

trä!

A MAGAZINE ON INSPIRING ARCHITECTURE
FROM SWEDISH WOOD » ISSUE 4 » 2021



CREATIVE AND OPEN TO ALL

Global spotlight on local landmark

**TREEHOUSES
VISIT DUBAI
ELONGATED FORM
IN HERITAGE SETTING
25 NEW HOMES ON
MOUNTAIN SLOPE**

TRÄ MEETS
Maria Larsson

KNOWLEDGE
Building from
a specific tree

add personality

FACADE BOARDS
BY CEMBRIT



Foto: Anders Bergön

Arkitekten berättar

”Vi har använt oss av den grova träpanelen med inslag av mörka skivor på de lite mer publika entrésidorna och ljusa skivor mot den mer privata och intima gården. Träpanelen och de mörka skivorna är som ett skal på utsidan medan insidan, kärnan, är ljus och lätt”, berättar Nina Sandahl, ansvarig arkitekt på Sajt Arkitektstudio.

Kombinationen fibercement/trä

”Det blir en dynamik och ett sätt att leka med de olika materialens egenskaper och olikheter, som tyngd - lätthet, grovt - lent, ljus - mörkt osv.”

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The skiing and the landscape attract people to Tännalden, Sweden, where 25 new homes on the north face of the mountain have been sited and designed in line with the topography.



Openness with the forest as a metaphor

The Swedish forest meets Arabic patterns at Expo 2020 in Dubai, United Arab Emirates. The pavilion is designed like a forest glade, with decorative tree trunks supporting eight treehouses ten metres up in the air.

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 SVENSKT TRÄ

Swedish Wood's aim is to increase the size and value of the market for Swedish wood and wood products in construction, interior design and packaging. Through inspiration, information and education, we promote wood as a competitive, renewable, versatile and natural material. Swedish Wood also lobbies on behalf of its members on key industry and trade issues.

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

Time to develop circular thinking

STOCKHOLM, SWEDEN COP26, the UN's climate conference, was held in Glasgow in November. Everyone agrees that the situation is critical and that action has to be taken fast – faster than before. However, there is no guarantee that this is going to happen. The lasting results of this type of summit usually take a long time to emerge.

Most commentators seem to agree that greater use of wood is a fast track to cutting the climate footprint of the construction industry, and we don't need to wait for any future advances in technology. Building in wood is tried and tested, and the technical solutions already exist. Sara Kulturhus, the arts centre that recently opened in Skellefteå as one of the world's tallest wooden buildings, has pushed the envelope – demonstrating just what is possible. And Sweden is not the only place where this approach to construction is snowballing. Last year, France announced that all public buildings must be built using at least 50 percent wood or other sustainable materials. The rest of the EU also sees wood construction as part of the solution to achieving climate neutrality by 2050. Even China is casting a keen eye over the options for replacing concrete with wood in its buildings, despite the nation not having much in the way of domestic wood resources.

When using this fantastic material, we still need to improve our processes to further reduce that climate footprint. We must design and digitalise to enable reuse. We must find business models that stimulate circular thinking. We must have the right materials in the right place and maximise the use of those materials in all our processes. These are major, vital changes to make, but only when we can get them in place can we talk about truly sustainable value chains.



Mathias Fridholm

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Read about smart, sustainable and inspiring architecture from around the world. Over its 30 years or so, Trä magazine has showcased the progress and possibilities of wood and helped to promote the modern, sustainable development of the construction industry.

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Robin Hayes

A softer expression

OBJECT Pumping station
ARCHITECT Urban design

STOCKHOLM, SWEDEN Nacka is one of the fastest growing municipalities in Sweden, and with more residents comes the need to expand the energy systems.

The pumping station on the slope below Hammarbybacken is important for the future district heating supply and its shape has had to adapt to the winding ski slope. The long façade that lines the path to Nacka Nature Reserve has been clad in sawn, silicon treated pine of quite large dimensions: 125 x 125 millimetres.

The rustic wood cladding connects with the

Inset benches and lighting aim to make the pumping station an inviting meeting place. The rough cladding draws a connection with the nearby forest.

nearby forest, and the façade has inset benches that form a natural social point. The façade is broken up into sections, with the horizontal gaps and exterior angles combining to form a play of light and shadow.

The idea behind the architecture is partly to show that even a technical building can bring something positive to a site, and partly to improve safety during the dark winter months. The building already merges into the landscape, and over time it will take on an increasingly wild look. «

w| urbandesign.se



Peter Molick

Inspired by driftwood

FORTH WORTH, USA At certain times of the year, the river races along in Fort Worth, Texas. At other times its waters

OBJECT Bridge
DESIGNER Volkan Alkanoglu
STRUCTURAL ENGINEER CMID engineers

ebb away leaving a riverbed strewn with driftwood, and it was this scene that informed the design of a new pedestrian bridge. The purpose of the bridge was to connect the two sides of the river and the neighbourhoods on either side. In addition, the materials had to be sustainable, the design innovative and the budget low.

Initially, the structural engineers wanted the bridge to be made entirely of CLT, but the limited budget led to a different innovative solution. Inspired by shipbuilding technology, the structural engineers chose a steel armature clad in CNC-cut wood. Each plank was custom cut, then stack-laminated into one undulating form that has a driftwood feel. The embedded benches, with their curved lines, allow people to take a seat and talk to passers-by or just gaze at the river and follow the floating driftwood. «

w| alkanoglu.com



Agnes Clotis

Made of Swedish pine, the pavilion contributes to the discussion about reuse and the role of wood in achieving the climate goals.

Pavilion for reuse

OBJECT Le pavillon Hexagonal
ARCHITECT In Praise of Shadows
STRUCTURAL ENGINEER Ramboll

PARIS, FRANCE Thanks to its geometric shape, France has long had the nickname L'Hexagone, which provided inspiration for the Swedish Institute's celebration of its 50 years in Paris. And so a new pavilion was erected in their garden for the official launch of the design programme in September. The geometric structure is made of Swedish pine, forming a symbiosis between the two countries. The airy design was created to blur the boundary between outside and in. But above all, the pavilion aims to encourage discussions about reuse and how wooden buildings can play an important role in achieving the UN's Sustainable Development Goals. It is therefore easy to disassemble and then re-erect somewhere else at a later date.

The idea of reuse has also been applied to the furniture, with the hexagonal table and stools made from by-products of the manufacturing process for the Lilla Åland chair. The pavilion is a joint initiative by Swedish Wood and Architects Sweden and will remain in the French garden for the rest of the year. «

w| inpraiseofshadows.se



Studio Any Let Matsushima

Debarbed cypresses, felled by the students themselves, form V-shaped pairs of posts along one side of the building.

Forestry school with honest materials

GIFU, JAPAN What could be more educational than teaching forestry and wooden architecture in a building that reflects the material and opportunities of the forest? The Gifu Academy of Forest Science and Culture has gained just such a building.

The monopitch roof gives the building a low-key look, as it gently rises from the back to provide a generous space at the entrance. The overhang in exposed wood is supported on

debarbed Japanese cypress trunks, which form a V-shaped pattern and an open area in front of the building. The trunks are anchored in the terrace beneath and in the glulam beams that complement the smooth roof surface. The cedar wood used around the large glazed doors has its bark left on, in another combination of design and education.

And as part of their forestry training, the students have been closely involved in the new building, since one of their tasks was to cut down the 100-year-old cypress trees. «

OBJECT Morinos
ARCHITECT Kengo Kuma & associates

w| kkaa.co.jp



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Årgångsvirke från norrländska skogar

Norrlands karga klimat gör att skogen växer långsamt här. Det gör träden senvuxna, finkvistiga och med täta årsringar. Här har generationer av skogsägare vårdat skogen i nästan hundra år innan den förädlas och blir till ett av världens mest ansedda virke.

norratimber.se

norra timber



The light interior contrasts with the concrete floor and a ceiling that is insulated using wool from the farm's sheep.

Warmth of wool

TASMANIA, AUSTRALIA In the heart of farming country on Bruny Island, the traditional farmhouse has been given a new interpretation. The red-brown façade, clad in sheet metal and punctuated by voluminous windows, is a play on the red roofs on the island's older farm buildings. So as not to make an unnecessary impact on important farmland, the building has been carefully situated by a forest glade.

The interior combines small and cosy rooms with open spaces, where the concrete floors contrast with the pale, plywood-clad walls. The ceiling lends a welcoming feel, with the exposed insulation making use of wool from the farm's own sheep. The wool helps to ensure a good indoor climate while visually connecting to the function of the farm. The windows lack both frames and protective eaves, so the changing weather feels close by, even when you are indoors. The building was designed for two families, but with the option of closing off certain parts when they are not in use, to avoid wasteful energy consumption. «

OBJECT Coopworth
ARCHITECT FMD architects
STRUCTURAL ENGINEER Aldanmark consulting engineers

w|fmdarchitects.com.au

Discreet blocks make up resort hotel

FUCHSEGG, AUSTRIA A summer resort with just a Fuchs egg few buildings, fully shut for parts of the year and without any claim to be an actual community. This was the model and the inspiration for the new hotel in Fuchsegg. The architects thought long and hard about how best to integrate a hotel into a relatively outlying and inaccessible landscape. What they eventually drew on were the small, simple summer cottages that combine to form a kind of village, each remaining fully freestanding

while having no fences or streets to separate them.

The hotel was designed as a series of elongated buildings, standing separately from each other but with a unifying look. On the exterior, adjustable screens sit over the windows, regulating the daylight that is admitted. These are integrated into the façades, whose timber is being left to naturally age to the same grey as the roof, while the interiors are dominated by pale, local wood on the walls, with floors in oiled hardwood. Sloping ceilings and wood burners add to the cosy feel and also recall the old farmhouses that provided the template. «

OBJECT Eco lodge hotel
ARCHITECT Ludescher+Lutz architekten
STRUCTURAL ENGINEER Plan drei

w|ludescherlutz.at



Several long buildings combine to form a hotel, inspired by Austrian summer cottages.



Ivan Segato

Community hall for unity

KAKUMA, KENYA As more refugee camps take on permanent status, there needs to be a discussion about what public buildings are required on site and what role they should have. So says the United Nations Human Settlements

OBJECT Community hall
ARCHITECT Petra Gipp
CARPENTER Ivan Segato

Programme (UN-Habitat), which works to promote sustainable development and good living conditions in the world's cities. Thanks to their programme, a refugee camp in the north of Kenya has recently unveiled a new community hall, where women and children in particular can get together.

The building's CLT frame uses wood from the Dalarna region of Sweden, and the project was made possible by the many Swedish stakeholders and organisations that contributed the prefabricated components and had them sent to Kenya. The camp's residents then had to assemble the parts on site to form an A-shaped building, with steps leading up to the smaller upper level. The building sits on concrete plinths and is easy to disassemble if the camp is later decommissioned. «

w|gipparkitektur.se, arvet.se

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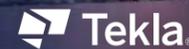


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Det är mer än förändring. Det är framsteg. Ta reda på mer på tekla.com/2021



Fondation Louis Vuitton / Paris, Frankrike. Modellerad i Tekla



The gently curved shape of the roof creates a cohesive unit, aided by the cedar wood in the roof and façade.

Curved shapes connect squares

BRIDGEHAMPTON, USA Long Island in New York is home to sumptuous country houses and spacious gardens just a short hop from the buzz of the city. One of the country houses was built in 1815, and its owners recently wanted to add a new building that would become the family's home, while the older residence would serve as a guest-house. The new building comprises six modules, with the gentle curves of the roof creating a cohesive whole, where the balance between the symmetrical and the asymmetrical creates a dynamic feel. The façades and roofs are clad in acetylated wood, the grey shade of which makes the volumes merge in with their surroundings, while ochre-coloured cedar has been used to clad the walls that surround the inner courtyard and outdoor space.

Each volume has its own function, with communal areas placed next to each other and the private spaces kept more separate. The curve of the roof also forms part of the interior, making the geometry different in every corner, with the white plaster walls, marble worktops and floors of oak and ash setting the tone. « [wj| young-projects.com](http://wj|young-projects.com)

OBJECT Six Square house
ARCHITECT Young projects
STRUCTURAL ENGINEER Silman

Geometry among the greenery

S:T GALLEN, SWITZERLAND Wood has many properties that can prove useful when it comes to ventilation, heat and moisture, as demonstrated in the new pavilion for the botanical gardens in Saint Gallen.

The structure is made of locally grown, soaped spruce, around which wind grapevines and other climbing plants. This wraps the building in a green screen that provides privacy and cooling shade in warmer weather. A custom liner of natural rubber and a thick layer of soil retain rainwater on the roof, from where it is then channelled down to the plants. Inside, tall cupboards divide the open space into multiple parts, including the foyer, event room



The roof structure in soaped spruce helps to regulate warmth and moisture in the botanical garden.

OBJECT Gren pavilion
ARCHITECT Tom Munz
STRUCTURAL ENGINEER Borgogno Eggenberger + partner

and store room. Thin curtains help with the separation and also regulate the light. Along with the concrete

floor, the wooden structure absorbs the warmth of the sun during the day, stores it and at night slowly releases it out into the room. On hot summer days the room-high ventilation shutters are used, combining with the façade greening to help cool the building. « w|tommunz.com



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Walter Unterrainer, Professor of Architecture, Chalmers University of Technology

Is wood a sustainable building material?

GOTHENBURG, SWEDEN Wood is a fantastic building material. Some of the world's most beautiful buildings have been constructed in wood, buildings that are centuries old. From farmhouses to churches to bridges, they highlight the potential lifetime of wooden architecture. The material's fantastic properties, its combination of strength and low weight, and its great thermal performance make it the ideal building material for our time. Most people like the sensory properties – scent, acoustics and aesthetic – of wooden interiors.



All this, and the fact that it is a renewable resource as well as a carbon sink, mean that wood is considered a sustainable building material.

However, the reality is more complex. Although we can find examples of attractive hand-split wooden roof shingles that are over a century old, some wooden buildings may need to be demolished after just seven years due to irreparable structural and building faults. The opposite of sustainable building. For a wooden building to be sustainable, I would say the five following issues must be considered.

1. THE WOOD'S ORIGIN. Was it a sustainable idea to source Siberian larch from Russia for the façades of Bildmuseet and Umeå School of Architecture? To harvest in an environmentally sensitive region with low standards of forest regeneration and then transport the larch to Sweden, a land with 70 percent forest coverage?

2. PLACE OF MANUFACTURE. When logs from Norway are transported to Austria to be converted into CLT elements, which are then transported 4,000 km back to Norway to build a hotel or student accommodation, it is hard to argue that the environmental footprint is low.

3. DRYING. Although wood's embodied energy is generally much lower than for other building materials, we need to discuss energy consumption during the drying process.

4. TREATMENTS. If wood elements are treated with adhesive that is harmful for the environment, synthetic paints or foams, an originally healthy material is soon transformed into toxic components that are also problematic for reuse and recycling.

5. CONSTRUCTION PROCESS. Last but not least – the quality and lifetime of a building are determined by how the wooden building is designed, built, monitored and kept dry during the construction process. This is the responsibility of the architect and the developer.

Advanced construction methods must thus be linked to historical knowledge in order to ensure a satisfactory result regarding lifetime, low maintenance, economics, functionality, aesthetics and a true, rather than just claimed, low environmental footprint for wooden buildings.

This is a chronicle, positions in the text are the writer's own.

SAMMANVÄVD STRUKTUR GER OANAD SPÄNNVIDD

PHOTOGRAPHER

Creatar

OBJECT

Botanical garden

ARCHITECT

Delugan Meissl
associated architects

STRUCTURAL

ENGINEER (TIMBER)

Structure Craft

TAIYUAN, CHINA A former coal mine in the Chinese city of Taiyuan has been transformed into a botanical garden, a place where the locals can come to relax in a green environment and learn more about nature's ecosystems, alongside the researchers there. The entrance building houses a museum and restaurant, but the main attractions are the three biodomes.

From the outside, the park's landmark glass-clad domes have a low-key look. On the inside, each building opens up into a spectacular timber-grid structure, which comprises double-curved glulam

beams arranged in three crossed layers and finished with glazing. The repetitive grid pattern creates a play of shadow that protects the visitors and plants from harsh sunlight. The design is based on a traditional Chinese building tradition that stacks up layers and weaves them together, and is a play on proportions and structure. «

- The largest of the three domes has an unsupported span of over 60 metres, which makes it one of the biggest wooden structures of its kind in the world.
- The decision to incorporate as much wood as possible into the design made it possible to prefabricate most of the buildings. The museum and restaurant also have natural links to the greenhouses.

w|dmaa.at

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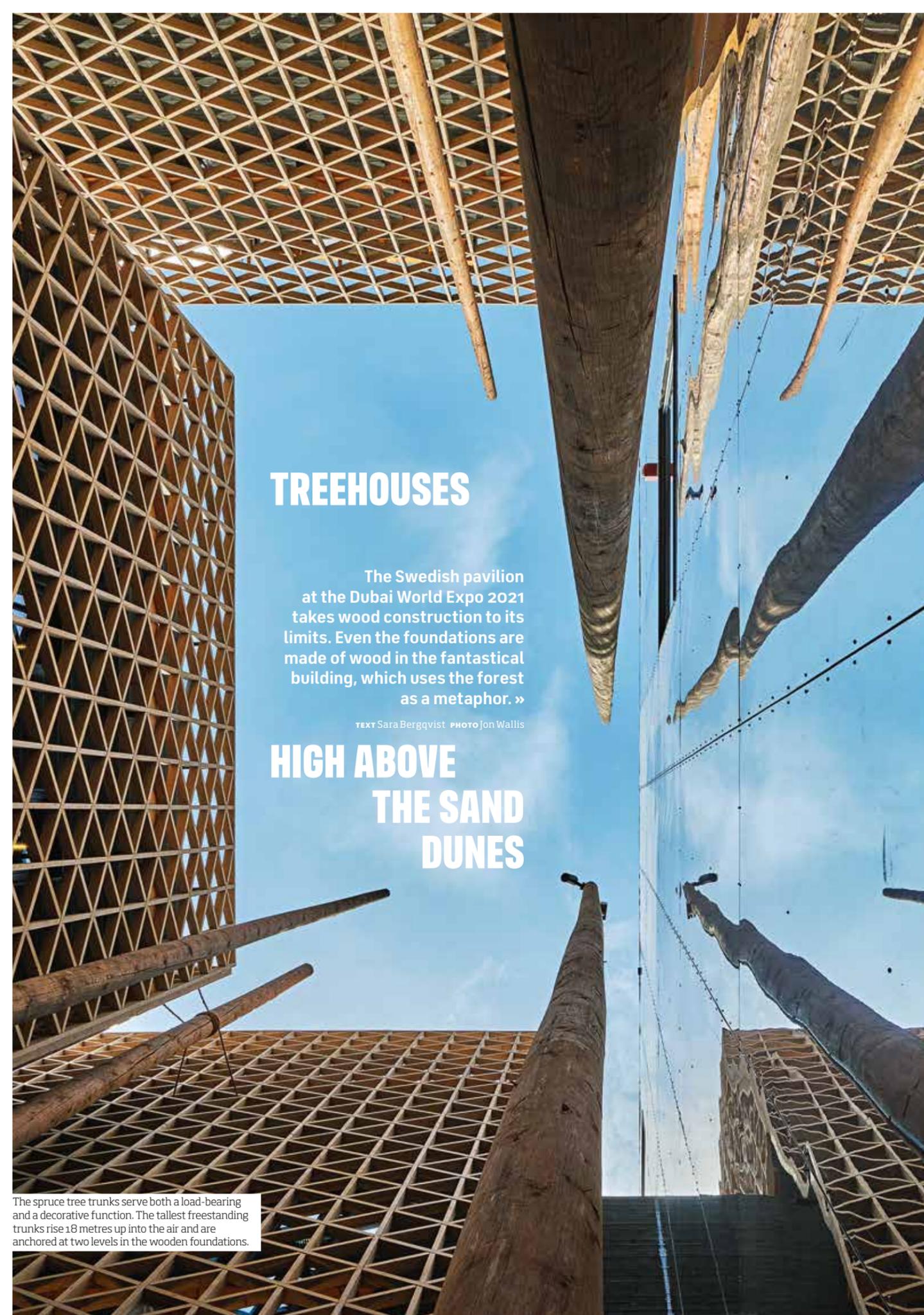
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TREEHOUSES

The Swedish pavilion at the Dubai World Expo 2021 takes wood construction to its limits. Even the foundations are made of wood in the fantastical building, which uses the forest as a metaphor. »

TEXT Sara Bergqvist PHOTO Jon Wallis

HIGH ABOVE THE SAND DUNES

The spruce tree trunks serve both a load-bearing and a decorative function. The tallest freestanding trunks rise 18 metres up into the air and are anchored at two levels in the wooden foundations.



Section.

Entering the Swedish pavilion at Expo 2020 in Dubai, UAE, is like stepping into the Swedish forest. There are no restrictive gates at the entrance. Instead, visitors can wander freely among the 300 tree trunks of various dimensions and heights, making them also a symbol of Sweden's Right to Roam. The tree trunks are not just decorative, but also load-bearing, supporting eight treehouses that include conference rooms and a roof terrace with striking views. In addition, there are two service buildings that begin at ground level and rise up over several floors. Practically everything in the pavilion is made of wood, including the foundations. As well as the tree trunks, the construction material in the building is CLT, supplemented with glulam posts and beams, plus regular timbers, all in spruce.

»The pavilion has attracted a great deal of attention because it is so genuine and has a manifestly sustainable perspective. It demonstrates a consistent acceptance of responsibility, from the extensive use of wood as a building material – including in the insulation, windows and flooring – to sustainable choices for the installations, pipes and ventilation. We wanted to show that you can build without concrete, and so we haven't used any structural concrete at all, not even in the foundations, and no structural steel apart from fixings,« explains Staffan Schartner, head of design for Expo 2020's Swedish Secretariat and the client who ordered the building.

The World Expo hosting the building has a long history. The very first one was held in London 170 years ago, and the initial focus was on industry, technology, culture and spectacular buildings. The Eiffel Tower in Paris, the Atomium in Brussels and the Space Needle in Seattle are just some of the structures that were built for a World Expo. In recent years, the exhibitions, which are held around every five years, have increasingly come to be about trade, exports and sustainability. 192 countries are taking part in this year's Expo, in an area the size of Södermalm in Stockholm. The main themes of Expo 2020 in Dubai are sustainability, mobility and opportunity, with Sweden adopting the sustainability theme of 'co-creation for innovation'.

»The forest is a fantastic metaphor for both sustainability and co-creation, with the whole of nature based on trees and

other organisms working together with each other in an ingenious ecosystem. The forest is also an architectural inspiration, with its vertical elements and light that filters through the trunks and tree canopy. In addition, the forest is a source of sustainable building material and a meditative environment for people to wander around in, something that we perhaps need now more than ever. All this laid the foundation of our concept, which we call 'The Forest',« says Alessandro Ripellino, lead architect at Alessandro Ripellino Arkitekter, who created the building in an international collaboration with the French firm Studio Adrien Gardère and the Italian firm Pardo Architetti.

While the building has drawn inspiration from the Swedish forest, it has also had to be adapted to the climate and

other conditions on site. The structure has been earthquake-proofed, designed to stand up to fierce sandstorms and partially surface treated with borate to prevent termite attacks. However, the local climate has also presented opportunities. For example, at an early stage and following the client's brief, it was decided that even the foundations could be made of wood and that all the roofs could be completely flat.

»In terms of its structure, you could compare the building to a wooden sailing ship. The wooden foundations are like the hull, the trees are the masts of a full-rigged ship and the treehouses are the sails,« suggests Eric Borgström, coordinator and lead structural engineer at Bjerking.

To get the tree trunks to stand up independently like flagpoles, two anchor points were needed, one upper and one

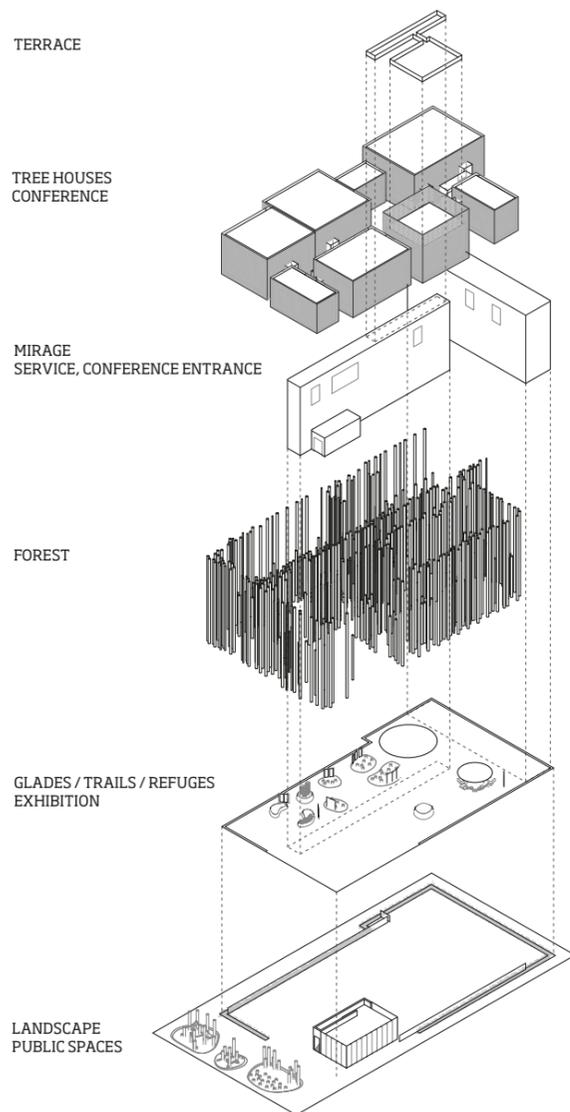
lower, so the foundations are shaped like a wooden box below ground level. The outer walls facing the sand are made of CLT, which has been stiffened up with transverse walls of CLT in two directions to handle horizontal loads from the sand, strong winds and earthquake forces.

»The structure is designed for the earthquake zone that applies to Dubai, but using an American standard based on the requirements of the local authorities. The specifications are robust and we have very much erred on the side of caution with regard to earthquakes and storms,« says Eric Borgström.

The base plate at sand level and the floor system beneath the paving are also made from CLT. Between them is a gap that ranges between 1.5 and 2 metres for drainage purposes.»



The Swedish pavilion 'The Forest' at Expo 2020 in Dubai is meant to reflect the Swedish forest, which is open and accessible, drawing visitors up into the treehouses.



Architect **Alessandro Ripellino**

» **A MEDITATIVE ENVIRONMENT FOR US TO WANDER AROUND IN.** «

» We also have a system of glulam posts and beams in the foundations with various structural functions,« adds Eric Borgström.

The holes in the upper plate are tailored to the dimensions of the trees, whose base diameters vary from around 200 to 400 millimetres. The trees continue all the way down to the base plate, with the load-bearing trees also resting on a square slab of CLT to further spread the load.

The initial idea was to place the wooden box directly in the sand, then in a compromise with the local authorities, a layer of bitumen bonded foam glass insulation was laid between the sand and the CLT's waterproof membrane to even out the pressure.

» Since we didn't want to bond the waterproof membrane directly to the CLT, we've placed a sacrificial layer of thin plywood in between. The entire pavilion is designed to be able to come down and be erected again or recycled, so this way we don't do any damage to the CLT,« says Staffan Schartner.

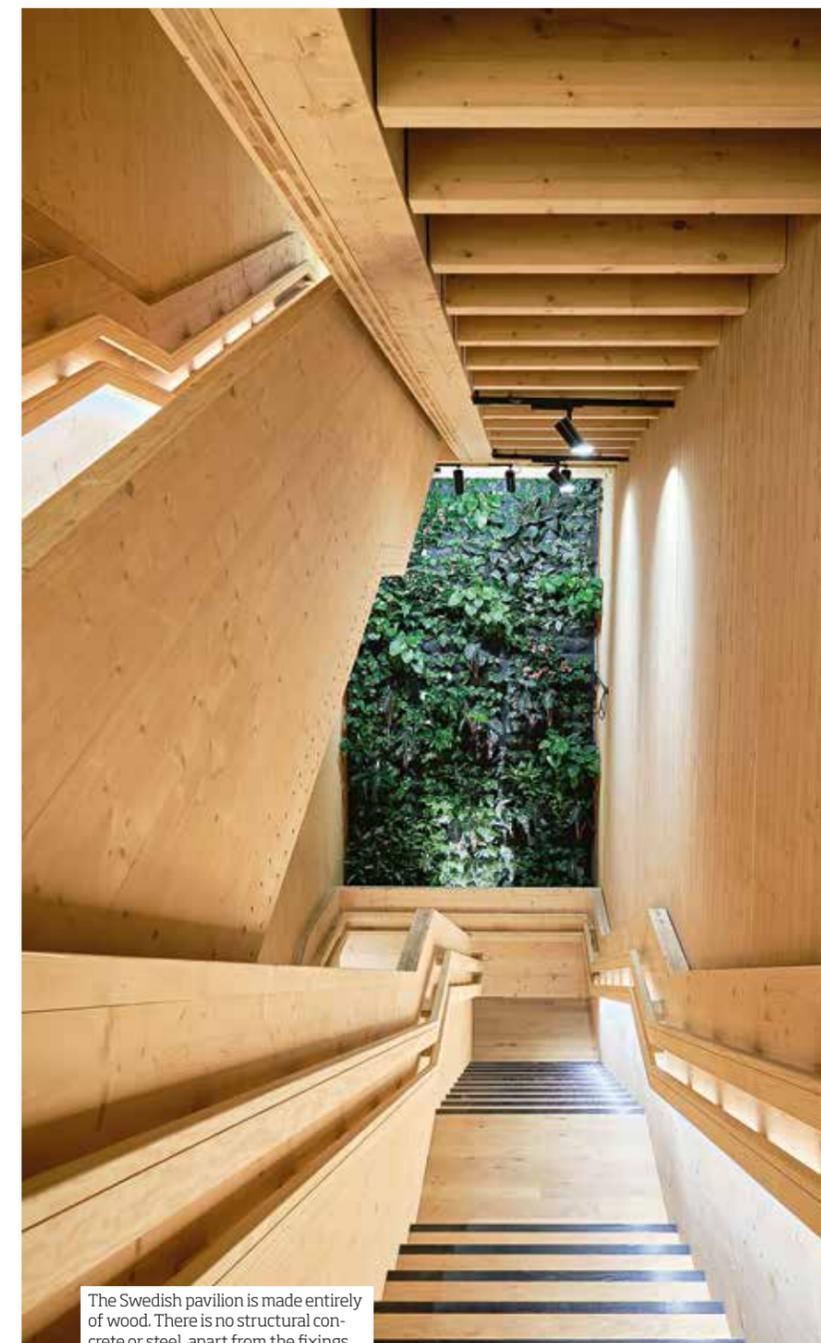
The 44 load-bearing trees rise nine or ten metres above the ground, supporting solid glulam beams on which the treehouses rest. The treehouses themselves have CLT in the walls, flooring and roof. The larger volumes use double-tee beams made of glulam and CLT that work with the floor and roof to bridge the long spans. The double-tee beams are also repeated as aesthetic elements in the service buildings and in the café and shop at ground level.

» Both service buildings have CLT walls, floors and roofs, and they provide the main stabilising system, in concert with the foundations. If there had been no risk of strong winds or earthquakes, the treehouses could have been left freestanding on the tree trunks. But to handle such loads, the volumes are connected to the service buildings and to each other at different levels via bridges. In addition, we've used glulam braces, both to channel loads horizontally and to combat the problem of twisting,« states Eric Borgström.

The pavilion also has another characteristic wooden feature. While the back wall at ground level is a mirrored surface that reflects the trees and enhances the forest feel, the



The façade is clad with a grid of timbers from the Swedish forest, inspired by the Arabic pattern of mashrabiya screens, uniting the two cultures.



The Swedish pavilion is made entirely of wood. There is no structural concrete or steel, apart from the fixings.

treehouses are instead clad in a grid of timbers that echoes the latticework of Arabic mashrabiya.

» Creating the pattern in wood establishes an architectural connection between the Swedish forest and the artistry of Arabic buildings, linking the two cultures together,« says Alessandro Ripellino.

The project has thrown up a number of challenges along the way. The already tight schedule was put under even more pressure because wood construction is uncommon in Dubai, and so it took an extra long time for the local authorities to approve first the concept and then the final design.

» Before we reached the final design, we had to submit 21 batches of drawings, descriptions and other reports, which were examined by various officials. The level of oversight here comes as a real shock to Swedish consultants who are not used to it,« says Staffan Schartner.

The extensive local rules also meant that the consultancy costs were four times higher than planned, and the cost of associated measures also increased. Another challenge was

Swedish pavilion, Expo 2020

DUBAI, UNITED ARAB EMIRATES

ARCHITECT Alessandro Ripellino arkitekten in collaboration with French firm Studio Adrien Gardère and Italy's Pardo Architetti.

CLIENT Committee for Sweden's participation in Expo 2020.

CONSULTANTS Omniplan.

STRUCTURAL ENGINEERS Bjerking.

AREA 3,000 sqm.

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that all the materials had to be adapted for shipping from Europe to Dubai.

The CLT elements thus needed to be made narrower than usual to fit into the containers they would be transported in. The remaining challenge now is about what happens to the pavilion once the Expo finishes in March 2022.

» It's a truly magical feeling to be able to wander around this forest. The hope is that it can be rebuilt somewhere else and continue to be used in some form,« concludes Staffan Schartner. ☺



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New silhouette lifts the city

Skellefteå city centre is now dominated by Sara Kulturhus, with its simple, restrained tower. Behind its wood façade, the building is flexibly designed to accommodate a wide range of activities, while also embracing sustainability in all its forms. »

TEXT Katarina Brandt PHOTO David Valldeby

The 20-storey arts centre in Skellefteå has now been officially opened. Behind the façade, a range of activities take place in flexible spaces that can be adapted to future needs.

Sara Kulturhus opened on 8 September 2021. At a height of 75 metres, it stands as one of the world's tallest wooden buildings, and as a testament to the close collaboration between several local stakeholders. The arts centre occupies a whole block between Möjligheternas Torg and what will be the city's new travel hub. But what makes the centre unique is not only the height and scope of the project, but also the way it has managed to gather so many different activities and uses under one roof. Now the City Library, Museum Anna Nordlander, Skellefteå Konsthall and Västerbottensteatern are ready to welcome their audiences and visitors. The building also houses the Wood Hotel, which has 205 rooms, three restaurants, a spa, gym and conference facilities.

Maria Ekberg Brännström is CEO of Sara Kulturhus and has been one of the driving forces in realising the vision for Skellefteå's new landmark. According to Maria, the building embraces sustainability on several fronts – not just because it is made of wood throughout, but also because of how the different parts of the building can be used in so many ways.

»This really is a building of possibilities. The stages can be transformed to suit different activities, and the other spaces can be integrated with and separated from each other for the greatest possible flexibility.«

It was in June 2015 that the City Council in Skellefteå decided to build a new arts centre. An open architectural competition was launched in November of that year, attracting 55 entries. White Arkitekter won with their design 'Side by Side'. The project has required a number of innovative solutions to handle the spans, flexibility, acoustics and the overall technical challenge that comes with building one of the world's tallest wooden structures. The solutions have included two separate construction systems, one for the arts centre and one for the hotel.

The lower section of the building, which houses the arts centre, comprises a prefabricated structural frame in CLT and glulam. The diversity of the activities and providers is reflected in the architecture, with the building given different volumes that are adapted in shape and size for the various activities. At the same time, Sara Kulturhus has been designed with flexibility in mind, so the spaces can easily be reconfigured to accommodate different uses and future needs.

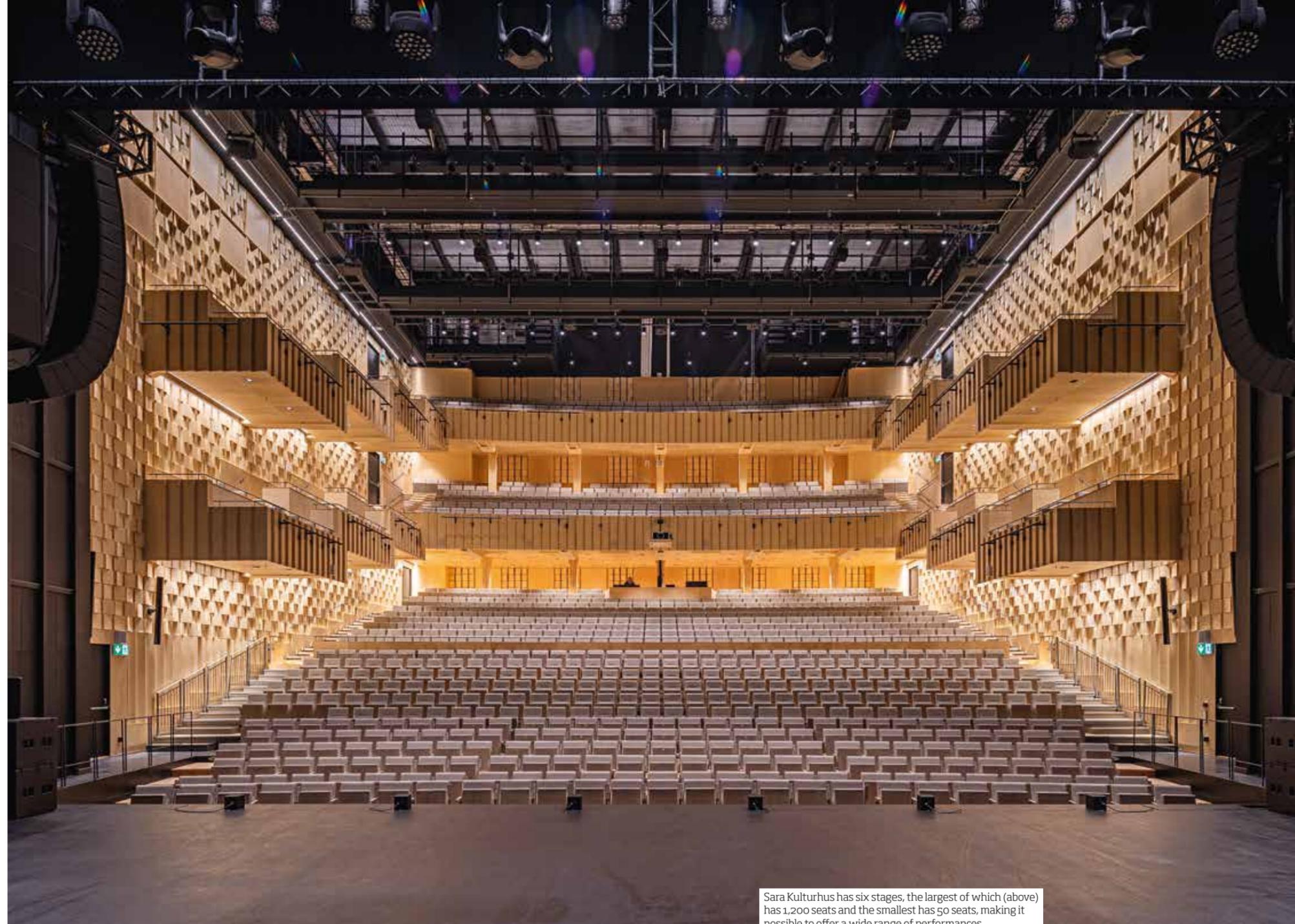
»The building has been tailor-made for the operations that have now moved in. But at the same time, it has a generality that opens up all sorts of other opportunities. The large stages are placed in a row at the heart of the building. Around them, we have then worked with the various operations that face out onto the street, creating a more vibrant streetlife. The aim has been to give the building engaging fronts rather than off-putting rear faces,« explains Robert Schmitz, who joins Oskar Norelius as the lead architects for the project at White.

The arts centre's large, open foyer to the south is a huge space that, despite its size, feels warm, comforting and

inviting. The large glulam posts and the ceiling's stylish supporting structure in wood and steel hold up not just the roof, but also the 20-storey hotel section.

»The foyer is designed as a sequence of rooms from which you can reach all the facilities. The roof trusses enable spans of over 20 metres and are an example of material optimisation, where wooden braces take the compression and the steel ties take the tension. This architectural feature is an important factor in defining the space. The dimensions of the braces match their function and the scale of the room,« continues Robert Schmitz.

The foyer leads to the arts centre's stages and exhibition spaces. Having all the stages and the foyer on the same level allows for large, connected events. The impressive multi-use staircase leads down to the main entrance and the City Library, forming a kind of internal path connecting the foyer with the north entrance. Gathered along the east wing, the



Sara Kulturhus has six stages, the largest of which (above) has 1,200 seats and the smallest has 50 seats, making it possible to offer a wide range of performances.

Västerbottensteatern's Chief Executive Director **Francesca Quartey**

» **I WANT TO TOUCH THE WALLS AND ENJOY THE SCENT OF WOOD.** «

building's administrative offices are connected via a three-storey corridor that enables the cultural workers to meet behind the scenes.

The county theatre Västerbottensteatern has waited a long time to move into Sara Kulturhus. The autumn saw a flurry of premières, with the curtain going up on attractions such as the world première of *The March of the Musicians*, plus *The Storytelling Festival* and a packed programme of guest performers, artistic talks and other events. »



» This building is like a church in the middle of the village or, as writer Sara Lidman put it, the village at the centre of the world. Although the centre is large and flexible, it has to be said that combining productive art and organised events poses certain challenges. To make it work, we need to establish good communication channels and show respect for each other's special character,« says Fransesca Quartey, who has headed Västerbottensteatern since 2013, when she was tasked with leading its move into Sara Kulturhus.

In all, Sara Kulturhus has six stages of varying sizes, from the largest stage with a ceiling height of 15,5 metres and an audience capacity of up to 1,200 seated guests, to the smaller lecture theatre with its 50 seats. Stage 1 is the largest and meets the Swedish National Touring Theatre's red standard. It is designed for a broad programme of events, including theatre, musicals and congresses. The stage can be separated off from the auditorium, and the front rows of seats can be lowered into the basement or into a wall for a more flexible space. There is also an orchestra pit where the entire seated orchestra can be raised or lowered.

Stage 2 is what the industry calls a black box theatre, with audience capacity of 292, and it is here that many of Västerbottensteatern's larger productions will be staged. The black box theatre is a modern, more flexible interpretation of the performance space, often painted black and with no fixed furniture. At Sara Kulturhus, the walls are painted in a dark petrol green that is reminiscent of ancient forests. When you move away from the traditional, fixed division between stage and audience seating, the performance space can be varied from one production to the next. The other stages have a capacity of between 50 and 100, making them ideal for

Sara kulturhus SKELLEFTEÅ, SWEDEN

ARCHITECT White.
CLIENT Skellefteå Municipality.
STRUCTURAL ENGINEERS Florian Kosche
(competition entry), TK Botnia.
AREA Approx. 30,000 sqm.
white.se, sarakulturhus.se

storytelling events, performances for children and schools, music and talks.

» We've been talking about the building for a long time. Now we have to look inwards to get to know it and use it to its full capacity. I'm a tactile person, and I can feel what a positive effect coming into this building has on me. I want to touch the walls, with their appealing lightness, and I enjoy the scent of wood. It feels warm and comforting, which bodes well for the journey we'll be taking together with our audiences and the centre's visitors,« says Fransesca Quartey.

White worked with Brekke & Strand as specialists in acoustics in wooden buildings. This led to solutions that combine highly effective sound insulation between the arts centre and the hotel with the right acoustics in the auditoriums. A prime example of this is the walls in the largest auditorium, which are clad in solid blocks of spruce with a triangular cross-section, made by the Spanish company Frapont. The wooden blocks have been arranged in a 3D parametric morphology that contributes to good room acoustics by reflecting the sound in every direction.

» To counter the wind loads, in static terms the tall hotel section has to be supported against the underlying art centre, which has brought considerable challenges for sound insulation. We worked on this in close collaboration with the structural engineers at TK Botnia, who developed steel connectors that are fixed between the wooden elements. The same is true for the hotel modules, which are joined together using steel screws and have been fitted with a sound damping intermediate layer,« says Kjell Nordmark, senior acoustician at Brekke & Strand.

The walls between the auditoriums are split into three sections, joined by an acoustic seal that runs from the basement to the roof. The outer part of the wall stands on a concrete slab and the inner part rests on posts, thus separating the load-bearing functions. This makes sure that the activities do not affect each other acoustically, meaning that a rock concert and a poetry reading can take place side-by-side.

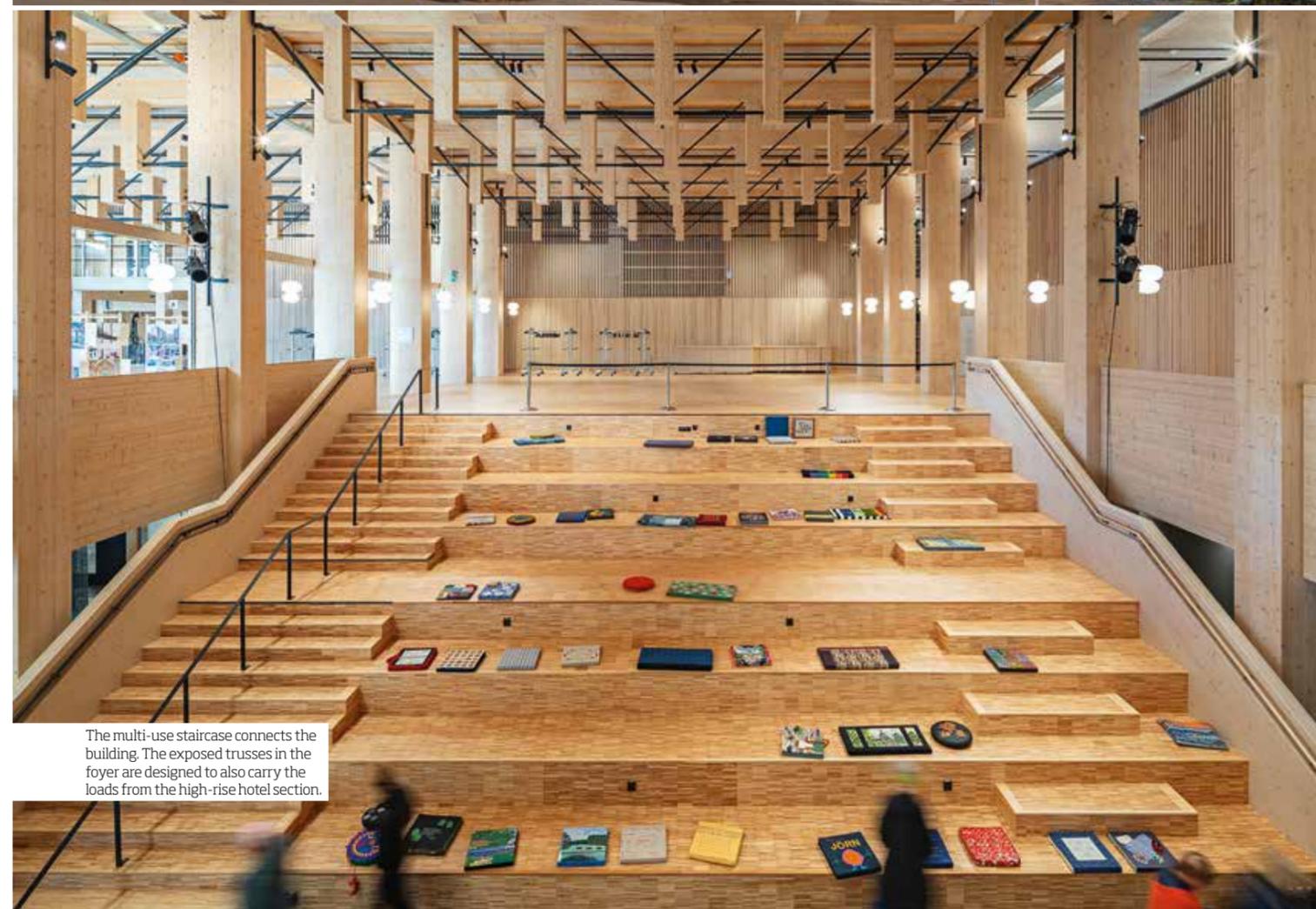
David Åberg was quick to accept the job of managing The Wood Hotel. He sees it as a dream project and looks forward to creating inspiring experiences for the hotel's guests, with the building itself playing an important role in that. »



Inside the Miss Voon restaurant, where the red wooden poles contrast with the exposed wood.



Instead of one main entrance, Sara Kulturhus has several entrances on different sides. The lower part of the building houses the smaller stages.



The multi-use staircase connects the building. The exposed trusses in the foyer are designed to also carry the loads from the high-rise hotel section.

»Our aim is to offer our guests one of the world's most sustainable hotel experiences, and naturally the material is a key factor, affecting both the quality of the accommodation and how a stay leaves our guests feeling. Personally, I find a different kind of calm in our 205 hotel rooms that are made entirely in wood. They provide a warm embrace and superb acoustics.«

It was decided early on in the project that 13 of the 20 storeys in the hotel section would be built from prefabricated 3D modules in CLT, produced at Derome's housing factory in Renholmen, just outside Skellefteå.

»The hotel has become a signature feature of the arts centre, due to its location in the high-rise tower. Here, we've turned the building inside out and opted to highlight what others choose to hide, which in this case is 75 metres of 400-millimetre thick CLT sheets,« says Robert Schmitz.

The material for the modules was taken from forests in

CEO **Maria Ekberg Brännström**

»SARA KULTURHUS IS NEITHER NEEDY OR COY.«

the region and processed by Martinsons in nearby Bygdsiljum, before being transported to Derome for assembly. The rooms were then delivered to the construction site almost fully complete, with a bathroom, windows, ventilation, electricity and the plumbing for sprinklers. They were then stacked on top of each other between two lift shafts, also made of CLT.

»With the project's schedule so tight, the industrial approach, with more time in the factory and less time on the construction site, has brought major benefits. The big challenge was to get traditional builders and external project planners on board. They needed to get up to speed on modular construction and find solutions that allowed as much as possible to be prefabricated off-site,« comments Per-Olof Landstedt, business planner at Derome.

Level 19 of The Wood Hotel is the location of the Miss Voon restaurant, with its panoramic views and sky bar. Seating around 70 diners, the restaurant combines the flavours of Asian cuisine with the fundamentals of Scandinavian cooking. The interior, which also draws on Asian and Scandinavian influences, was designed by architect Thomas Sandell, who grew up in Skellefteå. With his stamp on it, the hotel hopes to make Miss Voon a destination in itself.

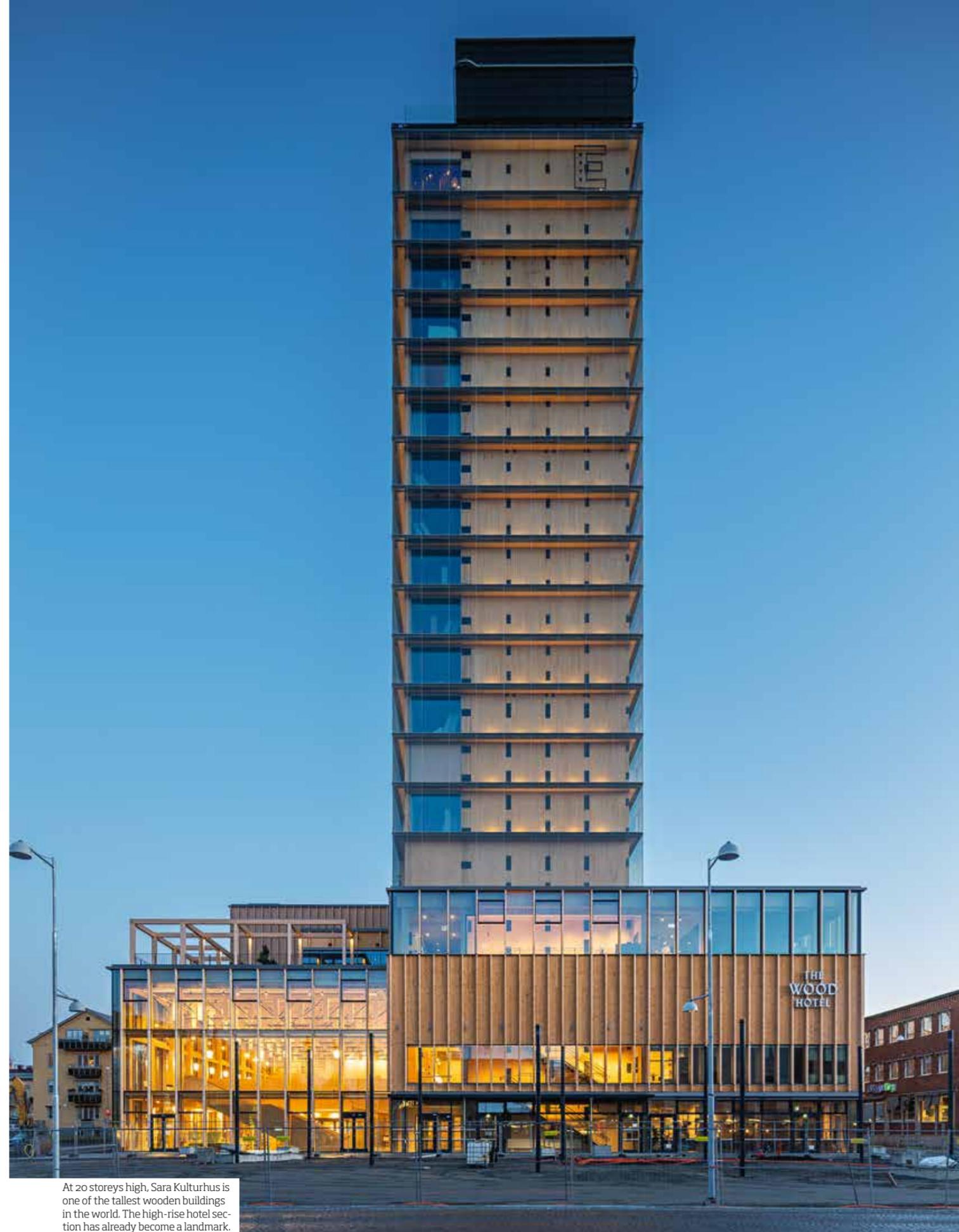
»The interior design follows the concept we worked on when setting up previous Miss Voon restaurants in Stockholm and Uppsala, with Chinese red wooden poles used as a recurring feature. The red brings a warm and inviting atmosphere and serves as a contrast with all the wood. It also works really well in both daylight and evening light, something we had to pay extra attention to in Skellefteå, where it is dark for one half of the year and light for the other half,« says Thomas.

In her role as CEO of Sara Kulturhus, Maria Ekberg Brännström has primarily chosen to create a place where everyone feels at home and can find something to like and discover, whatever their interests.

»Although the building is neither needy or coy, it has attracted a great deal of attention, not least from international journalists. Performers also love Sara Kulturhus and are happy to travel further north just so they can perform on one of our stages.«



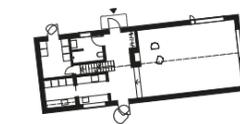
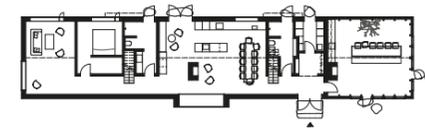
The main stage has walls clad in acoustic wooden blocks positioned according to a parametric morphology.



At 20 storeys high, Sara Kulturhus is one of the tallest wooden buildings in the world. The high-rise hotel section has already become a landmark.



The new farm buildings have a contemporary shape and function, while still reflecting tradition.



SHELTERED FARMHOUSE WITH AN OPEN VOLUME, A DISCREET ENTRANCE AND AN BOARDED ROOF INVITES THE HALLAND FOREST IN

TEXT Marit Engstedt PHOTO Petra Gipp Studio

In a space where the forest opens up in Rörbäck, east of Varberg, two newly built, elongated buildings combine with three older structures to create a farm setting. Both the farmhouse and the barn follow in the footsteps of unsalvageable old buildings. With the exception of the concrete slab, the new buildings are made entirely using a combination of Swedish pine and spruce that has been left untreated in order to age gracefully over time and gain a grey patina. Opposite stands an old stone building, which now has a new thatched roof.

»The buildings on this site are subordinate to the forest, and they are built of the same material. The old stone building against the new ones in wood is a great combination,« says architect Petra Gipp, whose studio was commissioned to design the two new buildings that couple Anna and Caspar Sandgren rent out for social gatherings and holidays.

Ten years ago, the Sandgrens bought some extra land to add to their forest holding, and that came with a farm, Rörbäck, which had been abandoned for a couple of decades. The main building was on the brink of collapse and could not be saved, but they wanted to preserve the existing farm setting.

»These Halland farm buildings with a pitched roof are protected, so you can't

change them even if you wanted to. Our idea was to insert the new buildings into the old cultural tradition – it felt both fun and appropriate. So we stuck with the basic principle of the long house with living accommodation at one end, and the stables at the other end, with a pitched roof of course,« says Petra Gipp.

In this case the stables were replaced with a winter garden that has full-height windows and self-opening skylights. The exterior and roof of the new buildings are clad in untreated Gotland pine and the interiors are lined with a custom range of Swedish spruce. Everything is built using timber framing.

The buildings stand on the site of an old Halland farm, and there was an interest in retaining the original layout, but the architects wanted to update it.

»We were keen to create a contemporary look by pulling together the design. Not having any projecting eaves creates a more coherent form and volume, resulting in a modern take on the traditional building,« says Petra.

The roof is an exciting structure – untreated wood in a board-on-board configuration running vertically with the pitch of the roof. At the bottom sits an internal gutter that extends beyond the gables. There are no downpipes or hanging gutters. The internal gutter drains rainwater away via a number of »

» spouts along the side that are held in place by forged stays attached to the façade.

“There used to be a problem with wooden roofs and damp, and you had to lay sheet metal underneath. But with this traditional boarded roof system, the boards are arranged so that the water runs off rather than pooling and damaging the wood,” says Petra Gipp.

Mattias Andersson, the chief carpenter and main contractor, is an experienced woodworker. He explains that every material has its downsides, and for wood it is the risk of rot if you build things incorrectly, so he was keen to give the roof extra protection.

»I haven't worked on a boarded roof before. We put down proper roofing felt, which was welded at the joints to ensure that water couldn't get into the structure. The boarded roof was then laid on top using extra big battens and counter battens to get as much air underneath and so that the water could drain away if it did get under the boards,« he says.

The architecture of the long farmhouse gives no indication of what awaits inside. At ground level, you move along a wall that is closed and wood panelled – except for a projecting bay window. Coming through the main door, the building opens out in both directions, with the orangery to the right and the actual living area to the left. First comes an open kitchen, then a passage that takes you along the whole façade, with rooms leading off. At the far end, there is a living room with large windows.

Arkitekt **Petra Gipp**

» YOU CAN CURL UP IN THE KITCHEN'S BAY WINDOW AND BE IN A SPACE BETWEEN OUTSIDE AND IN. «

»The length of the house ends at the courtyard and opens up towards the forest, because that's where most of the windows are. But it's great to have the kitchen section with its bay jutting out onto the courtyard. You can curl up there and be in an intermediate space between outside and in. Plus it has contact with the little stone outhouse and the barn,« says Petra Gipp.

The large windows in heartwood pine are positioned so they connect with the forest. The inner spaces have a relationship and interact with the outer spaces. The forest outside is 'forced into' the rooms, as Petra Gipp puts it. The volume of the rooms is also impressive, and because the walls and ceilings are lined with untreated wood cladding, there is nothing to stop the eye, giving a huge sense of space.

»The height inside is like experiencing the volume of the forest,« she adds.

As well as the architecture, the interior was also designed and chosen specifically for Rörbäck.

Client Anna Sandgren is an interior architect, and has been closely involved in the

Rörbäck Forest Retreat

RÖRBÄCK, SWEDEN

ARCHITECT Petra Gipp studio - Petra Gipp, Emil Bäckström and Jonas Hesse.

CLIENT Anna and Caspar Sandgren.

INTERIOR DESIGN Anna Sandgren, Våra rum.

STRUCTURAL ENGINEER Ingvar Ekholm, Paragon.

MAIN CONTRACTOR Mattias Andersson, Designwork.

WI gipparkitektur.se

whole project. After much research, she sourced the exterior cladding from Gotland. The island's wood is high-density and has high levels of resin acids which combat rot. It is important to use heartwood pine, otherwise spruce should be used. Anna also took care of the interiors herself, designing the kitchens, bathrooms, all the fixtures and fittings, the lighting and the furniture. Husband Caspar contributed too:

»We felt it was only natural for the buildings to be made entirely of wood. We run our own certified forestry operation, which I work on full-time. We also reused the foundation stones from the old buildings for outside steps, retaining walls and stepping stones in the garden. It feels great to have the old now conversing with the new,« says Caspar Sandgren.

The buildings sit on a cast concrete slab. Indoors, the concrete has been polished and soaped and runs throughout the ground floor.

»Concrete is best for foundations, as well as creating a wonderfully distinct contrast where the wood and concrete meet,« says Petra Gipp.

Generally, she enjoys working with a single, prominent material in the projects that the practice takes on – in this case wood from floor to roof.

»It's like carving a space from a block of wood. You sculpt the building. Wood enables you to work on a spatial and sculptural level, playing with details, different woods and treatments, while still keeping to the same material.« ©



The boarded roof has no drainpipes or hanging gutters. Instead, the water is carried away by a V-shaped internal gutter.



The interior cladding is planed and has a silky smooth lustre. All the material was chosen for its ability to age beautifully.

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Sara Kulturhus, Skellefteå
Foto: Martinssons

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Eras meet in barn conversion

Combining the traditions of artisan building with new production creates a meeting between designs and techniques from different times. This farm in Switzerland is an example of how to erase the boundary between old and new.

TEXT Stina Hagelqvist PHOTO Ruedi Walti

Architectural historian Nikolaus Pevsner defined architecture with the familiar words: »A bicycle shed is a building. Lincoln Cathedral is a piece of architecture. Nearly everything that encloses space on a scale sufficient for a human being to move in is a building; the term architecture applies only to buildings designed with a view to aesthetic appeal.« The quotation comes from An Outline of European Architecture, published in 1943.

It is not just the distinction between the ill-considered and the consciously designed that Pevsner points out. He also highlights modernism's tendency to categorise and contrast concepts such as wood – stone, rural – urban, old – new, folksy – professional and not least artisanal craft – modern technology, represented in the quotation by the ashlar masonry technique that is so associated with the construction of medieval cathedrals.

Developers in Switzerland have shown that sheds and barns certainly can be architecture, and that the meeting between specific categories can create something new, sustainable and high-quality. The 18th-century farm presented here sits on the Buechberg hillside in the hamlet of Tobler in St. Gallen and is listed for its heritage value. Kit Architects from Zurich have updated the traditional design and combined conservation with new production.

As was common locally, the farmhouse was attached to both the barn and shed, like many farms at the southern and northern tips of the continent. And like our traditional buildings, locally available materials were used and combined with the appropriate construction techniques for those materials. While the logbuilt farmhouse was well preserved, both the barn and the shed had extensive moisture and subsidence damage. Instead of using every means possible to try to preserve any original material and original structures, the dilapidated sections were demolished. The barn and the shed have, however, been reinstated in a more modern guise, with clear references to the local vernacular through the façade material and design. Older parts were renovated using traditional methods.

The Swiss farm now comprises two residences, one of which uses the spatial qualities of the barn, with the new volume forming an airy living room in the extension to the older accommodation. The new shed stands in its original location, at the back of the



farmhouse, connected once again, but with a new function and its own entrance on the lower ground floor. The surrounding nature and panoramic views are brought in through large windows. The light is filtered through vertical ribbed screens that slide across the opening like large barn doors – an updated take on the old farmhouse shutters.

The almost abstract boarded façade stands in contrast to the materiality of the horizontal logs, while at the same time vertical planks are the signature feature of the outbuildings. The boundary between old and new is very distinct, and yet not, with form, volume, material and technique building on what came before.

Pevsner's definition of architecture is neither classic or timeless, but of its time and rather outmoded, as we find aesthetic pleasure in seeing bike sheds, barns or other buildings that are neither consciously formed or architect-designed. Today, we know that these supposed extremes can successfully be combined. In actual fact, many of the simple wooden buildings constructed using traditional techniques are sources of inspiration, since they offer solutions and levels of flexibility that are well suited to modern needs and have already proven their worth over the centuries. Why reinvent the wheel, when the old one is still rolling along? ☺

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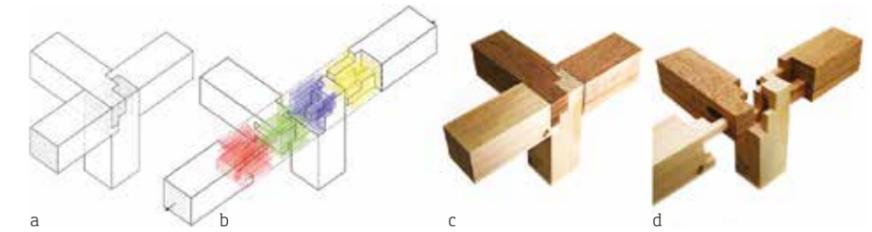
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» THE IDEA IS THAT ANYONE SHOULD BE ABLE TO DESIGN A WOOD JOINT. «

In her latest research project, Tsugite, Maria Larsson is exploring how wood joints can be designed with the help of a user-friendly digital interface. Having studied at the School of Architecture at KTH Royal Institute of Technology in Stockholm, her interest in wood construction and craftsmanship has taken her to Japan and the University of Tokyo, where she is exploring architectural opportunities within the subject of computer graphics.

TEXT David Valldeby PHOTO Privat

Did you turn to research as soon as you graduated?

I first worked at a Japanese architectural practice with a focus on digital design, but then I tired of just doing things digitally. I wanted to be a regular architect. My husband and I moved to Switzerland, and there I joined a practice that had more of an analogue focus. They built 1:25 scale models of everything and drew an awful lot by hand. While I was there, I worked on a wooden building of 30,000 sqm for a campus in Biel, but that project is currently on hold.

How did you get involved with wood?

I became interested in wood early on, because of its sustainability. That was also what sparked my interest in Japan – they have their own long tradition of crafting wooden buildings. However, it's not easy to study the craft, as it's just something that is embedded in the culture. I like that it's so aware of the aesthetic and the materials, combining sustainability and design.

All your projects seem to be linked to architecture

I find it interesting to combine architecture and computer graphics. There are things I want to do in the field of architecture, and computer graphics offers many different technologies that I can use to realise them.

Your projects are very educational in nature

As part of publishing something in a journal or at a conference, we create a video for the project. In the case of the Tsugite project, there was a conference on user interfaces that was held online during the pandemic. Instead of travelling there and giving a presentation, I got to record everything in advance. It has since had over 20,000 views on YouTube, which is a much bigger audience than a presentation at a conference would have achieved.

Looking at your research, it is very digital, but with a strong connection to the analogue world

It's fascinating how the digital relates to the physical, and what happens when you go back and forth between the states. My fellow researchers tend to be interested in anime and computer games, but I wanted something more anchored in reality. I love the fact that in Tsugite we designed the joints on the computer, cut them out with a CNC machine and saw them physically work.

In a previous project, Human-in-the-loop, you worked structurally and architecturally with tree branches

With a small group of people, I can conduct shorter experiments with slightly higher risk. It might work, it might not,

so I restrict myself to a small scale, but I always have architecture in mind.

Tell us more about Tsugite, where you are working on the different parameters that govern joints

The idea of the program is that almost anyone should be able to design a wood joint, and the program creates the right restrictions and gives feedback. It means that we can digitalise and democratise the process, compared with what craftspeople do. There are plenty of traditional joints, and I wanted to empirically test whether they really are good for their areas of use, and whether a simulation will bring us to the same designs. Tsugite is just the initial launch pad for this. My joints are not better than those rooted in a thousand-year-old tradition, but it is an interesting field to explore.

The mathematics behind it all is super simple, it's just ones and zeros, for example either it is a cube or it isn't. We've simplified things so the calculations are fast. You don't want the computer to stop and think for three minutes – you want to immediately see the outcome of what you've done. Friction and contact surface are quite easy to work out.

Are any strength calculations involved?

No, not really, but we follow basic physical and geometric criteria. I consulted a professor of structural engineering, Jun Sato. He works with the likes of Kengo Kuma and has made many experimental wooden structures. They don't do any computer simulations of the joints, instead using physical models to test whether they really hold up. FEM modelling (finite element method) for large contact surfaces doesn't produce reliable results.

I now have one and a half years left to complete my doctoral thesis, and I'm going to start analysing the patterns of wood in order to optimise the use of the grain and be able to adapt the form of the joint, which is my particular interest, according to what the wooden component actually looks like. Using current technology, I can analyse the surface with a laser or a CT scanner and try to reconstruct where, for example, specific knots are located. I'm working a little with Luleå University of Technology on this. Using an approximated computer model, I will be trying to guess the inside of the wood based on what can be seen on the outside. It will be interesting to see whether you can get stronger joints by adapting the wood joint to the grain.

Would you like to see this on a larger scale?

That's the main driver, to be able to create nodes for large buildings that are kept exposed. And to make the whole building wood, so it can be renovated and reused.®

w|ma-la.com (more about Maria Larsson's research)

Det nya normala.

När Holmen förvärvade Martinsons var det ett litet men värdefullt steg närmare en hållbar framtid, med positiva effekter för både oss som företag och vår omvärld. Tillsammans är Holmen och Martinsons cirkulära och bildar en stark, långsiktig värdekedja. Den inkluderar allt från framtidssmart förvaltning och förädling av skogen, till utveckling av nytänkande byggsystem i trä som säkrar levnadsmiljöerna för kommande generationer. Ett bra exempel på våra lösningar i mötet mellan natur och teknik är Sara kulturhus i Skellefteå, med 20 våningar i trä från regionens skogar. Det är ett av många bevis för att vi kan bygga en hållbar framtid med naturen som grund och att trä som materialval är det nya normala.

 **martinsons**
En del av Holmen

SARA KULTURHUS I SKELLEFTEÅ

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Innovative designs shape creative environment

The exposed wood and the statement design promote public interest in research and materials in Rotorua, New Zealand.

TEXT Johanna Lundeberg FOTO Patrick Reynolds

People are flocking to the new headquarters of the Scion timber research institute, located in Rotorua on New Zealand's North Island. Here, the triple-height atrium draws them into the building, where a cavalcade of exposed wood awaits. Since the building opened its doors to the public at the start of the year, it has attracted many thousands of visitors.

»The building has become a must-see destination for not just the public, but also civil servants and industry leaders. It's a showcase for what can be achieved using wood products and has encouraged lots more people to consider using wood in their newbuild projects,« says Douglas Gaunt, a research engineer at Scion.

The Crown research institute conducts research and technology development focusing on wood and other bio-based materials, and reflecting this in the building itself is a key strategy for generating interest in what the institute does.

»The structure is entirely visible as soon as you enter the building. It's exposed to make it easy to understand – which parts hold up

what and how,« explains Rich Naish, architect and founder of RTA Studio, which partnered with Irving Smith Architects to design the building.

To this end, they have also used as many different wood products as possible in the building's overall design.

»I believe people are drawn to wood because it's a natural material. It gives a warm and pleasant feel and is also soft and wonderful to work with. In this building, much of the beauty lies in the purity and simplicity of the structure,« says Rich Naish.

The reception on the entrance level is made of CNC-cut plywood, with cork tiling on the floor. The upper levels are floored with exposed CLT. LVL beams run from the ground floor all the way up, drawing the eye to the levels reserved for researchers and staff, made up of open-plan offices and informal meeting rooms. The neatly designed staircase in the middle of the space gives the illusion of floating independently. Made from CLT, it is mainly self-supporting, although a supplementary steel band runs around the edges.

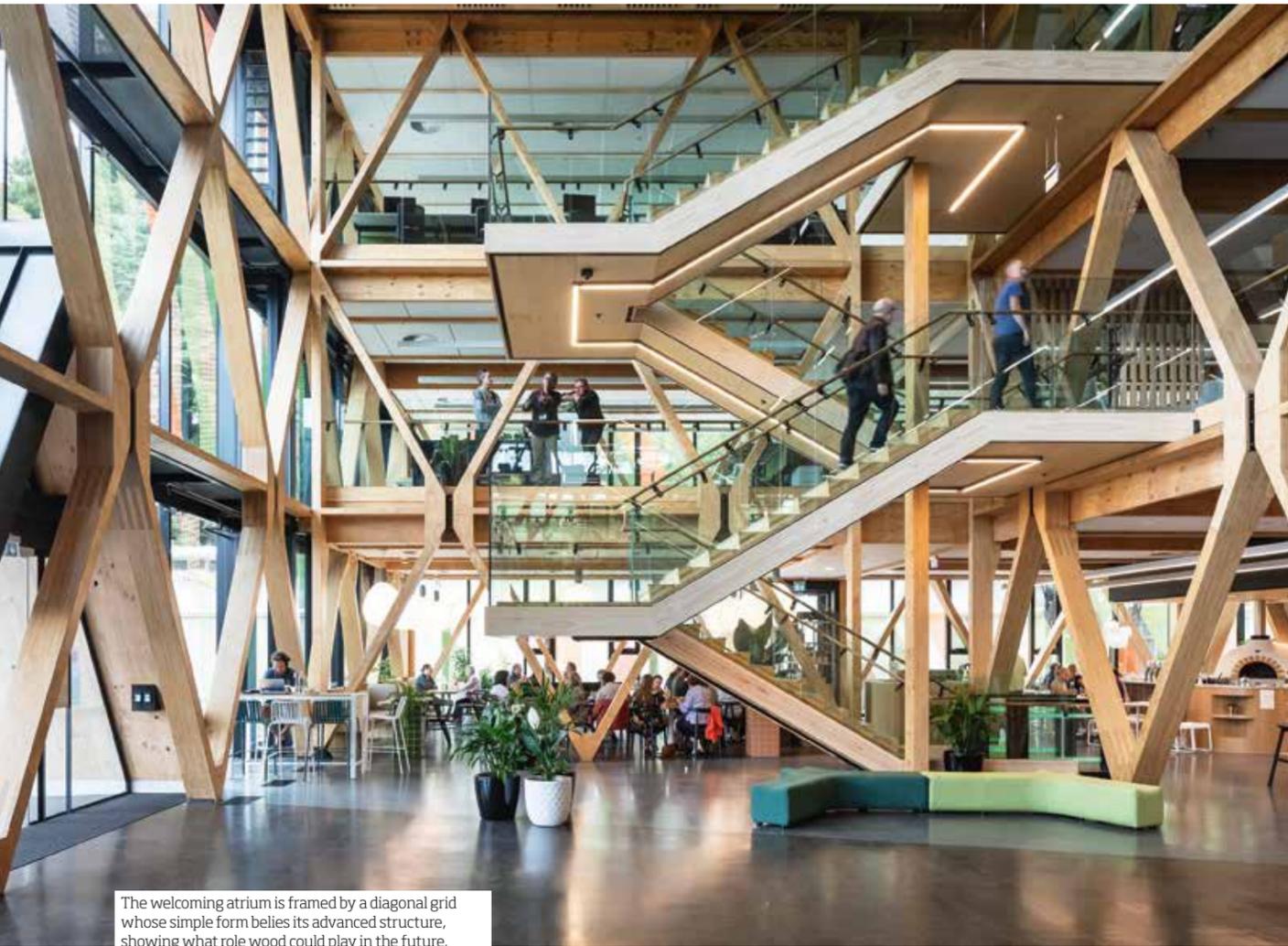
»We've tried to keep the thickness of the stairs to a minimum, which gives the »

1. The building's lower level is open to the public, giving access to a reception, a café and an interactive exhibition to boost interest in wood products.
2. The diagonal grid pattern at the entrance continues on the inside, while the painted pattern on the glass façade helps to regulate the light.

Scion innovation hub ROTORUA, NEW ZEALAND

ARCHITECTS RTA Studio & Irving Smith architects.
STRUCTURAL ENGINEERS Alistair Cattanach, Dunning Thornton.
AREA 2,000 sqm.
COST SEK 73 million.
w|rtastudio.co.nz





The welcoming atrium is framed by a diagonal grid whose simple form belies its advanced structure, showing what role wood could play in the future.

»elements a sculptural feel and makes them look like they're flowing as one,« says Rich Naish.

The most striking feature, however, is the diagonal grid that frames the atrium and binds the building together. Behind its pure and apparently simple design lies an advanced structure comprising 88 triangular frames, created from a total of 4,248 LVL pieces, all manufactured using CNC technology. Rich Naish likens it to a tree:

»A branch very rarely sits perpendicular to the trunk. It usually runs diagonally, which lowers the load, and it is this relationship between horizontal and vertical loads that is the key to strength.«

The parts of each triangle are bonded together using a finger-jointing system, making it possible to secure them to each other without using steel components.

»We initially looked at how we could make the joints using steel nodes. But since our brief was to create an innovative wooden building, we tried instead to develop as much as possible using wood. Together with the structural engineer, we came up with this solution where the parts are finger-jointed and glued.«

According to Rich Naish, this type of construction has never been used before for a diagonal grid of this size, so they had to begin by developing prototypes for each section and then testing them mechanically to see if they held.

The radiata pine accounts for a large proportion of New Zealand's timber production, so the plywood and mouldings in the ceiling are therefore designed to reflect its DNA structure. Some of the visual features were also developed in consultation with New Zealand's indigenous Maori people locally. Spotlights in the ceiling are positioned to form the southern hemisphere's Pleiades constellation, or Matariki as it is known in Maori, which is a symbol of when their New Year begins. The glass façade's painted pattern filters the daylight and is inspired by local weaving techniques, symbolising how the light falls through the neighbouring forest. This was all developed in cooperation with experts to ensure good light conditions without glare or overheating.

A key purpose of the building's design is to draw in the public. After a stroll in the nearby Whakarewarewa Forest, they can

Architect **Rich Naish**

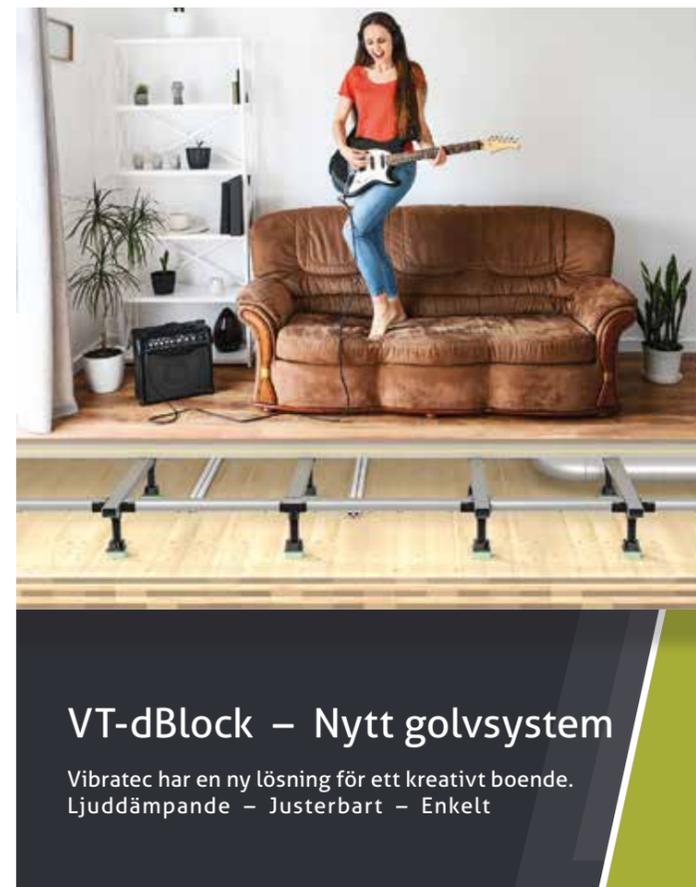
»A branch very rarely sits perpendicular to the trunk.«

come here for lunch or a coffee. At the same time, they get to learn more about the future role of wood through the interactive exhibition on the ground floor, where visitors can move around freely and stroke the tactile surfaces.

»They can find out all about the innovations and research going on here or they can just enjoy the building and relax. Either way, they'll be absorbing new knowledge about wood research and the possibilities of wood. When people like and are inspired by the material and see how it is used, that also encourages the work that goes on here,« says Rich Naish.

The staff are also pleased.

»It's a really calm and peaceful workplace, with excellent acoustics. Coupled with the view of the forest outside, the design of the building connects us with nature,« says Douglas Gaunt. ☺



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An attitude towards wood

Hooke Park offers a university education in architecture, where the students explore experimental ways of working practically with wood construction. One project has looked at how future structures can use tree branches.

TEXT Torsten Hild PHOTO AA Design and Make

Since 1987, architecture students have headed to the woodland landscape of Dorset, 200 km west of London. And the attraction is not the fresh air or the lovely pastoral setting. At its Hooke Park woodland site, the Architectural Association has established a leading programme for those who want to explore wood construction in practice. The experimental studies include both the latest digital technology – in the form of robots, 3D scanners and CNC technology – and traditional woodworking techniques. The programme is based around a real project, where the students are responsible for the whole process of the build. Wyatt Armstrong recently completed his Master's degree there.

»Hooke Park is great for learning how to build in wood, from the specific tree in the forest to the finished structure,« he says.

The project began with a brief, tasking the students with designing, planning and constructing a small building, intended as a recreational space for the school's students and lecturers. The process had to have a sustainability focus and the building had to be easily demountable if necessary. The design was dubbed the Woodland Cabin and was erected over the course of the 16-month programme.

The building can reasonably be described as a cabin, but conventional it is not. The load-bearing structure is made up of roundwood in the form of tree branches, which in turn rest on four circular concrete plinths sunk into the sloping ground at different levels. The roundwood is connected using a log-cabin inspired wood-to-wood technique, with no adhesive, screws or metal fixings. The floor system, walls and roof were prefabricated in one of the school's workshops and

then assembled on site against the roundwood supporting structure.

»We drew on previous school projects that explored how the trees' forks could be used structurally. It was fantastic to see how well the parts we had modelled on the computer then fitted together during assembly,« says Wyatt Armstrong.

Research at Hooke Park demonstrates that a tree's optimum strength can be found in its forks. Using them to achieve structural triangulations is effective, since the wood is at its strongest. Wyatt Armstrong and his fellow students, helped by a knowledgeable forester, identified potential tree forks out in the forest. These were then 3D scanned and processed on a computer. The modelling showed which forks could be used in the current model and allowed considerable freedom to explore how the branches could be joined together to create a strong and load-bearing structure. The trees were then cut down and processed, ready for their structural use.

»We employed robots so that we could handle such massive roundwood. For example, we connected a band saw to a robot, and at another stage the robot controlled a milling machine,« states Wyatt.

He explains that the process had to be implemented with the utmost precision so that the assembly would work, and this was where the digital technology was an enormous help. There were other tasks, however, that could not be predicted or calculated, and these were carried out by hand using traditional tools.

»Someone always has to program the robot, and that takes time. Plus, there are things that robots can't do, like reacting to

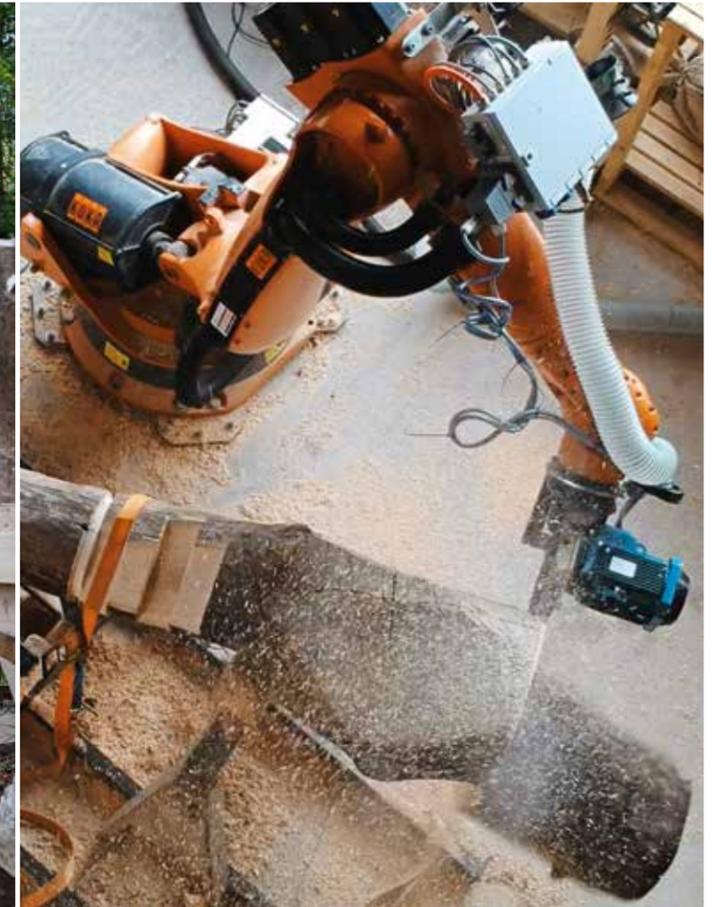
feedback from the material during machining. A woodworker can feel in their body what is happening and adjust accordingly, whereas a robot is operating simply on brute force.«

The aim is to explore what can be done with the parts of the tree that are otherwise discounted. The results show that it is possible to construct buildings in the way that the students have done on the Woodland Cabin project. The Hooke Park site has several buildings that apply similar technology. Over the years, the school has built its own premises using innovative methods that pair new technology with traditional woodworking techniques. From a broader perspective, the experimental work highlights new principles not just for construction, but also for the way the material is extracted from the forest.

It might seem like a long-winded and time-consuming way of identifying tree forks in the forest but, according to Wyatt Armstrong, 3D scanning can be used to record the forest stand. Drones can be deployed to quickly survey large areas of woodland. He also stresses that the extraction from the forest needs to be selective, focusing on only those trees that have the desired qualities.

This is not a problem for the students on the course, because they are working on a small scale, but the question is what this would mean for a large-scale logging operation. The results of the research at Hooke Park demonstrate the importance of understanding and taking into account the material in the very earliest planning and design phases. It is not just about technical qualities, but about knowledge of how the material is refined and letting it contribute to the process.

The exploratory work that takes place at Hooke Park could lead to new methods of wood construction. The established methods have got us where we are today, but new ones will be needed for the sustainable buildings of the future. ☺



The strength is optimal in the tree forks, and the students at Hooke Park are exploring how they can be put to structural use.



Mountain chalets carefully positioned on steep slope

The wooden houses in the Fjällöga development have become a new landmark in Tännålen. The chalets reference Härjedalen's traditional buildings and are adapted to the sensitive location.

TEXT Ulla-Karin Höynä PHOTO Christian Åslund

The terrain determined how the buildings would be positioned in the resort of Hamra. A total of 25 new chalets have been gathered around a curved road, near the skiing facilities. Architect Maria Sigeman Trigueiros explains that they worked with the constraints of the site and wanted to make as little impact on the land as possible.

»The chalets are built on plinths and rotated to follow the terrain. All of them have uninterrupted views of the valley. As architects, we start with the location. In a mountain environment, building sustainably requires more thought,« she says.

Trigueiros Architecture designed the

development and was responsible for the interior architecture. Sustainability runs through the whole project, which is based, as usual for this practice, on standard dimensions to reduce waste.

»We wanted to create a project defined by high-quality choices at every level and a sense of sustainability over several generations of use. Nothing should be just decorative. Everything should have a function. We always try to work with local companies and materials. It is important to have an element of craftsmanship and for handcrafted details to be of a high standard, both inside and out, and that every part of the building is given specific attention,« she comments.

The site has been developed by Ortalis Byggnation, who were initially doubtful about the idea of building accommodation on the north side of the mountain. They were unsure whether the project would be accepted in its entirety, but they opted to set it in motion anyway, despite not all the houses being sold off-plan.

1. The design of the buildings echoes the log cabin, with a tall and interrupted façade.
2. The 25 chalets are spread over nine plots and set at different heights that follow the terrain and give uninterrupted views.

Fjällöga TÄNNÅLEN, SWEDEN

ARCHITECT Trigueiros architecture.
CLIENT Christer Stenvall, Ortalis byggnation.
STRUCTURAL ENGINEER Kristaps Asnis, Pavašars housing construction.
COST: SEK 94 million.
COST: SEK 94 million
LIVING SPACE: 2,800 sqm.
w| trigueiros.net

»The planning took a little longer than usual. We contacted Sweco early on, and once the ground was broken, we were done in a year,« says Karl Panes, project manager at Ortalis Byggnation.

Fredrik Persson, structural engineer at Sweco Östersund, was responsible for the foundations of the chalets. He used data from the geotechnical engineers, who had conducted ground surveys and taken core samples, to establish the parameters for designing secure foundations. The next step was a feasibility study based on the architect's drawings.

The foundations are reinforced concrete with slabs under load-bearing walls. The width of the foundation slab is tailored to the forces that the ground has to deal with in order to prevent subsidence. Insulation was laid in the ground outside the slabs to stop ground frost penetration and to manage water drainage from above. There are a total of nine plots, with some of the chalets arranged in a semi-detached format.

»One part of the semi-detached building, which lacks a lower ground floor, has a steel frame running down to the foundation slabs in order to support the building and handle the loads from above,« says Fredrik Persson.

The most time-consuming part of the building project was developing the design of the chalets, with the process lasting almost two years. Ortalis wanted to create buildings that both stand out and work in a mountain environment.

»The result is a fantastic collection of houses. They merge in with their surroundings while at the same time making a striking impression,« says Karl Panes.

For Nils and Ulla Thudén, the nearby skiing facilities were what sealed the deal. They immediately snapped up a house in the top row, and they were in by November last year.

»We'd been considering Tännålen for a long time, and when we read the ad, we headed there to take a look. It was hard to find a better location. We enjoy downhill, touring and cross-country skiing, and it's all

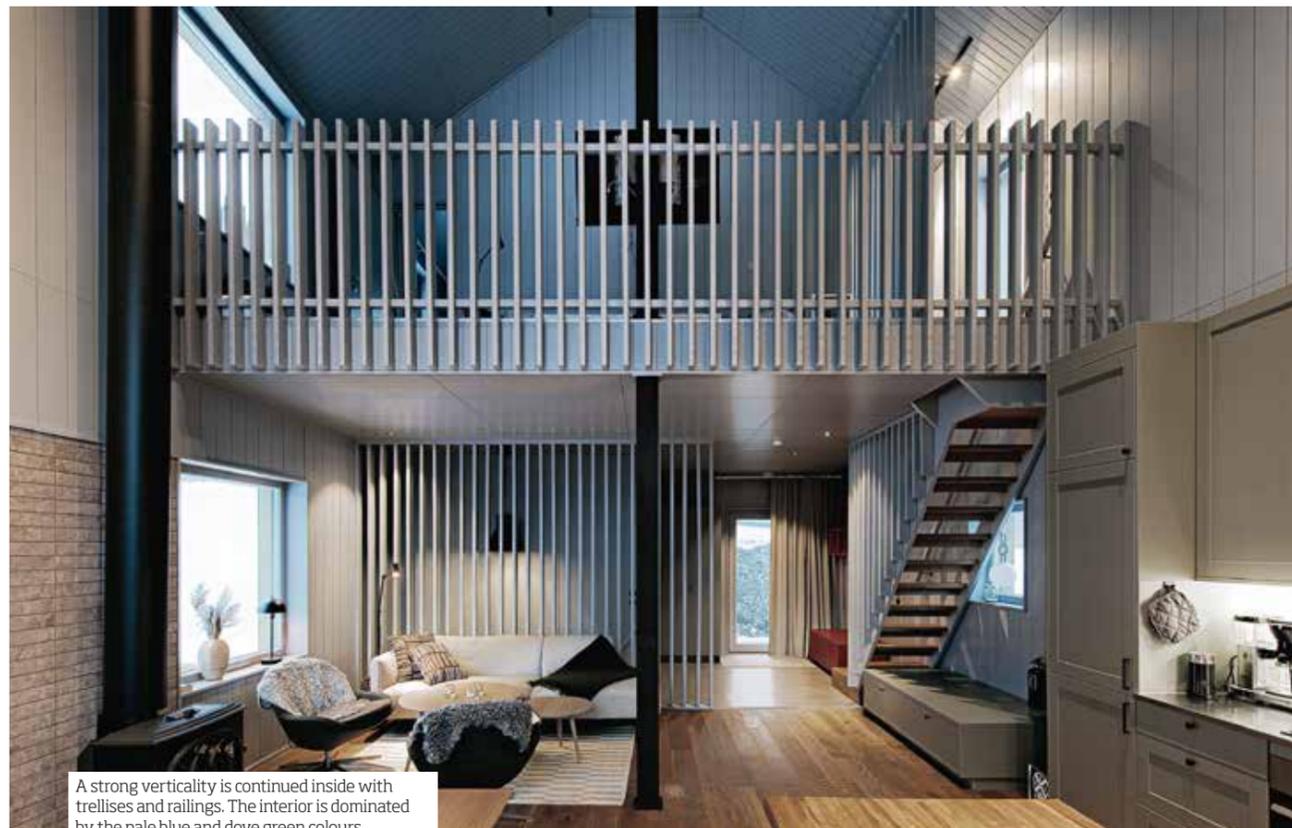
here on our doorstep,« says Nils Thudén.

They love the layout and the social areas such as the living room.

»It's so amazing to have a window that is four metres high. The only thing we would say is less successful is the staircase inside the house, which is very steep.«

The houses have three levels and were built in modules in a Latvian factory, with walls, floors and ceilings in wood. The façades were built on site using untreated Siberian larch timber that has since become a silvery grey. The vertical façade cladding in varying dimensions is tongue and groove, with square cover battens. The interior cladding is MDF with grooves to form a decorative surface.

Maria Sigeman Trigueiros guides us around one of the chalets, which sleeps 12 people. The main entrance leads to a spacious hall with oak flooring, wardrobes and a bathroom. There are long sightlines, and a ceiling height of seven metres. Straight ahead is the large living room with its »



A strong verticality is continued inside with trellises and railings. The interior is dominated by the pale blue and dove green colours.

» open-plan layout, and a cast-iron stove with a beige tiled feature wall behind it. One corner is occupied by a built-in sofa. The dining area features a large window onto the valley and the balcony, and to one side lies the kitchen with its island unit. Upstairs there is a lounge and two bedrooms. Downstairs is the ski entrance, with snow scooter and ski storage, plus a sauna and shower with separate wc. There are also two bedrooms down here. The idea behind the architecture is that it creates multiple experiences, and there are various places for social activities at different heights.

The windows play a prominent role in the design, bringing in the entire landscape and creating their own framed pictures of nature.

»We wanted to make a home for modern life in the mountains, using a modern interpretation of the local building tradition that meets today's high expectations of comfort and convenience. The indoor environment should feel rich and thoughtful. Having spent several hours of the day outside, you still feel close to nature once you're back indoors,« adds Maria Sigeman Trigueiros.

The interior colour palette uses matte shades of pale blue and dove green, with accents in coral pink. These are refined but slightly unexpected colours, inspired by Carl Larsson. The colour choices are a way of connecting with Härjedalen Municipality's design programme, which was one of the conditions of the project and involves highlighting features in older buildings such as windows and façades.

Härjedalen has traditionally experimented with various façades, both horizontal and vertical, some with narrower panels at the bottom and some with block cladding.

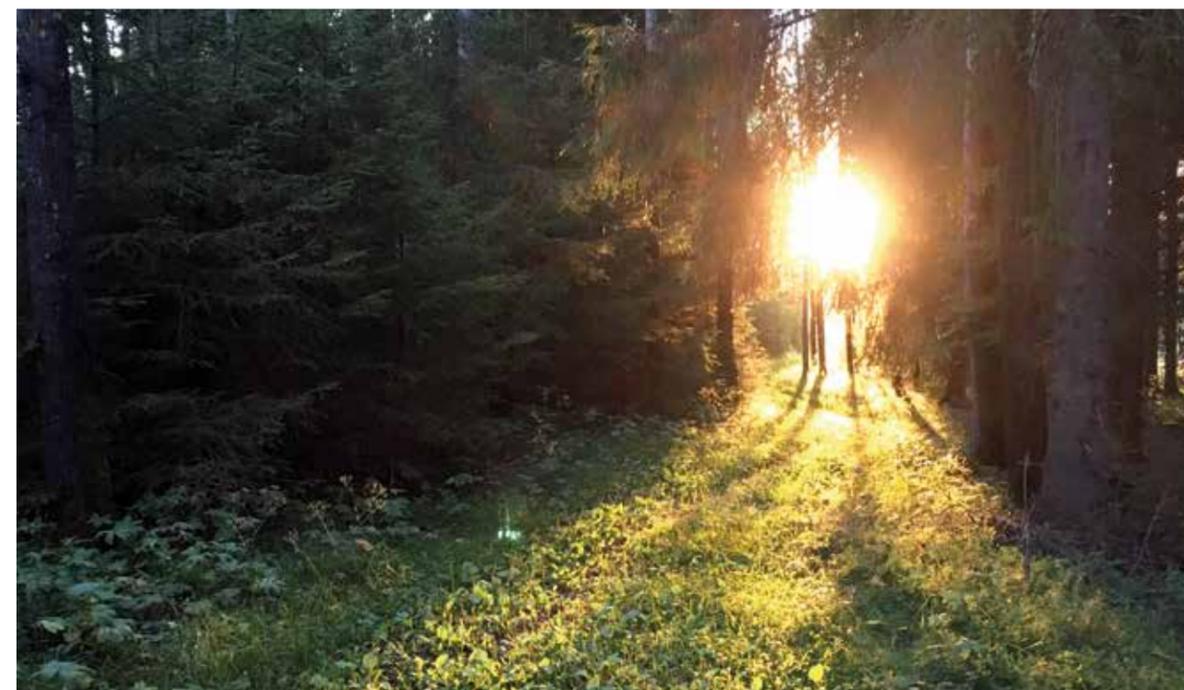
“For us, sustainability is also about giving back to the place you are building in and being able to preserve it through an attractive residential development, bringing new character and exciting life to Tännadalen. These chalets will live on long after the first buyers,” concludes Maria Sigeman Trigueiros. ☺

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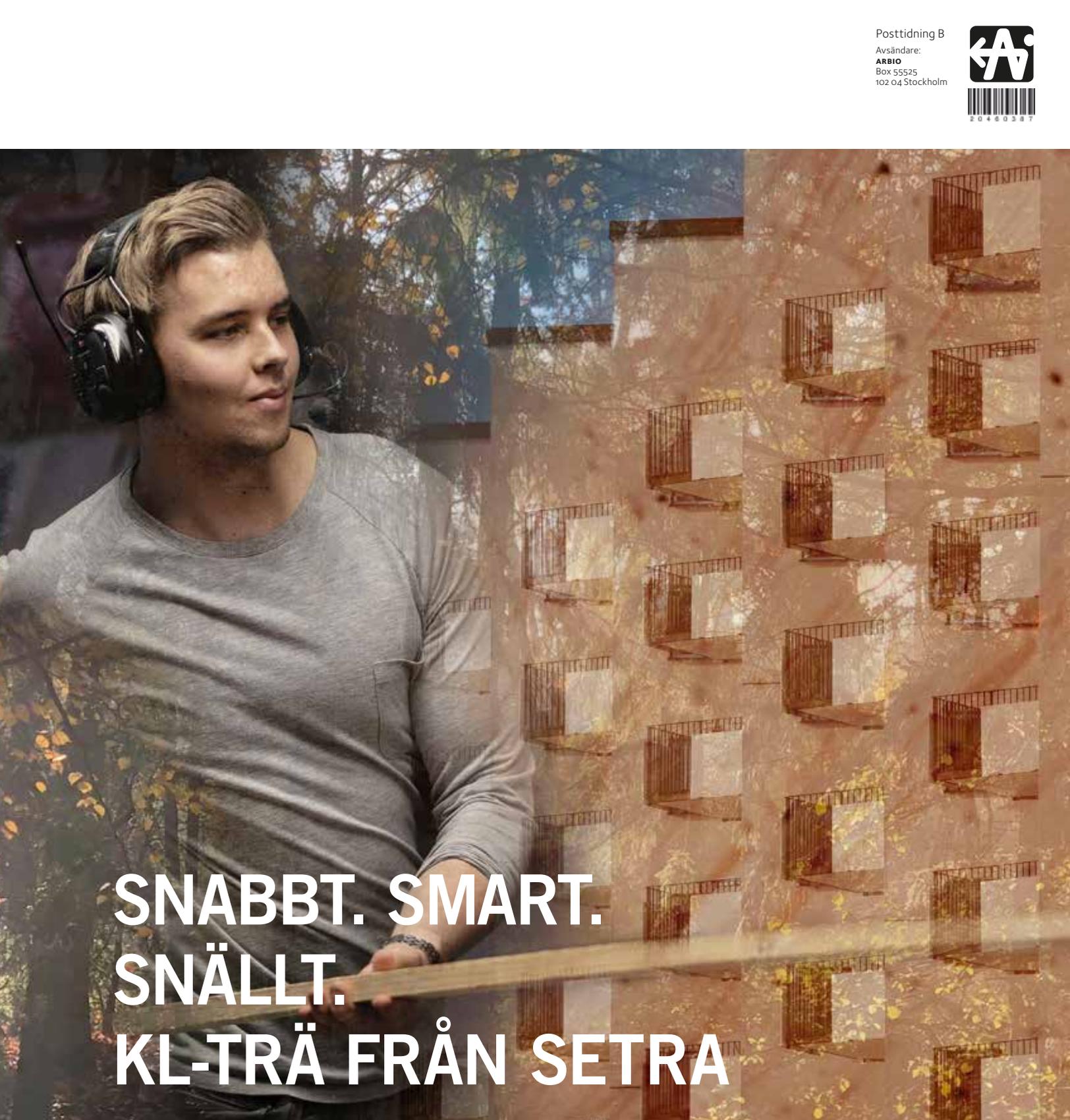
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