



**Buckland Timber**

Glulam Design | Manufacture | Installation









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*Wood is universally beautiful to man - It is the most humanly intimate of all materials.*

Architect: Frank Lloyd Wright



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## INTRODUCTION

**At Buckland Timber our structural engineers, project managers, carpenters and joiners specialise in the design, manufacture and installation of bespoke glulam structures - we are the largest manufacturer of glulam in the UK.**

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Currently most structural glulam timber used in the UK is imported from other European countries - mostly from Germany, Austria and Sweden. Whilst there are a number of independent British companies who have the capability of making small quantities of bespoke glulam. Buckland Timber is the only UK company capable of manufacturing glulam on a scale that makes our products competitive with imports.

Buckland Timber Ltd was established in 2012. The partnership was set up by Bill Blight, Ralph and Robin Nicholson, with the purpose of producing a UK grown (and manufactured) sustainable alternative to European imported glulam.

Bill Blight and Ralph Nicholson both own and manage forestry in the South-West. The impetus for establishing Buckland Timber was their desire to make better use of their own harvested, high quality timber and other 'high end' timber also found within the South West.

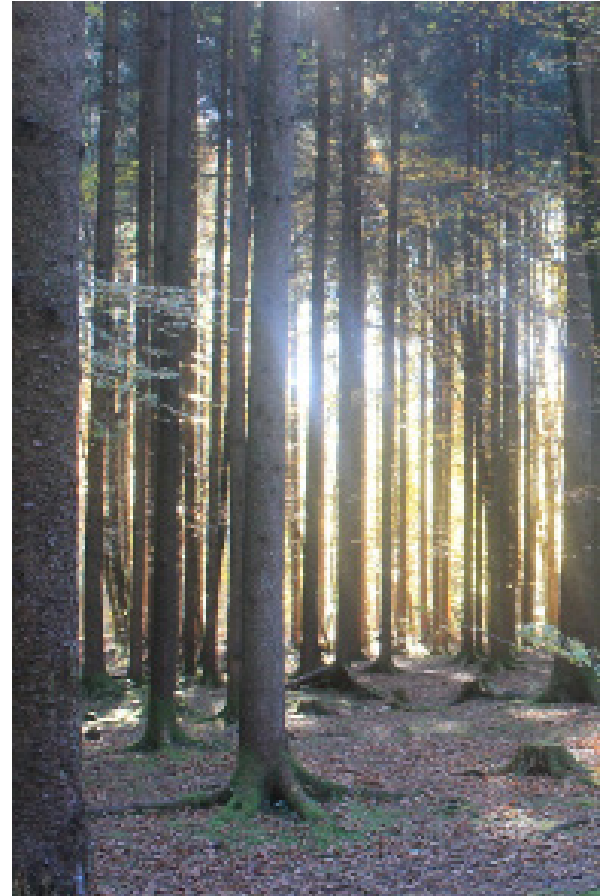
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Our closely linked design and manufacturing services give us a unique capability to explore the options available for your prospective timber structure and ensures that our solutions are tailored to your specific needs. We are always glad to give free preliminary advice and discuss the details of any projects you may be considering - just email over your drawings or give us a call.

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telephone: 01363 891 363

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Our future stock growing in Buckland Woods



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### **Glulam in brief**

Glued laminated timber (also abbreviated as glulam) is a structurally engineered wood product manufactured by bonding layers of timber together using durable, moisture-resistant structural adhesive. At a very basic level this means connecting a number of smaller layers of timber together to make a larger, single component. It is a way of manufacturing timber elements that cannot be easily sourced in solid timber due to their large size or unusual shape. The smaller layers can be dried much more effectively than large sections of sawn timber. This results in glulam being much more dimensionally stable than sawn timber.

Glulam is used for a wide range of purposes from joinery through to large span structural beams. Large glulam beams can often be seen in swimming pools or sports hall roof structures, more recently several large supermarkets have adopted glulam as both a decorative and structural component of their commercial spaces. Basically wherever a steel or concrete structure is utilised for a building, glulam could also be adopted as a more sustainable, and friendlier looking alternative.

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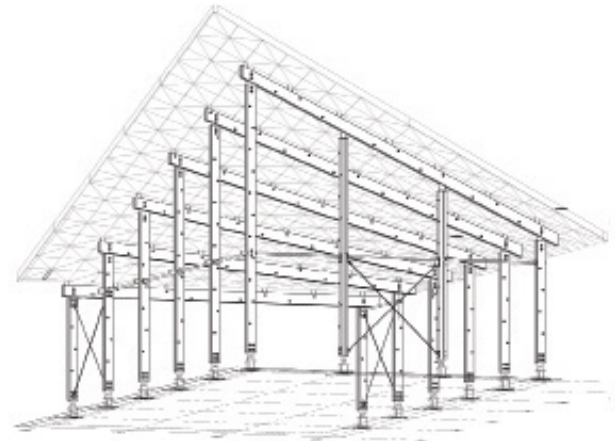
Glue laminated beams manufactured from Oak laminates

## SERVICES

### ENGINEERING DESIGN - *from ridge beam to complex 3D*

Our design team work 'hand in hand' with our manufacturing staff giving us the unique capability to explore the options available for any timber structure, whilst ensuring that our design solutions are tailored specifically to our client's needs. A design may have the aesthetic qualities our clients demand yet may not have the inherent buildability they require. Being able to manufacture and comfortably install a project is as important as its structural integrity. As part of our design services our structural engineers produce calculations for Building Control, 3D drawings for approval and finally full fabrication drawings for manufacture and installation.

We are always glad to provide free preliminary advice and to discuss the details of any project – in the first instance simply email outline drawings, telephone or visit us. We are practiced in taking projects from concept to completion and are happy to come in at any stage of the design process – anywhere from a 'back of an envelope' sketch through to completed structural or architectural drawings. We recognise that often buildings are not designed 'in one hit' and that a level of development and change are often required to successfully meet a clients desires.



**Above:** a double curved glulam roof structure - internally clad with over 700 individually shaped, CNC cut Birch faced plywood tiles. Engineering design, manufacture and installation - by Buckland Timber, including a prototype roof section and factory test fit of double curved roof panels.



## SERVICES

### GLULAM MANUFACTURING - *bespoke in-house capability*

The emphasis at Buckland Timber is to provide a flexible and fast manufacturing service, rather than a high volume commodity product. This allows us to make small runs of beams constructed from alternative timber species or to make bespoke curved or straight beams on short lead times.

Our finger jointing line is used to both grade and remove any defects in all the timber we use. Joining the timber in this way allows long lengths to be produced whilst maintaining the recognised strength grade. Once the timber is finger jointed and planed, glue is applied to the planks using a specialised application line. The glued laminates are stacked in mechanical clamps and pressure applied via screw jacks.



The clamps are secured to the ground and can be configured to create whatever shape is required. It does not necessarily need to be a radius, free form and complex curves are also possible. Once positioned in the clamps the beams are cured overnight and finished using a four sided industrial sized planing machine. Fully cured beams are then cut to size and shaped - this can include routing pockets for jointing, drilling holes for bolts, or installing metal brackets, shoes or collars. The final finishing process is to sand and apply stain, varnish or fire retardant to the beam's surface. After the treatment has completely dried each beam is wrapped, labelled and safely stacked with fixing components (threaded bar, nut, washers etc) ready for collection or transportation to site.



Our factory in Crediton (mid Devon) occupies 2750 square metres. Our machinery includes an automated finger-jointing line, mechanical clamps and industrial planer. Our plant is big enough to produce standard size straight beams at competitive prices, but we also have the flexibility to produce curved and long span beams - up to 30m. The production capacity of our workshop is about 5000 cubic metres per year.

## SERVICES

### INSTALLATION AND LOGISTICS

We supply much of our glulam as part of prefabricated structures, with all of the carpentry work completed within our workshop. Buildings (whatever the scale) are supplied in kit form - all of the columns, trusses and bracing members are numbered and marked. Thereafter, collated 'on site' and installed in a predetermined sequence.

Any steelwork required can be supplied with the glulam and where specified can be fitted in our workshop. Steelwork can be supplied unfinished, painted, galvanised or even manufactured from stainless steel.

We have a number of expert installation teams and work throughout the UK. We have installed our work in the tip of Cornwall, London, the Home Counties, the Midlands, Wales through to Scotland and even the Scottish Isles. We have experience of working at an industrial scale down to a single room household extension. We have worked in most of the UK's major international airports as well as commercial settings and exhibition venues.

We visit site, compose method statements, risk assessments and have developed safe working systems for particularly difficult installations. Our staff are trained to work with cranes, scissor lifts, scaffolding and carry the CITB recognised CSCS cards.



**Above:** to ensure all the component parts of each project fit together correctly we often 'dry fit' a project within our workshop. The size of the workshop enables us to check and adjust (where necessary) every component part prior to it being disassembled and packed for delivery to site. Where speed of construction and tight schedules are an issue this pre check is an invaluable part of the installation process.



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## SERVICES

### TECHNICAL TEAM

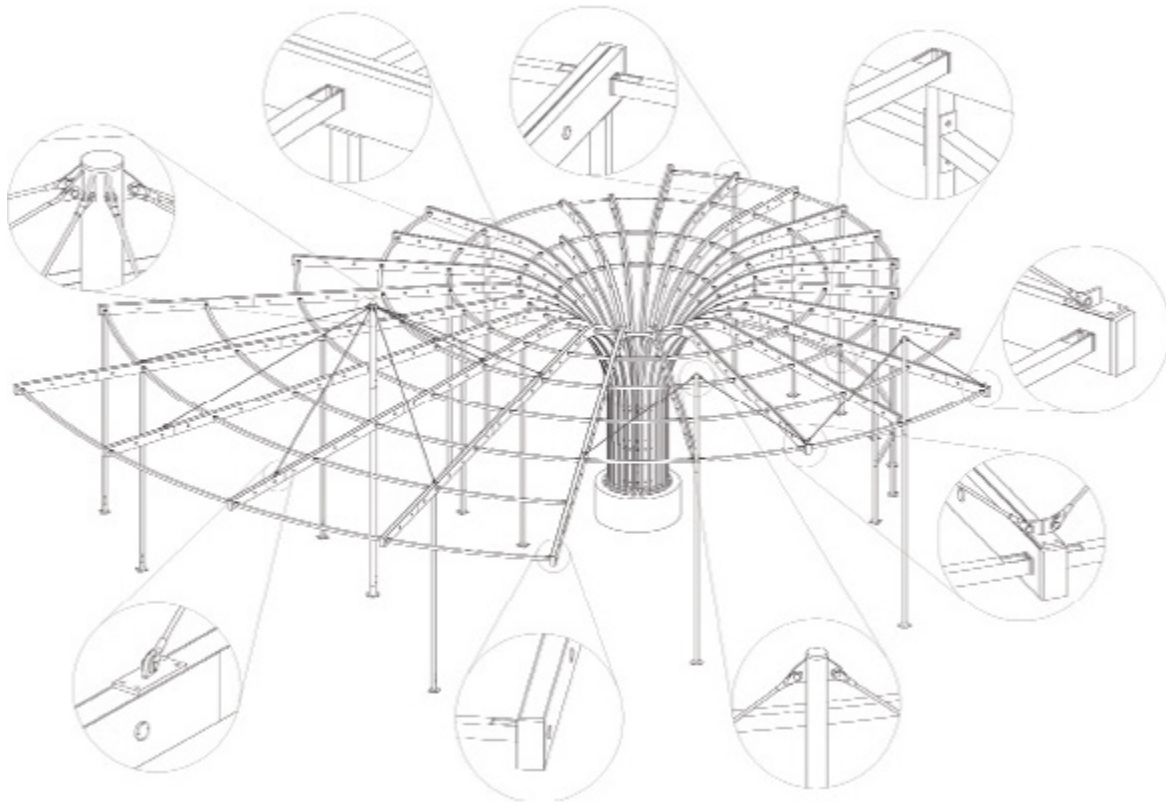


**Robin Nicholson** - is the Managing Director of Buckland Timber, a Chartered Structural Engineer with approaching two decades of experience in structural engineering and design - specifically with timber, along with his knowledge of building and traditional construction methods and materials.

**Keith O Ceallaigh** - is a graduate of Edinburgh Napier University. As our Technical Manager Keith has extensive knowledge of both the structural design of glulam buildings coupled with the technical aspects associated to glulam manufacture and logistics of installation.

**Brent Dicks** - is our Production Manager. Brent has a background in the design and manufacture of aerospace components, and provides a link between the design and manufacturing process. He plays a key role in informing the practical implementation of design in the workshop and during installation on site.

**Antonio Savinelli** - an Engineer graduate of the University of Naples (Italy). Antonio joined our technical team in 2018 and focuses on structural design - from simple projects to complex geometry needing three dimensional structural modelling.



## SERVICES

### GLULAM PRODUCTION



**Left:** the film crew from BBC's Grand Designs record our Glulam manufacturing process. The bracing frame is set to the specified curvature and our carpenters position layers of glued timber until they reach the required size. Once in place all of the timbers are clamped, covered and heated - curing the glue overnight.









## SERVICES

### GLULAM CANOPIES

We design and manufacture a range of glulam canopy frames which are used to create outdoor covered spaces. These are usually supplied as frame only for installation and roofing by others. We can include an installation service or recommend one of our supply partners on request.

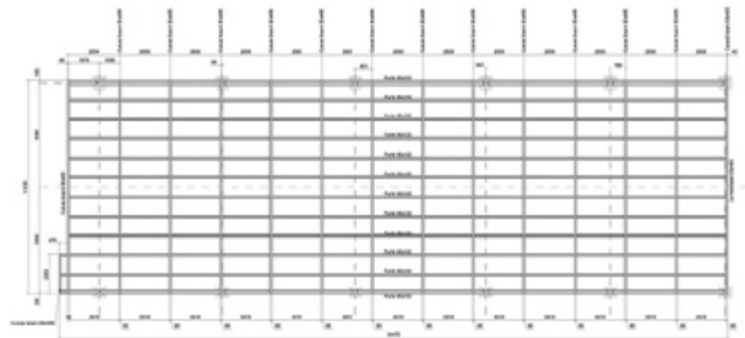
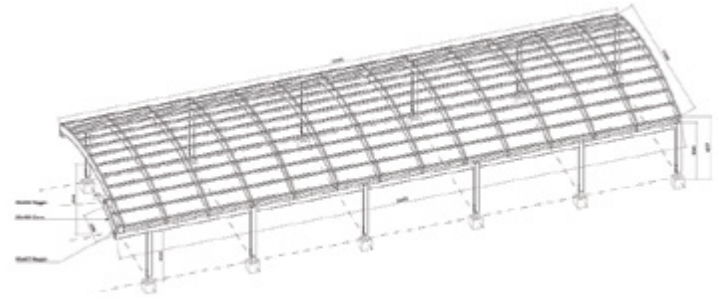
Canopies can be designed as wallmounted or freestanding, curved or straight. As standard these are manufactured from spruce glulam with a two coat stain applied, although other timber species are available on request. Roof material can be polycarbonate or tensile fabric.

Although the canopies are designed on standard principles, we are flexible with the design and can accommodate pretty much any plan layout or configuration with existing buildings.

Canopies can be as small as two metre square and up to a twelve metre span on similar design principles. Much larger spans are possible if required.



**Note:** many of the photos depicting canopies are supplied courtesy of Able Canopies.  
[www.ablecanopies.co.uk](http://www.ablecanopies.co.uk)





## TECHNICAL INFORMATION

### STRUCTURAL INTEGRITY

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#### Structural Certification

Buckland Timber carry CE certification for the manufacture of structural glue laminated timber. We have detailed processes and procedures in place to ensure that all beams manufactured by us achieve the required standards. Any structural material supplied to the construction industry is required to have CE certification.

The Timber Research Development Association (TRADA) assess our manufacture and testing procedures to ensure we are conforming to our Declaration of Performance (DoP). The DoP provides information on the performance of our products and records the standards to which they are manufactured (BS EN 14080).

A copy of our declaration of performance is available on request.

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#### Responsible Timber Sourcing

We are certified to supply FSC® (Forest Stewardship Council®) certified products sourced from responsibly managed forests. We are also certified to supply PEFC (Programme for the Endorsement of Forest Certification schemes) certified products from sustainably managed forests.



The mark of  
responsible forestry

FSC® certified products available upon request.





## TECHNICAL INFORMATION

### STRENGTH GRADES FOR GLULAM BEAMS

Buckland Timber manufacture GL24h glulams from imported timber and GL20h glulams from home grown UK timber. Other strength grades are available on request.

Buckland Timber - Structural Glulam Manufacturing				
Timber	Whitewood	Redwood Pine	Siberian Larch	British Larch
Scientific name	Picea abies	Pinus Sylvestris	Larix Sibirica	Larix Kaempferi
Durability	Slight	Slight	Moderate	Moderate
Strength Class	GL24h or GL24g	GL24h	GL24h	GL20h

The characteristic values for GL20h to GL32h glulam are listed in the table below (N/mm<sup>2</sup> unless noted otherwise).

Strength Class	Bending Strength	Tensile Strength	Tensile Strength	Compression Strength	Compression Strength	Shear Strength	Modules of Elasticity			Shear Modulus	Characteristic Density kg/m <sup>3</sup>
		Parallel to the grain	Perpendicular to the grain	Parallel to the grain	Perpendicular to the grain		Mean	Fifth percentile	Mean		
		$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$		$E_{0,mean}$	$E_{0,05}$	$E_{90,mean}$		
GL20h	20	16	0.5	20	2.5	3.5	8400	700	300	650	370
GL24h	24	19.2		24			11500	9600			420
GL28h	28	22.3		28			12600	10500			460
GL30h	30	24		30			13600	11300			480
GL32h	32	25.5		32			14200	11800			490

## TECHNICAL INFORMATION

### VISUAL GRADES AND MANUFACTURING TOLERANCES

We offer our glulam in three different visual grades:

- Non-Visual – suitable for use when the glulam is not seen or when the visual appearance is not important.
- Standard Visual – suitable for most applications where the glulam is seen and is a feature of the structure. Example – swimming pools, canopies, large residential structures.
- Best Visual – suitable for glulam that will be viewed at close distance. Example – worktops or tabletops, stair treads, small scale residential structures.

	Non Visual	Standard Visual	Best Visual
<b>Type of wood</b>	<ul style="list-style-type: none"> <li>• European Spruce.</li> <li>• Fifths grade Pine.</li> </ul>	<ul style="list-style-type: none"> <li>• European Spruce.</li> <li>• Unsorted grade Pine.</li> <li>• Douglas Fir.</li> <li>• Siberian Larch.</li> </ul>	<ul style="list-style-type: none"> <li>• European Spruce.</li> <li>• Unsorted grade Pine.</li> <li>• Douglas Fir.</li> <li>• Siberian Larch.</li> </ul>
<b>Lamella thickness</b>	40mm to 45mm.	30mm to 45mm.	20mm to 45mm.
<b>Surface</b>	Planed and levelled.	Neatly planed on all sides, sanded where there are planer marks - visible from 2m away.	Sanded on all sides, finished with minimum 80 grit orbital sander.
<b>Bevel</b>	Bevelled / sharp-edged.	3mm to 4mm bevel.	3mm to 4mm bevel.
<b>Knots</b>	No requirements.	Loose knots, knot holes up to 35mm diameter allowed	No loose knots or knot holes. Knot holes under 15mm diameter to have filler repair, larger to have infill timber repair.
<b>Resin pockets</b>	No requirements.	Permissible up to 50mm long and 5mm wide, otherwise repaired	Permissible up to 50mm long and 2mm wide, otherwise repaired.
<b>Inbark</b>	Permissible (no rot).	Not permissible.	Not permissible.
<b>Discolouring</b>	Permissible.	Blue stain and red stripe permissible up to 5% of the surface	Not permissible.
<b>Insect infestation</b>	Permissible subject to strength grading requirements.	Not permissible.	Not permissible.
<b>Cracks</b>	<p>No requirements or crack depth maximum.</p> <p>One sixth of component width.</p>	Top layer cracks up to 2mm wide permissible, radial shrinkage cracks up to 30cm in length permissible.	Cracks up to 2mm to be filled, over 2mm to have timber infill repair.
<b>Flaws</b>	Only severe damage is repaired.	Maximum three longitudinal / round wooden plugs behind each other, otherwise a wooden strip is used.	Repaired using strips of infill timber to match lamination.
<b>Hit &amp; Miss (planing)</b>	Permissible.	Not permissible.	Not permissible

## TECHNICAL INFORMATION

### CURVED BEAMS



Curved beams are made by clamping glued lamella around an arrangement of clamp frames which are bolted to the floor. Differing radii are achieved by adjusting the clamp layout and using different thicknesses of timber. The thinner the planks are, the easier they are to bend which allows tighter radii to be achieved.

As a rule of thumb, the thickness of plank required is the radius ÷ 200 i.e. a nine metre radius will require a plank thickness of 45mm, but a two metre radius will require a plank thickness of 10mm. The tighter the radius, the more expensive the beam is, due to the increased material wastage and labour costs.

We can achieve a minimum radius of around one metre by standard production methods. This would use 5mm thick laminates. Any tighter radii are usually made by cutting the curved shape from jointed straight beams.

## TECHNICAL INFORMATION

### BEAM SIZES

Reduced sizes are entirely flexible when allowing for beams planed from a larger size. In general Douglas fir and Larch beams will be manufactured from 30mm laminations, Spruce and Pine from 40mm to 45mm laminations.

The table below provides a guide for standard sizes available in Spruce. Please note that wider beams can be manufactured by gluing multiple beams together.

HEIGHT IN MILLIMETRES													
WIDTH	100mm	120mm	140mm	160mm	200mm	240mm	280mm	320mm	360mm	400mm	440mm	480mm	520mm
60mm		X	X	X	X	X							
80mm		X	X	X	X	X	X						
100mm	X	X	X	X	X	X	X	X					
120mm		X		X	X	X	X	X	X				
140mm			X	X	X	X	X	X	X	X	X		
160mm				X	X	X	X	X	X	X	X	X	
180mm					X	X	X	X	X	X	X		
200mm					X	X	X	X	X	X	X	X	X
220mm						X	X	X	X	X	X	X	
240mm						X	X	X	X	X	X	X	X



## TECHNICAL INFORMATION

### BOLT SPACING FOR BEAMS

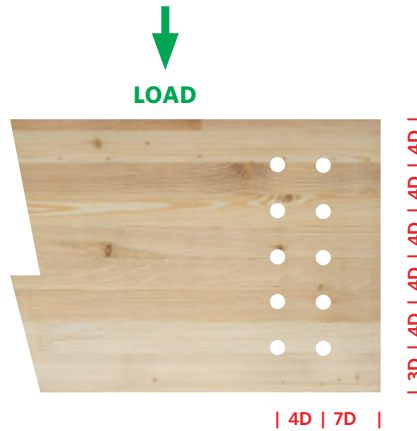
The information listed below relating to bolt spacing is a simplified version of the rules set out in BS EN 1995. This is as an aid to preliminary design of connections. It applies to dowel type fasteners with a diameter larger than 6mm.

**Please reference:** Standards: BS EN 1995-1-1: 2004  
D = bolt diameter

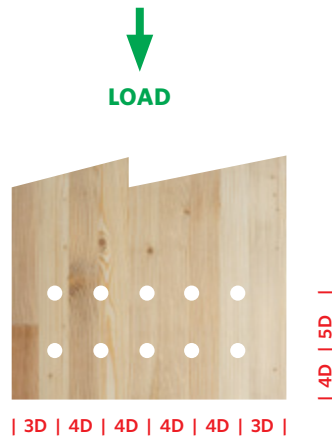
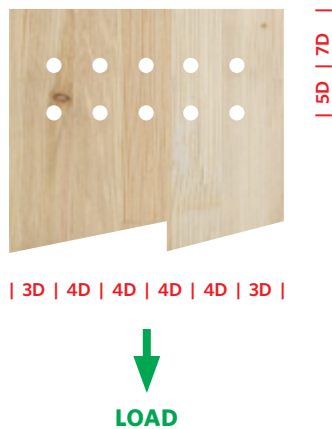
#### BEAMS WITH A LOADED EDGE PERPENDICULAR TO THE GRAIN



**Above:** the photograph shows the fixing detail for a roof beam and column - in this instance an integrated flitch beam is secured by stainless through bolts.



#### COLUMNS WITH A LOADED EDGE PARALLEL TO THE GRAIN



## TECHNICAL INFORMATION

### LOAD SPAN TABLE

#### FOR SIMPLY SUPPORTED BEAMS

**Please note:** This table is meant to provide beams sizes on a preliminary stage. Results given **do not** replace structural calculations.

#### Always reference:

Standards:  
UNI EN 1991-1-1:2002  
BS EN 1990-1-1:2002  
BS EN 1995-1-1:2004 + A2:2014

Strength Class:  
GL24 acc. to BS EN 14080:2013

Loading:  
Dead Load  
0.70 kN/m<sup>2</sup> Floor  
0.50 kN/m<sup>2</sup> Roof

Live load  
2.00 kN/m<sup>2</sup> Floor  
0.60 kN/m<sup>2</sup> Roof

Service Class: 1

It is very important to recognise that the specification and spacing of any fixings are crucial to the structural integrity of any beam or column. The information provided on this page is published simply as a guide. Specification of fixings, materials and loadings needs to be carried out and calculated by a suitably qualified structural engineer.

TABLE SHOWING ALLOWABLE SPANS IN M FOR VARYING SECTION SIZES AND LOADS - Glue Laminated Timber - GL24h

Section	Floor						Roof					
	Load Width or Beam Centres (m)						Load Width or Beam Centres (m)					
Size (mm)	2	2.5	3	3.5	4	4.5	2	2.5	3	3.5	4	4.5
100 x 160	2.58	2.40	2.25	2.14	2.04	1.97	3.01	2.79	2.63	2.49	2.39	2.30
100 x 200	3.22	3.00	2.81	2.67	2.56	2.46	3.76	3.49	3.29	3.12	2.99	2.87
100 x 240	3.86	3.60	3.37	3.21	3.07	2.95	4.51	4.19	3.95	3.75	3.58	3.44
100 x 280	4.51	4.20	3.93	3.74	3.58	3.44	5.26	4.89	4.60	4.37	4.18	4.02
100 x 320	5.15	4.80	4.49	4.27	4.09	3.93	6.01	5.59	5.25	4.98	4.78	4.60
120 x 200	3.42	3.18	2.99	2.84	2.72	2.61	4.00	3.71	3.49	3.30	3.17	3.05
120 x 240	4.11	3.81	3.59	3.40	3.26	3.14	4.80	4.45	4.19	3.96	3.81	3.66
120 x 280	4.80	4.44	4.19	3.95	3.80	3.66	5.60	5.19	4.89	4.62	4.44	4.27
120 x 320	5.48	5.07	4.79	4.52	4.35	4.18	6.40	5.93	5.59	5.28	5.08	4.88
120 x 360	6.17	5.70	5.39	5.08	4.89	4.71	7.20	6.67	6.29	5.94	5.72	5.49
140 x 200	3.60	3.35	3.15	2.99	2.86	2.75	4.21	3.91	3.68	3.49	3.34	3.21
140 x 240	4.32	4.02	3.77	3.58	3.44	3.30	5.05	4.69	4.41	4.18	4.01	3.86
140 x 280	5.04	4.69	4.39	4.17	3.99	3.85	5.89	5.47	5.14	4.87	4.68	4.50
140 x 320	5.76	5.36	5.03	4.78	4.57	4.40	6.73	6.25	5.88	5.57	5.35	5.14
140 x 360	6.48	6.03	5.66	5.38	5.15	4.95	7.57	7.03	6.62	6.27	6.02	5.79
140 x 400	7.20	6.70	6.29	5.98	5.73	5.50	8.41	7.81	7.35	6.97	6.69	6.43
140 x 440	7.92	7.37	6.92	6.57	6.30	6.05	9.25	8.59	8.10	7.68	7.36	7.08
160 x 200	3.76	3.50	3.29	3.13	2.99	2.88	4.40	4.08	3.85	3.64	3.49	3.36
160 x 240	4.52	4.20	3.95	3.75	3.59	3.45	5.28	4.90	4.62	4.38	4.19	4.03
160 x 280	5.28	4.90	4.61	4.37	4.18	4.02	6.16	5.72	5.39	5.11	4.88	4.69
160 x 320	6.04	5.60	5.26	4.97	4.78	4.60	7.04	6.54	6.16	5.84	5.58	5.37
160 x 360	6.80	6.30	5.92	5.59	5.38	5.17	7.92	7.36	6.93	6.57	6.28	6.04
160 x 400	7.56	7.00	6.58	6.21	5.98	5.75	8.80	8.18	7.70	7.31	6.98	6.71
160 x 440	8.32	7.70	7.25	6.84	6.59	6.32	9.68	9.00	8.47	8.04	7.67	7.39
160 x 480	9.08	8.40	7.90	7.45	7.17	6.89	10.56	9.81	9.24	8.76	8.37	8.05
180 x 240	4.70	4.37	4.11	3.90	3.73	3.59	5.50	5.10	4.80	4.54	4.36	4.19
180 x 280	5.48	5.09	4.80	4.55	4.35	4.19	6.40	5.95	5.60	5.31	5.09	4.89
180 x 320	6.26	5.81	5.48	5.19	4.98	4.79	7.32	6.80	6.40	6.07	5.82	5.59
180 x 360	7.06	6.53	6.17	5.82	5.60	5.39	8.24	7.65	7.20	6.82	6.54	6.28
180 x 400	7.84	7.25	6.85	6.46	6.22	5.99	9.15	8.50	8.00	7.59	7.27	6.99
180 x 440	8.62	7.97	7.54	7.11	6.85	6.59	10.08	9.35	8.80	8.33	8.00	7.67
180 x 480	9.40	8.69	8.23	7.76	7.47	7.17	10.97	10.20	9.60	9.11	8.73	8.39
180 x 520	10.18	9.50	8.91	8.49	8.10	7.78	11.88	11.05	10.40	9.88	9.45	9.09

**ESTIMATED SECTION SIZE FOR GL24H IN MM**

Span	Example for floor beams						Example for Roof beams					
	Center to Center Spacing of Beams						Center to Center Spacing of Beams					
	2m	2.5m	3m	3.5m	4m	4.5m	2m	2.5m	3m	3.5m	4m	4.5m
3.5m	140 x 200	140 x 240	140 x 240	140 x 240	140 x 280	140 x 280	140 x 200	140 x 200	140 x 200	140 x 200	140 x 240	140 x 240
4m	140 x 240	140 x 240	140 x 280	140 x 280	140 x 320	140 x 320	140 x 200	140 x 240	140 x 240	140 x 240	140 x 280	140 x 280
4.5m	140 x 280	140 x 280	140 x 320	140 x 320	180 x 320	180 x 320	140 x 240	140 x 240	140 x 280	140 x 280	140 x 280	140 x 280
5m	140 x 320	140 x 320	140 x 320	140 x 360	180 x 360	180 x 360	140 x 240	140 x 280	140 x 280	140 x 320	140 x 320	140 x 320
5.5m	140 x 360	140 x 360	180 x 320	180 x 360	180 x 400	180 x 400	140 x 280	140 x 320	140 x 320	140 x 320	140 x 360	140 x 360
6m	180 x 360	140 x 360	180 x 360	180 x 400	180 x 400	180 x 400	140 x 320	140 x 320	140 x 360	140 x 360	140 x 400	140 x 400
6.5m	180 x 360	180 x 360	180 x 400	180 x 400	180 x 440	180 x 440	140 x 320	140 x 360	140 x 360	140 x 400	140 x 440	140 x 440
6.75m	180 x 360	180 x 400	180 x 400	180 x 440	180 x 480	180 x 480	140 x 320	140 x 360	140 x 400	140 x 400	140 x 440	140 x 440
7m	180 x 360	180 x 400	180 x 440	180 x 440	180 x 480	180 x 480	140 x 360	140 x 360	140 x 400	140 x 400	140 x 480	140 x 440
7.25m	180 x 400	180 x 400	180 x 440	180 x 480	180 x 520	180 x 520	140 x 360	140 x 400	140 x 400	140 x 440	140 x 480	140 x 480
7.5m	180 x 400	180 x 440	180 x 440	180 x 480	180 x 520	180 x 520	140 x 360	140 x 400	140 x 440	140 x 440	180 x 480	140 x 480
7.75m	180 x 440	180 x 440	180 x 480	180 x 480	180 x 520	180 x 520	140 x 400	140 x 400	140 x 440	140 x 480	180 x 480	180 x 480
8m	180 x 440	180 x 440	180 x 480	180 x 520	180 x 560	180 x 560	140 x 400	140 x 440	140 x 440	140 x 480	180 x 480	180 x 480
8.25m	180 x 440	180 x 480	180 x 480	180 x 520	180 x 560	180 x 560	140 x 400	140 x 440	140 x 480	140 x 480	180 x 480	180 x 480
8.5m	180 x 440	180 x 480	180 x 520	180 x 560	180 x 600	180 x 600	140 x 440	140 x 440	180 x 440	180 x 480	180 x 520	180 x 520
8.75m	180 x 480	180 x 480	180 x 520	180 x 560	180 x 600	180 x 600	140 x 440	140 x 480	180 x 440	180 x 480	180 x 520	180 x 520
9m	180 x 480	180 x 520	180 x 560	180 x 560	180 x 600	180 x 600	140 x 440	140 x 480	180 x 480	180 x 480	180 x 520	180 x 520
9.25m	180 x 480	180 x 520	180 x 560	180 x 600	240 x 560	240 x 560	180 x 440	180 x 440	180 x 480	180 x 520	180 x 560	180 x 560
9.5m	180 x 520	180 x 520	180 x 560	180 x 600	240 x 600	240 x 600	180 x 440	180 x 480	180 x 480	180 x 520	180 x 560	180 x 560
9.75m	180 x 520	180 x 560	240 x 520	240 x 560	240 x 600	240 x 600	180 x 440	180 x 480	180 x 520	180 x 520	180 x 560	180 x 560
10m	180 x 520	180 x 560	240 x 560	240 x 560	240 x 640	240 x 640	180 x 440	180 x 480	180 x 520	180 x 560	180 x 600	180 x 600
10.25m	240 x 480	240 x 520	240 x 560	240 x 600	240 x 640	240 x 640	180 x 480	180 x 520	180 x 520	180 x 560	180 x 600	180 x 600
10.5m	240 x 520	240 x 560	240 x 560	240 x 600	240 x 640	240 x 640	180 x 480	180 x 520	180 x 560	180 x 560	180 x 640	180 x 640
10.75m	240 x 520	240 x 560	240 x 600	240 x 600	240 x 680	240 x 680	180 x 480	180 x 520	180 x 560	180 x 600	180 x 640	180 x 640
11m	240 x 520	240 x 560	240 x 600	240 x 640	240 x 680	240 x 680	180 x 520	180 x 520	180 x 560	180 x 60	180 x 640	180 x 640
11.25m	240 x 520	240 x 560	240 x 600	240 x 640	240 x 720	240 x 720	180 x 520	180 x 560	180 x 600	180 x 600	180 x 680	180 x 680
11.5m	240 x 560	240 x 600	240 x 640	240 x 640	240 x 720	240 x 720	180 x 520	180 x 560	180 x 600	180 x 640	180 x 680	180 x 680
11.75m	240 x 560	240 x 600	240 x 640	240 x 680	240 x 720	240 x 720	180 x 520	180 x 560	180 x 600	180 x 640	180 x 680	180 x 680
12m	240 x 560	240 x 600	240 x 640	240 x 680	240 x 760	240 x 760	180 x 560	180 x 600	180 x 600	180 x 640	180 x 720	180 x 720
12.25m	240 x 600	240 x 640	240 x 680	240 x 720	240 x 760	240 x 760	180 x 560	180 x 600	180 x 640	180 x 680	180 x 720	180 x 720
12.5m	240 x 600	240 x 640	240 x 680	240 x 720	240 x 760	240 x 760	180 x 560	180 x 600	180 x 640	180 x 680	180 x 720	180 x 720
12.75m	240 x 600	240 x 640	240 x 680	240 x 720	240 x 800	240 x 800	180 x 560	180 x 600	180 x 640	180 x 680	180 x 760	180 x 760
13m	240 x 600	240 x 680	240 x 680	240 x 720	240 x 800	240 x 800	180 x 600	180 x 640	180 x 680	180 x 720	180 x 760	180 x 760



## TECHNICAL INFORMATION

### GLULAM - CARBON FOOTPRINT

With Global Warming and our carbon footprints becoming an ever greater concern for most people, glulam would appear to be a valuable low carbon option. Rather than just state that a glulam frame is more environmentally friendly than the steel equivalent, we have attempted to check and quantify this statement.

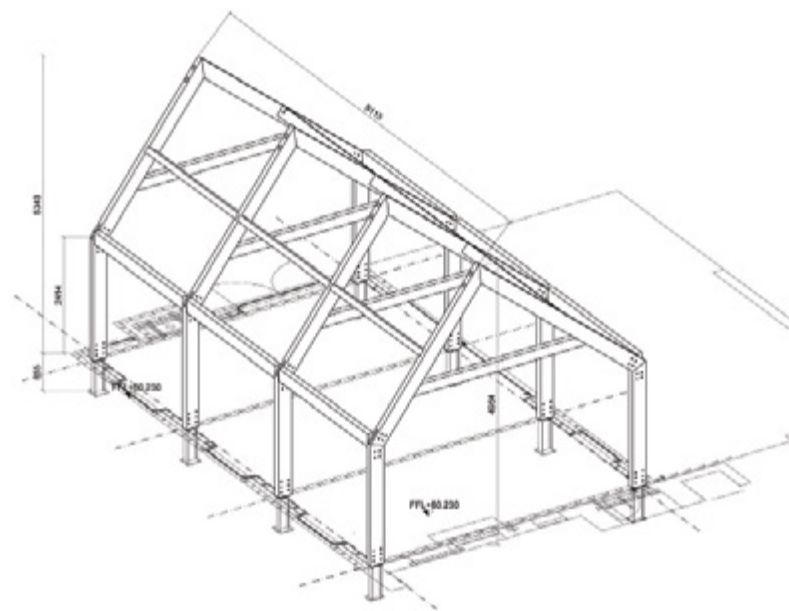
To do this we have considered a typical small project for us - a 9 x 5.7m house extension frame consisting of four portal frames. For the glulam options the materials used were 2.74 cubic metres of glulam and 255kg of steel brackets and fixings. The equivalent steel portal option we replaced the 115 x 270mm glulam beams with an equivalent steel of 102 x 203 (23 UB). The weight of steel to make the four portal frames would be 1640kg.

We have considered Cradle to Gate embodied equivalent carbon dioxide emissions for both materials - for steel a figure of 1.59 kg equivalent CO<sub>2</sub> / kg steel <sup>1</sup> and for glulam a figure of 361 kg equivalent CO<sub>2</sub> / cubic metre of glulam <sup>2</sup>. By this calculation the glulam option emits the equivalent of 1400kg of equivalent CO<sub>2</sub> emissions. The steel frame omits 2600kg of equivalent carbon emissions. So a saving of 1200kg, the same as about 10% of the yearly emissions of the average UK inhabitant.

Note that this does not take into account the carbon held within the timber itself - as it is assumed this will be recycled or released back into the atmosphere at some point in the future, likewise the steel would most likely be recycled at some point in the future. If we take a more short term view, and look at the CO<sub>2</sub> emissions benefit whilst the building remains in use, we can include an additional benefit of approximately 1000kg CO<sub>2</sub> equivalent stored per cubic metre of timber - this would give a total benefit of choosing glulam over steel of 3950kg, the same as about forty percent of the yearly emissions of the average UK inhabitant.

This analysis comes with the caveat that we are not academics or experts in this field and have taken figures we were able to find from internet searches of academic papers. However we think we are able to say that using a glulam frame instead of steel is better for the environment and that the impact is not insignificant.

Specifying glulam can help lower a project's carbon footprint and also positively contribute in relation to offsite construction. Wherever possible Buckland Timber are happy to support the new RIBA 2030 Climate Challenge and join other companies positively impacting on the reduction of carbon in construction.



1. Life Cycle Assessment of Steel Produced in an Italian Integrated Steel Mill. *Pietro A. Renzulli, Bruno Notarnicola, Giuseppe Tassielli, Gabriella Arcese and Rosa Di Capua.*
2. Life-Cycle Analysis of Wood Products: Cradle to Grave LCI of Residential Wood Building Materials. *Maureen E. Puettmann, James B. Wilson*

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## TECHNICAL INFORMATION

### CONNECTION TYPES

There are a wide range of both 'off the shelf' and bespoke connectors and structural joining solutions available - the ones we recommend and typically adopt are:

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#### Slotted Plate / Steel Dowelled Connections

We use this type of connection when the steelwork can be fitted in our workshops. Steel dowels are driven through the glulam into holes within the steel plates that are drilled at the same diameter as the dowels. This means that there is very little potential for movement within the joint.

The dowels are concealed with timber plugs so that no steelwork is visible. Dowels are often the best solution for highly loaded joints such as portal eave connections, where the large number of connections needed may look visually overpowering if they were left exposed.



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#### Slotted Plate / Bolted Connections

This method is often best when structural loads are relatively high and the project is to be supplied as a kit of parts, to be assembled on site. We usually use large form 'G' washers and counterbore the fixings so they finish flush with the surface of the glulam.

Where steel feet or internal plate reinforcement (fitch plates) are specified, slots are cut out, holes drilled and counter bored to receive bolts, nuts and washers. This provides the same structural integrity as steel dowels but visually provides a much more contemporary industrial aesthetic.



### Concealed Beam Hangers

We use a range of 'off the shelf' concealed beam hangers. These are fitted directly onto the beams in the factory and allow for an easy 'slot in' fit on site. When housed in the end of a beam they can be made invisible. If you desire no trace of fixings externally this is an ideal choice.



### Resin Fixed / Anchor Joints and Bolts

These are another rapid and cost effective method of jointing glulam. By adopting a resin anchor fixing system, no external traces are visible and the joining process is less labour intensive. These are best specified for joints that can be assembled in the factory under controlled conditions.



### Screwed Connections

One connection option can be designed using large structural wood screws. This is a good, cost effective and fast option for connections involving lower forces. Screwed connections can also be a good solution visually when there is a need to have no joist hangers or other steelwork visible.

Posts or beams can be counter bored, screwed into position and the holes plugged and sanded leaving very little external trace.

### Joist Hangers

These are the most used and recognised method to join posts and rails. Where the structural timber work is not being left in an exposed state, these are a quick, cost effective and structurally robust method to support beams.



**Above:** skew screwed connection.

**Right:** joist hangers set out across curved glulam beams connecting the purlins.



### Bespoke Steelwork

Every commission is unique and always needs a range of bespoke elements. Where steel is concerned, we work with specialist engineering companies that fabricate our bespoke steelwork. Where needed we can powder coat, plate (galvanised and chrome) and even spray finish our steel elements as specified.





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## TECHNICAL INFORMATION

### TIMBER SPECIES

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#### Timber Procurement Policy

There is now a legal requirement within the EU obliging all businesses trading in timber or timber-related products to use due diligence systems to ensure they are only using legally sourced timber.

The UK Government Timber Procurement Policy (TPP) is mandatory across the government estate, including central government departments, executive agencies and non-departmental public bodies. It is advisable across semi-autonomous organizations, such as schools, universities and local authorities.

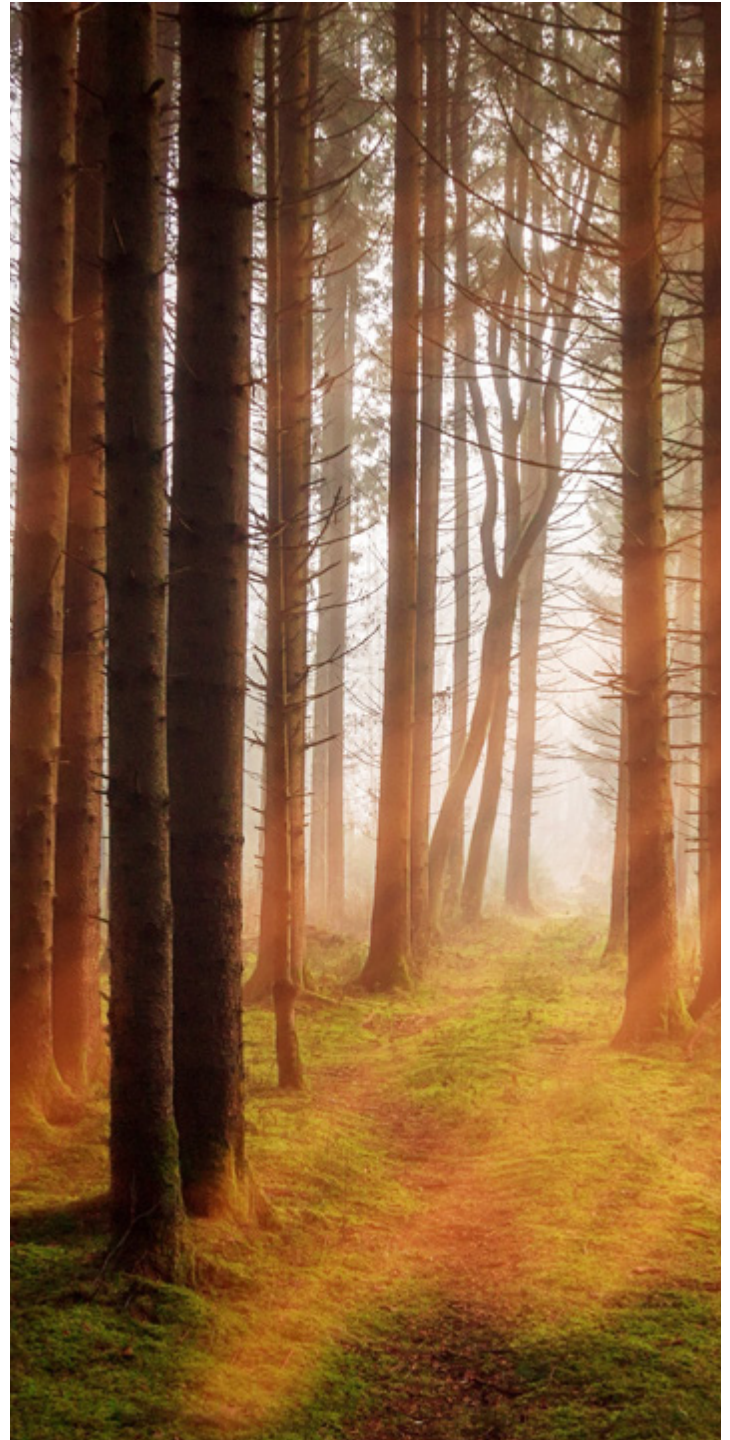
It covers the purchase of all timber components, from perimeter fencing to scaffolding boards. These must be purchased with clearly documented evidence of legality and sustainability. Organisations (including Buckland Timber) must hold documentation that records it coming from both legal and sustainable sources. As about forty percent of United Kingdom timber imports are used in public sector contracts, government policy is a major influence on the sector.

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Visit [www.trada.co.uk](http://www.trada.co.uk) for additional technical information.

More and more people recognize the need to use certified timber. In many cases, this is a legal requirement. For example, if you work as a contractor or subcontractor on public sector work, (such as NHS, National Trust, UK government or armed forces) you must ensure you comply with the procurement requirements, whether undertaking new build or maintenance work.

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### **Attributes, Characteristic and Use**

The embodied energy of timber is much lower than most alternate construction materials such as concrete and steel. With considered forest management, timber can be easily sustained and readily available worldwide. Being a very popular choice of building material, timber has great properties of strength, is lightweight, reliable, durable, and versatile. It has an incredible strength to weight ratio, twenty percent higher than structural steel and four to five times better than unreinforced concrete when used in compression.

Glue laminated timber builds on the inherent strengths of timber whilst increasing the dimension, complexity of beam shape and size. Perhaps with this in mind glulam is becoming the 'go to' sustainable option for growing numbers of contemporary architects and designers.

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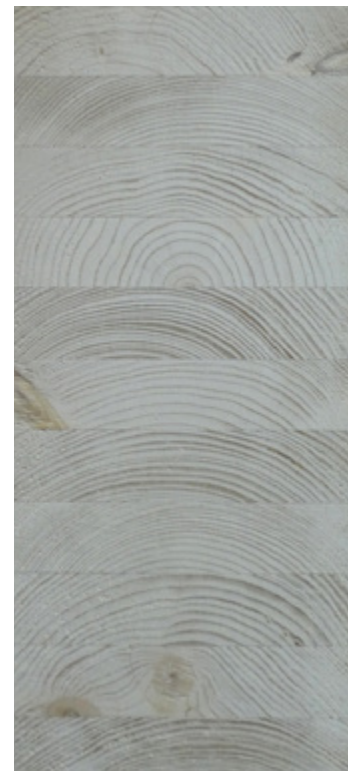
It is sometimes quite easy to forget that timber is a natural product - it varies in colour texture and grain. Even a single plank of wood visually changes greatly across its length. It is a beautiful, natural product. Wood has been used in some of the largest construction projects in the world and adopted for use in the smallest utilitarian tools (toothpicks and matches). It is a sustainable, versatile material and its use and application has helped to shape history - from bridges and boats through to arrows and pencils! Its application affords an unmatched natural resonance, and it continues to enhancing both the smallest of interior spaces and the largest exterior projects worldwide.

There are over 60,000 different species of trees on the planet. Some differ in such small ways that are hardly discernible to the naked eye whilst others are worlds apart. Even with this huge variety to choose from we predominantly use only five different varieties: Oak, Larch, Douglas fir, Spruce and Redwood. Their characteristics differ greatly but we have found this small combination can provide the widest possible option when used in the manufacture of glulam beams.

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It is always advisable to see samples of any timber species prior to placing an order.



**Spruce** - is the most cost effective and readily available timber for glulam manufacture. Also called Whitewood, Spruce is widely distributed throughout continental Europe and is a species of major economic importance. The large, fully grown trees usually have a straight trunk and grow to a height of about thirty meters, (the largest examples up to 55 metres). On average it is felled when its diameter measures around sixty centimetres. If left it can grow up to 1.5 meters.

Its colour ranges from a creamy white, light yellow to a reddish brown. The heartwood is not distinct from its sapwood. It is straight grained with thin and regular texture. The timber can emit sap even after being seasoned and machined. The wood is soft, easy to manipulate and work, low in weight and has a medium density. The strength properties are good, it is most commonly used in construction for both structural and internal joinery (skirting boards, architraves etc). It is an ideal choice for machining and structural application. Spruce wood from Central and Eastern Europe shows exceptional resonance qualities and is used for musical instruments like pianos, violins and guitars.





**Douglas Fir** - originates in the North West of America. It was introduced 200 years ago into the UK and Europe as a fast growing sustainable timber primarily for use in construction. Properties of European Douglas Fir (mostly relating to the speed of growth and grain size) differ depending upon altitude and weather conditions - colder the climate, closer the grain.

The heartwood has a pinkish to dark red colour and is clearly discernible from the yellow sapwood. The sapwood has a thickness of between five and ten centimetres. The texture of the timber is medium, it has a fairly straight grain with the light and darker colours differing in terms of hardness. It can show some resin pockets (sometimes in large sizes). The timber has a medium density and good strength properties. Gluing and sawing properties are good, as well as nailing and screwing, but pre-drilling is necessary as there is a strong tendency for splitting.

As with Siberian Larch, Douglas Fir can provide a more characterful option to Spruce. It can be used externally (if suitably treated and maintained) with a recommendation to use sapwood free Douglas Fir.



**Redwood (Pine)** - or also called Scots pine, has a growth range larger than that of any other softwood. It can be found from Scotland to the Pacific Coast of Siberia, Norway, Mongolia and also in the Mediterranean region. The trees grow from ten to thirty meters tall, its largest sizes are up to forty meters in height. Scots pine from the Nordic countries is used for construction with large volumes of timber being produced in Scandinavia for housing. We often use Pine for our glulam as it is readily available in joinery (or 'unsorted') grade which is relatively knot free.

Pine has distinct yellowish white sapwood and reddish heartwood. Heartwood is clearly recognisable from sapwood. Slow grown Nordic pine is very easy to machine to a smooth surface. Knots are tightly fixed in the timber and normally limited in size. The big red knots are common and give a decorative character to the timber. The wood is soft, medium in weight and has a medium density. The strength properties are good. Sawing and machining is easy, gluing can at times be difficult depending on the percentage of resin in the wood. In the UK it is mostly used for construction and also for joinery, interior finishings and furniture.





**European Oak** - is an exceedingly strong, heavy and durable timber. It has an attractive light colour with a prominent grain. It is resistant to fungal attack, thanks to its dense constitution and long-living nature. Oak is slow growing, very dense with a tight grain. It has been harvested and used in a wide variety of applications from joinery, large construction timbers through to barrel making, bowls and small decorative household items.

Our use of Oak glulam is predominantly for small scale house extensions where a high quality is required. We usually use prime grade Oak boards for our glulam, meaning that although the material is a little more expensive, the finish and quality is guaranteed.

Please note: Oak glulam does not carry a CE strength certification grade as it is not included in the CE glulam standards. We recommend designing to GL24 grade for our Oak glulam beams. Oak is a natural material - it comes in a broad range of colours and tones. We cannot offer or guarantee uniformity throughout the wood, only the physical integrity of each component.



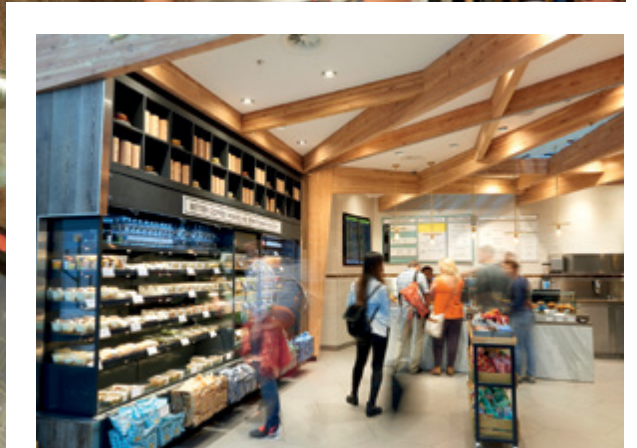
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## CASE STUDIES

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*The following pages list a range of commissions we have worked on since the establishment of Buckland Timber over ten years ago. It is by no means a finite portfolio of our work on but a valuable document showcasing the range of our work. We have tried to compile the broadest spectrum of projects here to help illustrate the range, possibilities and different applications of glue laminated timber.*

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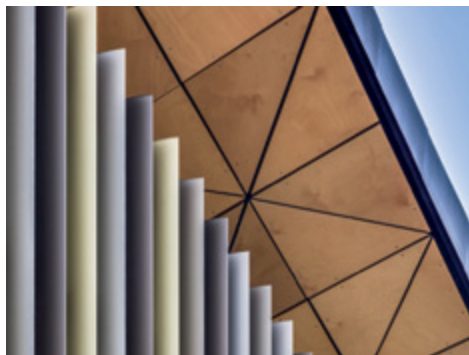
















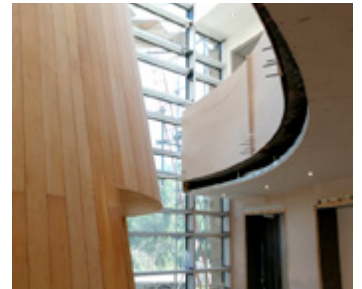




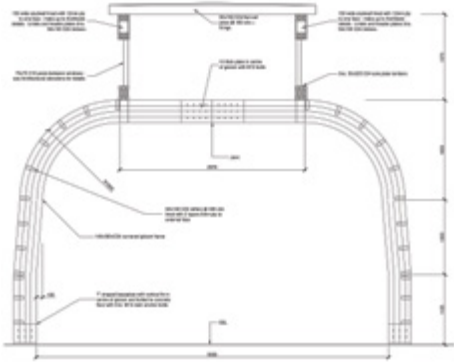




































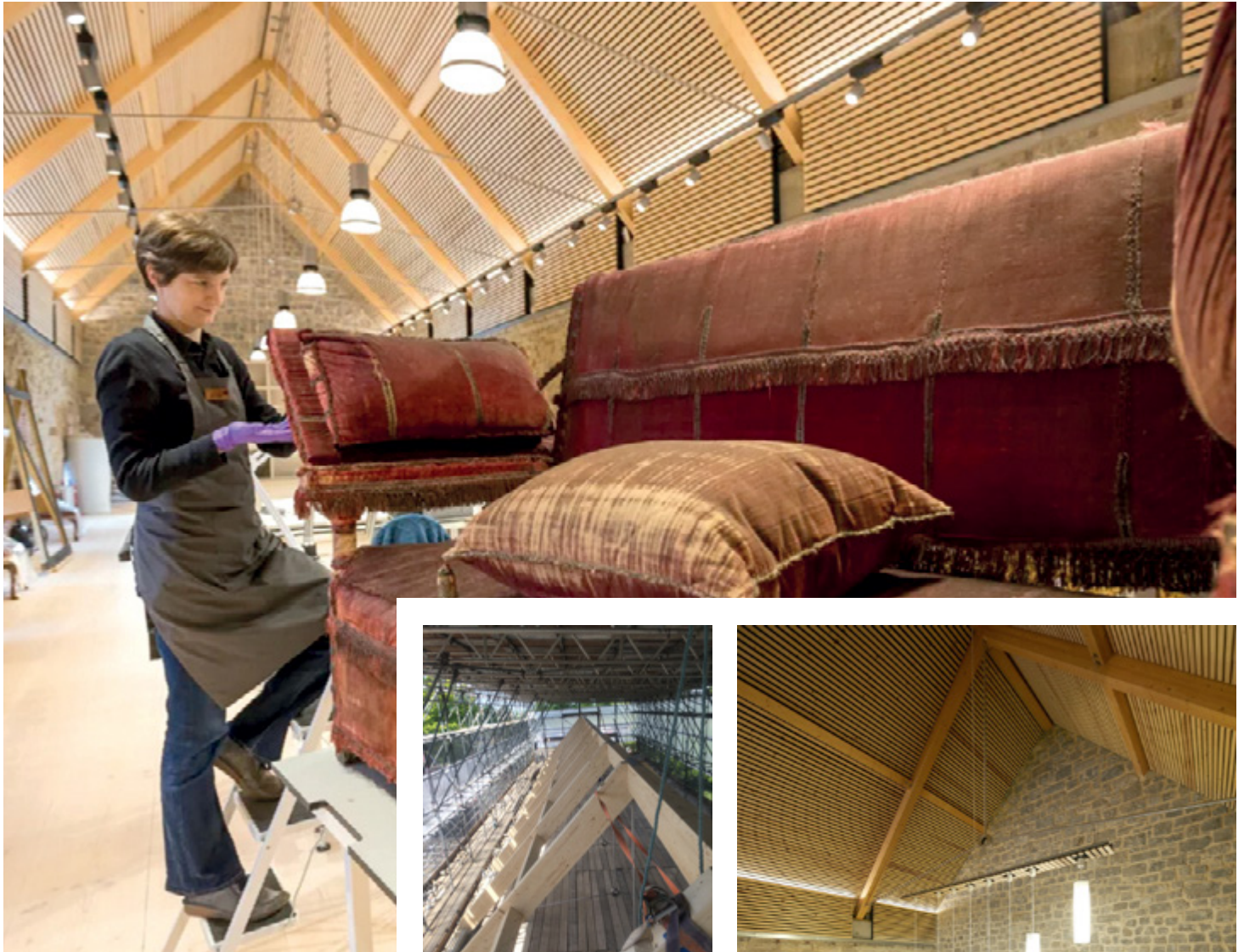






















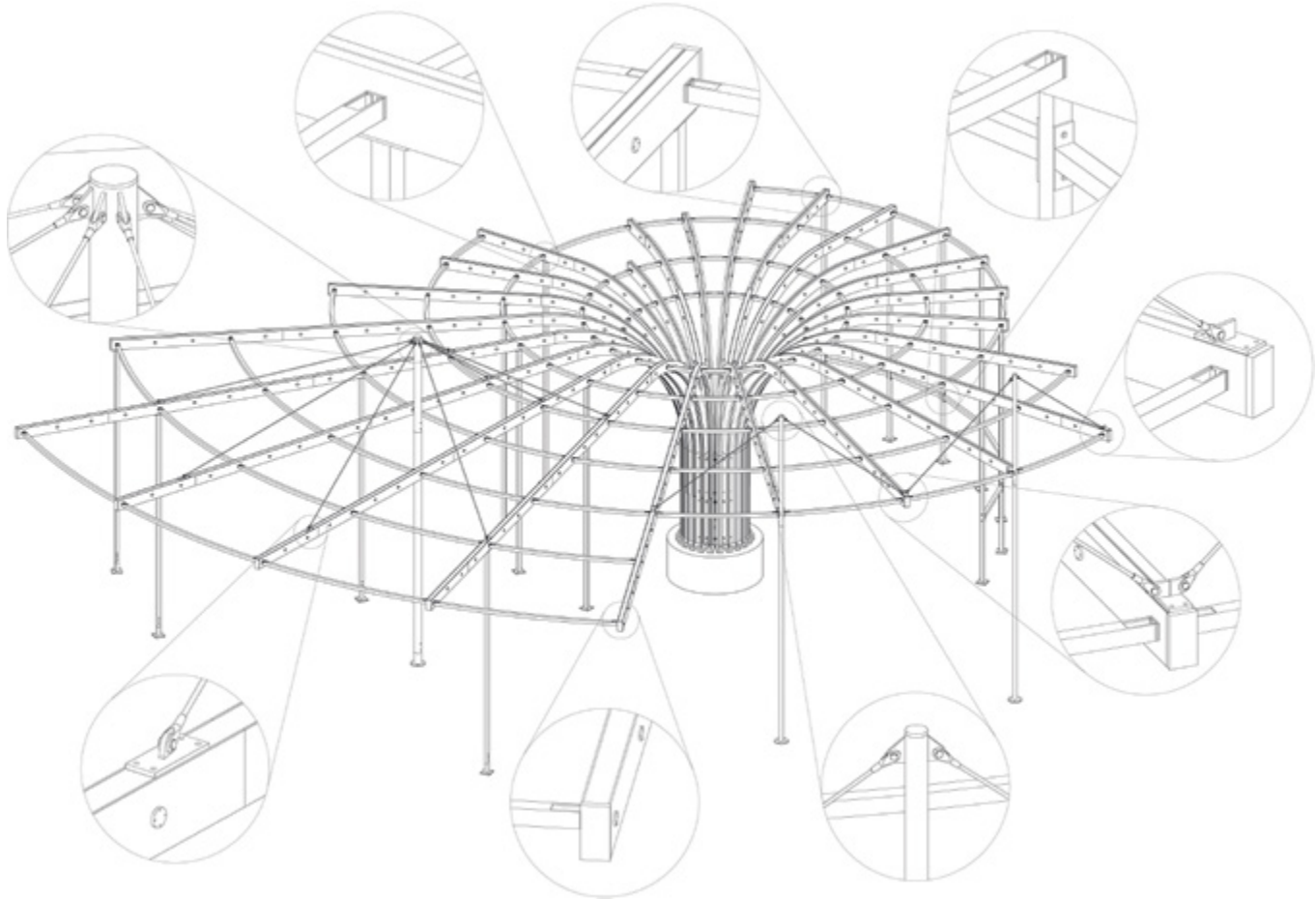


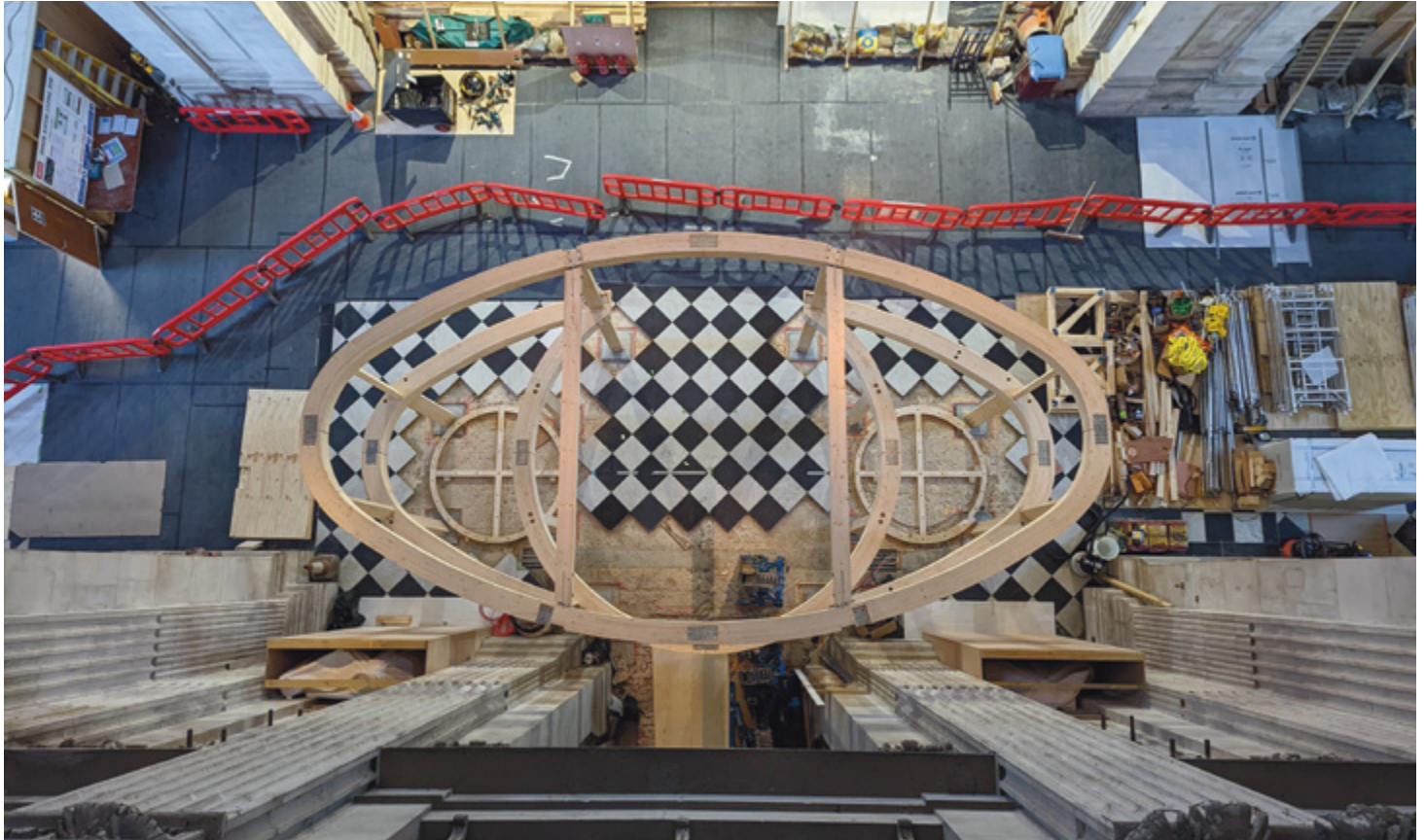














## Acknowledgements

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A publication such as this would not be possible without the combined efforts of all of the contributors. We would like to thank all of the architects, designers and engineers and acknowledge their skills in the broad range of projects featured in this publication. We would like to express our sincere gratitude to everyone who has given permission for the projects to be published. Every effort has been made to contact the architects and designers for permission: however, any omission or incorrect listings should be notified to us- we will be pleased to amend any future editions of this publication.

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### Architects & Designers:

Able Canopies  
Alsop Architects  
AR Design Studio Ltd  
Atelier Architecture  
Mark Baldwin  
Batterham Smith Architects  
Bournville Architects  
David Kohn Architects  
Christopher Beardshaw  
Cartwright Pickard  
Faulkner Browns  
Sadler Brown Architecture  
Scott Brownrigg  
Kyle Smart Associates  
Studio Four Architects  
Tigg Coll  
Path Design Ltd  
LHC Design  
TFQ Architects  
Judge Architects Ltd  
Lap Chan - Morgan Carn Partnership  
Oxenham Consultants Inc  
Holland & Green Architectural Design  
nKm Architects  
MIME Architects  
Marty McColl - UP Architects  
Kendall Kingscott Ltd  
Charles Adams Partnership Ltd  
Steuart Padwick  
One Red Wall

### Engineers:

HRW - London  
Elliot Wood  
Engenuti  
Team 4 Consultants  
Marbas  
AJ Locke Consulting  
Beal Consulting Engineers  
Hydrock  
Design 4 Structures Ltd  
Ward Consulting Engineers  
SLR Consulting  
Structural Solutions

## Commissions

At Buckland Timber we produce a huge range of glulam beams, structures, and even large sculptural components used in housing, commercial sites and retail spaces. Our work has been featured a number of times on television including Channel 4's Grand Designs and Ugly House to Lovely House, showcasing the best of contemporary architectural design.

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### Our clients and locations include

EDEXCEL Exhibition Centre - London  
Royal Holloway University  
Royal Horticultural Society  
Pret-A-Manger - Heathrow Airport  
Costa Coffee - Stanstead Airport  
Chelsea Flower Show  
Royal National Lifeboat Institute  
Church of England  
Wellinton Academy - Salisbury  
St John's School - Leatherhead  
St Albans Cathedral  
Diocese of Westminster  
Sir Robert McAlpine  
Channel 4  
Longleat Safari Park  
Morgan Sindell  
Kier

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## [WWW.BUCKLANDTIMBER.CO.UK](http://WWW.BUCKLANDTIMBER.CO.UK)

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**Buckland Timber Ltd**

**Marsh End**

**Lords Meadow Industrial Estate**

**Crediton Devon EX17 1DN**









At Buckland Timber we have been making bespoke glulam beams for over a decade - we are the largest manufacturer of glulam beams in the UK. Our work has been featured a number of times on TV's Grand Designs, been part of RIBA award winning architectural projects and helped win RHS Gold at Chelsea Flower Show.

Our team of structural engineers, designers and joiners allow us to support construction projects which range in scale from a small garden studio to a huge equestrian arena. If you have a project where you are contemplating the use of glulam or you have never used glulam before get in contact, we are always happy to discuss projects at any stage and also welcome visitors to our workshop.

Buckland Timber Ltd - Marsh End  
Lords Meadow Industrial Estate  
Crediton Devon EX17 1DN

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