

trä!

A MAGAZINE OF INSPIRING ARCHITECTURE
FROM SWEDISH WOOD » ISSUE 2 » 2021

**FROM TRAIN STATION
TO COMMERCIAL HUB
BANK'S CIRCULAR
BUILDING
DOVETAILS
ON STEEP SLOPE**

**TRÄ MEETS
Kai Strehlke**

**KNOWLEDGE
Modern foundation
using wooden piles**

AN UNUSUAL COLLABORATION

Neighbouring the forest

add personality

FACADE BOARDS
BY CEMBRIT



Där maskrosbarnen får blomma

Nya Skiftinge förskola sprakar och lever i sitt uttryck. Sidobyggnadernas lila färgtoner och lekfulla mönster framträder mot den högre huvudbyggnadens ljusgrå fasad i fibercement. En fasad som utsmyckats med skolans signum: maskrosor som sätter frön i vinden.

Arkitekten berättar

“Maskrosorna symboliserar att detta är en plats där barnen kan växa och blomma ut trots en dålig och mager omgivande jordmån. Fibercementskivor är tåliga, robusta och underhållet är minimalt. De ger även en möjlighet att få fram olika gestaltningsidéer.”

Anette Eriksson, Arkitekt SAR/MSA Carlstedt Arkitekter AB

Fler bilder och film från Skiftinge finns på cembrit.se



CEMBRIT
Building Better Days

13 » Deserted station filled with new life

The former railway station in Brussels has been transformed into a little miniature urban district, a place where CLT offers a warm welcome and sustainability rules.

26 » Sensitive intervention

Alongside a nature reserve just south of Stockholm, a house is emerging that features skilled craftsmanship, careful choices and an almost seamless transition between the material and its origin.

38 » Neat take on a wooden home

On a narrow plot in Molde, Norway, a family home has gone up instead of out, delivering an effective layout and rooms with generous ceiling heights. Modern design meets traditional techniques.



Ossip van Duivenbode

18 » Circular bank as sustainable investment

A bank that has a clear sustainability profile for its investment portfolio naturally also wants its offices to meet the same criteria. The new headquarters of Triodos are therefore circular, as well as being the world's first material bank.

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Swedish Wood represents the Swedish sawmill industry and is part of the **Swedish Forest Industries Federation**. The forest industry is one of Sweden's most important business sectors. It provides employment throughout the country. Thanks to its natural raw materials and products, the forest industry has a key role in the development towards a sustainable, biobased society.

Trä magazine is aimed at architects, structural engineers and everyone else interested in architecture and construction.

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Mathias Fridholm Director, Swedish Wood

We need to change how we consume

HUDIKSVALL, SWEDEN The debate surrounding Swedish forestry has been quite vocal over the spring. Should we leave the forest to grow or should we make use of its resources? Most people agree that increased use of wood is good if the alternative is to use more plastic, concrete or steel. This argument is, of course, right and few people oppose it.

However, there is another alternative, and that is that we, humanity, recognise the consequence of depleting resources and reduce our consumption. In that world, demand for all the above raw materials decreases, including for wood products – less in the way of wooden buildings, wood fibre-based packaging, hygiene products, biofuels, etc.

I have full respect for this argument, as long as there is clarity about the negative consequences of such a global transformation. Over the past century, our developing economy has driven research, innovation, education, health and prosperity. It is worth reflecting, in particular, on how the world has been able to create a vaccine in record time and distribute it to combat a pandemic that not so long ago would have been much deadlier than it is today.

My solution is far from simple, yet it can be summarised in two words: SUSTAINABLE CONSUMPTION! There is a way for us to combine continued growth, healthcare, education, vaccines and wellbeing with proper management of the planet's limited resources. It requires us to seriously and immediately switch to renewable materials! Leave fossil raw materials in the ground – their day is done. Invest in the sun, the wind and the forest, which give us new resources and materials on a daily basis and constantly recycle themselves. Let us also work on circular flows, where reuse becomes a profitable business model.

I believe this is the future, but it requires careful consideration, compromise, fact-based solutions, constructive discussions and development. The Swedish forest industry's challenge is to listen without being drawn into the dead-end of the polarising Twitter debate and opinion journalism. In contrast to many of these commentators, we have taken on the incredibly stimulating task of keeping several balls in the air at once. We are committed to biodiversity, giving people fantastic natural experiences, substituting fossil products and – most importantly of all – showing that all this can go hand-in-hand with growth based on sustainable consumption, optimal resource use and a smaller climate footprint.

A happy summer to you all!

Mathias Fridholm



A short way off the ground, the bent glulam beams divide to meet up with the adjacent beams, before curving back to unite at the top.

Elegant curves define the space

OBJECT Tervajärvi chapel

ARCHITECT Noan

STRUCTURAL ENGINEER Timo Haavisto, Ingenjörskontoret Askto Keronen

LEMPÄÄLÄ, FINLAND Confirmations, christenings and weddings next to a campsite? Absolutely, thought the congregation members who own Tervajärvi campsite and placed a chapel in the nearby forest.

The structure of the chapel also determines its aesthetics. Elegantly curved spruce glulam beams split in two just off the ground and branch out to each side to meet the next glulam beam in the middle, before curving elegantly back to reunite with their original beam at the roof ridge. The chapel is only small, so the joints have been made rigid so as not to interrupt the space with

crossbeams. The stiffness of the joints was achieved by placing the screws in a circle and skilfully concealing them so that no fixings are visible.

The exterior roof is made from grooved planks of Siberian larch that, like the façade, have been treated with coal-black tar. Since the wood is at risk of splitting with the varying moisture levels, the planks are only fixed down the centre line, with the heartwood facing outward to maintain watertightness as the wood gradually forms a convex curve. «

w|noan.fi



Ake Eison Lindman

Animals undisturbed

KARLSHAMN, SWEDEN Eriksberg Wildlife Park is a 900 hectare game reserve in the Blekinge archipelago, where visitors can encounter animals such as deer, European bison and sea eagles, all in a setting of leafy deciduous woodland. And there is certainly a good

OBJECT Illusion

ARCHITECT

Sandell Sandberg

STRUCTURAL ENGINEER

Kvarteret konstruktörer

chance of getting close to the wildlife in the 50 square metre Illusion Villa. The structure rests on four-metre high posts and is located above a feeding station, giving guests a great view through a glazed panel in the floor. The façade is clad in polished sheet metal that reflects the surrounding environment and from some angles makes the cabin difficult to spot. The thatched roof is a way to connect to the local building vernacular, and internally the dominant material is wood. The walls and ceiling have been painted in a subtle yet playful colour palette, set off by the white-oiled floors.

Powered by solar energy and gas, the building also has a wood-burning stove and a large terrace, creating a high level of comfort despite the lack of running water. «

w| sandellsandberg.se



Jeremie Leon

Preserved walls shaped the house

THOMERY, FRANKRIKE How much of a site's history should be kept for posterity? This was a question for the architects at Arba, when they were commissioned to design a family home and were confronted with two old stone walls that split the plot in two. Although the walls prevented the architects from creating a large, open unit, they were left in place, not just because they provided shade and a great backdrop for vines, but above all because they were part of the site's soul.

One wall was given a new opening, but otherwise the building has been fully adapted to the site, and thanks to the walls, the property has three different gardens, with varying degrees of sun and shade. For ease of access around the house, wooden decking runs between the façade and the walls, protected by generous eaves with visible beams. The gables are fitted with horizontal ribbed screening and the dark tarred façade contrasts sharply with the light interior, where wood of varying dimensions has been left exposed. «

OBJECT House between walls

ARCHITECT Arba

STRUCTURAL ENGINEER

ACDF Industrie

w| arba.pro

The house has been fully adapted to the site, surrounded by walls that lend both character and shade.



Jonas Olsen

Speculation about local light phenomena and ufos inspired the design of this Norwegian tourist cabin.

Stargazing from a spaceship

ÅLEN, NORWAY For centuries, people living near Hessdalen in Norway have been treated to remarkable light phenomena in the sky. Researchers talk about electromagnetic fields linked to the geology, but the play of light has also prompted speculation that it may be a popular landing site for ufos.

Forestry company Statskog took this to heart when having a new tourist cabin built, commissioning the architects to create something that looks like a spaceship. The structure is

raised on eight short, slender steel posts, creating the illusion that the cabin is hovering off the ground. The rest of the building is made of spruce CLT with wood fibre insulation. The spruce façade has been treated using the shou sugi ban technique and then oiled to give a dark, robust finish that also shrugs off the effects of the weather.

Internally, the exposed CLT elements are white-oiled to create a softer atmosphere. Openings have been cut into the façade for windows of different shapes and sizes, giving visitors great views of the surrounding landscape, so they can enjoy the legendary light show. «

OBJECT Ufo

ARCHITECT Studio Sjellsand

STRUCTURAL ENGINEER Reidar

Skogli, Harboe og Leganger

w| statskog.no

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Den öppna interiören avdelas naturligt till flera mindre ytor tack vare golvet's olika nivåer och material.



Alejandro Villanueva

Immersed in the hill

KVITFJELL, NORWAY Kvitfjell, north of Lillehammer in Norway, offers fantastic skiing as well as spectacular views of the mountainous landscape.

OBJECT Kvitfjell hytte
ARCHITECT Erling Berg
STRUCTURAL ENGINEER Fron bygg

At the top of the slope, a new holiday home has been subtly added next to the existing

cottages. The 26 metre-long, T-shaped building is made entirely of locally grown pine. This includes the roof which, like the façade, has been left untreated to gradually take on a grey colour that will allow the building to merge into the landscape.

The uniform material gives the holiday home a cohesive and subtle look that sits comfortably with the surroundings. Internally, the knotty pine covering the walls, ceilings and floors has been white-oiled so that even on dark, chilly winter evenings, it will give a soft and light feel. On the inside it is also clear how the shape of the pitched roof follows the topography of the site. Some of the generous windows face south, but most of them open out to the west to capture the evening sun. «

wj erlingberg.com

Level differences define the space

KVEGERÖ, SWEDEN This neat little holiday home has been carefully placed in the Sörmland landscape. The low, long building faces the neighbouring forest, instead of opening up onto the adjacent field to give a tranquil feel. The grey rendered façade is framed by the corrugated aluminium roof. Six slender glulam posts – that run from the floor of the veranda to the eaves – divide the exterior into five spaces, creating a cohesive and almost monolithic look, with the different shapes and sizes of the windows creating an animated façade.

The interior spaces inspire play and movement, with the concrete floor complemented by a linseed oil soaped pine floor over different levels. The mix of materials and levels gives both movement and spatial definition, despite the partially open-plan layout. The raised levels are also used as storage, allowing items to be stowed away between the floors. The rooms are visually connected via sheets of birch plywood mounted on the ceiling. «

wj norellrodhe.se

OBJECT Summer house RR
ARCHITECT Norell/Rodhe

Portico invites in theatre audiences

NEWTOWN, UK In the south-east of England, a former car park has given way to a theatre that has become something of a community hub. The building, including its outdoor amphitheatre, belongs to the neighbouring school, but outside of school hours it is open to theatre groups and other clubs.

At the entrance, visitors are met by the glulam posts of the portico, which serve as a noticeboard and a clear assembly space. The façade is clad in

panels of a cement and pine fibre composite, which was machine cut off-site to reduce waste and then assembled by hand. The warm red hue harmonises with the local brick buildings and is also echoed in the interior, but this time with beech battens that complement the exposed CLT of the structural frame and have been placed closer together in the lower part of the building to give the structure extra support. The CLT was chosen in order to reduce both the cost and construction time of the project. It also helps to ensure good air quality, as the building has no ventilation system. «

wj jonathantuckey.com

OBJECT David Brownlow theatre
ARCHITECT Jonathan Tuckey Design
STRUCTURAL ENGINEER Webb Yates engineers



The red shade of the façade is repeated in the beech interior and in the local brick buildings.

Nick Dearden/Jim Stephenson

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LÄGST KLIMATAVTRYCK har Masonite Beams Byggsystem enligt Svenska Miljöinstitutets nya livscykelstudie. ”MFB byggsystem har den lägsta klimatpåverkan för en byggnad som vi har analyserat hittills för referenshuset Blå Jungfrun” säger Martin Erlandsson, LCA-expert vid IVL.

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Marcus Horning, Planning Director, City of Malmö

Circular transition for the living environment

MALMÖ, SWEDEN Malmö is Sweden's fastest growing city, and that growth needs to be both resource-efficient and sustainable. This requires smart, responsible and sustainable thinking. We need to plan Malmö in a way that creates good conditions for all our residents to live a good life and realise their dreams within the planet's limits, today and tomorrow. Cities are key arenas for the ongoing transition work, as we switch from a linear way of building and developing our communities to a circular approach.



Our ambitious environmental goals have been in place for a long time, and now attention has turned to the climate impact of the construction and civil engineering sector. In partnership with the industry initiative LFM30 (a local roadmap for a climate-neutral construction and civil engineering sector in Malmö by 2030, with over 150 organisations signed up) we have concluded that a climate-neutral shift is both necessary and entirely possible. In a winning concept, everyone is expected to share knowledge and perspectives, taking on board the roadmap's focus on action.

To achieve the city's sustainability goals, it is important that the architecture and construction demonstrate long-term responsibility, resource and energy efficiency, and climate-neutral and healthy material choices. This requires strong collaboration within the building process and a greater focus on sustainability from a lifecycle perspective, with construction methods and materials assessed not only in terms of function and cost but also climate impact. As a circular material, wood has a central role to play in this transition.

In our jointly realised living environment, the materials we surround ourselves and live with are vital for our physical and mental wellbeing. The material's capacity to create an environment with good acoustics, plenty of natural light, clean air and stimulating texture is fundamental. This far north, we live much of our lives indoors, and so the architect's choice and treatment of materials has to be of the highest standard. But of course the same applies to our public spaces. The materials say something about our roots, our present and our future. Anyone who follows Pernilla Wählin Norén, an architect working in Dalarna, on Instagram will understand what I mean. Or anyone waiting for a bus in the warm light of Wingårdhs' Vasaplan station in Umeå – a space where the wooden structure creates a pleasant place.

We need to continue upping our game as we jointly evolve the construction process through close collaboration between architects, structural engineers, material suppliers and developers, in order to create a sustainably designed living environment.



The hushed feel of the interior is like a library, with several hundred wood samples stacked on the shelves.

Showroom for wood samples

FUKUOKA, JAPAN What better way to display wood products than to create a building that calls to mind a tree both inside and out? This was how the Japanese architects at Katori approached their assignment to create a showroom for Maruhon Fukuoka, a manufacturer of interior wood products. The oval building is meant to look like a large tree growing beside a crossroads in the city. Its vertical planks of Japanese cedar (*Cryptomeria japonica*) are joined without the use of screws and have been treated with a naturally made stain made from leaves, berries and roots.

Internally, to maintain the feeling of being inside a tree trunk, the number of windows is limited. Instead, spotlights place a focus on the two-storey high atrium, lined with exposed flooring, shelves, beams and tables of wood, complemented with narrow railings and details in steel. Here visitors are invited to sit down and take in the options that wood offers, not only via the more than 400 wood samples, but also the architecture and furniture. «

OBJECT Maruhon showroom
ARCHITECT Katori
STRUCTURAL ENGINEER KAP Inc.

w| katori-ada.com

Natural living with 11 alcoves

RANKOSHI, JAPAN Geographically close to busy ski resorts with lively après ski, but spiritually about as far from these as you can get. Surrounded by three hectares of forest, and accessible only via a narrow dirt track, stands a holiday home that a Japanese family heads for to enjoy a moment of leisure. The 230 square metre building is positioned on the edge of a forest glade and shaped like a tree, with 11 branches that extend from the central trunk, offering small, private alcoves. Each alcove terminates with a full wall of glass so that even when indoors, you feel like part of the forest.

The structure comprises a floating slab of reinforced concrete that combines with



Having dense forest as the only neighbour and a separate alcove for every bedroom creates a private space.

OBJECT House in the forest
ARCHITECT Florian Busch
STRUCTURAL ENGINEER OAK (Masato Araya, Takayuki Fujimoto)

the lightweight timber frame to accommodate the protruding branches. The frame is clad with narrow, vertical wooden battens, which are also integrated

into the screens over some of the windows. Resting the building on steel piles contributes to the stylish, suspended look. Internally, the white walls and polished concrete floor contrast with wooden features – just like the rocks and trees outside. «

w| florianbusch.com



THOUGHTFUL AESTHETIC WITH GRACEFUL SOLEMNITY

KYOTO, JAPAN A Japanese aesthetic and respect for nature were front of mind when a Kyoto hotel's wedding chapel needed sympathetic renovation work. Based on the idea of a new and inclusive spirit, a space was created to encourage more people to marry here, whether their belief is conventional or they want a ceremony without any religious elements.

PHOTOGRAPHER

Tomohiro
Sakashita

OBJECT

Westin Miyako
kapell

ARCHITECT

Katori

The new interior is based on the chapel's previous framing, with the architects adding a network of thin wooden battens. The light entering from the narrow window along the roof ridge and indirect lighting from spotlights combine to give the guests a sense of being

in a forest grove – like sunlight streaming through tree branches and casting natural shadows.

The roof trusses pierce the airy side screens to fix into the walls behind. This creates a symbiosis between the roof and the walls and a sense of depth and space, while also contributing to the chapel's acoustics and reverberation, an important factor in a ceremonial setting like this. ◀

- The roof and walls are made of Japanese cedar (*Cryptomeria japonica*) that has been stained and fireproofed. Behind the altar stands a wall of unpolished granite, which further accentuates the link between inside and out.
- The previous lattice windows have been replaced to bring in more light and connect with the forest beyond.

w| katori-ada.com



The photo

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The image shows the interior of a large, modern train station. The structure is characterized by a heavy, dark grey cast iron shell with a complex network of beams and trusses. The walls and ceiling are clad in light-colored, vertically oriented wood panels, likely cross-laminated timber (CLT). A prominent feature is a large, multi-level wooden staircase with a matching railing, leading to an upper level. The ground floor has large glass windows and doors, some of which are framed in wood. A person in a blue shirt and dark shorts is walking in the distance, and another person in a yellow jacket is visible near a glass door on the left. The overall atmosphere is one of industrial heritage combined with modern, sustainable architecture.

NEW LIFE FOR REUSED STATION

In Brussels there is now a district where it never rains. The architects have placed CLT buildings inside the seven covered halls of a train station.

Once upon a time Gare Maritime train station in Brussels played an important role in goods transport. Now the building has a new claim to fame. Inside the rustic cast iron shell, Europe's biggest CLT project has just been completed. »

TEXT Ellinor Thunberg
PHOTO Filip Dujardin/Neutelings Riedijk architects



Section through Gare Maritime's seven halls.

During the first half of the 20th century, Gare Maritime was a train station buzzing with activity, as goods were loaded and unloaded for onward delivery within Brussels by both sea and rail. The magnificent cast iron building was completed in 1907 in the Tour & Taxis industrial zone and was a vital cog in the logistical machine of the Belgian capital. But times change, and by the end of the 1980s the once so stylish building had been abandoned to its fate. When Neutelings Riedijk Architects entered the frame, the building was derelict, but now it has been brought back to life.

»We've transformed Gare Maritime and its seven halls into a little commercial centre, an extension of the urban district, where it never rains.« says architect Michiel Riedijk, who is CEO of Neutelings Riedijk Architects.

The whole area in central Brussels is being regenerated, with Gare Maritime as the crowning glory. The former station halls are all connected in a line – alternating between high and low ceilings, depending on whether they were once a track or a platform. One end opens onto a street, Picardstraat, and the other currently overlooks a small park. The neighbourhood feel continues inside the station, where existing service buildings have been renovated and whole new buildings with a CLT frame and oak façade details have been inserted. A timber frame was chosen in part for reasons of weight.

»The halls are made of cast iron and everything is sitting on slightly raised ground, so if we had used heavy panels or carried out heavy groundwork near the iron structure, that could have affected its whole load-bearing capacity. Instead, we went for a CLT frame since it is light and could be assembled as a prefabricated carcass.«

Measuring 280 metres in length and 140 metres in width, Gare Maritime is an enormous building, and the same inner structure that has now been completed in CLT would have weighed five times more in concrete.

Because the prefabricated CLT frame is so light, there was no need for any extensive foundation work or tall cranes, which in turn had several positive effects: the work progressed quickly and there was no need to open the roof, so everyone could work in the dry throughout the construction process. It also worked well to leave the CLT untreated, and everything can be disassembled later in a spirit of circularity. When the architects first began considering wood as a material, they were inspired by the old goods trains and cattle



wagons – although the result is significantly more elegant.

»Working with wood on a project of this scale was new for us, so it was a challenge. With respect for the building and the look we wanted to achieve, we chose a modest design that primarily accentuates the qualities of the wood. The palette is made up of restored wood in the historical frame, the colour of the cast iron, plus the oak and CLT, which together create a homely and welcoming feel.« states Michiel Riedijk.

But Gare Maritime is more than just Europe's biggest CLT project – the building is also fossil free and energy neutral and has more solar panels than anywhere else in Brussels. The panels are incorporated into the roof and the streetside



The architects were inspired by the goods trains of old and the wooden cattle wagons. The CLT also delivers good acoustics and a warm and welcoming feel.

façade, covering 17,000 square metres of the building in total. A commitment to sustainability immediately led the client, Extensa Group, to choose Neutelings Riedijk Architects' proposal to create a little wooden community within the station's walls.

»As soon as we heard the idea, building in wood felt completely natural and indeed inevitable. It links in with the sustainability issue, and the circular nature of the wooden structures illustrates that our focus on sustainability goes down to the tiniest detail,« explains Sandrine Jacobs, Head of Communications at Extensa Group.

Covering 35 hectares in central Brussels, this is an immense urban development project, and Extensa Group has a

number of properties there, but Gare Maritime seems to have something special about it.

»It's a building with soul that has been sympathetically renovated to retain elements from the past that, in a world beyond the pandemic, is ready to open up to the possibilities of the future. We believe Gare Maritime could become a flagship for the area, moving from a logistical hub to a hub for creativity,« says Sandrine Jacobs.

However, the pandemic is currently still with us and everything is moving at half speed. The building has not yet been officially opened, but soon there will be more shops and cultural events. One company to have recently moved in is Universal Music, which has vacated its offices outside the »



Sarah Blee

Head of Communications **Sandrine Jacobs**

» **BUILDING IN WOOD FELT COMPLETELY NATURAL AND INDEED INEVITABLE.** «

» centre. The sustainability profile of their new base was a strong argument for the move.

»We don't want to just echo our artists' values regarding sustainability. We want to set an example and contribute to a greener and more sustainable way of conducting our work. That's what makes Gare Maritime such a perfect fit for us,« says Pol Walraet, Finance Director at Universal Music.

Gare Maritime's attractive features include a climate-neutral building, an interesting location close to the centre and public transport, and a cultural edge linked to the events and creative industries sited here. But Pol Walraet also highlights the architecture and the building's history as contributing factors in the decision for businesses to relocate here.



The timber ceiling has been restored and cleaned, returning it to its former glory. It combines with the CLR and oak details to create a warm palette of woods.

»Absolutely. The decision to retain and accentuate the historical elements and then add wood into the mix has had a phenomenal effect. The site exudes energy and tranquillity at the same time, and that feeling is extremely motivating and overwhelming, in a good way. Working here gives a sense of exclusivity and puts a smile on your face every day.«

irwg is a company that specialises in offices and work environments, operating under different brands, one of which is Spaces – a concept for co-working that now has an address in Gare Maritime.

»The feel and look are incredibly important to us and to our clients, as part of creating their brand. Gare Maritime is a building people want to be associated with. I love going there



myself. It feels like home,« says Will Willems, Regional Manager at IWG.

In addition to the environmental profile, he explains that there is a great deal of charm in a future where you can kick back with a coffee in one of the shops or take part in an event. Gare Maritime appears well on the way to establishing itself as the place to be, not least to stroll along the 60 metre-wide boulevards lined with mature trees, or to linger in one of the 10 different covered gardens. The architect himself has also visited the project since its completion, and although it has not yet reached its full potential, he is very pleased with the feeling within its walls.

Gare Maritime

BRUSSELS, BELGIUM

ARCHITECT: Neutelings Riedijk architects.

STRUCTURA ENGINEERS: Bureau Bouwtechnie, Ney & Partners.

LANDSCAPE ARCHITECT: Omgeving.

CLIENT: Extensa group.

AREA: 45,000 square metres.

w| neutelings-riedijk.com

»I found an open café and had a cappuccino. It felt wonderful! I like the relaxed feel, the fact that this is a playful project with a sense of urban cool. I really hope Gare Maritime will become an extension of the public space,« concludes Michiel Riedijk. ©



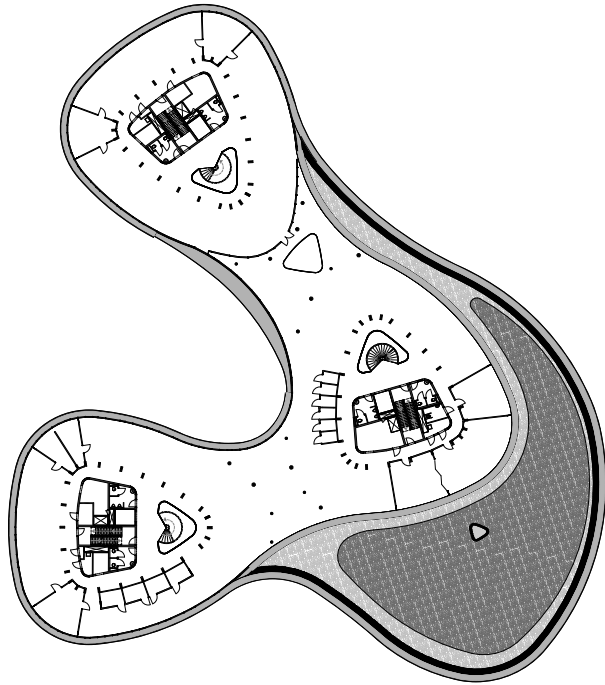
The bank's new offices have been built with circularity in mind. Behind the glass façade with its slim steel posts, the exposed wooden structure is an important part of the building's identity.



Bank that dares to innovate

Triodos Bank's new headquarters in the Netherlands are the pinnacle of sustainability. The building is fully circular, which means that all the materials in it, except the foundations, can be disassembled and recycled. It is also the world's first material bank. »

TEXT Sara Bergqvist PHOTO Alexander van Berge



Plan, second floor.

The bank's new offices are attractively situated on the verdant De Reehorst Estate in Zeist, 12 minutes by train from the fourth-largest Dutch city of Utrecht. Viewed from above, the building is a little like an elongated three-leaf clover. Standing just a few metres away, the billowing movement of the forest follows the form of the building. But it wasn't the forest that had to give way to the building, but vice versa.

»We had a report showing the paths that the bats were flying, and we didn't want to get in the way of that. So we designed the building in a way that would keep us 10 metres from the existing trees,« explains Erik Mulder, who was responsible for the project, along with Thomas Rau at RAU Architects.

It was also no coincidence that the new bank headquarters ended up where they did from a broader geographical perspective. It was around here that the bank first launched its business 40 years ago.

»We had grown out of our old premises and were looking to relocate. In contrast to our previous offices, we had a non-negotiable requirement that the new site would be near a train station. And that the building would be an expression of our identity. But when we looked, we couldn't find a suitable option right next to any of the more central cities, such as Utrecht or Amersfoort,« says Matthijs Bierman, former CEO of Triodos Bank in the Netherlands, who was deeply involved in the construction of the new offices.

Triodos Bank has an explicit sustainability profile, with all investments having to meet good standards of economic, ecological and social sustainability. When the bank began planning the new offices in 2011, they naturally also wanted their own headquarters to be at the cutting edge of sustainable building. To work out exactly what that might mean, several workshops were held jointly with the architect, landscape architect, interior architect and other consultants.

»As the plans began to take shape, Thomas Rau also put forward the idea that the building should be entirely circular,«

Ossip van Duivenbode



All the materials used in the building, primarily glulam and CLT, are registered in a material bank so they can be reused in the future.



» and the bank was brave enough to go with it,« says Erik Mulder.

In addition, the decision was made early on to build in wood.

»It was Triodos that decided the load-bearing structure should be made entirely from wood, which is quite unique for a building of this type. But it also feels like a completely logical decision in view of the focus on sustainability and circularity that this project has,« adds Sander Kok, project manager at structural engineers JP van Eesteren.

This means that absolutely all of the materials in the building, except for the concrete foundations, can be disassembled and reused in new contexts. And using wood for the frame made this possible.

»The only exception to the wood is that we've inserted narrow steel posts between the glazed units in the façade to avoid the floor bowing when people walk along the inside of the windows. The steel posts also channel water down from the roof,« says Erik Mulder.

In addition, the design avoids all types of elastic sealants and only uses metal screws – 162,382 of them – that can easily be removed.

All the materials used in the building are carefully documented, including their grade and specifications from the suppliers, and where in the building the material can be found.

»We work in 3D and build up the entire structure on the computer, and it's here that we link in information about each individual element. Thomas Rau has created a platform for this, with different identity numbers that mean we can see exactly what we could recover from the building and use again,« explains Erik Mulder.

The materials have also been registered in the material bank Madaster, a new public service where property owners can register material assets in their properties.

»Triodos' new offices are the first in the world to do this on such a grand scale. As such, the new building is not just the home of a financial bank, but also a material bank,« states Erik.

Prompting Madaster and the thinking behind it is the realisation that the world's raw materials and material resources are finite. As the supply of different materials shrinks and prices rise, it will become not only financially viable to reuse materials this way, but also a necessity in order to make the planet's resources stretch.

»At this moment in time, the material with the greatest financial value in the building is copper. But when the time comes to recover the materials, many years down the line, this may well have changed. And in terms of resources, there may be a greater shortage of some types of material that are currently readily available – such as wood, which is becoming increasingly expensive. It is therefore well worth recording all the materials in the building,« adds Erik Mulder.

A key factor in establishing the circularity and wider sustainability of the building was the use of wood for the load-bearing structure.

The building is essentially three towers of different heights, which are linked together by a shared ground floor.

Architect **Erik Mulder**

»**IF SOMEONE WANTS TO TAKE DOWN THE WHOLE BUILDING IN 20 YEARS, THAT CAN BE DONE QUITE EASILY.**«

The unique load-bearing structure on each level of the towers is like a mushroom, with a stem and a cap with gills on the underside. This also makes the wooden structure a core element of the visual identity. The design is a combination of glulam and CLT, made in the Netherlands using softwood from Germany.

»The mushroom-like structure in the middle is made of glulam. Running inside this is the section housing the stairwell, which is made of CLT along with the beams around the lifts, cloakrooms and toilets. The same is true of the floor system, which comprises 120 millimetre-thick CLT elements, cork flooring and several layers of sound insulation,« notes Erik Mulder.

In all, the design uses 1615 cubic metres of glulam and 1008 cubic metres of CLT. The restaurant also makes use of five natural tree trunks, which serve as both visual and load-bearing elements.

Many of the elements were able to be prefabricated and assembled in advance, including large parts of the 'mushroom structure', the CLT floor system and some of the panels.

»On that subject, one of the unique moments was the installation of the 16.5 metre-long wooden elements for the lift shaft, which we put in place with a single crane lift,« recalls Sander Kok.

The high degree of prefabrication meant that the construction time could be kept relatively short.

»It meant we were able to erect three floors in just a few days and complete everything in a total of 13 months,« says Erik Mulder.

Wood also features in many other places around the building. The small service units on the roofs, for example, are clad in pine that has been acetylated to improve its durability and reduce maintenance. Some of the chairs in the building, along with the handrails for the fire escape stairs, are made of wood taken directly from the property itself. Taking into account all the fixed wooden installations, the building stores over 1633 tons of carbon dioxide, which is more than it emits – even including the production time.

»Another great fact is that the building already has several circular features. The wood flooring in the restaurant is recycled, as are the wooden beams in the ceiling, which come from an office in Rotterdam,« says Erik Mulder.

Although the façade is almost entirely glazed, the building has good acoustics. This is in part due to its soft, rounded form, which prevents the sound from bouncing directly off the hard glass, but also the good sound insulation properties of the floor and wall systems. In addition, the ceilings in some of the spaces are fitted with a perforated acoustic screen in metal. »



The building already contains recycled material, including roof beams and the floor in the restaurant. Tree trunks appear throughout the building, serving both a visual and a load-bearing function.





Sectional view. The building comprises three towers of different heights, connected by a shared ground floor and basement.



Sedum roofs collect rainwater that is then used in the building, and they are also good for insects.

Triodos bank headquarters

ZEIST, NETHERLANDS

ARCHITECT: Rau Architects.

CLIENT: Triodos Bank.

STRUCTURAL ENGINEER: JP van Eestere.n

AREA: 12,994 square metres.

w|rau.eu

»Plus, the office areas are fully carpeted for further sound reduction. To ensure that the carpets are easy to take up at a later stage, they have been secured in place with double-sided tape,« adds Erik.

Alongside the circular efforts, several other measures have been taken to help make the building one of the most sustainable office blocks in the world. One of these is the facility's 3,000 square metres of solar panels that are fitted to the roof over the car park. Together, they produce around 505,000 kilowatt hours a year, which is more energy than the building consumes. With the help of a smart, bidirectional charging system, the electric cars connected to the system can be used for temporary storage of energy that is surplus to the building's requirements.

The green sedum roofs on the towers fulfil several functions. One is that they collect water that is then channelled away and used to flush the toilets. Another is that they support local insects and birds.

»The restaurant roof, which is slightly larger, also has some larger plants to improve biodiversity by attracting different types of birds and insects,« says Erik Mulder.

Last but not least, the building is designed to uphold and promote human values. Each floor has natural meeting places where colleagues can get together. In the areas between the towers there are open spaces where you can sit and talk, as well as meeting rooms and workrooms of different sizes. The ground floor, which houses the restaurant, is also open to external visitors.

The glazed façade is surrounded by nature, offering great views and plenty of natural daylight. However, there is considerable flexibility. If you don't want daylight, you can simply screen it out, the temperature can be regulated everywhere and all the windows can be opened.

»There is no doubt this building is fully focused on people. There is a huge amount of choice, and working here should be both comfortable and healthy. Natural, non-toxic paints and materials – the main one being wood – contribute to a good environment,« comments Erik Mulder.

The thing he's most pleased about regarding the whole project is the commitment from everyone involved, which has made it possible to pull all the elements together to create a successful whole.

»Our speciality at Rau is working on sustainable buildings. But this is by far the most circular one we've done so far. If someone comes along and wants to take down the whole building in 20 years and use the parts or relocate it somewhere else, that can be done quite easily, which makes me feel incredibly proud,« says Erik.

Sander Kok agrees: »I'm proud that we've had the courage to take this on and be the first in the Netherlands to realise a sustainable building in wood on this scale. We've learned so much along the way and helped to give the construction industry – and maybe the whole world – some forward momentum. I'd love to do more projects like this and put what we've learned to good use.«



Material: Cederträspån med vattenfast brandimpregnering SP Fire 105, Moelven
Projekt: Norrvikens Kust, Båstad
Arkitekt: Wingårdhs Arkitekter

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The frame-sawn spruce cladding captures the shades of nature. The guttering is built into the roof and terminates with U-beams in corten steel.

UNIQUE COLLABORATION, WITH THE FOREST AND LOW IMPACT AS REFERENCE, CREATES A HOME WITH AN EYE FOR DETAIL.

TEXT Katarina Brandt PHOTO David Valldeby

Over the past three years, 28 year-old Rasmus Larsson has devoted practically all of his spare time to building his house in the forest. The plot on which he is creating his dream house sits in an area of high conservation value, where the forest has remained undisturbed for over 100 years. The local landscape includes rocky woodland, marshland and humid spruce forest. Quiet and stillness abound, with the sounds of the forest enveloping any visitor. In addition, the site is rich in remains from the Stone Age. In fact, Rasmus has chosen to drive in his piles close to the oldest known settlement in the County of Stockholm – almost 9,000 years old.

Rasmus has drawn on the surrounding forest for the majority of his choices, with the aim of having as little effect as possible on the nature around him. For this reason, none of the rock has been blasted away and only a few trees have been cut down to make way for the 5 x 21 metre edifice by designer and interior architect Jonas Bohlin, in collaboration with the architect Hans Murman.

»Rasmus' enthusiasm was infectious, and I thought the plot was amazing. I also liked his idea of building on nature's terms. It's great to get to adapt buildings to the local nature, topography and flora. It doesn't happen often enough these days,« says Jonas Bohlin.

Jonas immediately contacted his colleague and friend Hans Murman, who became involved in the project. Amongst other things, he converted sketches into architectural drawings and also came up with suggestions

for details and many of the house's technical solutions.

»The wonderful thing about Jonas is that we have more or less the same approach to problem solving. Driving steel piles into the ground instead of using explosives is a foundation solution that I've tried out on several buildings in the mountains. To a large extent, it's about orientation and height. Getting the house to sit comfortably in its surroundings. This is one of the big contributions that one makes as an architect,« says Hans Murman.

The house is supported by a framework constructed from three tons of glulam, which in turn rests on high steel piles to handle the hilly terrain. The structural frame is made from a combination of CLT and IsoTimber. The latter is a Swedish invention – load-bearing and insulating blockwood made up of vertical timbers with a thin layer of plywood glued to each side. Thousands of air channels are milled into the timbers, giving good insulation properties. The whole structure is diffusion-open and no plastic barrier is used, since the material is breathable and balances moisture levels in the walls.

»Building with IsoTimber is like building in an older tradition. The system allows moisture to move in both directions. The house can breathe and nothing is trapped in the walls,« says Rasmus Larsson.

To minimise the building's impact on nature and the local roads, Rasmus chose to erect the structural frame with the help of a »

» helicopter. The assembly required 52 lifts, and it took a total of nine hours to transport and assemble the constituent elements.

»We used a helicopter to transport construction materials out to the archipelago when we were working out there. It was a bit more expensive, but not as much as you might think. The alternative would have been to use a mobile crane, but we dismissed that idea quite early on,« says Rasmus.

Once the wall units were in place, Rasmus and his girlfriend, along with family and friends, managed to erect the frame without inflicting the slightest scratch on the surrounding trees. The lightweight material in the wall units and the structural engineer's optimised designs made the assembly a breeze, even on an inaccessible building site like this.

The entire exterior of the building is finished in elegant, framed-sawn spruce cladding of various widths. Rasmus personally hammered in the 9,360 nails that secure the façade, to make sure that each nail sits perfectly. On the inside, there is a layer for utilities, followed by brushed, white-glazed pine cladding. The cladding is used throughout as

the interior finish, to create both a light interior and a unifying motif.

A slight scent of tar lingers around Skogsvillan (the Forest Villa), coming from the façade's pine tar treatment. The warm grey colour picks up the variegations in the rock and the pine trunks, allowing the house to merge into the landscape in a natural way. The board-on-board roof in heartwood pine, with its chunkier and more hard-wearing wood, is also treated with pine tar.

»Pine tar comes from the forest and contains the substances that the tree itself uses to protect against attack. It provides natural moisture protection while still allowing the wood to breathe. We started by painting a test piece that we then left outdoors to see what the colour would do over time,« explains Rasmus Larsson.

The guttering is built into the roof and terminates with U-beams in corten steel. This is one of many elegant solutions that emerged as the journey progressed. For Rasmus Larsson, Ångsvillan, the home that Jonas Bohlin designed and built for himself in Nacka, was a huge source of inspiration. Here

Skogsvillan

HUDDINGE, SWEDEN

ARCHITECTS: Jonas Bohlin and Hans Murman.

CLIENT: Rasmus Larsson.

CONTRACTOR: RPJ Bygg & Snickeri.
Structural engineer: IsoTimber.

COST: SEK 2.8 million (excl. labour).

AREA: 2,100 square metres.

www.rpjbygg.se

too, the shape, volumes and details of the buildings are interwoven with the local nature, ground and sky, light and topography.

»I'm thankful that Jonas and Hans chose to get involved and design Skogsvillan for me. Realising their ideas has been a huge responsibility. They showed confidence in me and trusted that I would make it all come together,« says Rasmus.

The home's pièce de résistance is the combined kitchen and living room, which is open to the roof, giving a ceiling height of 7 metres. The pine floor has 22 tapered planks of 10.3 metres laid alternately root end to top end. The large main window invites nature in, and Rasmus has followed the advice of Jonas Bohlin, cladding it with copper plate that will develop verdigris over time and tone down all the white wood.

Rasmus Larsson believes that attention to detail is always worth the effort and that allowing the house to develop over time has been an advantage. It has meant that he hasn't needed to compromise on his finely crafted vision. Or to hurry all the decisions had to be taken along the way.

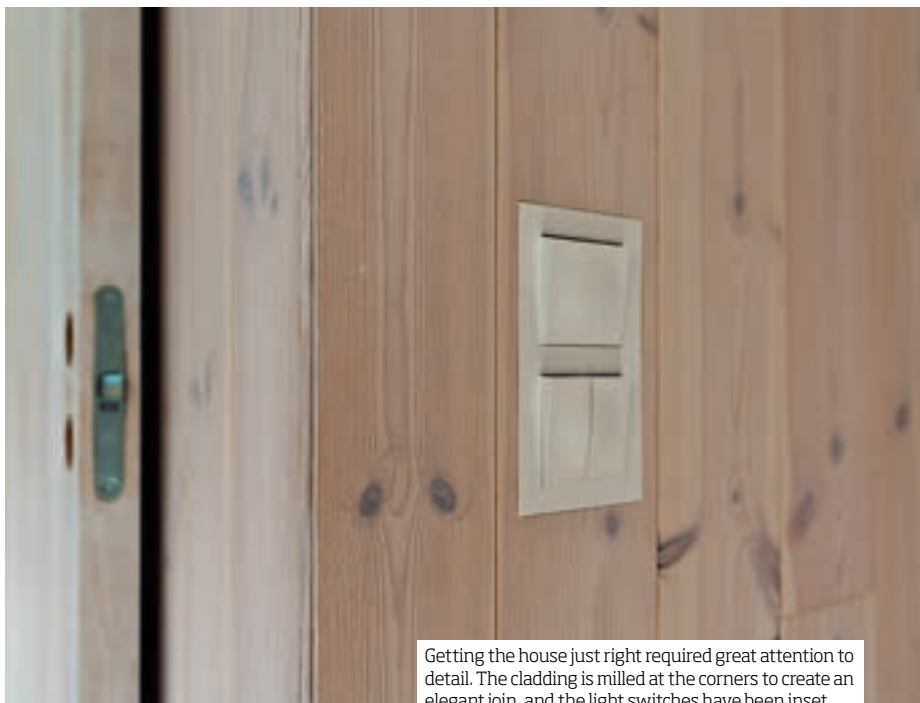
»I was perhaps a little optimistic initially, when I thought the build would only take 18 months. On a self-build project, the actual process surrounding all the decisions is the big challenge.«

There are still a few details to finish, before Rasmus and his girlfriend Anna can move into their house in the forest. A kitchen needs to be put in, and they also have to think about how to connect the house with the land around it.

»It has been inspiring to work with a smart, meticulous and skilled client who essentially just wants help ironing out the kinks. I also enjoy working with Jonas, who is an experienced and talented colleague. We've spurred each other on, discussing and trying solutions that are impactful and slightly different. I'd like to think that Rasmus has gained a lot from our collective experience,« says Hans Murman. ©

Developer **Rasmus Larsson**

» ON A SELF-BUILD PROJECT, THE PROCESS SURROUNDING ALL THE DECISIONS IS THE CHALLENGE. «



Getting the house just right required great attention to detail. The cladding is milled at the corners to create an elegant join, and the light switches have been inset.



The interior is also defined by natural materials. The floor of tapered pine boards gives a light and welcoming feel that reflects the greenery outside.



Steel details such as the braces in the roof and load-bearing posts in the deep window recesses contribute to the overall feel and provide a contrast with the pine cladding.



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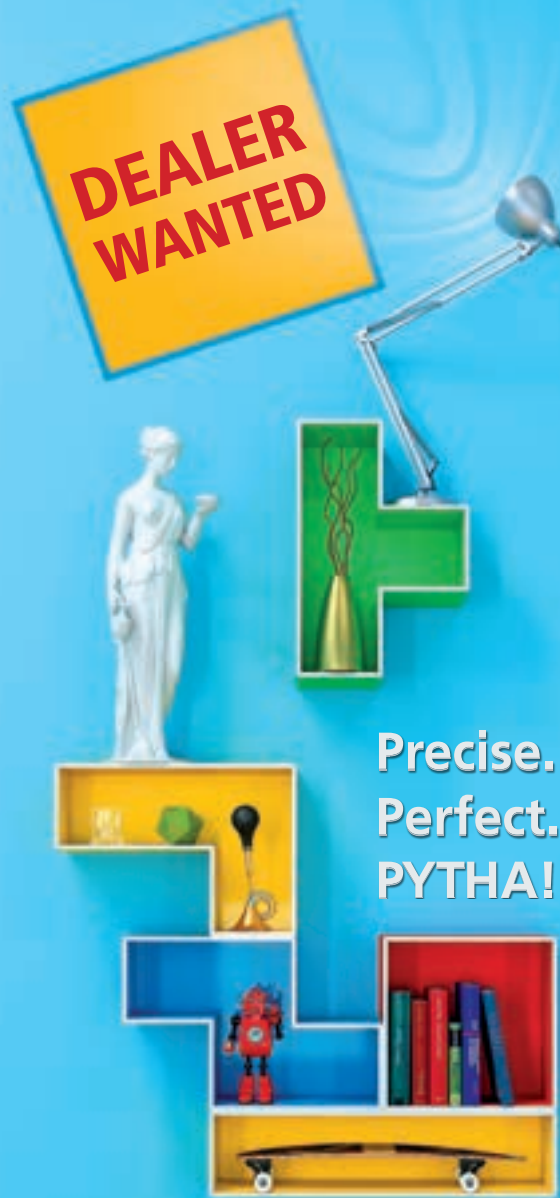
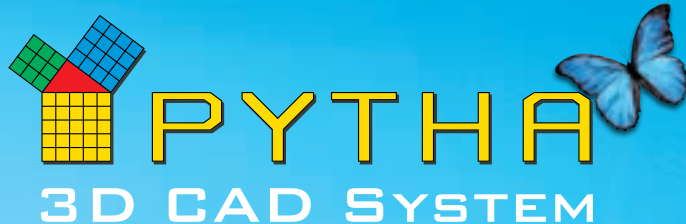
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Dimensions of roof trusses, fixings and joints are a key question during reconstructions and have to be recreated as accurately as possible from archive material.



SFV/Mia Fernlund

Reconstruction brought back lost knowledge

September 2016. Everyone who witnessed the column of smoke rising up from Skeppsholmen in Stockholm feared the worst and knew it was serious. Båtsmanskasernen, or Kasern II, on Skeppsholmen was in flames.

TEXT Stina Hagelqvist

The building was erected in the 1810s to house 240 seamen, and was designed by the architect, professor of construction, colonel and fortifications engineer Fredrik Blom – one of the 19th century's most versatile and productive architectural engineers. The building itself – simple and austere like many other government buildings of that time and by Blom – sits squarely in the Swedish building tradition as a brick structure with a classic Swedish roof. Extravagance was not to be wasted on simple crew, but over time the building has secured a place in Swedish architectural history, making a strong contribution to the unique heritage setting of Skeppsholmen. Båtsmanskasernen became a historical monument in 1935 and is now a listed building.

A major fire in a building of Båtsmanskasernen's status is a disaster. The firefighting work took over a day and significant quantities of water were used, putting extra stress on the brickwork and wooden beams and jeopardising their stability and load bearing capacity. The fire consumed all of the building's wooden roof trusses, and during the clean-up, the attic floor structure was demolished. Irreplaceable historical assets

were lost, but new assets were created during the reconstruction, not least in the form of knowledge and expertise on the strength and load-bearing capacity of historical wooden structures, timber and traditional timber joints.

The National Property Board Sweden specified reconstruction of the roof, the fire-damaged façade and the windows, all using traditional methods and materials. No documentation of the original plans could be found, which made designing the new roof trusses more difficult.

One critical issue was how to determine and verify the dimensions of the roof trusses, fixings and joints. This is a recurring issue when reconstructing historical buildings – how reliable is the strength of the traditional joints using dowels, wedges and hand-forged nails? The joints are the wooden structure's weakest points and the dowel is the critical element of the joint. Using oak dowels instead of spruce or pine in the reconstruction of Båtsmanskasernen's roof trusses made it possible to improve the performance of the joints. Oak is both denser and stronger than pine and spruce, and highly resistant to rot.

Sourcing the right grade of timber in large enough dimensions was a further problem. Large dimensions of slow-grown wood are not an industry staple, so each tree needed to be practically hand-picked. Building conservation projects often require heartwood pine, preferably slow-grown pine that is rich

in resin. This, combined with birch bark as a vapour barrier, makes the structure a sustainable project with an ecological profile. Following tradition, each floor joist was also clad in birch bark on installation. Preserved beams from Båtsmanskasernen show that the age resistance of birch bark far exceeds the technical service life required from modern materials.

It is well known that older measurements, dimensions and joints differ from their modern counterparts, and although historical structures sometimes exceed today's requirements concerning load-bearing capacity and strength, they fall short when it comes to the fire safety requirements. This shortcoming has now been rectified in Båtsmanskasernen.

The reconstruction shows that the traditional Swedish roof truss in frame-sawn pine with oak dowels can achieve the same performance as a modern glulam truss with mechanical joints. The restoration was a great moment for modern construction, with its strength requirements, dimensioning and project planning on the one hand, and traditional craftsmanship, with its knowledge of materials, structural solutions and material need on the other hand – an opportunity for both sides to come together and draw on each other's skills and experience.

A fire, however unwelcome, provides a chance for more in-depth investigations that can revive valuable knowledge about an older building tradition, and the reconstruction of Båtsmanskasernen was no exception. ¹⁰

Seamless dream in a private world of light

Supported on modest braced wooden posts, the house in Svinninge almost appears to be floating. Inside, it is a seamless dream with ceilings, walls and floors in spruce, large west-facing windows and an airy sense of space.

TEXT Catrin Hellmark PHOTO Erik Lefvander



It is actually a traditional wooden house, according to architect Daniel Widman of the firm Lowen Widman. But to the casual observer, the impression is far from conventional.

The house is also a manifestation of the client and the architect's shared interest in building materials and sustainability. There is no plastic or mineral wool here. The focus is on natural materials and a structure that is built to last.

The gable end containing the entrance has no windows. It overlooks the road, and the idea was to create a protective atmosphere, explains Daniel Widman.

»We've tried to put the large windows primarily in the west and south walls, keeping the building quite closed to the east and north. It is all very intentional. When you step into the house, it should be like stepping into your own world, one that is slightly screened off from the road and the other houses in the area.«

And this personal world is a restful experience, with light and space dominating. The rooms in the quite long and narrow home draw light from several directions, and one of the central parameters was sightlines:

wherever you are, the eye is taken a long way in the open-plan layout.

»Coming in through the entrance, for example, you can see the whole length of the house and out the other side,« says Daniel Widman.

He also stresses the importance of circular flow in the layout – it invites action and movement; think children happily running around. Different rooms can enrich each other, too:

»Designs generally give different rooms only one door, and that room can then never have more qualities than it contains within itself. If, on the other hand, a room has two doors, the neighbouring room can lend light and interest to the first room.«

The Svinninge house demonstrates this, not least, in the upper floor's master bedroom and bathroom.

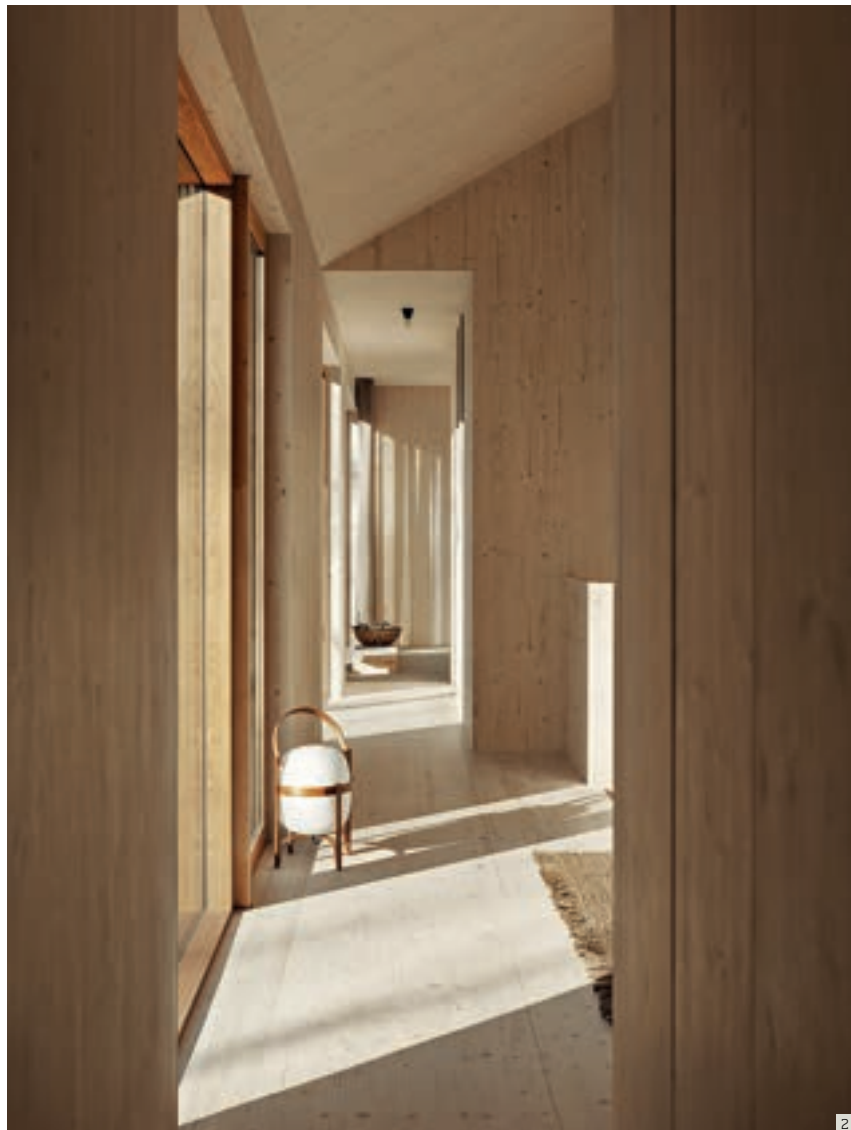
»The master bedroom on the gable end has two entrances, so the bathroom in the middle gains light from both directions.«

The ceiling height also contributes to the airy feel, reaching 2.7 metres on the lower floor and 2.6 metres on the upper floor, except in the family room at the top of the stairs. This is open to the full height of the

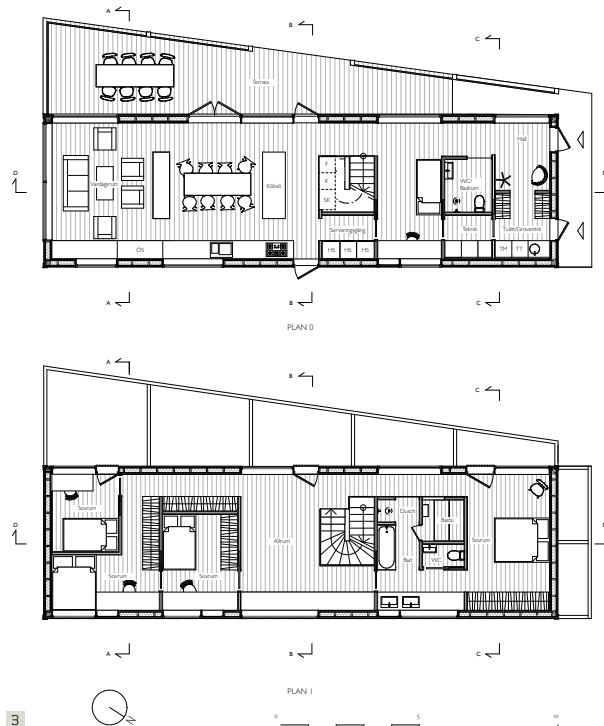
1. Spruce is the dominant wood in this attractively coherent solution: ceilings, walls and tables in the same kind of three-layer, edge-glued panelling, plus spruce floorboards. All dried for five-six weeks before installation to reduce the risk of shrinkage. Kitchen with doors in oiled oak.
2. Light from several directions and restful sightlines in a mostly open-plan layout are key features of this wooden home in Svinninge.
3. Plan.
4. The generous windows facing west make the most of the evening sun.

Svinninge House ÖSTERÅKER, SWEDEN

ARCHITECT: Lowen Widman.
CLIENT: Martin Lydén.
STRUCTURAL engineer: Anders Håggstam.
AREA: 180 square metres.
COST: SEK 6 million.
www.lowenwidman.se



2



3



4

roof, 4.1 metres, and in Daniel's opinion, that variation is important.

»Having different ceiling heights is crucial in giving a more dynamic feel.«

Perhaps the most striking feature of the Svinninge villa is the coherent and seamless wooden interior: the walls and ceilings throughout the building are clad in the same spruce panelling, with precision joints. Harmonising spruce floorboards strengthen the look. The same panelling also hides the white goods and the many wardrobes in the house. In addition, the material has been used to build the stairs, sliding and hinged doors and an item of kitchen furniture, as well as a couple of built-in desks and benches.

»The panelling is three layers of edge-glued spruce. It comes in 1200 millimetre widths and has a tongue and groove edge. It took a lot of screws, but they are mostly concealed, since you can screw the panels in the groove, so the next panel always covers the screws,« explains Daniel Widman.

Following installation, the cladding was treated with a mix of linseed oil, a little beeswax and a touch of white pigment.

Architect **Daniel Widman**

»The idea was to retain the fresh, light colour.«

»The idea was to avoid paints and retain the fresh, light colour.«

Only a few places in the building use materials other than wood: the entrance hall has a polished concrete floor treated with silicate mineral paint and soap, while limestone is used in the bathrooms. Limestone is also used in the counter that runs over the built-in kitchen cupboards – which are in fact not spruce, but birch plywood with oiled oak doors.

»The window surrounds and external doors are larch, and the sauna uses elm. So there are a few different woods, although the majority is spruce,« says Daniel Widman.

He is keen to point out that, despite the minimalist feel of the rooms, a normal family can easily live here with all their stuff: on the upper floor there are plenty of wardrobes

and the back wall on the lower floor combines the laundry and utilities with a long line of cupboards. The space under the stairs is also set aside for storage.

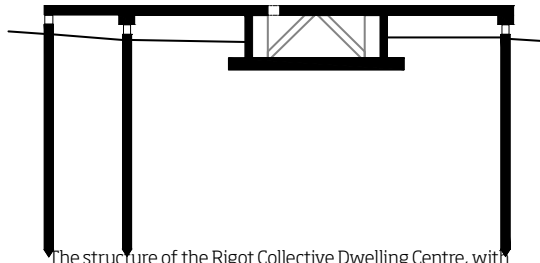
The interplay with the environment outside adds a further dimension to the interior character of the home.

»Even the terrace outside is important for the interior. It's easy to access from indoors and has something of a treehouse vibe,« says Daniel.

The spruce deck fans out from the entrance along the whole façade, culminating in a pergola that creates a welcoming outdoor room. A place to relax in, surrounded by nothing but trees.

»The house juts out from the hillside, so it rests on a slab at the entrance, but then rises off the ground, standing on concrete plinths and timber posts and crossbeams. We tried to keep the sense of a house on a forested hillside, where blueberry bushes can grow underneath,« adds Daniel Widman.

»Since the focus is on wood, this was a way to minimise the use of concrete – usually a popular choice for foundations – and to be able to control the lower floor system, with its diffusion-open structure.« ①



The structure of the Rigot Collective Dwelling Centre, with wooden piles and a modern wood foundation, where even the spaces below ground are constructed from wood.

Sustainable foundations with no footprint

Sustainable building is often associated with structures that stand for many centuries. The question is whether this is always the case. Considering how often our needs and way of living change, there may be many advantages to building something that, with a minimum of effort, can be changed into something else or moved to another location.

TEXT Petter Werner Åström & Tomas Alsmarker **PHOTO** Acau architecture, Anders Lundström (cross section)

Moving houses is nothing new. Log cabins have been moved around since time immemorial to make best use of an existing structure. The cabins were taken apart like a 3D jigsaw, ready to be assembled at the next site. Apart from small traces in the form of a foundation wall or some foundation stones, it is impossible to tell that a house once stood on the land in question. So what can we learn from history as circular building becomes increasingly vital? And how can we design simple foundations that leave no trace after them when the building is moved?

This was one of the challenges facing the firm Acau Architecture, when they were



Anna Ulfstrand, Stockholms läns museum

Precursor to the crawl space, a »mullbänk« from an old timber house.

commissioned to design temporary housing for newly arrived refugees, in the form of the Rigot Collective Dwelling Centre in the Swiss city of Geneva. The intention is for the accommodation to remain in place for only 10 years, before potentially being moved to a new location – not something modern architects have had to consider very much.

As well as making the building easy to disassemble, the brief also required minimal use of concrete. The result was a building of lightweight, demountable box units in glulam and CLT, with the piles and cellar also in wood.

»Using wooden piles means that we don't have to deal with the recycling of concrete at the end of the project. When the building is eventually moved, the wooden piles can either be lifted up and reused, or cut down to ground level and left in place without any impact,« says Darius Golchan from Acau Architects.

These wooden piles are larches from the surrounding forest, and the only processing was the debarking of the trunks.

»The foundations tend to account for a large part of a building's climate impact, so just choosing wooden piles is a major win for the climate,« says Darius Golchan.

Some people might find it strange to



think of plinths or piles – or even cellars – in wood. Yet this is how we have built in Sweden for centuries. In its simplest form, the wooden sill was laid directly on the ground, as a wooden frame beneath the house's exterior walls, like the reinforcing blocks edging today's floating slabs. This was common in stables, but it was known that these buildings would not last more than one generation.

Homes had to stand for much longer. In the most elementary form of foundations, dwellings sat on flat stones in each corner. The space between the cornerstones was initially filled in with a low bank of soil to keep out the cold and drafts. Gradually the earth embankment was replaced with loose or mortared stones, which became a stone wall, also called stone footings. Cornerstones sitting high on a wall allowed the wooden sills to be raised up from the ground, while higher stone footings could recreate the look of the



The foundations tend to account for a large part of a building's climate impact, but with debarked larch trees as piles, the footprint can be significantly reduced.



As with old Swedish foundation-laying methods, the cellar is made of wood, but the peat has been replaced with external insulation and the protective birch bark with waterproof sheeting.

houses in the cities.

The floor joists were laid directly on the ground, with the floorboards placed on top, completely unconnected to the stone footings. This in effect created a wooden slab. With higher foundations, the space was not fully filled in. A crawlspace was formed between the ground and the floor, and the open fire kept the wooden floor and the joists warm all year round.

For rot to take hold of wood, it requires nutrients, water and oxygen. Take one of these away and the wood-decaying fungus is unable to survive. Keeping the wood warm reduces the risk of condensation and damp, which is why these foundation methods have historically worked so well.

The Rigot Collective Dwelling Centre demonstrates much of this old foundation technology in a modern guise. The building stands on 'cornerstones' in the form of wooden piles. There is insulation instead of peat, waterproof sheeting instead of birch bark

and better draining materials, but essentially the same construction principles apply. Wood in the ground is nothing new and not as odd as it sounds. Done properly, it can last extremely well. Just look at the wooden pile from Helgeandsholmen, dating back to the 1250s (see image). There are many examples of wooden piles working as a durable, long-term foundation. As long as the piles are placed below the groundwater level, the wood-decaying fungi can't attack the wood due to a lack of oxygen.

In these modern wooden foundations, we can recognise the foundation methods of yesterday, but also today's floating slab. The difference is that the concrete has been replaced with a biobased and climate-neutral material.

Just like in the past, we have to be careful with the material. In the past this was due to financial concerns, but today it is also for environmental and climate reasons, so as not



Cross-section of a sample post taken from Birger Jarl's wooden sea defences, dating from the 1250s. The healthy, intact wood has split as it has dried out, but only after more than 700 years in the ground.

to put further stress on our planet. Once again, we need to think about ease of disassembly in newbuilds, so that they can be relocated and adapted to the changes that occur.



» WE HAVE AN EYE ON BOTH THE PAST AND THE FUTURE. «

Kai Strehlke loves every minute of his current job. He is an architect and head of digital processes at Blumer Lehmann in Gossau, Switzerland, where he has been involved in projects including the Cambridge Central Mosque, designed by Marks Barfield Architects, and the Swatch headquarters by Shigeru Ban.

TEXT Carmen Izquierdo PHOTO Blumer Lehmann

Kai Strehlke trained as an architect at the Swiss Federal Institute of Technology in Zurich, where he then worked for six years in the Department of Computer Aided Architectural Design (CAAD). He spent the following ten years working at Herzog & De Meuron Architekten and set up their digital technology team. Kai got to wrestle with exciting projects where geometry, aesthetics and structure challenged manual skills and required computer aided design.

»In my mind, what I do is a kind of choreography, a kind of dance that the machine then performs. You design and write the code, and then see how the machine sets the large tools in motion. You can hear the tools biting into the wood, watch the sawblades going with or against the grain, chips flying off... The experience activates the senses, it's visual, auditory, tactile and you can smell the scent of wood.«

Wood has always been in his life. Both his father and grandfather worked in forest management, and the forest was a big presence growing up. So it felt right to come back to the material when Blumer Lehmann recruited him in 2015. He has also been a lecturer in architecture, wood and civil engineering at Bern University of Applied Sciences since 2016. Digital manufacturing, the new form of prefabrication, has been in place at Blumer Lehmann since 2010, when the company invested in its first five-axis CNC machine. Kai Strehlke says this is entirely down to the vision of Katharina Lehmann.

The firm aims to drive forward the development of wood construction in all its forms and make it possible to use and showcase wood in different, new and fascinating ways. Exploring new areas is a natural aspect of this development, as exemplified in the Urbach Tower. It was made using self-shaping timber, an innovative way of twisting wood that was created in collaboration with Stuttgart University.

Kai has seen a dramatic change in the understanding of how wood can be employed, following the updating of the fire safety regulations over recent decades and the technical advances in fire extinguishing system in buildings. We can now imagine new forms of architecture in wood that were just not possible a few years ago.

»We're inventing entirely new techniques, building on our forefathers' knowledge, and working at this company I've learned so much about wood as a material and about the tools we now have. It's a real combination of old tradition and knowledge plus the dream of new and liberated designs.«

In the factory itself, the traditional sawmill works in concert with the very latest digital software for the production of free-form building components.

»It's part of our culture, just like you can travel around Zurich on both the original trams and on trams built using cutting-edge technology. There is an eye on both the past and the future,« explains Kai Strehlke.

»We exploit the natural properties of the wood, its strength along the grain, with an understanding of its weakness across it. When you shape wood by bending and gluing together the laminates, this creates a beam with internal tensions. Since these can't be calculated, you need to work with them using a strategy that ensures no deformations occur later on.«

Kai Strehlke describes his work as digital craftsmanship. It is about understanding both today's tools and a material that has been around for centuries, and getting them to work with rather than against each other.

»When we produce thousands of unique parts, like for the Swatch headquarters, which had over 4,000 parts, the preparation of the code is critical. Rather than working with off-the-shelf CNC software, aimed at an industrial process that isn't suited to free-form designs, we write our own code. It defines the type of tool that is needed for each piece, to make a particular cut, which is exactly what a carpenter would have done 150 years ago. We use the 3D program Rhino to describe the geometry and we produce the script and the CNC code that is directly fed into the machine. It is more difficult, but this way we have complete control over how the tools move and machine each part.«

For every new design, they produce a prototype. The full-scale test piece is necessary for many reasons: when breaking new ground, there is plenty of scope for the process to stall, often for fear of making the wrong decision, and the prototypes have proven to offer good support for decision-making, according to Kai.

The prototypes are a way to test the design in terms of the material and the technology, and small but crucial changes are often made to optimise the design and achieve a production-friendly detail that meets the stringent design standards and technical requirements.

Kai Strehlke emphasises the importance of collaboration between the different talents in the company's own team and the visionary architects, as a success factor in creating the new processes. The more difficult it has been to understand each other at the start, the more interesting the methods that they have managed to develop. The solutions to these spectacular buildings have been born out of friction and respect for each other. ①



Open-plan solution for so

The wonderful scent. The softness of the material. The cathedral-like feel. Marie Midtsund and Bård Lyster have many reasons to love their house in the Norwegian town of Molde. They are particular pleased to be living in a house that stores carbon dioxide rather than emitting it.

TEXT Ingela Hofsten PHOTO Tom Auger

Behind Marie Midtsund is a log wall that stretches high above her head. She is in ›stuen‹ – the living room – on the middle floor of the house, with a partial opening up to the third floor and a balcony that sparks thoughts of Romeo and Juliet.

»If we have a party or someone wants to perform, they can do so here,« says Marie, who is herself active in music and theatre in her spare time.

But there are other aspects of the house that make it perfect for her. Like the fact that it is built with ecological sustainability in mind. And that she can feel a connection

with the building material. As the daughter of a man who personally felled and rafted the timber for the house that he built, she enjoys having wood exposed inside and out. She and her husband Bård Lyster also love the location of their home, near the forest, with amazing views of the fjord from the large windows that frame magical moonlit nights.

Zieglers Nest, as the architectural firm has chosen to call it, »because the street name is Zieglers Gate and the house resembles an eagle's nest«, was completed in late 2019. The Midtsund-Lyster family, with their three children, were so eager to celebrate Christmas here that they moved in on the day before Christmas Eve with just mattresses, festive food and a tree.

They previously lived in an old wooden house in the middle of town. But it was in need of renovation and actually felt too big for a family whose core belief is that family life should be a sociable affair. So when the opportunity came up to work with their good friend, architect Martin Beverfjord, to create

1. Zieglers Nest sits on a 30–40 degree slope and has been built into the hillside. At first sight, the large windows can trick the eye into believing that the house is smaller than it is.
2. By not lining the walls, wood is also a distinct feature indoors. With light flooding in and a connection to the outside world, the overall result is light and airy.

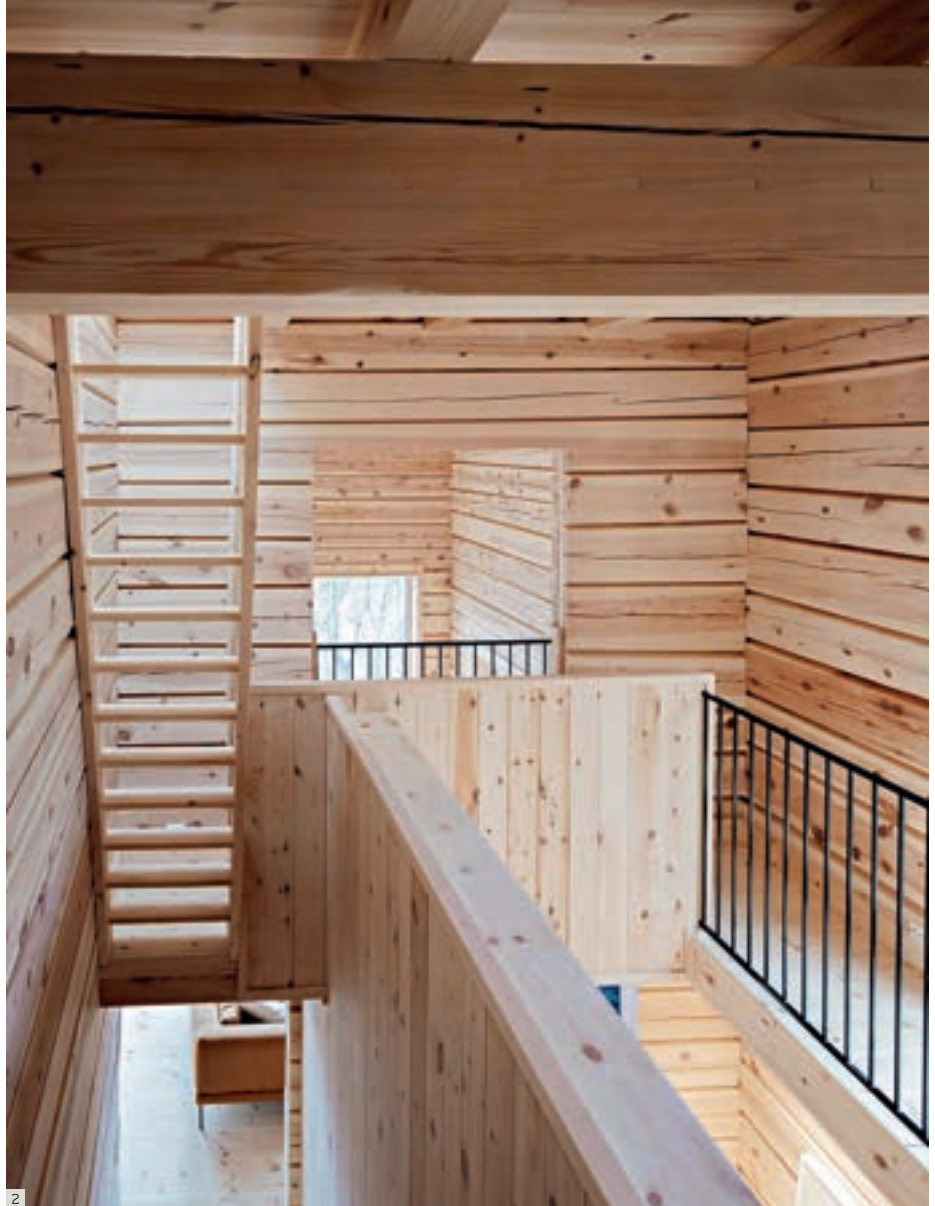
Zieglers nest MOLDE, NORWAY

ARCHITECTS: Rever & Drage.
CLIENTS: Marie Midtsund and Bård Lyster.

STRUCTURAL ENGINEER: Lervike.
AREA: 150 square metres of heated living space, 75 square metres of unheated space.

COST: SEK 7,5 million.
HEIGHT: 12,9 metres.

W|reverdrage.no



ciable living and theatre

a house from scratch, they took it.

Martin Beverfjord is an architect at the Oslo-based practice Rever & Drage, which specialises in wooden homes built using traditional techniques, but with a modern look and a focus on ecological sustainability. The three architects have all been apprenticed to traditional craftsmen in order to familiarise themselves with both the materials and the techniques. For Zieglers Nest, the load-bearing structure on the ground floor is a framework that combines wood and steel. The other floors apply a traditional log-built system.

»By building a log house, we were able to avoid using a plastic moisture barrier, since the building is able to breathe,« says Martin Beverfjord.

He found it technically interesting to design a log-built house, as the technique means that the whole structure will settle after construction.

»I had to think quite carefully about how the stairs would move as the timbers were compressed.«

The logs are traditionally left to protrude at the corners, where they overlap, but for Zieglers Nest Martin Beverfjord chose instead to create flush joints. This made it easier to board the two most exposed façades with wood cladding, to counter the effects of the open location in the coastal town. Otherwise, the combination of wind and driving rain would have accelerated the aging of the log surfaces on these aspects.

»For financial reasons, we've only boarded where absolutely necessary,« says Martin Beverfjord.

He chose to arrange the cladding horizontally on the west wall of Zieglers Nest and vertically on the south wall. The south face has upright cladding because that is the side that visitors see first.

»It gives a grand feel,« says Martin Beverfjord.

Another way to protect the house against the forces of nature was to use local and slow-grown wood, primarily pine, which tolerates the damp climate, has a high degree of denser heartwood and is rich in resin,

a natural preservative. As a further layer of protection, the wood was coated with a time-honoured blend of wood tar, vegetable turpentine and linseed oil.

»The wood is also planed, which creates tighter seals.«

Internally too, the main wood is pine, although the floor on the entrance level and in part of the kitchen is oak, which is more resistant to wear from wet shoes, for example.

»But we used pine higher up as it is softer against bare or stockinged feet,« says Martin Beverfjord.

For him as an architect, the most interesting thing about the build was its location. Not only is the plot small, at only 500 square metres, but it also sits on a steep slope. To make as efficient use of the space as possible, the foundations were partially excavated into the hillside. After careful consideration, Martin Beverfjord and the family agreed to use concrete for the foundations.

»Concrete isn't great for the environment, »



» but it is cheaper and easier to use than natural stone, for example. Building the house upwards rather than outwards kept the foundations relatively small (7 x 10 metres) and we placed both a garage and a utility space in the volume that these groundworks created. As such, we have still managed to significantly reduce our ecological footprint.«

What he calls the utility space is designed so that daylight comes in through large gaps that, while they might let in rain, also admit sunlight that quickly warms up the concrete and draws out moisture. The lighting inside creates a visually exciting effect on the road outside on dark evenings. With a 5 metre-high ceiling, the room is perfect for the trampoline that currently occupies the space, which has provided great family entertainment over a rainy pandemic year.

Naturally, the small size of the plot limited the size of the house, but by building upwards it was still possible to achieve a floorspace of 150 square metres. It is true that more rooms could have been fitted in, if the family hadn't

had other wishes, like double ceiling height in the living room.

»Going up the stairs and coming out into that room is like entering a cathedral,« Bård Lyster says reverently.

A company specialising in traditional crafts was used for the build. The first step was to erect the house and carry out the log-building work in an assembly hall, as is usual in this area due to the weather, before disassembling it and re-constructing it on site.

»It was a little more challenging for them in the places where we wanted a more modern look,« says Martin Beverfjord, giving the example of the moulding-free transitions between ceiling and wall.

»But they were also fascinated by how you can make log-built walls look so lightweight by bringing in a lot of daylight.«

The insulation is primarily sheep's wool, although the roof has the addition of Norwegian wood fibre insulation and, in places where snow gathers, pressure-resistant mineral wool.

3. The architect's aim was to combine traditional craftsmanship and modern needs, allowing space for the best of both worlds.

4. Cross-section, 3D rendering.

5. Building upwards has allowed the ceiling heights to be varied up to five metres, with open sections that contribute to an airy feel.

6. The logs have flush joints, with no wood protruding at the corners. The wood is slow-grown pine that has been treated with a tar paint known as Roslagen mahogany.

«But I look forward to the arrival of a pressure-resistant wood fibre insulation in the near future, that we can use in future projects,« says Martin Beverfjord.

With tall windows and the kitchen's insulated glass veranda, the house can also draw on the warmth of the sun, coupled with ground-source heating and a modern Danish tiled stove.

The wood has been left exposed indoors in part because the logs need time to settle, but also because the owners love it.

As Marie Midtsund says:

»I feel completely at home here.«



The German software company PYTHA Lab sets high standards in the world of CAD with its soon-to-be-released PYTHA version 25.

From concept to completion PYTHA 3D CAD is one of the leading 3D CAD systems for the woodworking industry, furniture design, commercial joinery, high end kitchen, exhibition planning and interior design.

Version 25 will provide an incredibly powerful programming interface, allowing users all over the world to develop additional components by themselves. Depending on operational requirements, you will be able to effortlessly create your own generators and wizards.

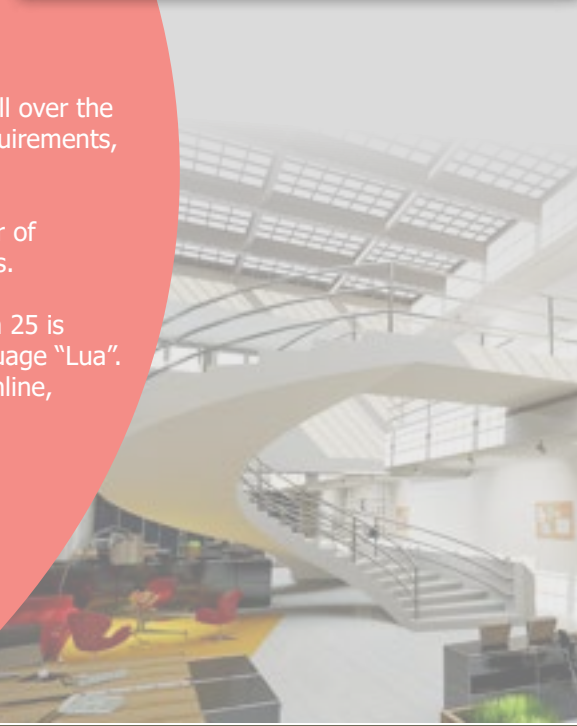
Whether it be kitchen planning, staircase construction or office furnishings: in a matter of minutes, you can configure a fully equipped kitchen or a complex construction of stairs.

The new PYTHA Plug-ins will complement the module "generators", as soon as version 25 is released. The interface of the plugins is based on the simple script programming language "Lua". A full documentation as a reference as well as some example plugins are accessible online, helping future developers to smoothly "learn the ropes" of Lua.

For more information, contact your local PYTHA dealer or visit www.pytha.com!



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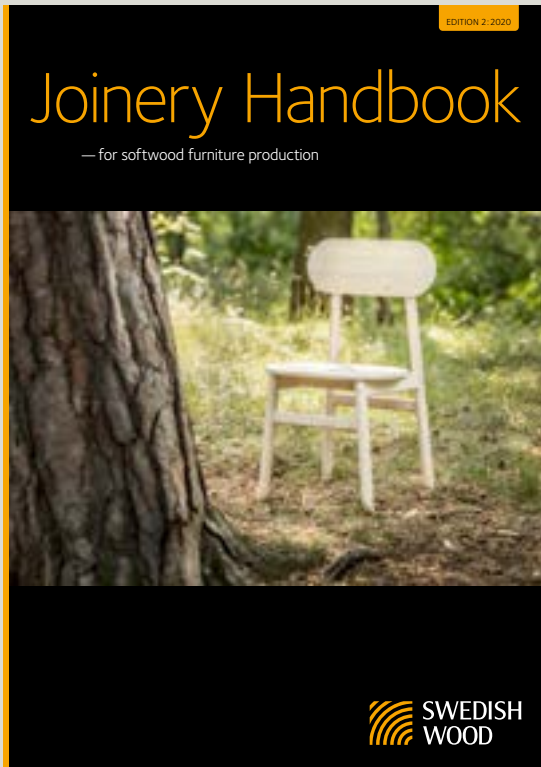


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Joinery Handbook – for softwood furniture production
 Swedish Wood (Eng)
 978-91-985214-6-7

These days, the furniture industry has a huge array of options when it comes to processing solid wood for joinery and furniture production – manually and increasingly by automated means using CNC machines. Sustainability is important at every stage of production, and not just from an ecological perspective, but also in economic and social terms.

The first chapter of the *Joinery Handbook* is about the way designs and drawings have a major impact on how sustainable and circular the furniture or product will be. It is here that you can choose natural materials and connection methods that enable simple dismantling for renovation or disposal purposes. Chapter 2 provides a detailed explanation of everything to do with wood and what to think about when ordering wood for a project. In the next chapter,

1.1 Drawing techniques

From concept to design

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It is possible to build houses, boats and furniture without drawings, as has been done throughout history. But for the customer or client to judge what is proposed against what is finally delivered, a drawing has to be created in advance. A drawing is also required where the work will be carried out by someone other than the designer – when the designer and the craftsman are not the same person.

Drawings for individual furniture and prototypes are usually made by the designer or printer and are called working or construction drawings. A different kind of design material is necessary for operational series manufacture on a large scale. These are called production drawings and are part of the design documentation. They must be adapted to standard dimensions that are prescribed in the production process.

This chapter takes a deep dive into the different kinds of drawings that occur in modern manufacturing. This is followed by some general advice and recommendations about suitable dimensions for furniture, tables and chairs. The chapter concludes with a description and definition of the requirements that usually apply for the various parts of furniture in the large-scale manufacturing industry.

1.1 Drawing techniques

The process from concept to finished product requires drawings of various kinds, for which there are international standards. Knowing about these and all the technical terminology in the different parts of a drawing is important for communication with the client and everyone else involved.

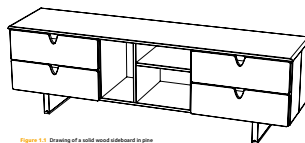


Figure 1.1 Drawing of a solid wood cabinet in pine

4 Joinery Handbook

1.1 Drawing techniques

1.1.1 Drawings

A picture says a thousand words. We can see this as soon as we try to describe an object just with words. A description can end up being extremely extensive and detailed. A drawing of the object, on the other hand, allows us to instantly understand what it looks like and how it is constructed. Simple words can, for example, describe details, joints, structures and more. Drawings are therefore an important operational part of a manufacturing company and used in production. When we have an idea about what we want a product to be, we usually start with a sketch.

A sketch helps us to develop our idea

Detailed drawings are necessary for us to get the products that we really want. A company's customers have the right to receive the products they have been promised. It should also be possible to return with orders for the same product. The products therefore have to maintain their same quality and appearance from one time to the next. In other words, for the manufacturing to operate in a way that keeps the customer happy, we have to work from the same foundation every time we produce a new order. Drawings are therefore an important element of the company's quality system.

Fig. 1.1, page 4 shows a type of drawing that is common in the joinery industry. Architects often use this kind of drawing and it is therefore referred to as an architectural drawing. These drawings are similar to a scale of 1:1. The disadvantage of a 1:1 scale drawing is that it takes up a lot of space and is hard to handle. There are, however, various methods for reducing the size of the drawing.



Furniture design, Malin, Lindqvist University

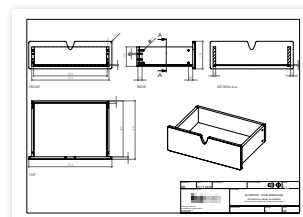


Figure 1.2 Drawing of a solid pine drawer

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2.3 Quality and range

2.3 Quality and range

Some woodworkers and artisans gather their wood from the forest and work on the material in its fresh state. However, most producers and designers of products in wood choose from the range of wood offered by their supplier.

2.3.1 Wood grades, appearance grading

The grade of wood can be specified using a number of parameters, including:

- Knots
- Crack grain
- Deformation
- Checks
- Top exposure
- Insert damage
- Wane
- Compression wood
- Distortions
- Pitch pockets
- Wavy grain
- Handling damage
- Bark-included saw
- Pinholes
- Distortions
- Open scars
- Fungal attack
- Distortions

The parameters are covered in visual sorting, known as appearance grading. In Sweden this is usually done at the sawmill following the guidelines in the document *Grading of sawn timber: 2019 version 1*. Builders' merchants use the grading standard SS-EN 16131-1. The sawmill will commonly stamp each piece of wood on the end with a shipping mark. This allows the grade quality to be checked along the chain from the sawmill to the joinery workshop. After processing, e.g. planing or planing, these marks may be cut away or hard to identify. The grade is then marked on the packaging.

The grading of wood is a general process based on appearance. It is thus not designed to take account of the wood's use, for example in joinery, construction or packaging.



Pin edge glued joints

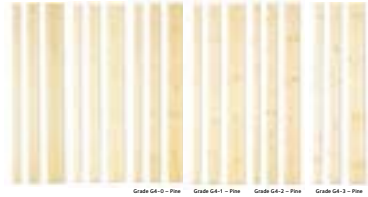


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2.3 Quality and range

Appearance grades - Quality classes

The wood is shown in the dimensions: 25 x 100, 50 x 100 and 75 x 200mm



Class I - Pine, Class II - Pine, Grade GA - F - Pine, Grade GB - F - Pine, Grade GC - F - Pine, Grade GD - F - Pine

32.1 Regulations for appearance grading

Grading of sawn timber

Under the rules in the document "Grading of sawn timber", wood is sorted into seven classes, with Class I representing the highest quality. Classes I-III are usually graded under the designation GS, whereas Class V is generally referred to as G6h and Class VI as named timber.

Standard SS-EN 16131-1

According to the standard for appearance grading of softwoods, SS-EN 16131-1, the grading may be performed on the faces and the edges or only on the faces. In these cases, the grades are called G1 and G2 respectively. The grading designation and followed by a number from 0 - 4 rating the quality of the wood, with 0 being the highest quality. A grade can thus have the designation G4-2, which means a 4-sided visual sorting of typical construction timber, corresponding to the G4h grade, V. An approximate comparison between the two sorting systems is given in table 2.3. G2 is a grade that is rarely used in Sweden.

Table 2.4 Wood grades, common wood products with their typical wood grades

Type of wood product	Grade class	Wood type
Interior cladding	G1-1, Class IV	Pine and spruce
Planned wood for interior (plywood)	G4-1, Class IV	Pine
Floorboards	G4-2, Class V	Pine and spruce
Mouldings	A - B	Pine and spruce (SS 23028:1)

See also table 2.5.

Table 2.5 Wood grades, approximate relationship between the different quality classes

Grading system	Class	Quality class
Grading of sawn timber	G1	GS
	G2	GS
SS-EN 16131-1	0 - 4	G1-1, G1-2, G2-1, G2-2, G3-1, G3-2, G4-1, G4-2
	0 - 4	G1-1, G1-2, G2-1, G2-2, G3-1, G3-2, G4-1, G4-2

0 - 4: 0-sided grading, G2: seldom used in Sweden, GS: named timber for construction timber

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the handbook goes through machining, connections, hardware, surface coating and maintenance procedures for a long service life.

The content of this book is aimed at smaller joinery workshops and students, but also at larger companies that work in the production

and design of furniture and fittings, predominantly in softwood.

The *Joinery Handbook* can be ordered in printed form or downloaded as a PDF. www.swedishwood.com/publications/list_of_swedish_woods_publications/snickerihandbok/

Young Swedish Design 2022 SWEDEN

18 May marked the launch of this year's Young Swedish Design competition. A change this time around is that the industry body Swedish Wood will be a competition partner, inviting competitors on a journey of learning and inspiration with a focus on wood, its origins and the wide range of applications in design and architecture.

With its touring exhibitions and range of supportive grants, Young Swedish Design is well established as the most important showcase for the young design scene.

A selection of the competitors will be offered an award in the form of a journey of inspiration and learning through central Sweden over the course of four days. During this time, the competitors will learn about the importance of the forest and the links along the whole value chain.

www.ungsvenskform.se



15 september 2021 | Trä! issue 3

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