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TECHNICAL DATA SHEET No.4

Technical Data Sheets

HISTORY OF GL GRADES

Introduction

The history of the glued laminated timber industry in Australia has its beginnings with the sawmilling industry which saw the opportunity to value-add structural timber into a valuable engineered product. There developed a range of proprietary brand products with section sizes and grades to suit the individual manufacturer's resource. Add to this array of varying products, design philosophies which varied from engineer to engineer due to individual application of deflection limits, and we had a confused user base of Glulam.

The result created confusion in the minds of the end users and made choice of material in the design phase of a structure very brand-specific.

Early in this decade, the Glued Laminated Timber Association of Australia (GLTAA) set about developing standard Glulam grades, designs criteria and section sizes so the industry presented to end users a generic product, easily specified, engineered and procurable competitively anywhere in Australia.

The end result of this process is the publication of the new grades in AS/NZ 1720-Timber Structure code.

Why GL Grades?

The new Glulam grades have been developed with a suite of structural properties which are different from the "F" ratings used on solid timber and the use of "F" ratings to grade Glulam is therefore now inappropriate. Youngs Modulus of Elasticity (E) is the structural property which generally governs the design of a Glulam beam and for this reason, the GLTAA adopted a descripter based on the E value of the grade i.e. GL18 means it has an E value of 18500 Mpa (old F27 value).

The new system, in Table 1 below is that adopted in AS/NZ 1720.

Table 1 - Characteristic Strengths and Elastic Moduli for Horizontally Laminated Glulam Grades

	CHARACTERISTIC STRENGTHS (Mpa)				ELASTIC MODULI (Mpa)	
Stress Grade	Bending *(f'b)*	Tension parallel to grain *(f't)*	Shear in beam *(f's)*	Compression parallel to grain *(f'c)*	Short duration average modulus of elasticity parallel to grain *(E)*	Short duration average modulus of rigidity for beams *(G)*
GL18	50	25	5.0	50	18500	1230
GL17	42	21	3.7	35	16700	1110
GL13	33	16	3.7	33	13300	900
GL12	25	12	3.7	29	11500	770
GL10	22	11	3.7	26	10000	670
GL8	19	10	3.7	24	8000	530

Design Criteria

All GLTAA members publish safe load tables based on a uniform design criteria, which has been developed from good engineering practices in timber design. By adopting this approach, published safe load tables by all GLTAA members are consistent.

The Uniform design criteria is published as Technical Data Sheet No. 3.

HISTORY OF GL GRADES continued...

Section Sizes

The following tables show the standard section sizes adopted by the GLTAA members for all grades. This uniform approach by the GLTAA means that specifiers can confidently detail GL grades and section sizes and know the product will be available, no matter where in Australia, the project is being constructed.

Table 2 - Uniform GL Section Sizes

GL GRADES	GL18	GL17	GL13	GL12	GL10 & 8
Nominal beam widths in MM	40	38		40	38
	65	65		65	60
	85	85	80	85	80
	115	115		115	110
	135	135	130	135	
Nominal beam depths in MM	90				
	120	130		130	
	155	165	152	165	
	185	195	190	195	
	215				
	240	230	229	230	
	250	260	267	260	
	270				
	280				
	300	295	305	295	
	315				
	330	330	343	330	
	350	360		360	
	380	395	381	395	
	410				
	445	425	419	425	
	475	460	457	460	
	505	495	495	495	
	535	525	533	525	
	570	560	572	560	
	600	590		590	
	630	625	610	625	
	660	655	648	655	
			686		

Conclusion

This approach by GLTAA members has benefits for end users.

- Availability
- Ease of specification
- Generic product specification ensures competitive market

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TECHNICAL DATA SHEET No.1

THE RECOMMENDATIONS FOR HANDLING, ON SITE STORAGE AND PROTECTION OF GLUE LAMINATED TIMBER DURING CONSTRUCTION

Introduction

This document has been prepared to outline the specific requirements for the on site storage and handling of glue laminated structural timber beams (Glulam). Strict adherence to these requirements will ensure that the finished product performs to specifications. This document does not necessarily prevent damage resulting from negligence or other factors beyond the control of the manufacturer during shipment, handling and storage on site.

Glulam may be supplied to site with various forms of protection, dependant on its final use in the structure. This protection shall be commensurate with the end use of the product. Glulam may be supplied to site in one of the following ways:

1. Without timber sealant or plastic wrapping
2. Without timber sealant but with plastic wrapping
3. With timber sealant but without plastic wrapping
4. With timber sealant and plastic wrapping

Handling

Glulam shall not be dropped, jarred or dragged. Care shall be taken to prevent damage to the finished surfaces in handling, as such treatment may cause damage to the surfaces and edges and possibly structural damage.

Lifting or securing Glulam shall employ the use of webbing slings only. Chains and wire slings shall not be used. Glulam shall be lifted on edge wherever possible and spreader bars of suitable length used on long members to eliminate the possibility of overstressing the member.

Protection (On Site Storage)

Members shall be supported with blocking so spaced as to supply uniform and adequate support. If covered storage is not available, the members shall be blocked well off the ground at a well drained location. Other Glulam, such as reinforced Glulam, curved Glulam, fabricated items and other "special application" Glulam shall be handled and stored in accordance with the manufacturer's specific requirements for that product.

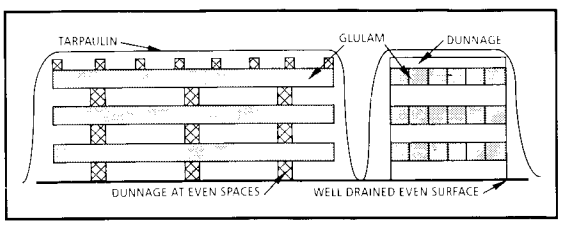

Diagram No. 1 - Site Storage

Glulam shall be maintained in a dry condition on site and protected from direct exposure to the weather. If covered storage is not available, the members shall be covered with suitable non-transparent plastic or tarpaulins. The cover shall be placed to preclude moisture whilst maintaining good air circulation in and around the members. Glulam members that are supplied individually wrapped shall be placed on the dunnage with the wrapping material edge or seal face down. Refer to diagram 2.

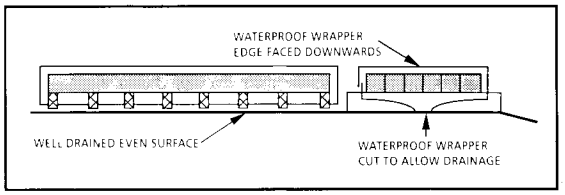

Diagram No. 2 - Site Storage

Protection (Fixed in Position)

Glulam when installed shall be protected from direct exposure to the weather (especially sunlight and moisture). Methods of protection may be a timber sealant coating or impervious covering/ wrapping.

a. Protective timber sealant coating shall inhibit moisture ingress during normal domestic construction periods (around 6 weeks). Should this period be extended or signs that the sealant is no longer performing, renewal of the protective sealant may be necessary. Should the Glulam be cut, checked, bolted or otherwise worked on, renewal of the protective sealer to the exposed or unsealed timber shall be required.

b. The impervious wrapper shall be placed with the edge on the underside if possible and shall be slit on the underside to allow moisture to escape. Refer to diagram 3.
Where supports or intersecting members damage the protection, moisture ingress shall be prevented.

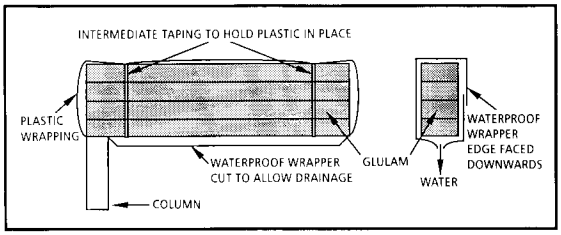

Diagram No. 3 - Protection in Final Position

Technical Data Sheets

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TECHNICAL DATA SHEET No.2

GLUE LAMINATED BEAMS IN EXPOSED SITUATIONS

Introduction

Glue laminated timber members can be used successfully in weather exposed conditions.

Providing the correct species/adhesive combinations are specified, and suitable protective design and maintenance measures are implemented, glue laminated timber members will have an adequate service life in Service Class 3 (exterior exposed) applications.

This data sheet provides the specification, design and maintenance criteria which will enhance the appearance and service life of timber laminated members in weather exposed situations.

Service Class 3

AS 1328-1995 Glue Laminated Structural Timber defines three service classes - 1, 2 and 3.

Service Class 3 encompasses those situations where the equilibrium moisture content of the timber will, periodically, exceed 20% and the member is fully exposed to the elements.

Where laminated timber members are used in exposed situations, it is vital that the correct species/adhesive combination is specified and that appropriate protective measures are taken to preclude the adverse effects of ultra violet light and moisture ingress to the timber.

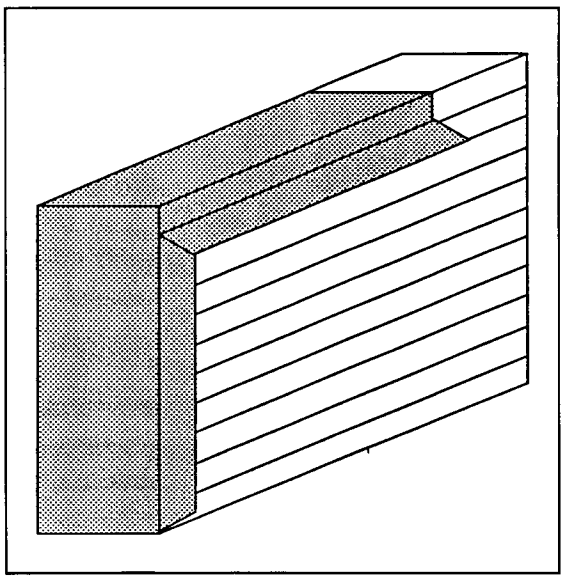


Diagram No. 1 - Illustration of Typical End

Product Specifications

The two factors affecting the inherent durability of laminated timber beams in exposed situations are:

(a) Species
(b) Adhesive Type

(a) Species

The species of hardwood timber used in laminated beams destined for Service Class 3 applications should be durability Class 1 or 2. AS 1720.1-1988 provides the durability rating of most commercial timber species used in Australia.

Most softwood species can be treated with non-leechable preservative salts (CCA) which will impart decay resistance. The level of CCA preservative treatment specified for softwood laminated beams used in Service Class 3 applications should be H3. Similarly LOSP envelope treatment can be used satisfactorily. Check with manufacturer for recommended use.

(b) Adhesive Type

Adhesives used to bond laminate together for Service Class 3 applications should be of the Polyphenolic/Resorcinol type.

Protective Measures

In exposed service situations, UV light will break down lignin in the timber, which bonds wood fibre together, and moisture ingress to the timber will cause dimensional instability and promote fungal decay (rot).

A number of issues must be addressed to limit the adverse effects of ultra violet light and moisture on timber laminated beams. These are:

(a) Design Best Practice
(b) Protective Coatings
(c) Maintenance

(a) Design Best Practice

The design of structures incorporating timber laminated members which will be fully exposed to the elements should include measures to mitigate exposure to direct sunlight and moisture ponding, and promote rapid shedding of moisture.

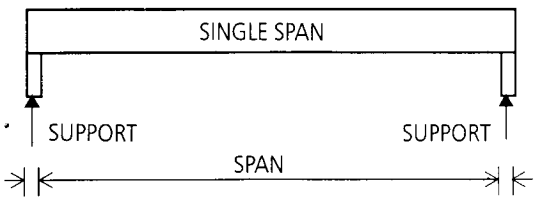
The following detailing and design practices are desirable with regard to enhancing the structure's service life:

(i) Joint detailing should comply with the following:
- ensure moisture entering the joint is not trapped but can run away freely

Technical Data Sheets

UNIFORM DESIGN CRITERIA continued...

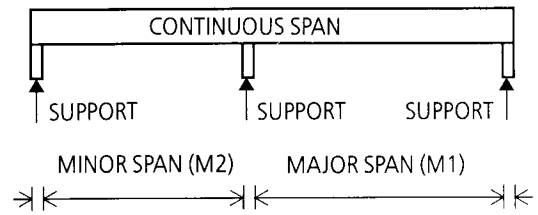
Single Span



SINGLE SPAN is the clear internal (face to face) distance between support points.

Diagram No. 1

Continuous Span



A continuous member is one which is supported in three or more places (2 or more spans). For the purpose of determining a Glulam section size using safe load tables for a single span, an effective span can be used to allow for the effect of backspan loading on adjacent spans.

Note 1 -

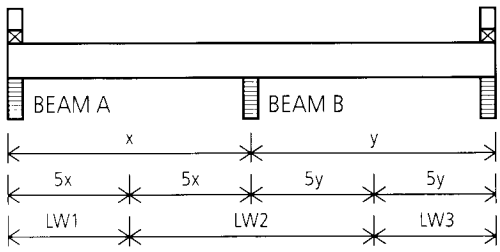
If the beam is continuous, the major span (M1) may be used in the continuous section of the span table to determine the beam size.

Note 2 -

If the beam is continuous, but span table only has a single span section, then an "effective span" may be used to determine the beam size. Effective span = 0.8 x major span (M1)

Diagram No. 2

Floor Load Width

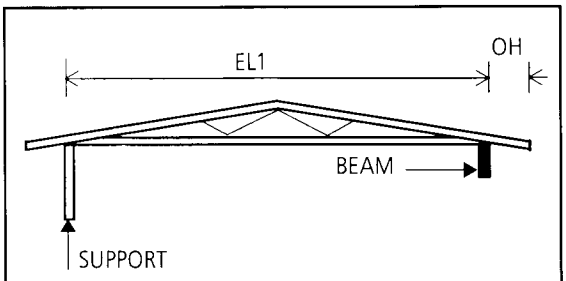


Beam A
Floor load width (FLW) = $\frac{X}{2}$

Beam B
Floor load width (FLW) = $\frac{X + Y}{2}$

Diagram No. 3

Roof Load Width



Roof load width (RLW) = $\left(\frac{EL1}{2}\right)$ + OH

Diagram No. 4

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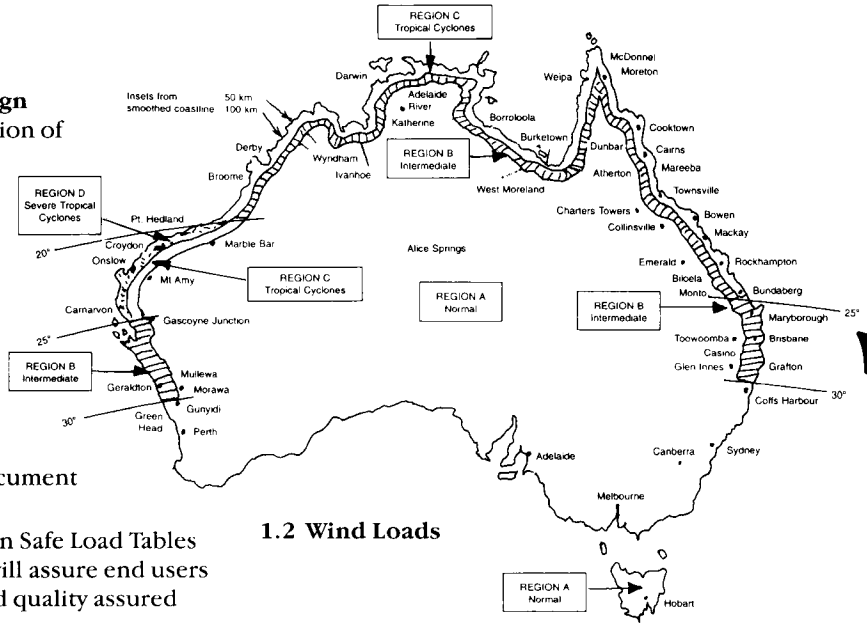
TECHNICAL DATA SHEET No.3

Technical Data Sheets

UNIFORM DESIGN CRITERIA

Introduction

This Data Sheet dictates the **design criteria** to be used in the derivation of Safe Load Tables for laminated timber members. It also dictates the minimum **information** to be provided in the documents in which Safe Load Tables for laminated timber members are published. The design criteria have been drawn from research into the short and long term behaviour of laminated timber members in service and AS1684. They are set out in full in this document in Part 1: Design Criteria.



The information to be included in Safe Load Tables for laminated timber members will assure end users that they are using an engineered quality assured product.

This information is set out in Part 2: Information, and falls under the categories of:

2.1 Span Table Information
2.2 Material Properties
2.3 Product Tolerances
2.4 Safe Load Table Presentation Information
2.5 Quality Assurance

Part 1: Design Criteria

The following design criteria shall be used in the calculation of Safe Load Tables for laminated timber members.

1.1 Deflection Limits

Deflection Limits to be applied are stated in table 1.

Table 1 - Deflection Limits

Member	LONG TERM J2 X DL	LONG TERM J2 X (DL + 0.5kPa)	SHORT TERM LL	SHORT TERM Serviceable WL
Bearers (Floor Load only)		SPAN / 300 or 15mm	SPAN / 360 or 18mm	
Bearers (with Roof Loads)		SPAN / 300 or 15mm	SPAN / 360 or 18mm	SPAN / 150
Joists		SPAN / 300 or 15mm	SPAN / 360 or 9mm*	
Lintels (with Roof Load only)	SPAN / 300 or 9mm		SPAN / 250 or 9mm	SPAN / 150
Lintels (with Roof and Floor)		SPAN / 300 or 9mm	SPAN / 360 or 9mm	SPAN / 150
Strutting/Hanging Beams/Hip Beams/ Patio/Verandah Beams	SPAN / 300 or 12mm		SPAN / 250 or 15mm	SPAN / 150
Roof Beams and Rafters	SPAN / 300 or 20mm		SPAN / 250 or 15mm	SPAN / 150

For Long Term Deflection - Camber can be added to Deflection Limits.
WHERE: DL = Dead Load LL = Live Load WL = Wind Load
J2 = Factor for Duration of Load
* AS1684 refers to joists being designed to meet dynamic criteria, however to date, theoretical analysis is inconclusive. Designing joists to the above deflection limits and constructing deep joisted floors as per Industry Framing manuals, should eliminate the effects of dynamic resonance in practice.

1.2 Wind Loads

WIND CLASSIFICATION SPANTABLE SELECTION

DESIGN WIND CATEGORY	DESIGN WIND LOAD (kPa)	SERVICEABLE WIND LOAD (kPa)
W33 - 41N		
W33/A	0.72	0.62
W33 - 41/B	0.11	0.67
W33/C	1.04	0.65
W50N - W41C		
W41/A	1.11	0.95
W50/B	1.65	0.99
W41/C	1.72	1.06
W60N - W50C		
W41/A	1.65	1.42
W50/B	2.38	1.43
W41/C	2.40	1.48

Notes to this table: N = Non Cyclonic C = Cyclonic

1.3 Design Loads

Dead Loads are:

Pergola roof structures	10kg / M²
Sheet roof without ceiling (roof beams only)	20kg / M²
Sheet roof with ceiling	40kg / M²
Fibro roof with ceiling	60kg / M²
Tiled roof without ceiling	70kg / M²
Tiled roof with ceiling	90kg / M²
Timber floor with ceiling under	50kg / M²

Live Loads are:

Roof (non-trafficable) = 0.25 kPa minimum

$$\left(\frac{1.8}{\text{AREA}} + 0.12\right) \text{kPa}$$

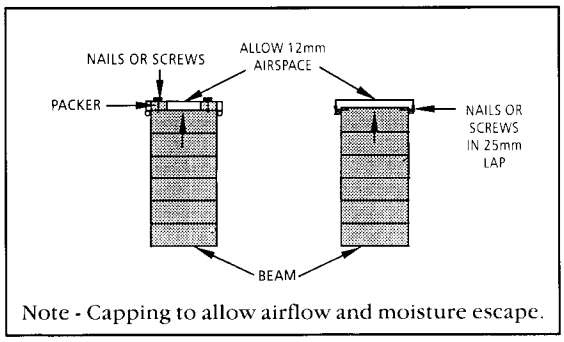
or 0.75 kPa maximum

Floor Loads (domestic) = Internal 1.5kPa
External, i.e. balconies and decks 3.0 kPa

Technical Data Sheets

GLUE LAMINATED BEAMS IN EXPOSED SITUATIONS continued...

- keep horizontal contact areas to a minimum, favouring self-draining vertical surfaces
- use non-corroding fasteners which do not cause splitting during installation
- minimise use of morticed joints.



Note - Capping to allow airflow and moisture escape.

Diagram No. 2 - Capping Details

(ii) Beams should be provided with adequate ventilation.

(iii) Damp proof membranes should be used where timber members are in contact with masonry.

(iv) Metal or plastic shields on the top and ends of laminated timber beams can exclude moisture and sunlight.

Refer to diagram 1 and 2.

(v) Arrissed edges on timber members help prevent the failure of coating systems.

(vi) Building overhangs will provide protection from moisture and direct sunlight.

(b) Protective Coatings

Protective finishes will prolong the service life of structures incorporating laminated timber members by excluding UV light and moisture ingress and imparting dimensional stability to the timber members.

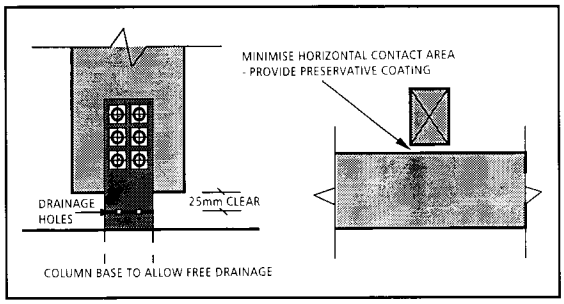


Diagram No. 3 - Detailing to avoid moisture traps

The following products are available:

(i) Oil based surface applied preservatives, in brushing and paste forms, impart fungal resistance and dimensional stability in the short term. They should be used to provide protection to laminated members from the elements during construction. Their compatibility with finishes intended for the long term protection of the members should be confirmed prior to use.

(ii) Oil based stains are non-film forming and penetrate the timber to provide weathering resistance while leaving the grain semi-exposed. This protective coating should be renewed annually if adequate protection is to be achieved.

(iii) Oil based paint systems will provide the best long term protection of laminated members in Service Class 3 conditions. Paint manufacturers' instructions should be followed, but will usually consist of the following:

1 coat of oil based primer
1 coat of oil based under coat
2 coats of oil based exterior house paint.

(iv) Acrylic paint systems are popular. When combined with oil based primers and recoated every five years they will provide satisfactory protection.

(v) Clear finishes are not recommended for timber used in exposed applications due to an absence in UV filters and a propensity to break down readily in exposed situations.

In selecting a finish for laminated timber members in Service Class 3 conditions, consideration must be given to the need to effectively and permanently remove the effects of UV light and moisture ingress to the member.

Special attention should be given to sealing exposed end grain at the end of members and joints.

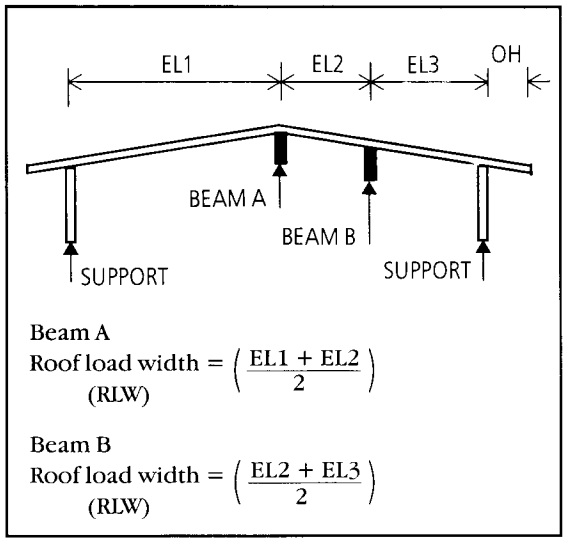
(c) Maintenance

Timber laminated members in exposed applications will give excellent service life if the protective design and coating measures are maintained to limit the effect of weathering. A maintenance schedule should be documented and implemented for all structures. Coatings should be renewed in accordance with manufacturers' instructions and joint and capping details kept in good repair.

Technical Data Sheets

UNIFORM DESIGN CRITERIA continued...

Roof Load Width continued...

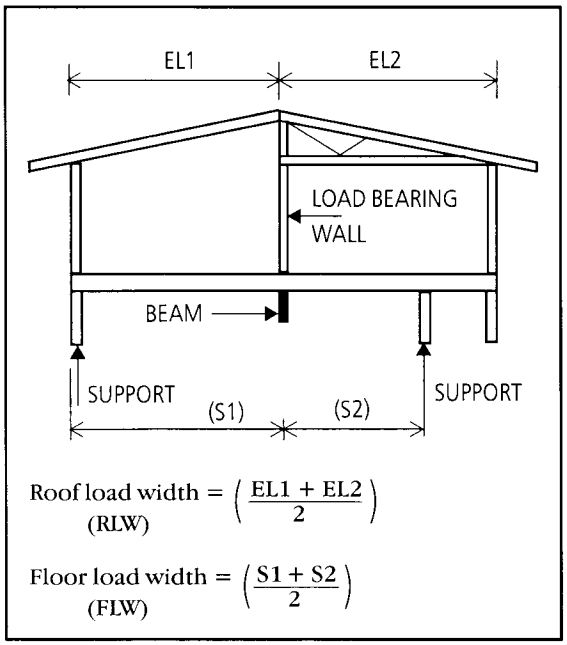


Beam A
Roof load width = $\left(\frac{EL1 + EL2}{2}\right)$ (RLW)

Beam B
Roof load width = $\left(\frac{EL2 + EL3}{2}\right)$ (RLW)

Diagram No. 5

Roof Load Width continued...

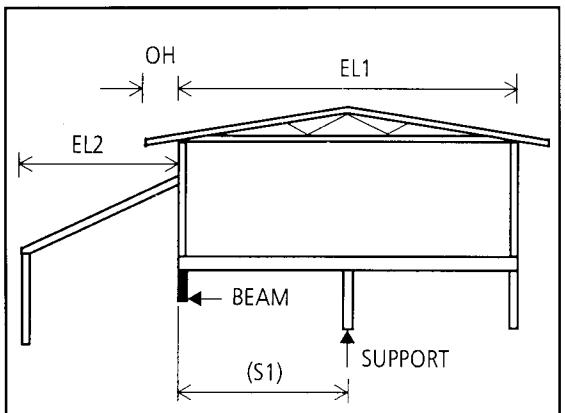


Roof load width = $\left(\frac{EL1 + EL2}{2}\right)$ (RLW)

Floor load width = $\left(\frac{S1 + S2}{2}\right)$ (FLW)

Diagram No. 7

Roof Load Width continued...



Roof load width = $\left(\frac{EL1 + EL2}{2}\right)$ + OH (RLW)

Floor load width = $\left(\frac{S1}{2}\right)$ (FLW)

Diagram No. 6

UNIFORM DESIGN CRITERIA continued...

Duration of Load Factor (J2)

LOAD DURATION	SERVICE CLASS/EXPOSURE CLASSIFICATION 1 & 2	3	SEVERE / ADVERSE i.e. pool enclosure
Short Term < = 1 day	1.0	1.0	1.0
Long Term > = 12 months	1.5	2.0	3.0*

Notes

1. Any Glulam to be used in Service Class 3 applications require specialist design advice from an engineer. A conservative approach to sizing of a Glulam beam in these applications can be as follows:
   (a) Determine the Glulam beam size for Service Class 1 and 2
   (b) Obtain the EI from the manufacturers' "Section Properties" tables for the Glulam beam determined in (a)
   (c) For a Glulam beam to do the same application in a Service Class 3 environment, obtain from the "Section Properties" table a Glulam beam size with an EI = > ($^2/_{15}$) EI determined in (b)
   (d) Follow the recommendations of the G.L.T.A.A. Technical Data Sheet "Glue Laminated Beams in Exposed Situations" (Sheet No. 2)
2. Service Class 1, 2 and 3 are defined in AS1328 - 1995 (Draft)

Part 2: Information

2.1 Span Table Information

(a) All safe spans shall be derived using AS1684 Light Timber Framing Code. This shall be stated in the span tables.

(b) Member section properties shall be stated.

(c) The design criteria contained in Section 1.1 shall be published in all Safe Load Tables.

(d) Single and continuous span and load width shall be defined as illustrated in diagrams 1-7 on page over.

2.2 Material Properties Information

(a) The material properties for each grade of glued laminated timber beam produced must be stated in full.This statement shall include characteristic strengths and elastic moduli. Refer appendix A.

- Design Bending Strengths
  F'b (MPa for equivalent 300mm deep beam)
- Design Tension Strengths
  F't (MPa for equivalent 300mm deep beam)
- Design Compression Strengths
  F'c (MPa) for equivalent 300mm deep beam)
- Design Shear Strengths
  F's (MPa for equivalent 300mm deep beam)
- Design Modules of Elasticity
  E (MPa for equivalent 300mm deep beam)

(b) The means by which the characteristic strength and elastic moduli values have been derived must be stated.

These values should be obtained through In-grade testing in accordance with AS4063-1994, and shall conform with the performance criteria specified in AS1328 (Draft 1995).

(c) The timber properties for each type of beam produced must be stated.

Timber properties shall be defined:

- Strength Group
- Joint Group
- Maximum Density
- Durability Class

(d) The type of adhesive used to bond end joints and laminae must be stated.

(e) The means by which laminae are end jointed shall be stated, i.e. finger jointed, scarf jointed or butt jointed.

(f) The use of lower strength laminae in the centre section of laminated members shall be stated with a full description of the proportion of inner laminae to outer laminae regime adopted.

(g) The adoption of any method of reinforcement shall be fully described, along with a description of the means by which the characteristic strength and elastic moduli for the reinforced laminated timber products have been derived.

2.3 Product Tolerances Information

(a) The length size and tolerances shall be stated.

(b) If camber is built into the product, then the radius of the curvature of 600M shall be stated.

Camber Dimensions on Glulam - 600M Radius

Beam Length m	Camber mm	Beam Length m	Camber mm	Beam Length m	Camber mm
3.3	2.2	6.3	8.3	9.3	18.0
3.6	2.7	6.6	9.1	9.6	19.2
3.9	3.1	6.9	9.9	9.9	20.4
4.2	3.7	7.2	10.8	10.2	21.6
4.5	4.2	7.5	11.7	10.5	23.0
4.8	4.8	7.8	12.7	10.8	24.3
5.1	5.4	8.1	13.7	11.1	25.7
5.4	6.0	8.4	14.7	11.4	27.0
5.7	6.8	8.7	15.7	11.7	29.0
6.0	7.5	9.0	16.9	12.0	30.0

2.4 Safe Load Table Presentation Information

(a) All spans shall be defined diagrammatically.

(b) Only roof and floor load widths shall be used and shall be illustrated diagrammatically in plan projection.

(c) Maximium roof pitch measurements must be nominated. Generally 25° maximum.

2.5 Quality Assurance Information

A statement of compliance with the G.L.T.A.A. quality assurance program shall be included.