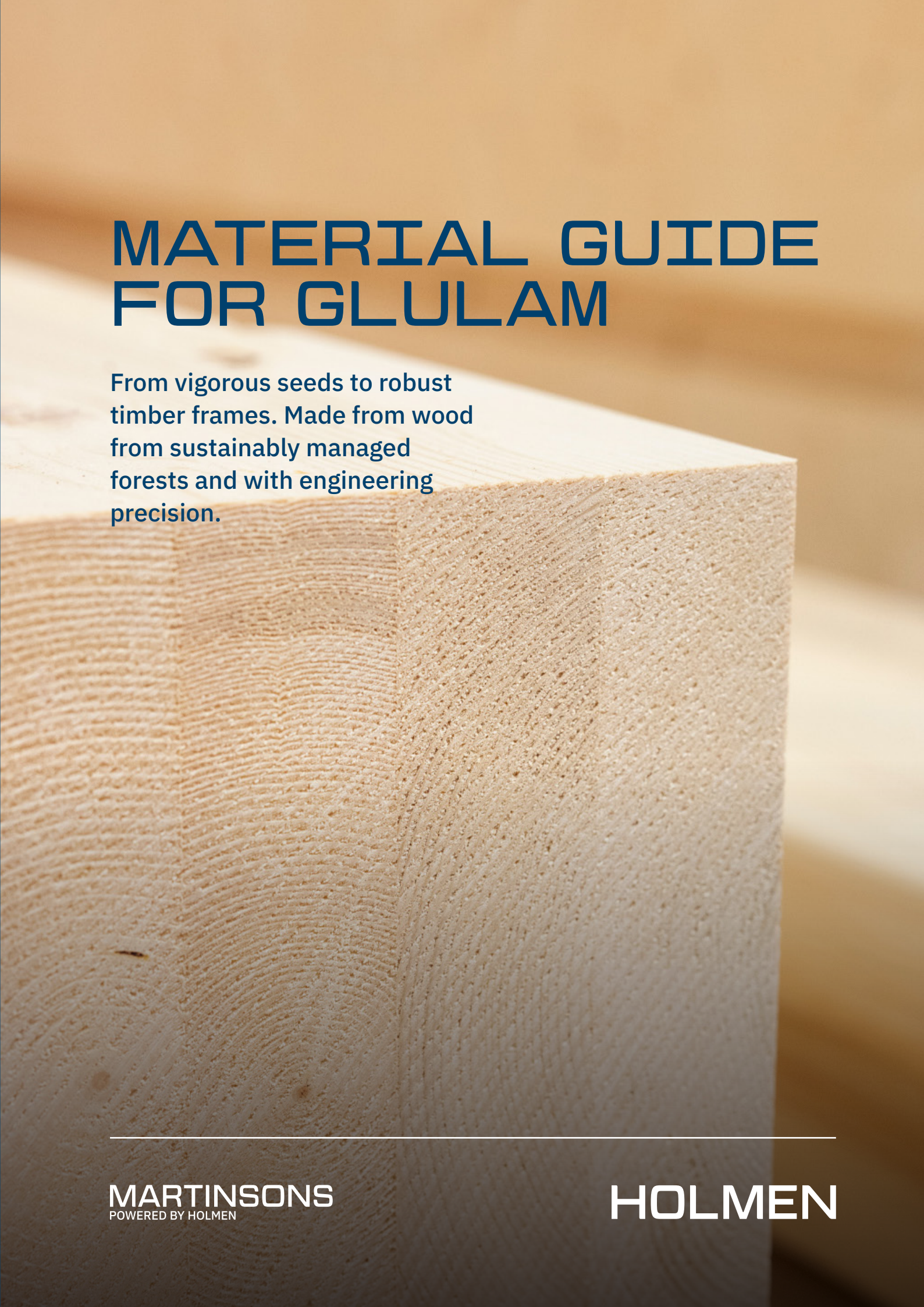
MATERIAL GUIDE FOR GLULAM

From vigorous seeds to robust timber frames. Made from wood from sustainably managed forests and with engineering precision.

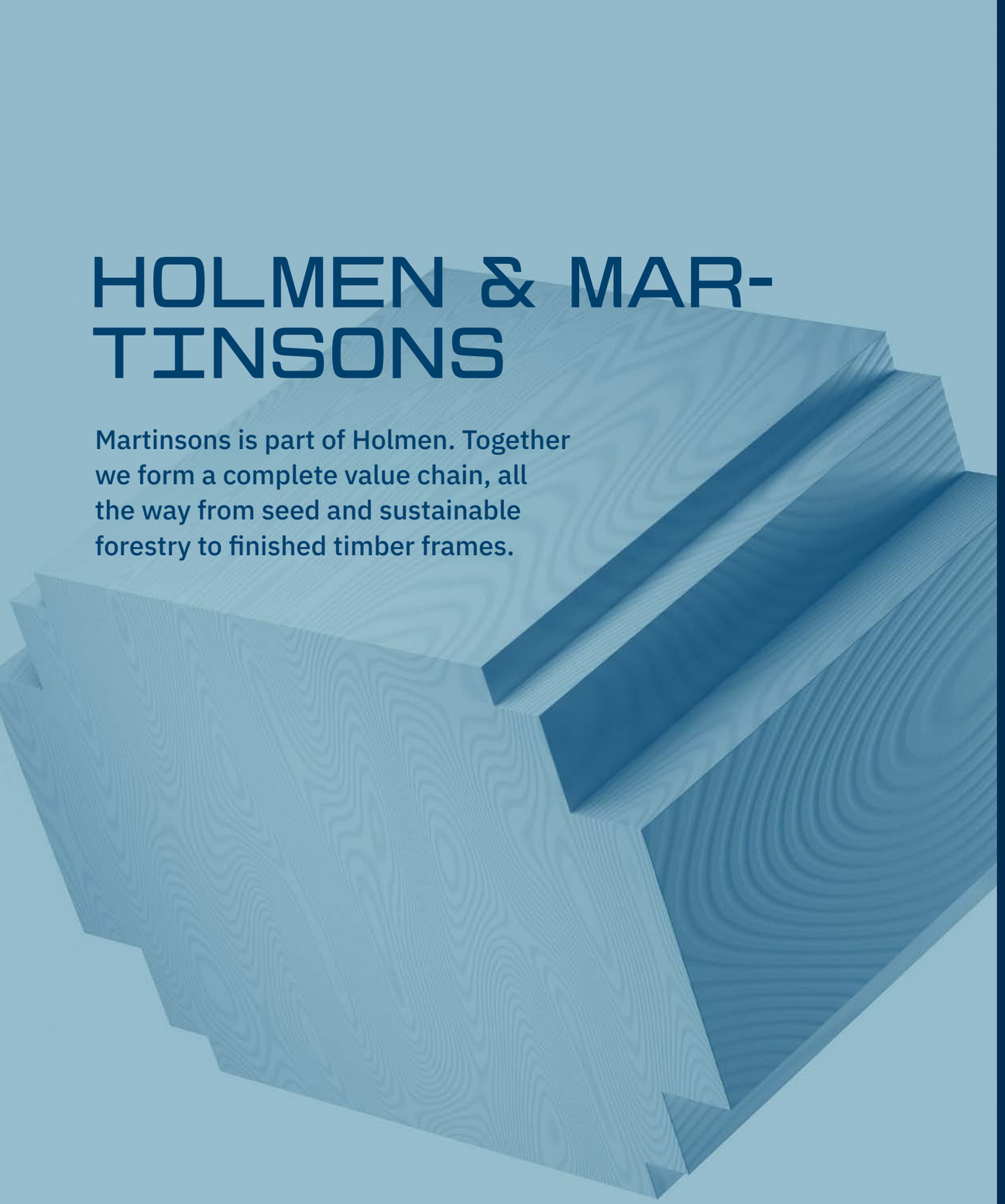


MARTINSONS
POWERED BY HOLMEN

HOLMEN

HOLMEN & MARTINSONS

Martinsons is part of Holmen. Together we form a complete value chain, all the way from seed and sustainable forestry to finished timber frames.



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Holmen Wood Products

PRODUCTION OF GLULAM

Holmen Wood Products supplies high-quality wood products to the joinery and construction industry, builders' merchants and wood product importers. Holmen's high-tech sawmills are the hub of our circular business. All chain-of-custody certified, our sawmills are located in Linghem, Braviken, Iggesund, Kroksjön and Bygdsiljum in Sweden.

Martinsons Building System has been part of the Holmen Group since 2020. Martinsons has accrued extensive experience as a leading player in the development, construction and delivery of glulam and CLT frame systems. Martinsons' offering in custom glulam is based on Holmen's range of products, with delivery tailored entirely to the needs and requirements of a specific structural object. As a customer, you simply contact Martinsons about what you require, and we then develop a proposal to meet your brief.

As part of Holmen, we create a cohesive and secure value chain that stretches all the way from seed to fully assembled frame, in a close collaboration that allows us to ensure high quality and sustainability every step of the way. As responsible users of forest resources, we contribute to a more sustainable future for construction and community development. We are proud to offer our customers a complete solution that always has a keen eye on quality, efficiency and sustainability.

Glulam factory 1

Glulam factory 2

Kunskapshuset, Gällivare
Architects: M.A.F Arkitektkontor and Liljewall Arkitekter
Client: Gällivare Municipality
Contractor: Nåiden Bygg

GLULAM

General information on the composition, function and benefits of the material.

Glulam

WHAT IS GLULAM?

Glulam comprises finger-jointed lengths of wood that are glued together to form beams of the desired length and dimensions. In relation to its weight, glulam has a higher load-bearing capacity than both steel and concrete. This makes it the ideal material for creating buildings with large spans and flexible layouts. It is also easy to work on and quick to assemble.

The Bygdsiljum mill has been manufacturing glulam since the mid-1960s, making it one of the most experienced and well-established production facilities in Sweden.

WHY CHOOSE GLULAM?

Strong and light. Compared to its own weight, glulam has a higher load-bearing capacity than both steel and concrete, making it ideal for large spans and flexible layouts.

Pleasant environments. Glulam contributes to light and pleasant indoor environments. Moisture-buffering properties create a good indoor climate and exposed wooden details can become key elements of attractive design solutions.

A smart climate choice. The construction components are made using renewable raw material, in a process that has a low impact on the climate, and they bind carbon dioxide throughout their lifetime. This is most evident in perhaps the best EPD on the market*.

Sustainable forestry. The glulam products are based on forest raw material from sustainable forestry in the north of Sweden.

Environmental awareness at every level. The production facilities are certified to ISO 14001, and all the glulam covered by a harmonised standard is CE marked.

*** An Environmental Product Declaration describes the environmental performance of a product from a life cycle perspective**

Mörmoskolan, Hammarö
Architect: Mondo Arkitekter
Client: Hammarö Municipality
Contractor: Byggdialog AB

Arlanda, Terminal 5
Architect: White Arkitekter
Client: Swedavia
Contractor: Skanska

PRODUCT RANGE

Below is a summary of the range of glulam products offered by Holmen, including specific dimensions and measurements.

The glulam we offer comprises finger-jointed lengths of wood that are glued together to form beams and columns of the desired dimensions. The maximum length is 34.5 metres, with a maximum height of 1710 mm and widths up to 215 mm. Beams can then be block glued together for other geometries, usually larger widths.

Glulam columns
A glulam column can be either square or rectangular and is used vertically in load-bearing structures.

Glulam beams
A glulam beam is used horizontally in load-bearing structures such as lintels and whole frames.

Dimensions
The dimensions of glulam columns and beams are always given in W x H x L, e.g. 90 x 315 x 5900.

Dimension and strength overview for spruce glulam

Height/ width (mm)	42	45	48	56	66	78	90	115	140	165	190	215
90	GL28hs			GL28hs	GL28hs	GL28hs	GL28h	GL30h	GL30h	GL30h	GL30h	GL30h
115								GL30h	GL30c	GL30c	GL30c	GL30c
135	GL28cs			GL28cs	GL28cs	GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
165										GL30c	GL30c	GL30c
180	GL28cs	GL28cs	GL28cs	GL28cs	GL28cs	GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
220		GL28cs										
225	GL28cs	GL28cs	GL28cs	GL28cs	GL28cs	GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
270	GL28cs	GL28cs	GL28cs	GL28cs	GL28cs	GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
315	GL28cs	GL28cs	GL28cs	GL28c	GL28cs	GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
360	GL26csMB*	GL28cs	GL28cs	GL28cs	GL28cs	GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
405	GL26csMB*	GL26csMB*	GL26csMB*	GL28cs	GL28cs	GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
450		GL26csMB*	GL26csMB*	GL26csMB*	GL28cs	GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
495				GL26csMB*	GL28cs	GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
540						GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
585						GL28cs	GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
630							GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
675							GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
720							GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
765							GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
810							GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
855							GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
900							GL30c	GL30c	GL30c	GL30c	GL30c	GL30c
945								GL30c	GL30c	GL30c	GL30c	GL30c
990								GL30c	GL30c	GL30c	GL30c	GL30c
1035								GL30c	GL30c	GL30c	GL30c	GL30c
1080								GL30c	GL30c	GL30c	GL30c	GL30c
1125								GL30c	GL30c	GL30c	GL30c	GL30c
1170									GL30c	GL30c	GL30c	GL30c
1215									GL30c	GL30c	GL30c	GL30c
1260									GL30c	GL30c	GL30c	GL30c
1305									GL30c	GL30c	GL30c	GL30c
1350									GL30c	GL30c	GL30c	GL30c
1395									GL30c	GL30c	GL30c	GL30c
1440										GL30c	GL30c	GL30c
1485										GL30c	GL30c	GL30c
1530										GL30c	GL30c	GL30c
1575										GL30c	GL30c	GL30c
1620										GL30c	GL30c	GL30c
1665											GL30c	GL30c
1710											GL30c	GL30c

Explanation: h=homogeneous, c=combined, s=split

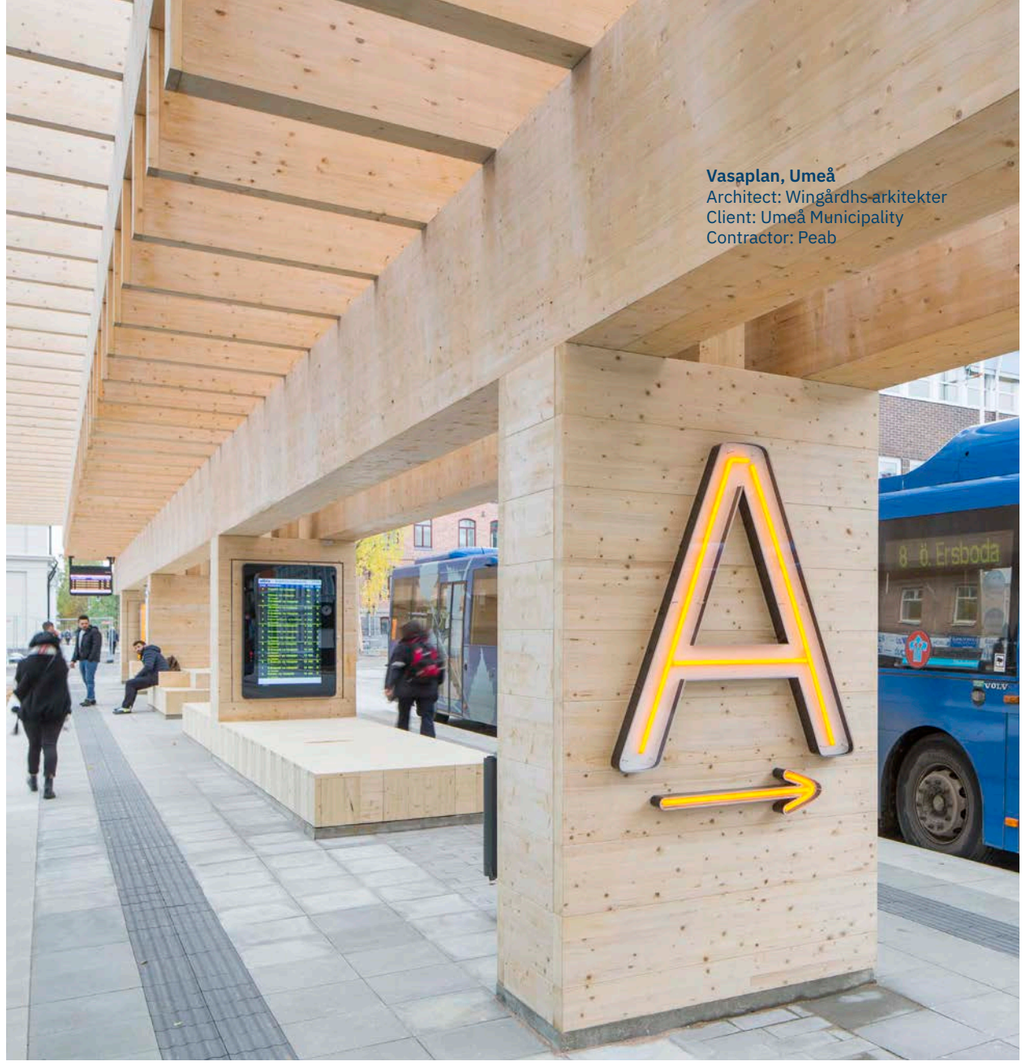
*Width/Height ratio of split beams <90 MM: Since SS-EN 14080 specifies not exceeding 1/8, Holmen has its own type approval for strength class GL26csMB.

All glulam manufactured to a harmonised standard is CE marked.

Stock dimensions have been highlighted in orange.

To contribute to more efficient production, the above dimensions are ideally specified in the following categories:

GL28c	GL28h	GL28h



Vasaplan, Umeå
Architect: Wingårdhs arkitekter
Client: Umeå Municipality
Contractor: Peab

Dimensional tolerances for glulam in line with SS-EN 14080

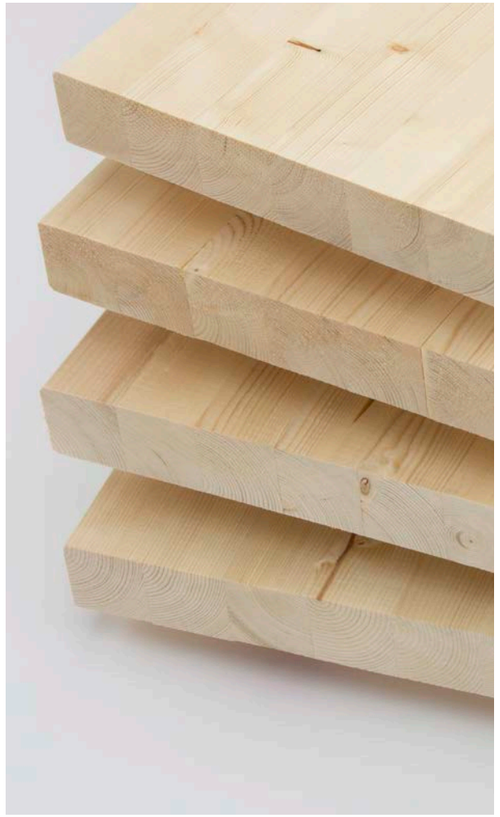
Measurement w		± 2 mm
Measurement h	≤ 400 mm > 400 mm	+ 4 mm to - 2 mm + 1% to - 0.5%
Length (m)	≤ 2.0 m > 2.0 ≤ 20 m > 20 m	± 2 mm ± 0.1% ± 20 mm
Angles	Cross-section angles must not deviate from the right angle by more than 1:50 (approximately 1°).	
Straightness	Between two arbitrarily chosen points (straight 2 m intervals, on any of the elements) along the edges of the glulam element, the deviation may be a maximum of 4 mm. Cambered beams are excluded.	

M®-BEAM

The M®-beam in 45 mm wide glulam is offered in the standard range and is available to resellers. The M®-beam opens up new possibilities in construction, not least because of its suitability for floor joists and purlins. M®-beams are ideal for use in roof trusses, in combination with construction timber.

REMEMBER

Standardised width of 45 mm
Fits standard fittings
Easier to insulate
Longer spans
Rounded edges



Dimension and strength overview

Height/Width (mm)	45
180	GL28cs
220	GL28cs
225	GL28cs
270	GL28cs
315	GL28cs
360	GL28cs
405	GL26csMB*
450	GL26csMB*

Same height as regular construction timber.

Explanation: *Width/Height ratio of split beams <90 mm: Since SS-EN 14080 specifies not exceeding 1/8, Holmen has its own type approval for strength class GL26csMB.

Stock dimensions have been highlighted in orange.

PRESSURE TREATED

We offer a number of pressure treated wood products in pine that together make it easy to create pleasant and weather resistant outdoor environments. Pressure treated glulam is most commonly called on when larger dimensions are needed for outdoor projects, such as a glulam column that harmonises with other parts of a large terrace. Glulam beams can also be used as thicker trimmer joists in a terrace structure. Pressure treated glulam is offered in larger dimensions than pressure treated products in homogeneous timber. Glulam beams and columns are offered in wood preservation class NTR B.

Dimension and strength overview

Height/Width (mm)	90	115
90	GL28h	
115		GL28h
200	GL28h	
300	GL28h	GL28h
400		GL28h

Stock dimensions have been highlighted in orange.

Sara Kulturhus, Skellefteå
Architect: White Arkitekter
Client: Skellefteå Municipality
Contractor: Hent AB

MATERIAL PROPERTIES

Information on the composition of glulam, plus factors such as strength values, deflection and fire resistance.

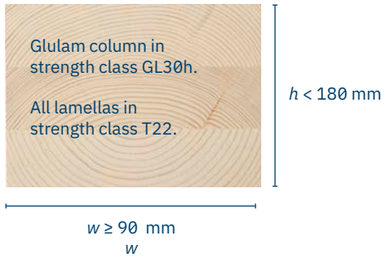
THE COMPOSITION OF GLULAM

The stresses are normally greatest in the outer parts of the glulam cross-section, so to optimise the use of the wood material, glulam is manufactured with lamellas of different quality in the outer and inner layers.

The outer lamellas should account for at least 17 per cent of the height of the beam and, as these take the main tensile and compressive loads, holes should always be drilled in the centre of the beam, rather than in the outer lamellas. Making holes and cutouts in the outer lamellas may adversely affect the load-bearing capacity of the glulam beam.

Glulam beam with lamellas

Homogeneous glulam beam



REME-MBER

Never cut down the height of a load-bearing C-beam. As the outer lamellas of a glulam beam are of higher quality to handle the load, splitting it down to a smaller dimension changes the properties of the beam.

Strength values for glulam in line with SS-EN 14080

Strength values in MPa		GL26csMB	GL28cs	GL28hs	GL28h	GL30c	GL30h
Bending parallel to grain	$f_{m,g,k}$	28.9	28.0	28.0	28.0	30.0	30.0
Tension parallel to grain	$f_{t,0,g,k}$	15.0	19.5	22.4	22.3	19.5	24.0
Tension perpendicular to grain	$f_{t,90,g,k}$	0.5	0.5	0.5	0.5	0.5	0.5
Compression parallel to grain	$f_{c,0,g,k}$	21.0	24.0	28.0	28	24.5	30.0
Compression perpendicular to grain	$f_{c,90,g,k}$	2.5	2.5	2.5	2.5	2.5	2.5
Shear strength	$f_{v,g,k}$	3.5	3.5	3.5	3.5	3.5	3.5
Rolling shear strength	$f_{r,g,k}$	1.2	1.2	1.2	1.2	1.2	1.2
Stiffness values in MPa							
Modulus of elasticity parallel to grain	$E_{0,g,mean}$	12 000	12 500	13 100	12 600	13 000	13 600
Modulus of elasticity Characteristic	$E_{0,g,05}$	10 000	10 400	10 500	10 500	10 800	11 300
Modulus of elasticity perpendicular to grain	$E_{90,g,-mean}$	300	300	300	300	300	300
Shear modulus	$G_{g,mean}$	650	650	650	650	650	650
Density in kg/m³							
Density, characteristic	$P_{g,k}$	391	390	430	425	390	430
Density	$P_{g,mean}$	430	430	480	460	430	480

CE marked glulam is manufactured in Sweden in strength class GL30c or GL30h.

Split glulam beams are classified down to strength class GL28cs or GL28hs.

The characteristic values for the calculation of load-bearing capacity, stiffness and density, plus average values for stiffness and density, are shown in the table above.

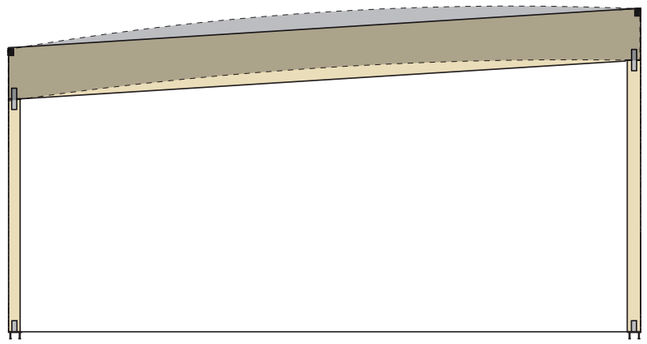
Sources:
Properties and numerical values taken from SS-EN 14080:2014, Table 4 and Table 5.

GL26csMB: Report P104940, RISE Research Institutes of Sweden.

CAMBERING OF BEAMS

Cambering may be needed for simply supported beams with spans of more than 10 metres, but is not normally needed for continuous beams across several supports. If deflection is considered to be a problem, this can be counteracted to some extent if the glulam elements are planned with some cambering.

It can be a good idea for the size of the camber to equal the deflection corresponding to at least the calculated self-weight, which can be considered to result in a straight form in use. Holmen has a number of standard camber templates when manufacturing glulam elements.



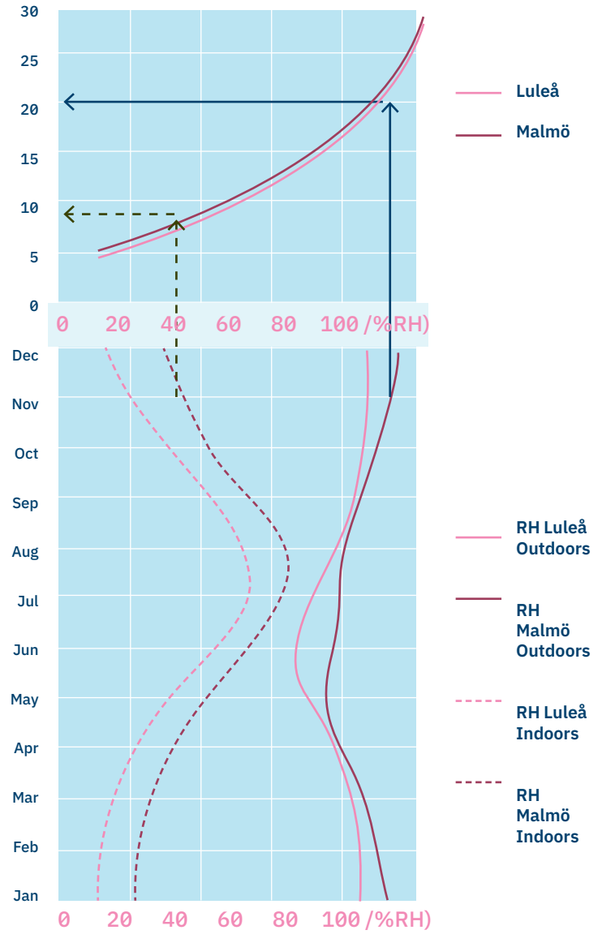
FIRE

Thanks to their large, homogeneous cross-sections, glulam structures have good protective properties in the event of a fire. The structure of the material helps it to remain stable during the initial stages of a fire, and its fire stability also improves with increasing size. In addition, it is slow to ignite and burns slowly.

The way the heat develops during a fire is often crucial in determining whether the fire will spread or burn out. The charred layer that forms on the surface of the glulam in a fire protects the inner parts and helps the glulam to retain its load-bearing capacity as the fire continues. Further fire protection can be achieved via surface treatment or encasing.

MOISTURE VARIATIONS

WOOD MOISTURE CONTENT (%)



The top section shows the correlation between ambient relative humidity (RH) and moisture content. The temperature also affects the correlation, but the effect is less than 1% of the moisture content in the temperature range 0–20°C. The lower section shows the monthly average value for RH in the north of Sweden (Luleå) and the south (Malmö).

The solid curves show RH outdoors and the dotted curves show RH indoors. The RH curves for indoors should be increased by around 18% RH to account for the moisture added by a normal family (cooking, showering, laundry, breathing, perspiring and so on).

Examples: What is the RH and average moisture content indoors in Malmö in November?
Following the black arrows, RH = 32% and the moisture content is 7%. (Outdoors, the corresponding figures are RH = 89% and moisture content = 20%). At an RH of around 32%, the wood's moisture content is thus around 7%.

The moisture content of a wooden structure will constantly change due to seasonal variations in climate and other factors. The variation is 3–5 percentage points for indoor structures and about 2–3 percentage points for protected outdoor structures. Indoor wood is usually driest in winter, while outdoor structures are driest in summer. Like other types of wood, glulam swells when its moisture content increases and shrinks when the moisture content decreases.

The movements are greater across the grain than parallel to it, at 0.2% and 0.01% respectively for each percentage change in moisture content.

Assume the following maximum moisture movements for glulam for each percentage point change in moisture content in service classes 0 and 1:
- perpendicular to grain approx. 2 mm/m
- parallel to grain approx. 0.1 mm/m

Martinsons Building System

VALUE-CREATING EXPERTISE

Martinsons develops and supplies timber framing systems in glulam for everything from industrial buildings, commercial premises and sports halls to high-rise apartment blocks and office buildings. As part of the Holmen Group, we offer a secure value chain with full control over the entire project process – from forest raw material to finished building.

The skillsets of our employees complement each other to create exactly the package we want to offer our customers and partners. We have expertise in everything from sales, consultancy and costing, to development, design, project management and installation.

Our ability to draw on the company's many years of expertise – with thousands of projects completed – makes it only natural that we will continue to drive forward the development of new, more efficient and smart ways to build sustainably with wood.

We are more than happy to take the lead in project partnerships, to enable a green vision of the future through our value-adding expertise.

Logicenters innovation project
Architect: Equator
Client: Logicenters/NREP
Frame assembly: Martinsons

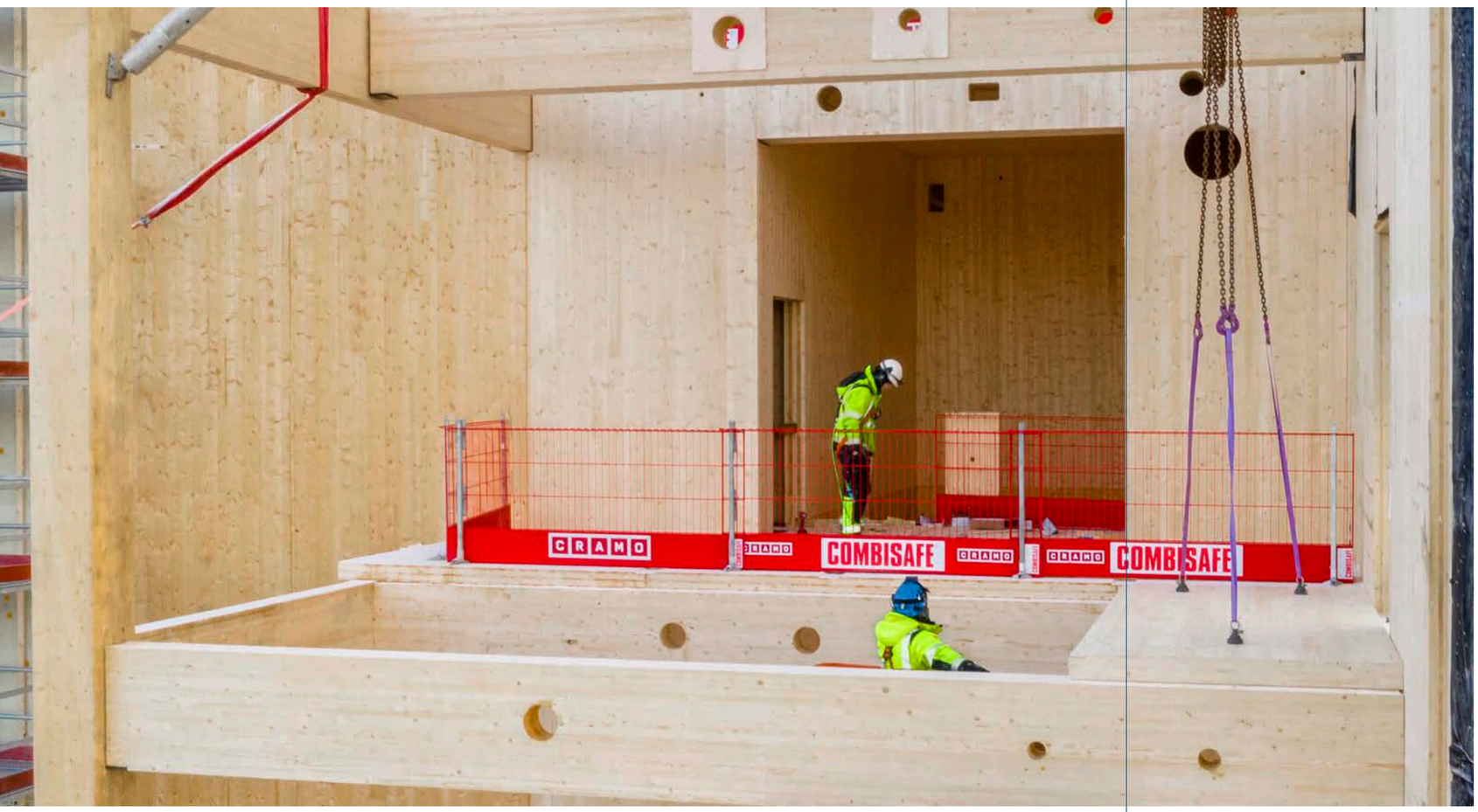
PROCESSING

Our glulam products can be processed according to the recommendations described here, in order to meet the needs of a specific project.

CUTOUTS AND MANUFACTURING DRAWINGS

When ordering glulam, it is important that manufacturing drawings are drawn up according to our standard, in cases where you are carrying out the design yourself in-house. If you do not wish to carry out the design yourself, Martinsons offers manufacturing drawings and design services.

CNC machining is offered for beams under 200 x 450 x 12050 mm, for which we prefer to receive control files in the file formats: .bvx .ifc and .dwg. This could be for cutouts, reinforcements for hole drilling, surface treatment, block gluing, factory-fitted metalwork, etc.



HOLE DRILLING

Holes, recesses and any reinforcements must be shown on a structural drawing checked by the responsible structural engineer. Only minor cutouts may be made without their authorisation.

In general, cutouts in glulam beams should be avoided, but there are some situations where they are necessary for functional reasons. Roof beams and other glulam beams on a slope usually sit on horizontal supports at the glulam columns and walls, which are interventions that do not significantly weaken the glulam element.

Holes up to 50 mm in diameter can usually be made anywhere on a glulam beam, except in the three outermost lamellas (135 mm from the bottom and top edge) and near supports.

Make a habit of always contacting the responsible structural engineer for advice.

In the case of larger holes, or when there are several holes in a row, drilling should always be authorised by the building's structural engineer.

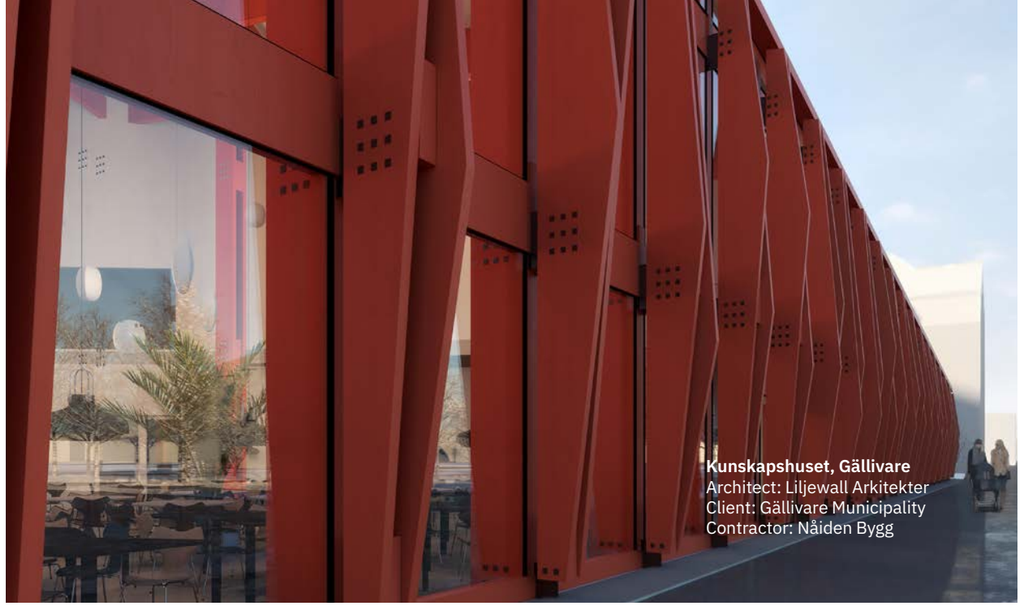
It is important not to let the saw overshoot when forming a cutout, as this may cause a crack to form. To avoid this, the internal corner can be drilled first with a 25–30 mm drill bit, making it easier to see where the saw is while also creating a cutout with a rounded corner.

SURFACE TREATMENT

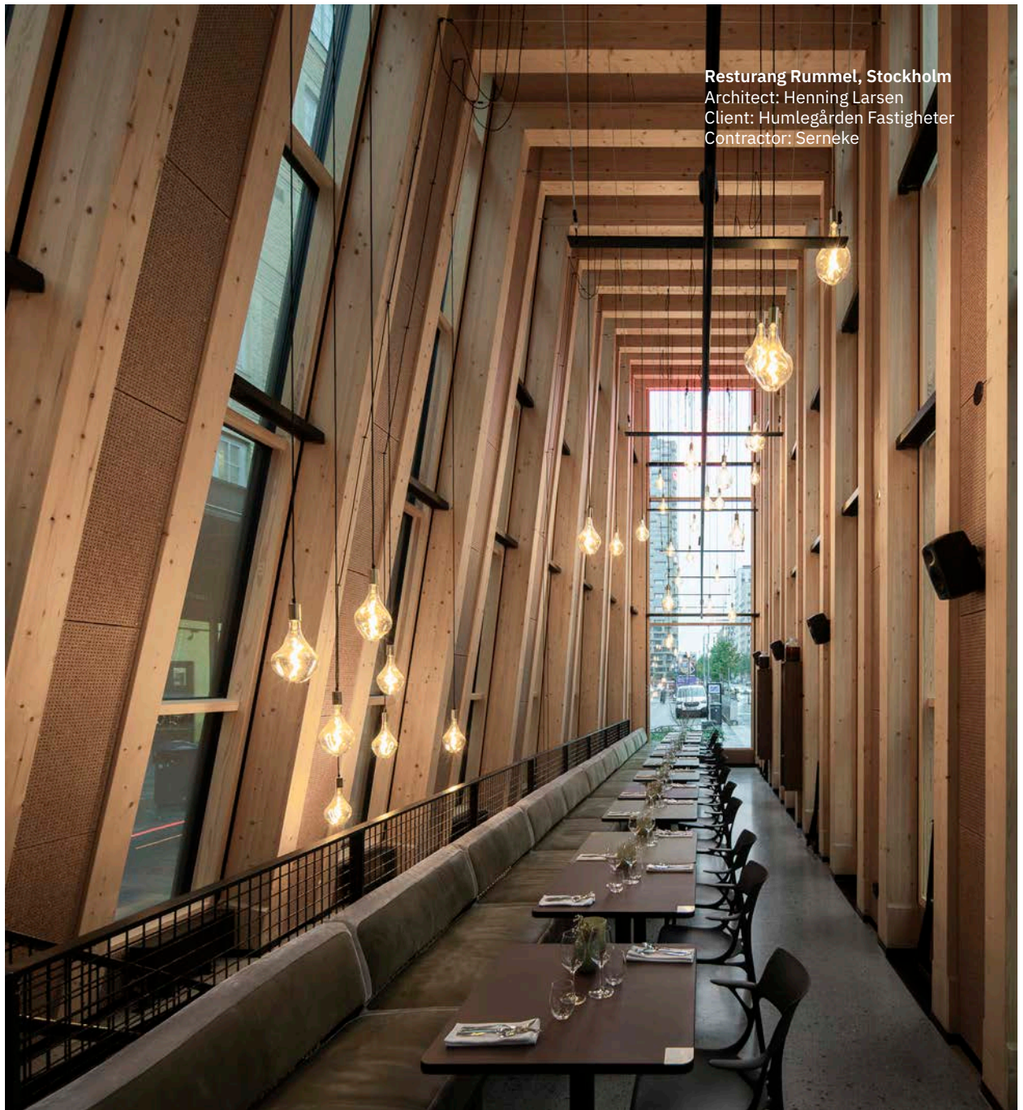
To ensure a surface finish that lasts, a surface treatment can be applied in the factory. These treatments can be divided into the following categories:

- **Aesthetic**
- **Moisture-proofing**
- **Fireproofing**

Contact Martinsons for more information on the various surface treatment options.



Kunskapshuset, Gällivare
Architect: Liljewall Arkitekter
Client: Gällivare Municipality
Contractor: Nåiden Bygg



Resturang Rummel, Stockholm
Architect: Henning Larsen
Client: Humlegården Fastigheter
Contractor: Serneke

Kv. Sirius, Skellefteå
Architect: Collage/
Björnfabriken
Client: Skellefteå Kraft
Contractor: Rekab

DELIVERY AND HANDLING

Information on delivery, handling on site and lifting methods during assembly.

DELIVERY AND HANDLING

According to the Swedish Planning and Building Act (PBL), an acceptance check must be included in the inspection plan. This check is carried out when the glulam elements are unloaded and ensures that the delivery contains everything stated in the order and on the delivery note. The person responsible for receiving a glulam delivery should know how to handle it and what to check.

To ensure smooth, efficient and quality-assured reception and handling of glulam deliveries, there are a number of points that should be followed, including certain pre-delivery preparations. Martinsons' project manager can help you with planning and managing deliveries.

For further information, see The Glulam Handbook Part 1 from Swedish Wood.

RECEIPT OF DELIVERY

- Identify a suitable storage location for the glulam elements. The material should be easily accessible, taking into account factors such as order of assembly.
- Be well prepared so that both the supports and tarpaulins are already in place when the delivery arrives.
- Carry out an acceptance check to ensure that the delivery is correct, i.e. that it matches the order and the delivery note.
- Check that the packaging is intact and examine the glulam for any visible damage or soiling. Also compare the strength class and labelling with what is stated in the order and delivery note.
- Clearly and systematically label each glulam element and fixing to streamline installation.
- Cut open the bottom of the packaging to drain any moisture.
- It is not usually necessary to perform a moisture content measurement when receiving deliveries directly from the manufacturer. However, if required by the inspection plan, a number of glulam elements should be checked with an electrical resistance moisture meter to establish that they have the correct moisture content.

Delivery and handling

Tinnerbäcksbadet, Linköping
Architect: 3XN Sweden
Client: Lejonfastigheter, Linköping Municipality
Contractor: Serneke Sverige AB

STORAGE AT THE CONSTRUCTION SITE

Glulam elements should ideally not be stored outdoors on site for more than three weeks. When circumstances require prolonged storage, special measures should be taken and regular checks carried out. Here are some general tips for short-term storage of glulam:

- **Never lay glulam elements directly on the ground. Use clean supports at least 250 mm high to ensure good ventilation.**
- **Keep in mind that the substrate must be dry and flat to prevent the glulam elements from bending or warping.**
- **Lay clean counter battens (45–95 mm thick) between the glulam elements, placing then vertically one above the other. The thickness of the battens depends on how the elements are to be lifted, but bear in mind that a forklift requires at least 70 mm clearance.**
- **For outdoor storage, the glulam elements should be protected with tarpaulins, which are laid on clean studs for sufficient ventilation under the tarpaulins. The tarpaulin should never lie directly against the glulam or reach all the way to the ground.**

REMEMBER

Glulam that has become damp should be dried out slowly to prevent cracking. It is normal for minor cracks to occur during the first year that the glulam is installed in a building, but their small size means that they have no impact on the performance of the material.

Fit a moisture barrier if not already done in production.

TIPS FOR ASSEMBLY

When lifting glulam elements by crane, wide straps should be used to avoid lifting marks, and when lifting heavier elements, they should be fitted with edge protection. Everything that comes into contact with the material, such as work gloves and straps, should be clean and dry. Check temporary bracing to secure the frame against wind and other stresses during construction.

Careful preparation is essential for the glulam elements to be lifted into place correctly, safely and efficiently.
These operations are carried out in advance from the ground and ideally the glulam elements are placed at a good working height.

- **Mark where other building elements, such as load-bearing metal fixings, will connect.**
- **Install the fixings for purlins, beam hangers for compression struts, fittings for wind braces and so on.**
- **Preferably, fit cover plates to the tops of glulam columns before lifting.**
- **Decide whether it is best to leave the transport wrap on the glulam element as weather protection or to remove it.**
- **Fit a moisture barrier to the foot of glulam columns, if not already done in the production.**
- **Consider whether any other local weather protection should be used.**
- **Prepare for temporary bracing by installing webbing straps and tensioning straps or wires so they can be raised as part of the lift.**

MOISTURE DURING CONSTRUCTION

Managing moisture in the erection of a glulam frame is a key factor that the main contractor should actively engage with, from the early stages of the construction project to the completion of the building. To ensure the right conditions, it is important to ensure that both the technical solutions for the frame and the moisture management procedures are designed to avoid unnecessary exposure to unfavourable weather conditions.

Brief exposure of glulam to rain does not damage the chances of a quality-assured end result. It is also important that the wood is sufficiently dried out before being encased. Proper moisture prevention measures during frame construction therefore serve two purposes:

- **To prevent the risk of prolonged exposure to moisture.**
- **To avoid the unnecessary time and cost of drying out the pre-assembled frame.**

Wet weather
During assembly, wet weather will not usually cause any major moisture issues for glulam elements. Moisture takes time to penetrate the large cross-sections and the surfaces dry out quickly when the rain stops. End grain surfaces should, however, be protected from rain and snow. If the assembly will be taking one or two weeks, it works well to install the roof immediately after the glulam assembly is completed, while for larger buildings the installation should be divided into stages.

Sun exposure
When wood is freely exposed to the sun, its colour can change. UV radiation breaks down the wood's lignin, giving it a more yellowish look.

Local protection
Where rain may run along glulam surfaces, for example at external walls, the surfaces should be protected locally. The water may be contaminated with dirt from the roof, resulting in unsightly stains on the glulam surfaces. A solution may be needed to prevent water from running down the glulam columns, e.g. covering the top of the column with a drip cap.

Surface moisture content
According to AMA Hus, at the point of assembly glulam may have a maximum moisture content corresponding to a target moisture content of 16 per cent. With encasing, AMA states that the surface moisture content must not exceed 18 per cent, and glulam surfaces to be painted on site must have a surface moisture content of no more than 16 per cent at the time of painting.

TECHNICAL SOLUTIONS

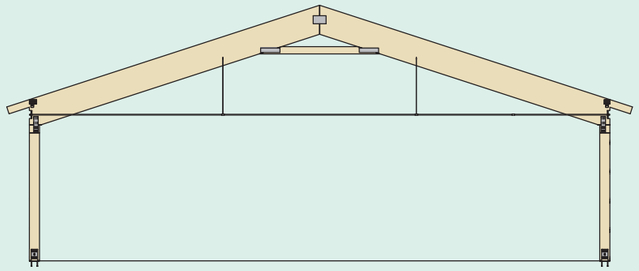
Overview of the types of timber frames we offer

IFU Arena, Uppsala
Architect: Metod arkitekter
Client: IFU Arena AB
Contractor: NCC

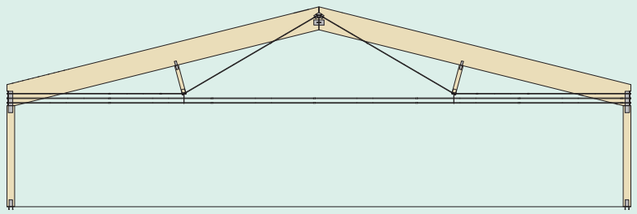
GLULAM FRAMES

Martinsons offers eight main types of frame and is happy to consult on the choice of frame type. Using our standard range as a starting point, Martinsons can customise a frame to suit your needs. Three-pin roof trusses are made with two beams of glulam as the upper frame and ties of glulam or steel.

Tie rod trusses

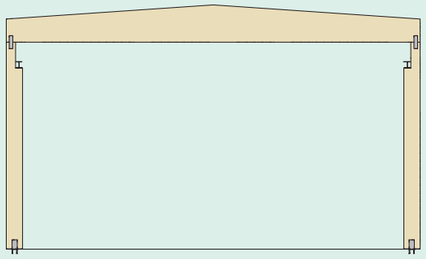


This frame solution is usually used when standard roof trusses are insufficient and offers a very economical option. Normal roof pitch 14–30 degrees. Suitable width 15–30 metres.

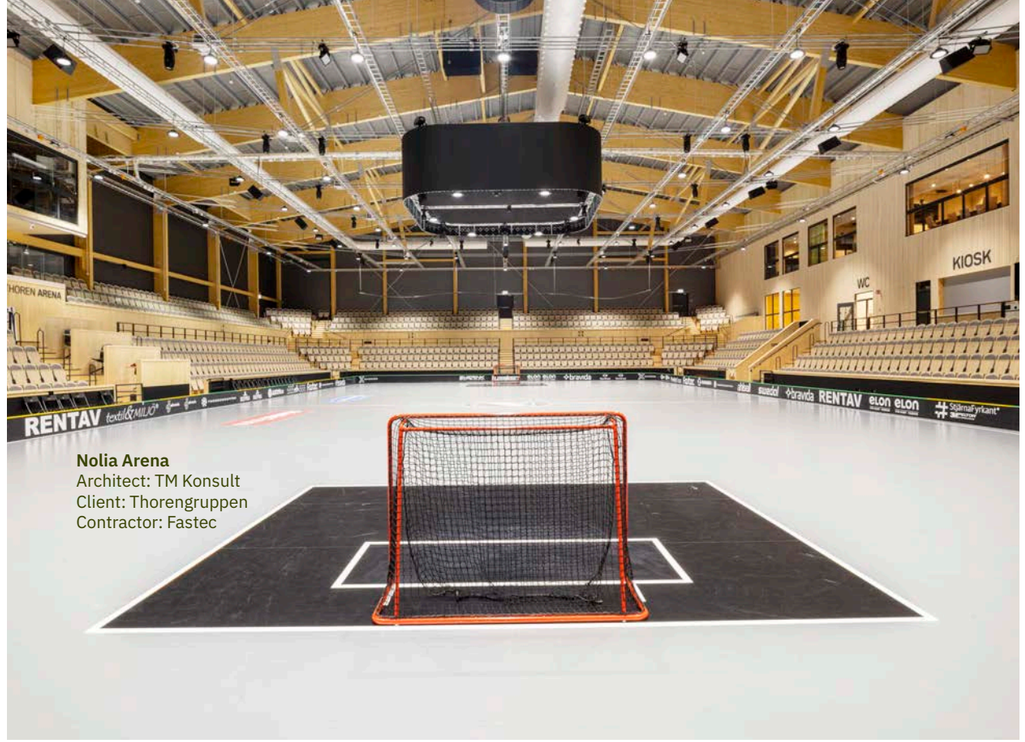


Suitable for sports halls, industrial premises, warehouses, etc. Three-pin roof trusses are made with two beams of glulam as the upper frame and glulam or steel ties. They allow an open span and thus full freedom in designing the layout of the space. Normal roof pitch 14–20 degrees. Suitable width 30–50 metres.

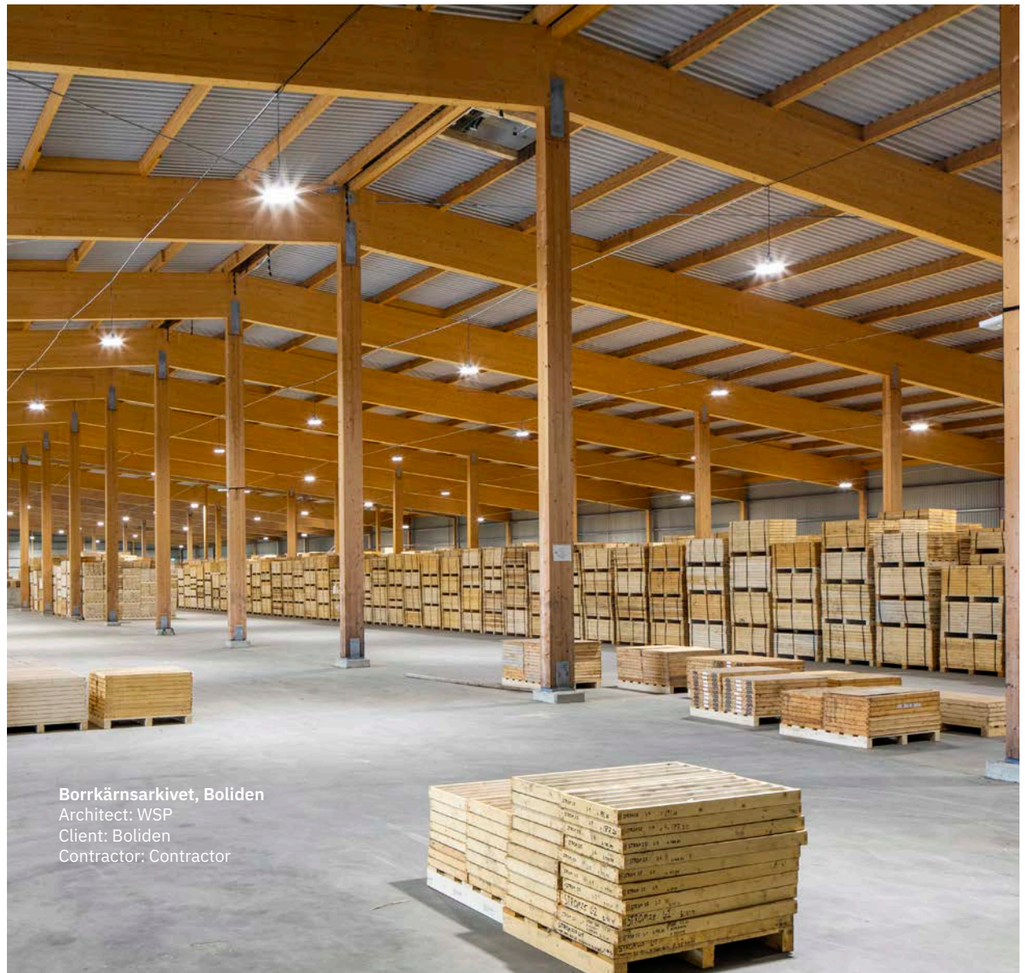
Pitched beam on columns



Suitable for sports halls, industrial buildings, commercial premises, etc. An uncomplicated and easily assembled frame, usually with spans up to 24 metres. Roof pitch 3–6 degrees. Suitable width 10–24 metres.

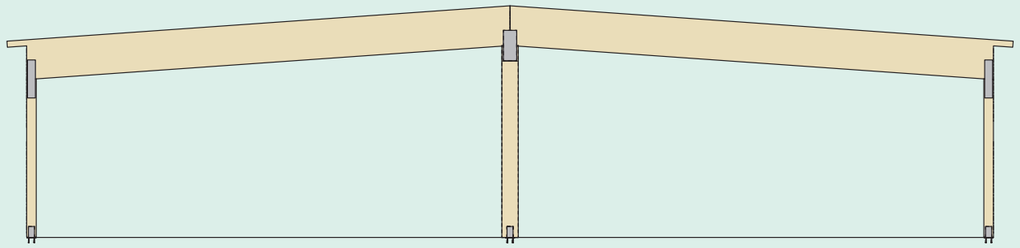


Nolia Arena
Architect: TM Konsult
Client: Thorengruppen
Contractor: Fastec



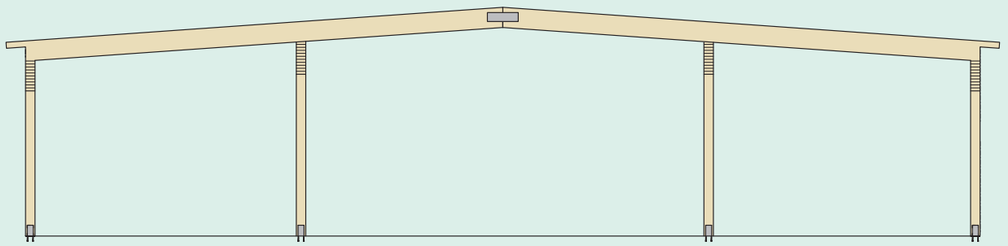
Borrkärnsarkivet, Boliden
Architect: WSP
Client: Boliden
Contractor: Contractor

Straight beam on columns



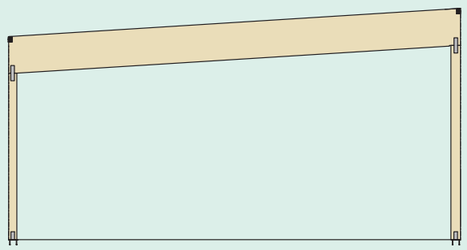
Suitable for industrial premises, sports halls, agricultural buildings, etc. The frame comprises simply supported beams on columns and is easy to assemble.

A standard wheel loader is usually sufficient to lift the elements into place. Suitable width 15–35 metres.



Suitable for industrial premises, agricultural buildings, etc. This frame type has longitudinal beams with columns in the desired locations and purlins along the sloping roof. Easy to assemble

and especially suitable for cold halls, as it is very easy to build an effective moisture barrier into the roof. The frame type also makes insulation easier. Suitable width 12–20 metres.



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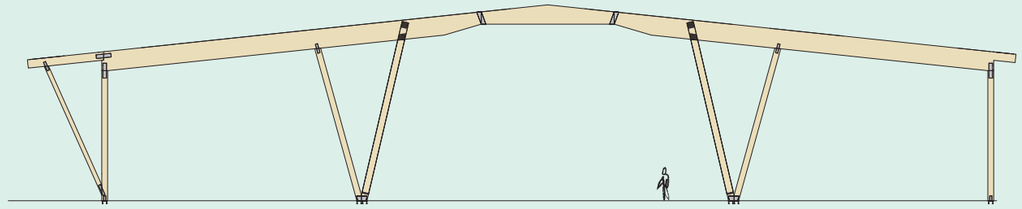
Cow shed
Byske, Skellefteå

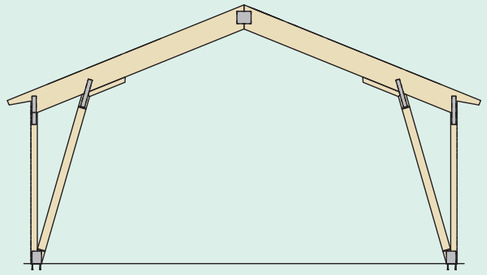
Stigamo logistics centre
Architect: Catena
Client: Catena
Contractor: EAB

Paradisbadet swimming pool, Örnsköldsvik
Architect: AFRY Infrastructure AB
Client: Örnsköldsvik Municipality
Contractor: Rekab

Framework with supports

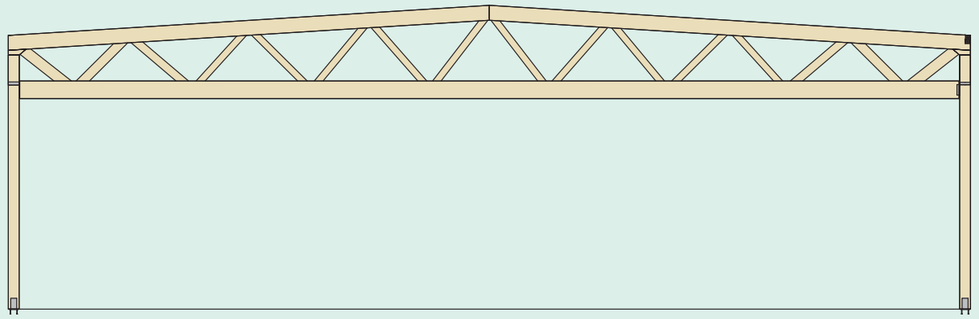


Suitable for industrial premises, commercial premises, etc. A natural choice when looking for large widths up to 60 metres with few supporting columns. Suitable roof pitch 3–7 degrees.
Trusses can be used as an alternative to the inset pitched beam in the mid section to allow for the placement of ventilation, for example.



Suitable for industrial premises, warehouses, agricultural buildings, etc. The structure is stabilised against wind load directly via the frame action on the long side. Optimised dimensions provide a cost-effective frame that is relatively easy to assemble. Width 12–25 metres, with a roof pitch of 18–45 degrees.

Trusses



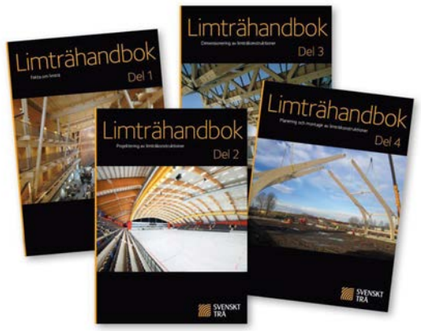
Suitable for sports halls, industrial buildings, commercial premises, etc. Timber trusses are normally used as simply supported beams. Glulam trusses are aesthetically pleasing structures that offer advantages such as running ventilation through the truss and a wide choice of roof pitches. Suitable width 20–34 metres.

Karlslund ice rink, Landskrona
Architect: Krook & Tjäder
Client: Landskrona Municipality
Contractor: Peab

Klagshamn riding centre
Architect: Fojab Arkitekter
Client: City of Malmö
Contractor: MVB AB

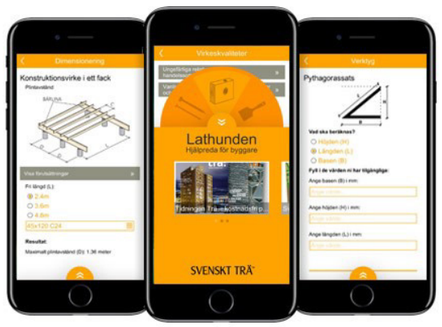
SOURCES FOR MORE DETAILED INFORMATION

This material guide contains information and technical facts relating to glulam. For further guidance on the calculation of mechanical properties and structural solutions for specific applications, we recommend the following sources of information:

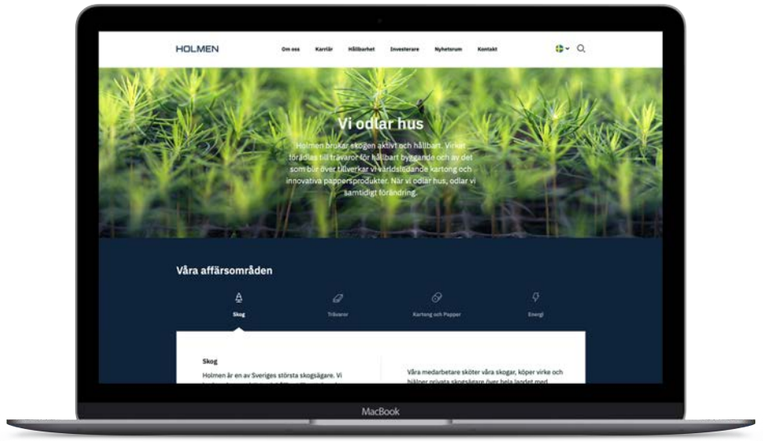


The Glulam Handbook – Swedish Wood
This industry handbook helps construction planners to design and plan glulam structures. The information includes guidance on factors such as acoustics, fire safety and joints.

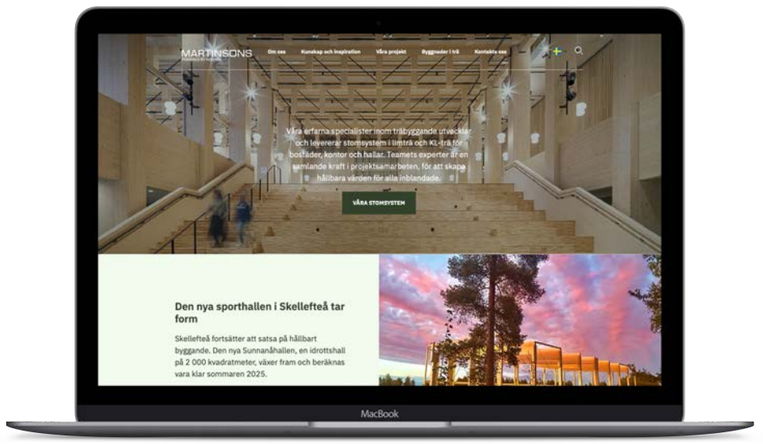
To download the Glulam Handbook, go to Swedishwood.com



Dimensioning tool
The industry organisation Swedish Wood has a dimensioning tool that helps you calculate the right dimensions for components such as roof beams, ridge beams, columns or joists for floors and decks – in construction timber, glulam or lightweight beams. You can find it at: byggbeskrivningar.se/dimensionering/



Holmen.com
Holmen's business concept is to own and add value to the forest. Our extensive forest holdings are thus the foundation of our business. Using our own production facilities, the growing trees are refined into everything from wood for climate-smart building to renewable packaging, magazines and books, while at the same time we generate hydro and wind power on our own land. You can find out more about us and our contribution to a sustainable future on the Group's website, where you will also find information about our certifications relating to glulam.



Martinsons.se
Martinsons supplies construction systems in glulam and CLT for everything from sports halls, commercial premises, schools, industrial buildings and warehouses to high-rise apartment blocks and office buildings. The business covers both development and design, as well as sales,project management and assembly.

Visit martinsons.se for some useful information to help you make decisions and discover the opportunities available. You can also draw inspiration from our previous projects and gain valuable knowledge about building in wood. Browse the content on the site or use the search function to quickly find what you are looking for.

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