure and when dry is a difficult challenge to overcome. Either the structures deform slightly during printing or drying cracks form in the printed material.

The basic materials for 3D printing have only recently begun to be developed with the climate and circularity in mind. Several companies are developing solutions for wood fibre and cellulose-based materials that are as close to natural as possible.

RISE WAS A pioneer in this area, aiming to bring the technology to small and medium-sized enterprises.

»We were collaborating with ABB on exploring the use of industrial robots for 3D printing. We connected an existing ABB robot to an extruder (see box) and started experimenting. We wanted to explore the technology around 3D printing so that we could print larger objects and at a higher »



1



2

Malin Fleen  
Reform design lab



3



4

Normada



5

» speed than traditional FDM systems,« explains Seyed Hosseini, head of the RISE Application Centre for Additive Manufacturing.

**DESIGNER MALIN FLEEN** was one of the first in Sweden to work with 3D printed furniture. For her degree project at the University of Gothenburg, she 3D printed a wood fibre-based frame that she modified and then covered with linen and epoxy, a lamination technique common in the marine industry. The armchair was exhibited at the Stockholm Furniture Fair in 2020, and two years later the Reform chair won Furniture of the Year at the Elle Deco design awards. Designer Yuri

Rahimkulov and co-founder Måns Broman had similarly been sketching out an armchair when they were approached by RISE.

»The challenge was to find the right material. We started with waste streams from the automotive industry, but that wasn't what we were looking for, and then Stora Enso entered the picture with a wood fibre-based material. We immediately knew this was the material for us. However, there was a lot of development work to get a good surface finish,« says Måns Broman, CEO of Reform Design Lab.

Progress came quickly, resulting in the birth of perhaps the world's first item of 3D

1. Rendering of Melker of Sweden's new Värmdö kayak, which was tested in a 3D printed version.
2. Malin Fleen's armchair, clad in linen fabric and epoxy.
3. Normada's rocking sofa, designed by Johanna Vesterberg.
4. Detail, rocking sofa.
5. Reform chair, designed by Yuri Rahimkulov at Reform Design Lab.

printed furniture made from a wood fibre-based biocomposite produced on a large scale. The Reform chair is not just recyclable but fully circular – it can be ground down and printed into any new shape at least seven or eight times, according to Reform Design Lab, although new research indicates that wood fibre should be reusable up to 25 times. With the design studio estimating an average lifespan of 15–20 years for an armchair, the material will keep going for a long time.

»As far as we're concerned, the future lies in developing and implementing new technologies in the furniture industry to achieve sustainable solutions,« says Måns.

**WHEN JOHANNA VESTERBERG**, founder and CEO of Normada, designed the rocking sofa known as The Nest, she was already thinking that it would be printed. However, there was some doubt as to whether it would be possible to print such large 3D items. Just in case, a wooden version was produced.

»I want to change the way we look at furniture. We don't want to use furniture that was made a century ago; we need a material that we can reshape for future living. The investment needs to shift from the furniture to the material, so we can create something that is truly reusable,« she says.

There have been many challenges along

the way, material shrinkage being one of them. But the technology is advancing rapidly, as are software solutions that can analyse what will happen to the material and account for that. Normada is exploring how much cellulose they can mix into the corn starch that makes up their base. At present, it is 20 percent, but go over 40 percent and the material becomes brittle and difficult to work with. Wood fibre gives a rougher surface, whereas cellulose produces a more polished finish that is more comfortable to sit on.

»Initially, when the technology was in its infancy, we were working with primary »



Melker of Sweden's kayak is printed in one piece, with the tool changed for milling in the same assembly.

Melker Of Sweden/RISE

» materials, but now we're testing different biomaterials or blends of recycled materials. We shouldn't be burning or destroying fossil-based plastic, and we also need to label the materials, like other industries have started to do with product passports,« says Johanna.

Normada is now opening a 3D studio in Luleå to give more companies the opportunity to use the technology, and they are working with RISE to study how they can source materials from local recycling centres. One of the hopes is to be able to recycle wind turbine blades, a product that in most countries is buried in the ground at end of life. The aim is to find recipes that work around the globe, so the furniture can be printed wherever the buyer is, instead of being transported halfway around the world.

**KAYAK MANUFACTURER MELKER** of Sweden has created a fully functional kayak printed using pellets made from a mixture of wood fibre and plastic from recycled fishing nets. This system provides unique opportunities for a kayak manufacturer to develop and build new models, but also to customise the shape according to the user's wishes. Historically, the Inuit built kayaks from driftwood and greased skins. In recent decades, these materials have been replaced by extruded

plastic or fibreglass. It is almost poetic to see the process going back to its origins, but with the addition of recycled plastic to create a waterproof material. At present, the technology is only being used to develop new models.

»We can listen to the needs of the market and quickly 3D print a full-size, one-piece prototype, which we can then put through real-world testing in various conditions. We can also keep repeating the process until we're completely happy,« says Pelle Stafshede, CEO and Creative Director at Melker of Sweden.

For Melker of Sweden's kayak prototype, RISE worked with the parties involved to develop a combination of different process steps, in which the same robot goes from printing the product to milling the desired surfaces through a tool change. This enables them to achieve much higher standards of surface finish and tolerances.

»It's important to look at the possibilities and not get stuck in a conventional mindset when it comes to using additive manufacturing. 3D printing can add a level of design freedom that many other processes can't match. Structural engineers and designers could, for example, develop topology-optimised products or products that are more like nature, bionic shapes,« says Seyed Hosseini. ☺

#### What is an extruder?

An extruder can be simply described as a tube with a rotating screw inside. The tube is fed with plastic pellets, which are propelled by the screw and simultaneously heated into a malleable plastic material. When the material is pushed through a nozzle (extruded), it is moulded into a continuous profile.

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# Riding schools and engine sheds pioneer new technical solutions

One might think that the grand buildings – the stations, libraries and theatres – were the drivers of modernity in the mid-19th century. But this was not necessarily the case.

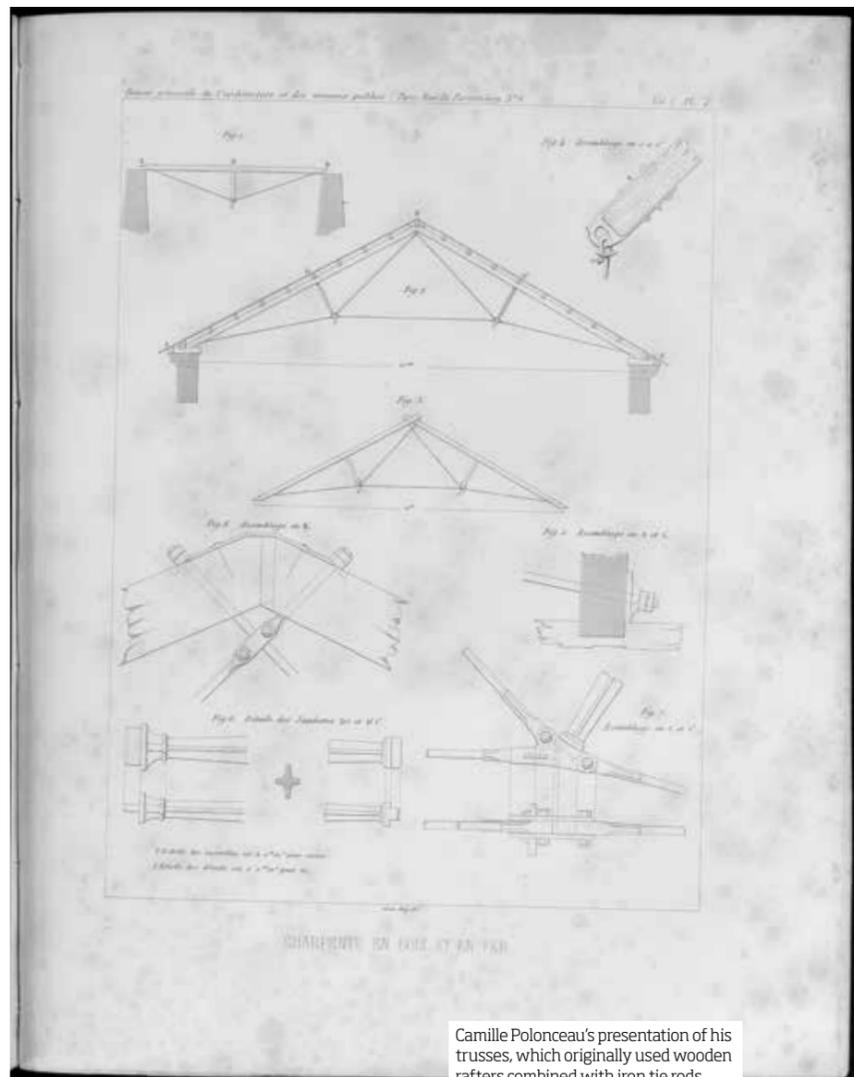
TEXT Stina Hagelqvist

RATHER, IT WAS the less ostentatious buildings, such as riding schools, gasometers, market halls, factories, railway halls and engine sheds, that promoted experimentation and development – building types that required space and large spans. Architectural history tells us that the new materials such as glass, iron and eventually concrete defined the era and sparked rapid industrialisation. But wasn't modernity more about new ways of solving old problems, i.e. new ways of thinking rather than new building materials?

Wasn't it more about how the problems were solved than that they were solved and that they actually managed to combine space with strength and affordability?

Often it was the traditional wooden structures that provided the solutions, because the problems were not new. Various hybrid solutions with reinforced wooden beams and laminations were tried in the late 18th and early 19th centuries, with the optimum design appearing in the 1820s in the form of an under-tied beam. Again, it was not a so-called modern material but a simple rope that unravelled the Gordian knot. The design was simple, effective and economical, but with limitations in terms of the rope's tendency to stretch and the need for repeated re-tensioning, so the rope was soon replaced by iron tie rods.

CAMILLE POLONCEAU'S FAMOUS 1840 truss, with two under-tied beams resting against each other, is usually thought of as an iron



Camille Polonceau's presentation of his trusses, which originally used wooden rafters combined with iron tie rods.

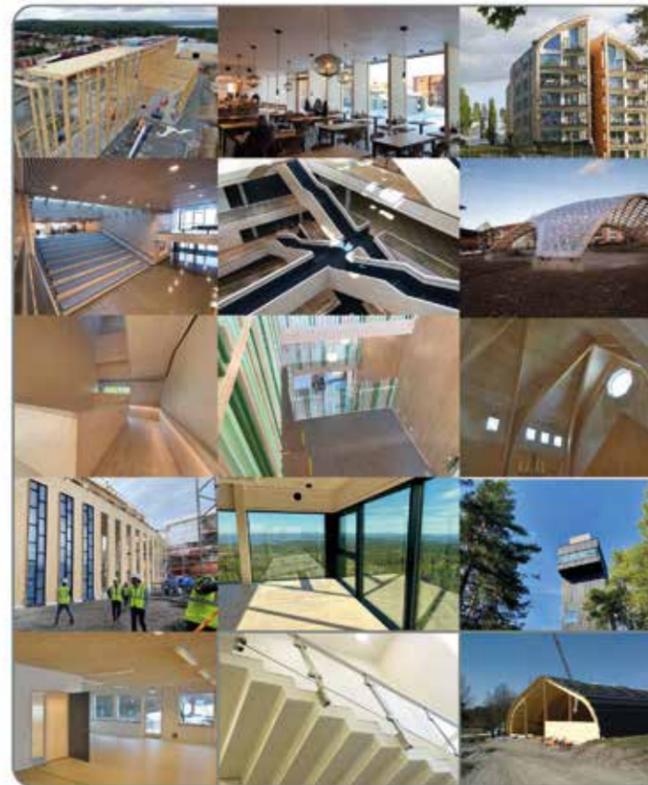
structure but has its origins in timber trussing, and wooden rafters were used in combination with iron ties until the early 20th century. Both Polonceau and his contemporary Arnold Wiegman, who produced a theoretical explanation of truss construction, stress how rational and economical the under-tied truss is. The desire to experiment was thus not only about spans, tensile forces and loads, but also about optimisation, finding the best structural solution at the lowest possible cost. Minimum dimensions for maximum strength.

And Polonceau's under-tied roof truss remains a relatively cheap, material-efficient and strong roof truss design. Halls are still a common type of building, but now with even more varied content and spans that

sometimes far exceed what 19th-century structures were capable of. And now environmental sustainability has been added to the already complicated calculus. The question is whether the new wood materials represent the potential for advances. Glulam, with its low self-weight and low environmental impact, for example, seems to be another step in the development of the optimal roof truss for large spans. Experiments are ongoing with new hybrid materials and hybrid structures that have wood as one of their main components. Today's climate and environmental debate also makes the 19th century zeal for optimisation relevant once more. Producing more with less may seem impossible, but it has been done before and can be done again. ☺

Bibliothèque Cité de l'architecture & du patrimoine. Revue Générale de l'Architecture et des Travaux Publics, vol. 1, 1840

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Wood – a fossil-free, renewable material that stores carbon – has a key role to play in the green transition. But what is the situation with the forest? In a series of articles, Trä raises questions about why Swedish forestry looks the way it does and what opportunities and challenges are just around the corner.

# AI is the future of forest management

**Forestry machines are trained using artificial intelligence (AI). The Swedish forest is being laser scanned from the air and ground. Powerful IT systems with smart algorithms allow researchers to look hundreds of years into the future. The digitalisation of Swedish forestry is in full swing.**

TEXT Göran Crafoord

**IN ORDER TO** make forecasts and plans for future forestry, we first need to understand what the country's forests look like today, how healthy they are, what types of trees grow where and how much wood raw material they contain. Johan Holmgren is an associate professor of remote sensing in forestry at the Swedish University of Agricultural Sciences and one of the pioneers of airborne laser scanning of forests.

»We started airborne scanning of our experimental areas just before the turn of the millennium. The laser scanning provides us with data on the trees and the topography, information that we then use to analyse the current situation and make forecasts about the future,« he says.

The more pulses per second, the higher the resolution. Twenty years ago, the technology was capable of a few thousand measurements per second; now the figure is two million. To get an even better picture of the



Johan Holmgren.



Martin Servin.

forest, aerial remote sensing is complemented by ground-based laser scans.

»Combining the two methods allows us to assess the height, shape and circumference of each individual tree in a section of forest. We can even see how the branches are arranged, what can be sawn into timber and what will become pulp,« adds Johan.

But simply scanning the forest is not enough to get a complete understanding, so the remote sensing analysis is combined with data from the National Forest Inventory – 18,000 measurement sites around Sweden where trees are measured by hand and where soil types, shrubs, mosses and lichens are also examined.

»It's important for forest owners to know the composition of their own forest today and in the future. Accurate data makes it possible to plan how planting, thinning and harvesting should be done,« he says.

The information gathered can also be used to assess which tree species are best suited to a particular area or what type of forestry is appropriate.

»Mixed forests may be better in locations with strong winds, for example, and it's important to adapt the silviculture activities. Large clearfelled areas can increase the wind speed, which in turn can lead to storm felling in the remaining forest.«

There is no doubt that digitalisation is revolutionising forestry. Martin Servin,



Attaching a laser scanner to the forestry machine allows researchers to collect data from different sample areas. The image on the right shows how the scanner creates a 3D point cloud of the information.



The most accessible and environmentally friendly route is determined using data from laser scanning and simulation modelling.

lecturer in digital physics at Umeå University, conducts research in the field of simulation, AI and forest machines.

»We're going to benefit greatly from AI in forests, not least when it comes to meeting the UN's Sustainable Development Goals. We can use AI to create smarter routes in the forest, save energy and reduce the carbon footprint. Vehicles without cabs will also be lighter, which reduces the risk of natural damage in connection with actions such as harvesting,« he says.

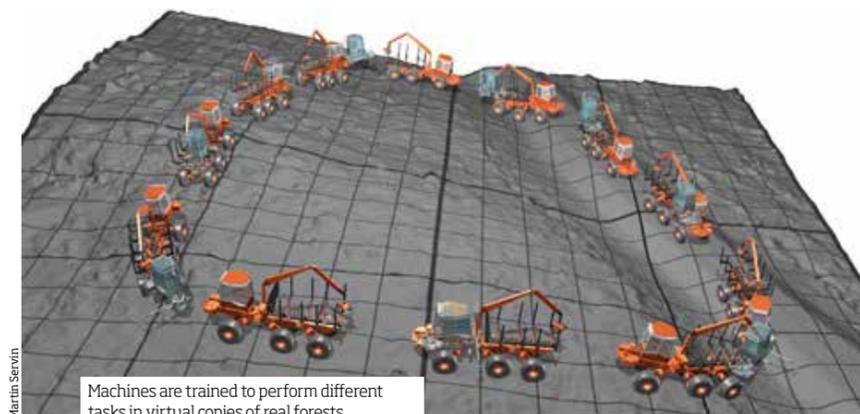
Martin adds that working in the forest can be risky, and the operator of the forestry machine has to make a series of decisions under severe time pressure. With the help of AI, an operator can sit in a warm and safe place and coordinate several machines at once, making for a better and safer working

environment. And on those occasions when decisions beyond the AI's level of expertise are required, the operator can step in.

**AI CAN ALSO** contribute to more precise and low-impact harvesting, which can benefit biodiversity and reduce the carbon footprint. But to make the right decision in a given situation, it needs to be trained, in a process similar to the human one, where we as children learn through school and play.

»As humans, we try things out and learn to recognise certain patterns. We adopt the behaviours that produce the best results and drop the others. This is also how we train AI, so that it becomes increasingly capable of interacting appropriately with its environment.«

Martin Servin and his research team create



Machines are trained to perform different tasks in virtual copies of real forests.

## Mistra digital forest

A research programme focused on developing digital tools and automation techniques for the forestry sector. Johan Holmgren and Martin Servin are two of the programme's work package leaders. [mistradigitalforest.se](http://mistradigitalforest.se)

virtual copies of real forests and real machines from CAD models and remote sensing data, and then use these digital environments to train machines and vehicles to independently perform different tasks in the forest.

»For example, the machines are put to work on steeply sloping terrain with slippery surfaces. They have to choose between going over or around difficult rocky areas. If a forestry machine gets stuck or falls over, it means the AI made a bad decision in the given situation. This behaviour is screened out and the AI gets to try a new strategy,« says Martin.

But what is the point of doing all this in digital environments rather than in real life?

»The tough tests that we do virtually would be extremely dangerous in real life, not to mention putting huge strain on all the equipment and costing a lot of money. At the same time, taking a trained AI and putting it in a real, physical forestry machine rarely works, as there is always a discrepancy between reality and the environment created by the computer. So the tests are continued in the real world,« says Martin Servin.®

Trä meets | Karin Öhman (page 50–51) »

# »WE NEED TO THINK AND PLAN BROADLY AND A LONG WAY AHEAD«

**Using data and smart algorithms, Karin Öhman and her research team at the Swedish University of Agricultural Sciences (SLU) are able to glimpse the future. This knowledge can then be used to determine how today's forests should be managed.**

TEXT Göran Crafoord PHOTO Johan Olsson

## **You are a certified forester and professor of forest planning. What is forest planning?**

It's a process that leads to decisions on how to use, or not use, the forest. The research group I lead is developing methods and tools that can be used in this planning process. We use them in future analyses, where we look at how the forest will develop, depending, for example, on how it is managed.

## **Why did you go into research?**

A researcher seeks knowledge and wants to find solutions to different problems, and I like that. I want to improve. I also like to see things from several different angles, which is often a must in research. If we want to find solutions to different problems, we have to study both sides of the argument.

## **Why is research on forests of the future important?**

It's a crucial issue. Forests are one of our most valuable natural resources and their importance to our environment and economy cannot be overestimated. The forest is on everyone's radar and has an important role to play in the green transition. We can use forests to replace fossil-based products, and they are needed to store carbon.

The forest is also an important place for biodiversity and recreation. We need to find a good balance between all these demands, and we need to find ways to manage forests that contribute to the climate transition without jeopardising all the other values of the forest.

## **How does the research work?**

The methods we develop are implemented in an analysis and planning system called Heureka. Developed by the SLU, this unique system has been created with the help of specialists from a wide range of disciplines. The programme allows us to see what the forest will look like in a hundred years if it is managed in a certain way. My speciality is developing methods, mathematical models and algorithms that enable the system to find the best solution based on the forest owner's goals and circumstances.

## **Heurekasystemet**

The Heureka system is a suite of software that enables forestry analyses and planning against multiple objectives. Short- and long-term projections can be made for timber production, economics, nature conservation, recreation and carbon sequestration.

The software can be applied to

everything from individual stands and properties to entire landscapes or regions. The Programme for Forest Sustainability Analysis (SHA) at SLU's Department for Forest Resource Management has been responsible for managing the Heureka system since 2011.

**READ MORE AT** [slu.se/heureka](https://slu.se/heureka)

## **How do you forecast the future?**

In simple terms, we enter the forest owner's goals and forestry practices into the system. We then add data describing the current state of the forest land: tree types, age, height, density, topography, soil condition, etc.

Next, we add other factors, such as prices for different types of timber and harvesting costs. In just a few seconds, we can see the best way to manage the forest and the consequences of a particular choice.

## **What information do you get from Heureka?**

We can see what the forest will look like, how much wood it will contain, what kind of trees will grow there, how much the forest will be worth, and so on. We can also see how much carbon will be stored or how much dead wood there will be, which is crucial for biodiversity.

## **What do you think is the best way to manage the forest?**

We need variety, and that means utilising different forestry methods. Clearcutting dominates at the moment, but in the current debate some people cite continuous cover forestry as a better alternative. Each method has its pros and cons. CCF is not the answer to all challenges, but it can be part of the solution.

Our research shows that a palette of forestry practices is the best way to capitalise on all the values: good timber production, improved biodiversity, recreational opportunities and reduced risks of storm damage and spruce bark beetle attacks.

## **What challenges do the forests face?**

One challenge is understanding how climate change will affect forest growth. Another is that forests have a rotation period of a hundred years, during which needs can change. In the past, wood was needed to build large ships.

Today, we see the forest as an important part of the green transition. We don't know what role the forest will play in a hundred years' time – we thus need to think and plan broadly and a long way ahead so we can manage the forest in the best possible way.

## **Will the forests of the future be more robust than the ones we have today?**

While a warmer climate would favour growth, it also increases the risk of drought, fire, spruce bark beetle attacks and storm damage. And if we plant exotic fast-growing and more heat-resistant trees, we will have other problems with diseases and biodiversity. More robust forests come from the use of different forestry methods and an increased proportion of deciduous trees. But this will not happen by itself. There are choices to be made by forest owners or political decisions to be taken. ☺

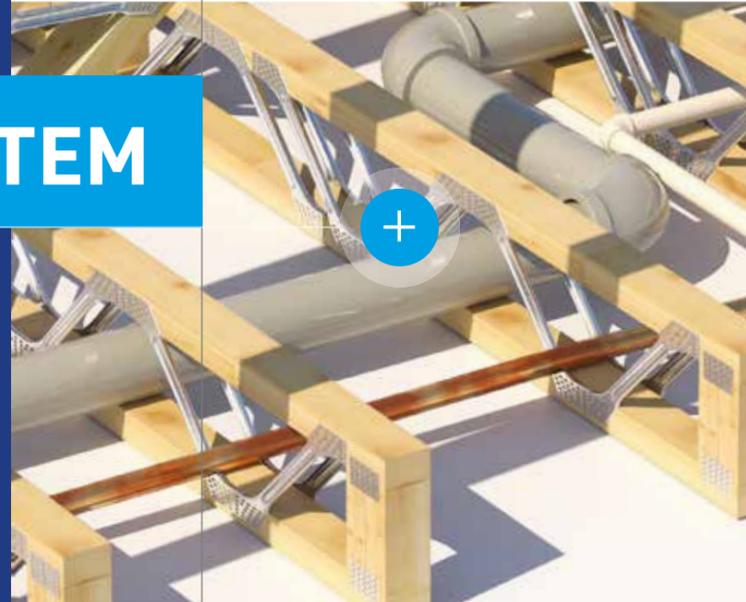
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A screen lined up with the balconies creates a more intimate space for meetings between neighbours. The cantilevered roof reinforces this feeling.

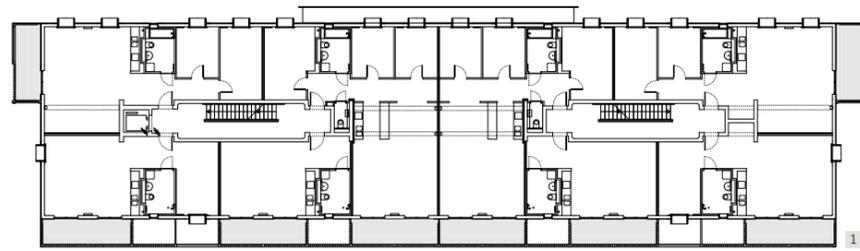
## Housing with a focus on simplicity and socialising

**A few years ago, a vision of a future society was realised in the southern German town of Bad Aibling. On a 70 hectare site, which was an air base in World War II and has since housed both a prison camp and an American listening station, is now the experimental City of Wood.**

TEXT Katarina Brandt PHOTO Sebastian Schels

THE CITY OF Wood is a place where researchers, architects, engineers and craftsmen work on various wood construction projects, and Munich-based architect Florian Nagler jumped on board at an early stage. Between 2017 and 2020, his practice was involved in three high-profile and almost identical buildings constructed for research purposes. The only difference between them was the frame, which used a wall system of either mass timber, lightweight concrete or brick. The project was realised in collaboration with the Technical University of Munich, where Florian Nagler is a professor.

In the interdisciplinary research project »



» 'Simple Building', his research team has sought to investigate and monitor the basic principles of the concept, which includes an energy-efficient building method with thin wall and roof structures, a return to traditional building methods and a minimum of technical installations.

Investing only in essential technologies can keep costs down, while also reducing energy consumption and operating and maintenance costs, which in turn results in lower rents.

»We often see housing not working in practice as it was intended in theory, and there are, of course, many reasons for this. One may be that many errors occur in today's complex projects, another that the residents don't behave as they were expected to. Through our research, we want to show that it may be worth considering a simpler and more robust approach to construction,« says Tillman Jarmer, architect at Florian

Nagler Architekten and project manager for Simple Building.

Some of the insights from the CLT research building have now been incorporated into one of the firm's latest projects – an apartment block commissioned by the Wogeno housing cooperative, just a few hundred metres from the three research buildings in Bad Aibling.

This building has none of the widespread over-technification that, according to Tillman Jarmer and his colleagues, comes with considerable needs in terms of knowledge, control and maintenance.

»Wogeno has been an outstanding partner on the project and the courageous client that we as architects and researchers like to work with when exploring new avenues. As they represent a housing cooperative, their focus is on providing housing of a socially acceptable standard, rather than turning a profit.«

The apartment building was completed in

1. Plan, floors 1–2.
2. The outer cladding, which varies in width, has been installed with narrow gaps. Together with the frames around the window openings, this creates a distinctive aesthetic for the building.
3. The exposed wooden surfaces, which have only been gently sanded, help to regulate the humidity in the apartments.
4. The set window sizes are designed to provide the apartments with adequate ventilation when opened.

Architect **Tillman Jarmer**

»**WE WANT TO SHOW THAT IT MAY BE WORTH CONSIDERING A SIMPLER AND MORE ROBUST APPROACH TO CONSTRUCTION.**«

2022 and is based on a simple 3.1 metre grid that is well suited to timber designs. The basic structure has made it easy to incorporate a wide variety of floor plans into the building, which contains 23 apartments built according to the principles of the research project. Apart from sanitary installations, the only visible technology in the apartments is the surface-mounted electrical wiring for wall-hung radiators and a reasonable number of electrical sockets and switches.

From the centrally located entrance, concrete staircases on either side lead up to two floors of eight apartments each. It was not

possible to build a basement due to the high water table in the area. Instead, each apartment has access to a storage room in the attic. The staircases provide stability and reduce sound transmission to and from other parts of the building.

The walls and roof of the apartment building use a mass timber wall system of cross-laminated layers, the two outer of which are a mere 45 millimetres thick. The middle layer is 170 millimetres and has sawn-out grooves that create an insulating layer. The outer walls have a U-value of 0.28 W/m<sup>2</sup>K, which without the air ducts would be

0.5 W/m<sup>2</sup>K. Thanks to the specialist construction, the walls keep the house warm in winter and cool in summer without the need for additional insulation. The walls are breathable, allowing them to both release and absorb moisture.

»Construction is the sector that consumes the most resources and generates the most waste both nationally and internationally, which is why we've investigated the potential for reuse in the research project using the Urban Mining Index tool. This revealed that the timber frame house is best aligned with the goals of circular construction.«

The exposed interior wood in the walls and ceiling is untreated and has only been gently sanded, which also helps to regulate humidity and provide a more even indoor climate. All load-bearing wooden components are dimensioned in a way that allows them to maintain their load-bearing function after 30 minutes of exposure to fire. »



» The external walls have been reduced to 26 centimetres, compared with 39 centimetres in the research building. The advantage of thinner external walls is that the living space is larger, delivering added value for everyone involved in the project – the contractor, the client and the residents.

»In this project, the thinner outer walls meant that we could free up as much as 55 square metres of living space, enabling us to include a communal space and a small guest apartment.«

**THE FLOOR PLANS** and window sizes are designed to allow the building to manage without technical installations for ventilation. Simply put, there is no traditional ventilation system; instead, the residents can get fresh air by opening the windows. The mass timber walls also help the building to breathe on its own.

Vertical cladding in grey-painted pine lends character to the façade of the building,

with the protruding window openings and the screen between the balconies providing structure and reinforcing the aesthetic look of the building. The client was clear that they did not wish the balconies to be separated by partitions, instead wanting them to be a common space for the neighbours to socialise in.

Work on site progressed quickly and smoothly. The two concrete stairwells were completed in 8 weeks. Then the wooden frame was built around them, which took 6 weeks, followed by completion of the interior in 16 weeks.

»We've worked closely and successfully with the tradespeople, who have been able to build rapidly, without a hitch, thanks to the high degree of prefabrication in the wooden frame. The feedback we've received from the residents is that they're also happy and feel that everything works as it should. The only thing that bothers them a bit is all the curious visitors who want to take a closer look at their block,« says Tillman Jarmer. ©

#### Apartment block

BAD AIBLING, GERMANY

ARCHITECTS Florian Nagler Architekten.

DEVELOPER Wogeno.

STRUCTURAL ENGINEER Merz Kley partner, Hebensteiner Holzbau.

COST SEK 47.5 million.

AREA 2,364 sqm.

[www.nagler-architekten.de](http://www.nagler-architekten.de)

5. The balconies have no separating walls, to encourage neighbours to socialise. Thin walls have also made it possible to increase the living space.



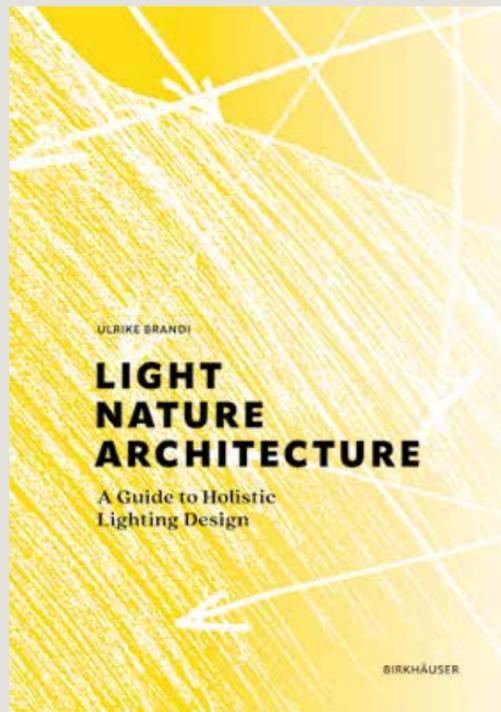
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**Light Nature Architecture**  
A guide to holistic lighting design  
Ulrike Brandi  
Birkhäuser (Eng)  
978-3-0356-2415-1



In her new book *Light Nature Architecture*, lighting designer Ulrike Brandi offers her views on how light can be designed more sustainably. Taking as its motto "It's better to make the most of natural light from the start, rather than compensating with artificial light afterwards", the book is structured as a planning guide based on the author's findings on the subject of light design, daylight, sustainability and healthy living spaces.

The Light Nature Architecture philosophy proves how important, but also easy, it is to integrate natural light into architectural planning and thus into the design of healthy and pleasant

living and working environments. Creating holistic light design is a challenge, but it is the right thing to do when it comes to achieving sustainability in the use of light and energy.

This richly illustrated handbook, based on natural light phenomena, combines Ulrike Brandi's vast experience, theoretical principles and design methods. The book is easily accessible and could have become a reference work if the various concepts had been further elaborated and the diagrams and different lighting design principles had been presented more extensively.

[www.birkhauser.com](http://www.birkhauser.com)

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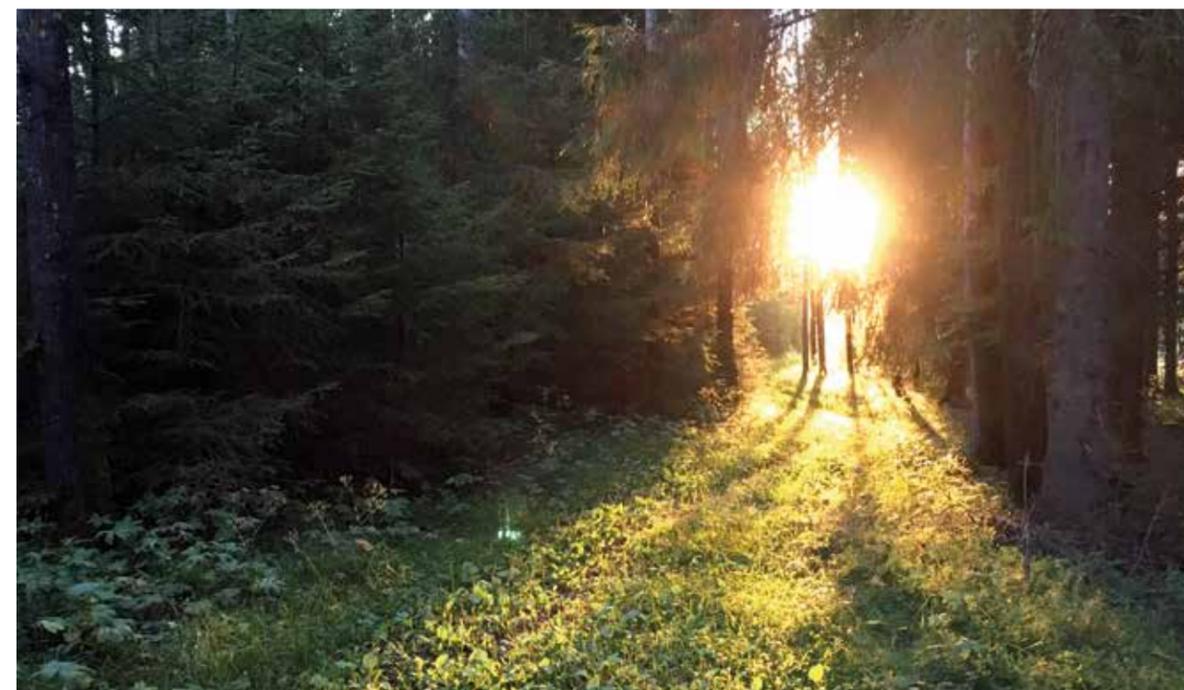
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Beviljade anslag beräknas kunna rekvireras fr.o.m. april 2024.

Vi ser gärna att du kontaktar fonden innan du gör din ansökan för att diskutera om ditt projekt kan vara av intresse för fonden. Vi bistår då med råd om hur ansökan bäst skall utformas.

Kontakta oss kan du göra genom:

**Ulla Westermark**  
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[ulla.westermark@live.se](mailto:ulla.westermark@live.se)

**Charlotte Bengtsson**  
070-510 66 03  
[charlotte.bengtsson@skogforsk.se](mailto:charlotte.bengtsson@skogforsk.se)

**Ulf Carlson**  
070-522 68 05  
[carlson.ulf@gmail.com](mailto:carlson.ulf@gmail.com)

**Sista ansökningsdag 2024-01-30**

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