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RED ALERT 12 (Including SMARTLVL 12)

DESIGN GUIDE
EDITION 1
2026

SMARTFRAME® BY TILLING

Red Alert® LVL Design Guide

Scope of this publication

This Design Guide and Load Tables assist in the selection of Red Alert LVL beams for most of the common structural arrangements met in domestic construction.

Methods of developing lateral restraint and providing adequate support, adequate anchorage against wind uplift, and overall structural stability are outside the scope of this publication, however some limited examples have been reproduced within this document.

Information on the above matters can be obtained from AS 1684 Residential timber-framed construction or from a structural engineer experienced in timber construction.

Tilling Timber Pty Ltd have structural engineers at the SmartFrame Design Centre who can be contacted for advice on matters concerning the use of its engineered timber products in timber construction at techsupport@tilling.com.au or on the Techsupport HelpLine 1300 668 690.

Substitution of other products

All load tables in this document are designed using in-grade tested properties of SmartLVL as distributed by Tilling Timber Pty Ltd. Other manufacturer's LVL may have different properties and therefore cannot be designed using these span tables.

Copyright

Certification

As a professional engineer, qualified and experienced in timber engineering, I certify that the use of the SmartLVL members as shown in these tables, and installed in accordance with the provisions of this Design Guide, complies to the National Construction Code (NCC). These span tables have been prepared in accordance with standard engineering principles, the relevant test reports and Australian standards, ie:

- AS 1720.3 Design criteria for timber-framed residential buildings
- AS 1720.1 Timber structures - design methods
- AS 4055 Wind loads for houses
- AS/NZS 4357 Structural laminated veneer lumber
- AS/NZS 4063 Characterisation of structural timber

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1. Red Alert LVL

Description

Red Alert LVL is a structural Laminated Veneer Lumber (LVL) manufactured by toll manufacturers for Tilling Timber to meet the quality controlled process requirements of AS/NZS 4357 - Structural Laminated Veneer Lumber.

Sustainability

SmartLVL is manufactured from wood fibre from sustainably managed forests and is produced under a chain of custody system certified to comply with the PEFCTM International Standard – Chain of Custody of Forest Based Products – Requirements (PEFC ST 2002:2103) Certificate No SCS-PEFC-COC-004061.

Quality

Compliance with process based quality control requirements is third party audited by CMI Certification Pty Ltd, a JAS-ANZ accredited Product Certification Body and the audits, together with end product testing is used as the basis for CMI ProdCert certificates PC10101 and PC10096.

CMI ProdCert

JAS-ANZ

Preservative Treatment options

Stock SmartLVL is H2s (glue line) treated for use South of the Tropic of Capricorn. It can be post- production pressure treated to H2 or H3 to AS/NZS 1604. (see page 11)

Short term water repellency

SmartLVL comes with a clear **new generation** short term water repellency H_2O Shield™ to replace the old fashioned wax sealers used by most other LVL manufacturers. H_2O Shield™ is a water-based sealer specifically formulated for SmartFrame EWP.

H_2O™ shield offers numerous key benefits:

i) High-penetrating surface treatment

ii) Formulated to repel rain during storage and construction

iii) Includes a biocide/fungicide

iv) Paintable - acrylic and oil based coatings

v) Glueable – using standard construction adhesives between the LVL and wood or plaster products

vi) When transporting or walking on the LVL, it does not become slippery like the wax surface coating

vii) Environmentally friendly

Users will notice that the new sealer absorbs into the wood instead of leaving a film on top of the surfaces, which is the key to its added benefits.

1.1 SmartLVL Design/effective span

Normal structural analysis uses the centreline representation of the member. The term "span" can be defined in a number of ways and these are defined as follows:

Clear Span. This is the distance between the faces of any support. It is generally the one easiest to measure and read from the drawings

Nominal span/centre-line span. This is the distance between the centre of the supports. This span is used to determine bending moments and deflections for continuous spanning members

Design span/Effective span. This is the span used for single span members to determine the bending moment, the slenderness of bending members and the deflections. In NZS 3603 this is the dimension referred to as "L", and is defined below.

Design span/Effective span is the distance between -

- The centre of the bearing at each end of a beam where the bearing lengths have **NOT** been conservatively sized
- The centre of notional bearing that have been sized appropriately, where the size of the bearing **IS** conservative.

Diagram (a) shows beam where bearings have been designed appropriately. The effective span is taken as the distance between the centre of each bearing area

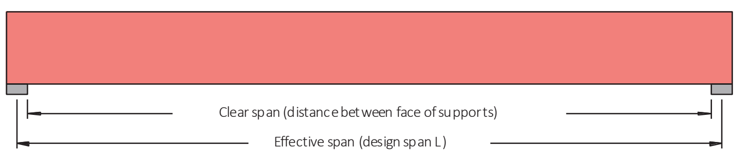
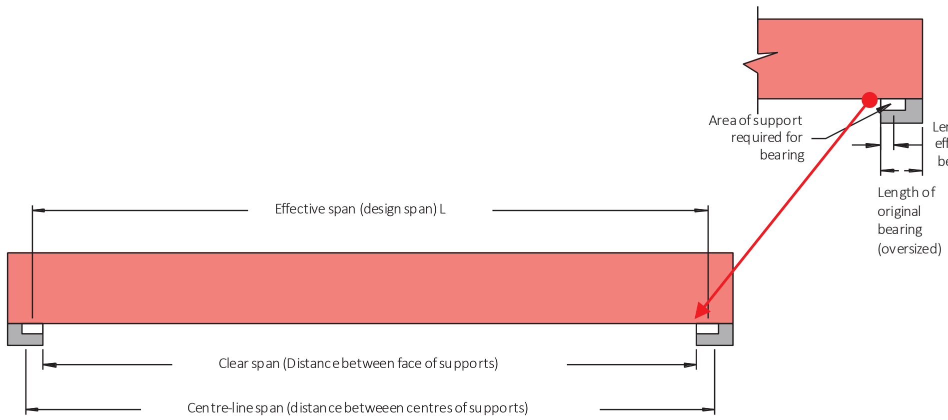


Diagram (b) shows beam where bearings at each end have been oversized. (This is frequently the case for beams that bear onto brickwork or concrete walls where the thickness of the wall is in excess of the area required to give the beam bearing capacity).

To find the correct effective span:

1. Calculate the minimum bearing required to carry the loads satisfactorily
2. Add minimum bearing length to "clear span" distance.



1.2 Continuous spans

For beams continuous over two (2) unequal spans, the design span and the "Resultant Span Description" depend upon the percentage difference between the two spans as shown below:

Note, for continuous spans, the Design Span is taken as the distance between the centre of the supports, as shown in **"Design Span"** on page 1 of the Design Guide.

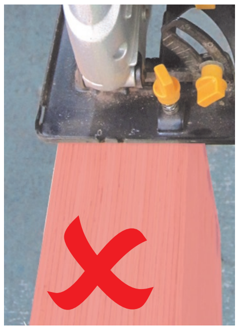
Span Difference %	Effective span	Resultant span Description
10% max	Main span	Continuous
10 - 30%	1.1 x Main span	Continuous
above 30%	Main span	Single

$$\text{span difference} = \frac{(\text{main span} - \text{second span})}{(\text{main span} + \text{second span})} \times 100$$

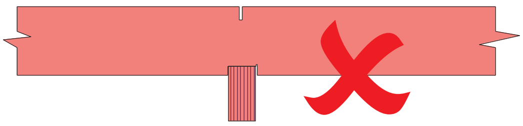
Continuous spans

1.3 Rip sawing Red Alert LVL

One of the unique properties of Smart LVL is that it may be ripped through the depth to the smaller section sizes as those given in these span tables without affecting the basic strength properties. It is important that the new members are not cut undersized if the maximum spans in these tables are to be used.



The sawing through the thickness to produce sections of a lesser thickness may decrease the integrity of the SmartLVL and is therefore NOT recommended under any circumstances.



Joist and bearer span tables do NOT allow for the practice of notching the top of the member over a support

1.4 Multiple Red Alert LVL section beams

Vertical laminations may be achieved by adopting the procedures described in clause 2.3 of AS1684, however these procedures should be considered as the minimum requirements to achieve the desired effect.

Experience with Red Alert LVL beams indicates that this degree of fixing may not satisfactorily prevent cupping of individual components as a result of the ingress of moisture between laminates during construction.

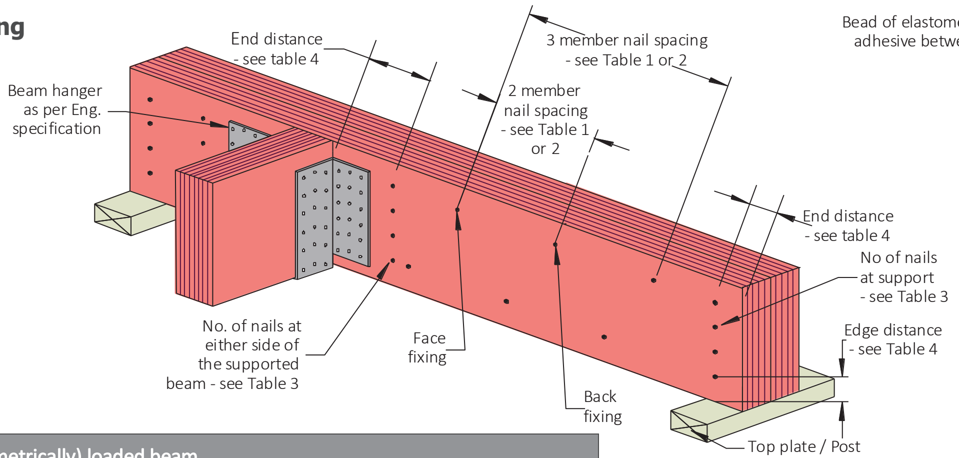
The suggested methods of vertical lamination below provide a greater level of fixity between individual components, and with the use of an elastomeric adhesive, also prevents moisture penetration between the laminates.

Maximum floor load width tables for multiple member laminations of Red Alert LVL:

1. Nail lamination
2. Type 17 screw lamination
3. Bolt lamination

are shown below.

1. Nailing



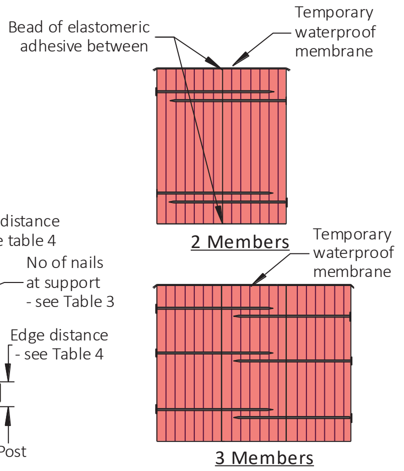


Table 1

Top (symmetrically) loaded beam			
Section width	**Nail type**	**No of nail rows (both sides)**	**Nail spacing (mm)**
2/35	3.15 x 65	2 or 3*	300
3/35 & 2/45	3.30 x 90	2 or 3*	300
2/42	3.06 x 75	2 or 3*	200
3/42, 3/45 & 2/58 3/58, 2/65 & 3/65	Nail lamination is not suitable, requires screws or bolts		

* Beam depth ≥ 300 mm 3 rows of nails

Note: Addition Tables 2,3 and 4 are on next page

1. Nailing (cont'd)

Table 2

Side (non-symmetrically) loaded beam					
Section width	Nail type	No of nail rows at 300mm ctrs (both sides)	Max. floor joist span supported by outer member (mm)*	No of nail rows at 300mm ctrs (both sides)	Max. floor joist span supported by outer member (mm)*
2/35	3.15 x 65	2	2150	3	3250
3/35	3.30 x 90	2	5100	3	7600
2/45	3.30 x 90	2	2550	3	3800
2/42	3.06 x 75	2	2300	3	3400
3/42 & 3/45	3.30 x 90	2	2550	3	3800
2/58 & 3/58	3.30 x 100	2	2500	3	3800
2/65 & 3/65	3.30 x 100	2	1350	3	2050

* Floor loads G = 62 kg/m^2, Q = 1.5 kPa

Table 3

Beam depth (mm)	Min. number of nails required	
	At support	At either side of supported beam
90 –150	3	3
160—300	5	6
> 300	6	8

Table 4

Nail dia. (mm)	Min. edge distance (mm)	Min. end distance (mm)	Min. distance between nails (across the grain) (mm)
3.06 & 3.15	20	70	40
3.30	20	75	45

2. Type 17 screws

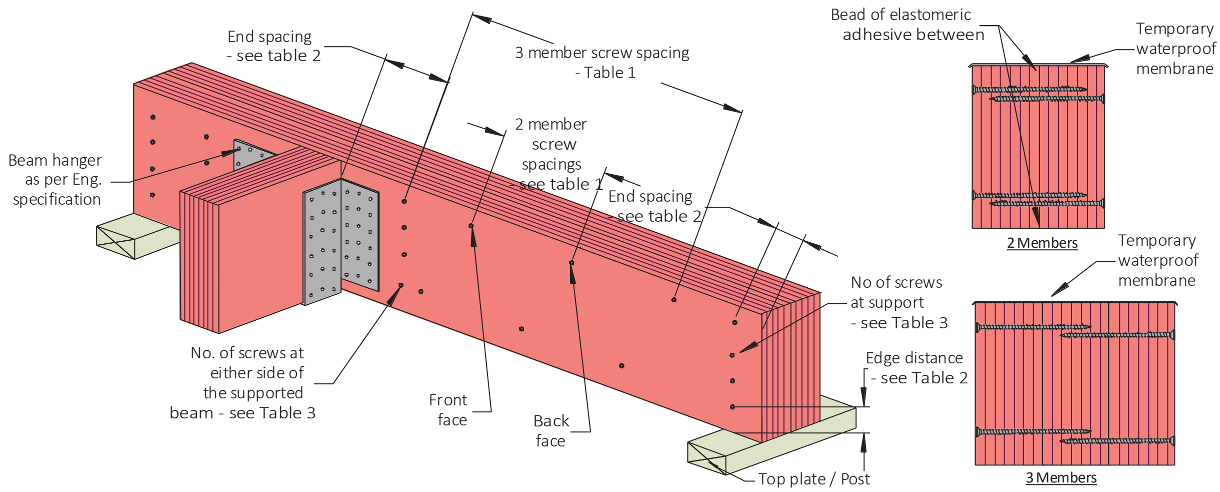


Table 1

Side (non-symmetrically) and top loaded beam				
Section width	Type 17 screw size	No of screw rows (both sides)	Screw spacing (mm)	Max. floor joist span supported by outer member (mm)**
2/35 & 3/35	10g x 65	2 or 3*	200	4500
2/42 & 3/42	12g x 75	2 or 3*	200	5900
2/45 & 3/45	12g x 90	2 or 3*	200	6400
2/58 & 3/58	14g x 100	2 or 3*	200	7100
2/65 & 3/65	14g x 125	2 or 3*	300	6000

* for beam depths ≥ 300 mm, use 3 rows of screws

** Floor loads G = 1.25 kPa, Q = 2.0 kPa

Table 2

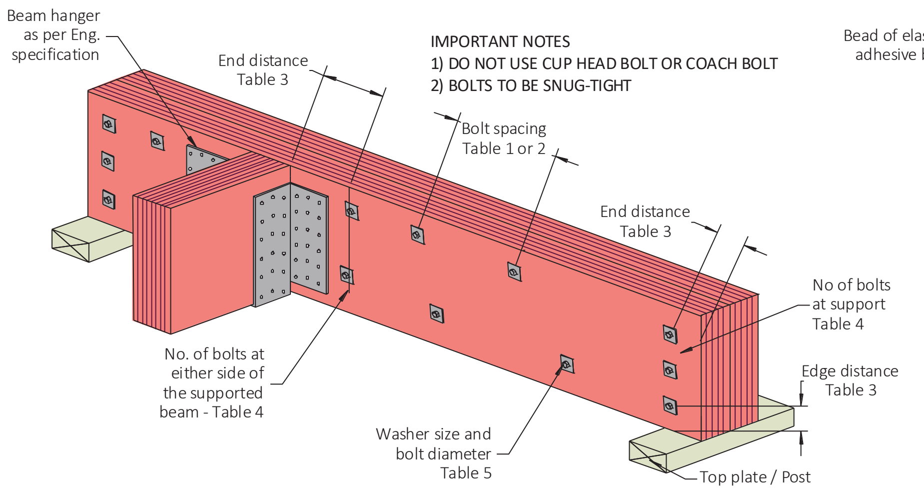
Type 17 screw size	Min. edge distance (mm)	Min. end distance (mm)	Min. distance between screws (across the grain) (mm)
10g	30	50	20
12g	35	60	25
14g	40	70	30

Table 3

Beam depth (mm)	Min. number of screws required	
	At support	At either side of supported beam
90 –240	3	3
> 240	4	4

Multiple member lamination (Cont'd)

3. Bolts



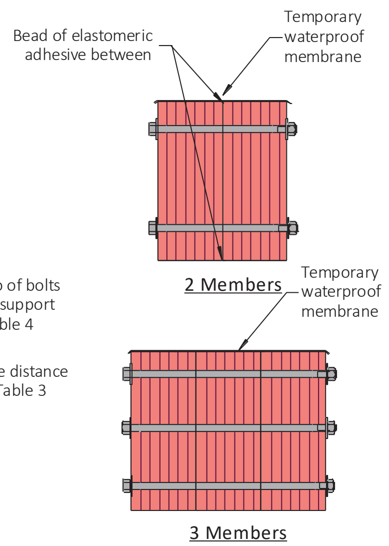


Table 1

Top (symmetrically) loaded beam - M12 Hex head bolt	
Beam depth ≤ 300 mm	Beam depth > 300 mm
2 rows of bolts at 300 mm ctrs	3 rows of bolts at 300 mm ctrs

Table 2

Side (Non symmetrically) loaded beam - M12 Hex head bolt		
Maximum floor joist span supported by the beam mm*		
2 rows at 600 mm ctrs	2 rows at 300 mm ctrs	3 rows at 600 mm ctrs
7200 mm	12,000 mm	10,800 mm

* based upon floor loads of G: 1.25 kPa Q: 2.0 kPa

Table 3

Bolt size	Min. edge distance	Min. end distance	Min. distance between bolts (across grain)
M12 Hex head	60 mm	60 mm	60 mm

Table 4

Beam depth (mm)	Min. number of bolts required	
	At support	At either side of supported beam
90 –150	1	1
160—240	2	2
> 240	3	3

Table 5

Bolt diameter (mm)	Washer dimensions		
	Thickness (mm)	Min. diameter of round washers (mm)	Min. side length of square washers (mm)
M12	3	55	50

1.5 On-site cutting, notching and drilling of SmartLVL beams, bearers, rafters and joists

The cutting, notching and drilling details within Fig 4.1 of AS 1684 pre-date both the introduction of LVL and the common use of roof trusses, and therefore presents deemed-to-satisfy solutions based upon the solid section timber types/sizes and systems commonly used to frame a typical Class 1 and 10a building at that time.

Contemporary open plan building styles with larger spans and deeper/thinner beams made possible by the introduction of LVL combined with the near universal practice of building with roof trusses that typically load only to external walls have now rendered some of these deemed-to-satisfy solutions non- conservative, especially in cyclonic wind loadings.

It is for this reason that it is recommended that on-site cutting, notching and drilling of Red Alert LVL be limited to the provisions shown below.

Further information about the effects of cutting and notching of timber elements can be found in Appendix E of AS 1720.1.

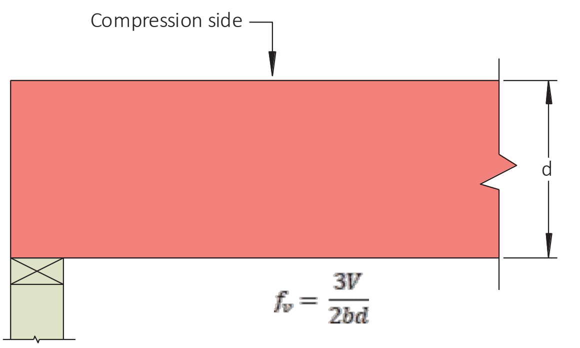
1. Notching

Notching of LVL beams should be avoided whenever possible, especially on the tension side of a member. Tension-side notching of LVL beams is not recommended except at end bearings and then only under specific conditions. The notching of LVL beams on the tension side results in decreased strength caused by stress concentrations that develop around the notch and a reduction of the net cross section resisting the bending and shear forces. Such notches induce perpendicular-to-grain tensile stresses which, in conjunction with horizontal shear forces, can cause splitting along the grain, typically starting at the inside corner of the notch. Stress concentrations, due to notches, can be reduced by using a gradually tapered notch configuration in lieu of a square-cornered notch.

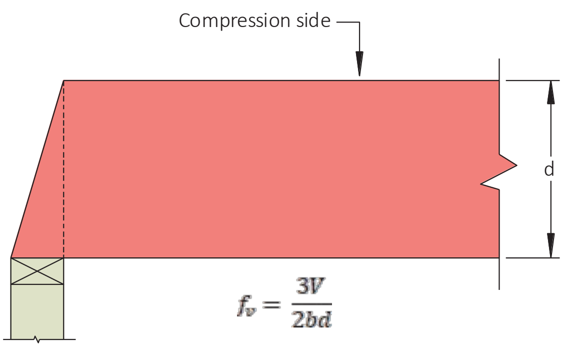
All onsite notches should be accurately cut. Avoid over cutting at the corners of the notch. Drilling a 16 mm ϕ pilot hole in a member at the interior corner of a notch as a stop point for the saw blade provides both a rounded corner and minimizes over cutting at the corner and reduces stress concentrations in these areas.

1.5 On-site cutting, notching and drilling of SmartLVL beams, bearers, rafters and joists (Cont'd)

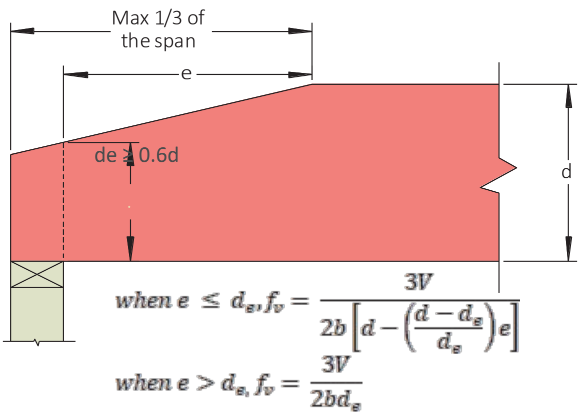
Figure 1



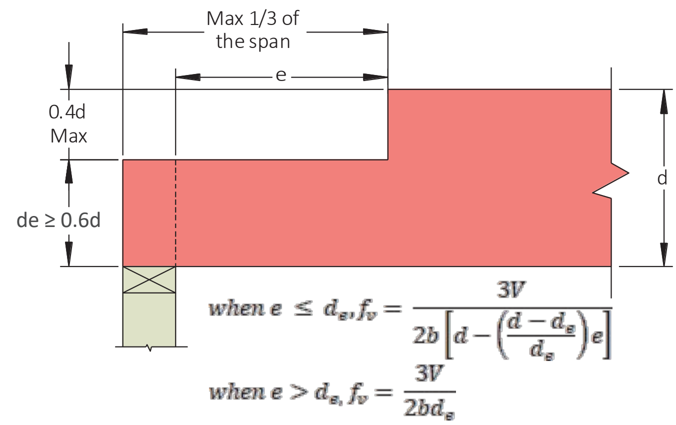
(a) Square end bearing



(b) Slope end bearing

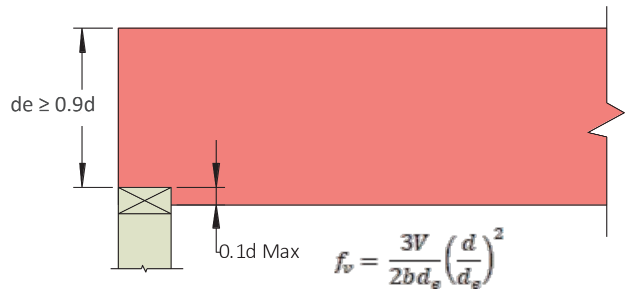


(c) Taper cut end bearing



(d) Compression-side notch

Where LVL beams are notched at the ends for bearing over a support, the notch depth is recommended to not exceed 1/10 of the beam depth (Figure 1 (e)).



(e) Tension-side notch

f_v = shear stress (MPa) V = shear force at notch location (kN) b = width of LVL beam (mm)

d = depth of LVL beam (mm) d_e = effective depth as shown (mm) e = length of notch as shown (mm)

For notches on the compression side, a less severe condition exists and equations for the analysis of the effects of these notches are also given in Figure 1. The equations given are empirical in nature and were developed for the conditions shown.

As the notching provisions given in this Note are limited to uniformly loaded simple span beams, the notches shown in Figure 1 occur in areas of high shear and lower moment. For this reason, the design equations given are shear equations.

When necessary to cut a small notch in the top of an LVL beam (in the compression side) to provide passage for small-diameter pipe or conduit, the cut should be made in an area of the beam stressed to less than 50% of the allowable bending stress. The net section in this area should be checked for shear and bending stresses to ensure adequate performance.

It should be recognized that the top of an LVL beam might not always be stressed in compression and the bottom of an LVL beam might not always be stressed in tension. For example, if the LVL beam is designed for wind uplift, the top of the LVL will be stressed in tension and the bottom of the LVL will be stressed in compression.

In this case, the recommendations given above should be applied accordingly. Furthermore, when evaluating the effect of notching, the shear force within a distance from supports equal to the beam depth should not be neglected, as typically permitted by the design of rectangular wood members in accordance with the AS 1720.1.

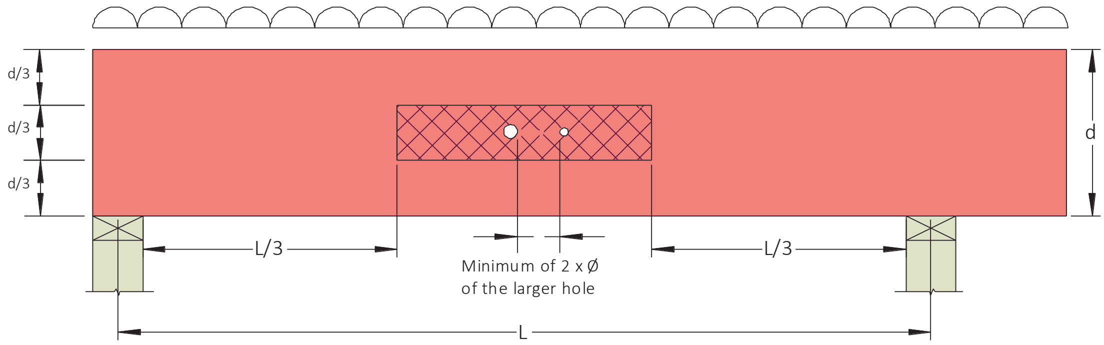
Horizontal holes

Like notches, holes in an LVL beam reduce the net section of the beam at the hole location and introduce stress concentrations. This causes a reduction in the beam capacity. For this reason, horizontal holes in LVL are limited in size and location to maintain the structural integrity of the beam. Figure 2 shows the zones of a uniformly loaded beam in simple or multiple spans, where the onsite drilling of holes may be considered. The requirements given consider the effect of the horizontal hole on the shear and moment capacities of an LVL beam, and may be applied to multi-piece built-up LVL beams.

Where larger horizontal holes than those specified in this document cannot be avoided in design, in some circumstances larger penetrations may be specifically designed by a structural engineer experienced in timber engineering.

Figure 2

Permissible horizontal round hole locations for LVL beams under uniform loads



Zone where horizontal holes are permitted for the passage of wires, conduits etc.

Beam depth (mm)	Hole Ø (mm)
90	20
150	30
200	40
> 200	Max 50 (unless specifically designed by an engineer)

a) Maximum of three (3) holes per span

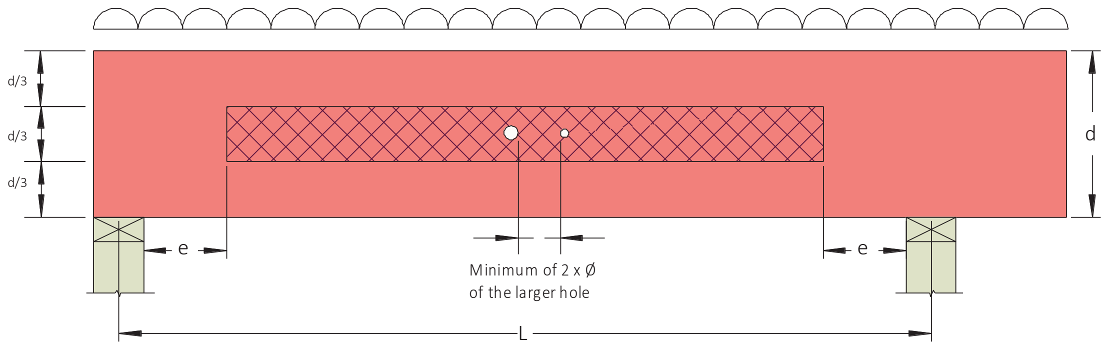
b) Holes should not be cut in cantilevers

A 25 mm Ø or smaller hole may be cut at the middle ⅓ of the beam depth anywhere along the span, except for the area that is within 150 mm of clear distance between the face of the support and the nearest edge of the hole (see Figure 3 on next page), provided the following conditions are all met:

1. The beam is at least 190 mm in depth
2. The beam is subject to uniform loads only
3. The span-to-depth ratio (l/d) is at least 11
4. The maximum number of holes for each span is limited to three
5. The horizontal spacing must be a minimum of two diameters clear distance between adjacent holes based on the diameter of the larger hole
6. The hole must not be cut in cantilevers.

Figure 3

Zones where a 25 mm or smaller diameter horizontal holes are permitted in a uniformly loaded LVL beam of depth ≥ 190 mm



Zone where a maximum of 25 mm Ø holes are permitted for the passage of wires, conduits etc.

a) Maximum of three (3) holes per span

b) No holes permitted in cantilever

e = 150 mm where L/d ≥ 11, or L/6 where L/d < 11

1.5 On-site cutting, notching and drilling of SmartLVL beams, bearers, rafters and joists (Cont'd)

Horizontal holes (Cont'd)

Beam depth (mm)	Span when L/d = 11 (mm)
200	2200
240	2640
300	3300
360	3960
400	4400
450	4950
525	5775
600	6600

The L/d of 11, is the span to depth ratio that segments the expected failure modes between shear and bending. When L/d < 11, the span is short, and it is expected that shear strength rather than bending will govern.

Onsite-drilled horizontal holes should be used for access only and should not be used as attachment points for brackets or other load bearing hardware unless specifically designed as such by an engineer. Examples of access holes include those used for the passage of wires, electrical conduit, small-diameter sprinkler pipes, fibre-optic cables and other small, lightweight materials.

For LVL beams that have been over-sized, the guidelines given above may be relaxed based on an engineering analysis. When holes are required to be drilled outside the allowable zones, an engineering analysis should be conducted and approved by a structural engineer experienced in timber engineering.

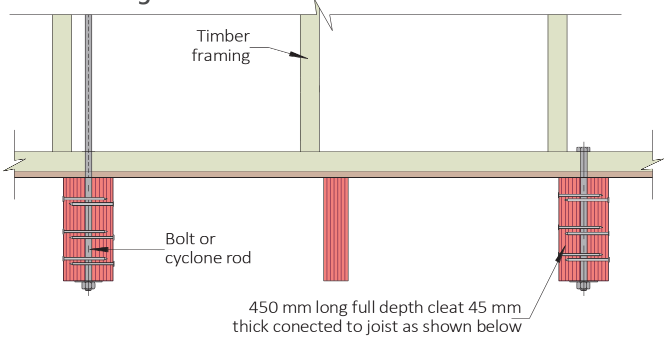
Regardless of the hole location, holes drilled horizontally through a member should be positioned and sized with the understanding that the beam will deflect (creep) more over a period of time under in-service loading conditions. This deflection could over-stress supported equipment or piping unless properly considered.

Vertical holes

Whenever possible, avoid drilling vertical holes through LVL beams unless the beam width is at least 58 mm. For SmartLVL elements ≤ 58 mm thick, a 450 mm long cleat should be added as shown below, to avoid drilling vertical hole through thinner member.

Use a drill guide to minimize "wandering" of the bit to ensure a true alignment of the hole through the depth of the beam. The vertical hole should be centred in the beam width.

450 mm long reinforcement cleat



Nails/screws/bolts	Design Capacity
6 off 3.75 ø nails each side with min 40 mm penetration into adjacent joist/cleat	20 kN Wind uplift
6 off No 12 Type 17 screws with min 40 mm penetration into joist	
5 off No 14 Type 17 screws with min 45 mm into joist	
3 off M10 bolts	

As a rule of thumb, vertical holes drilled through the depth of an LVL beam cause a reduction in the capacity at that location directly proportional to the ratio of 1½ times the diameter of the hole to the width of the beam. For example, a 12 mm hole drilled in a 58 mm wide LVL beam would reduce the beam capacity at that section by approximately (12 x 1.5)/58 = 31%

Holes for support of suspended equipment

Heavy equipment or piping suspended from LVL beams should be attached such that the load is applied to the top of the beam to avoid inducing tension perpendicular-to-grain stresses.

Any horizontal holes required for support of significant weight, such as suspended heating and cooling units or main water lines, should be located above the neutral axis of the beam and in a zone stressed to less than 50% of the allowable bending stress. The beam capacity should be checked for all such loads to ensure proper performance.

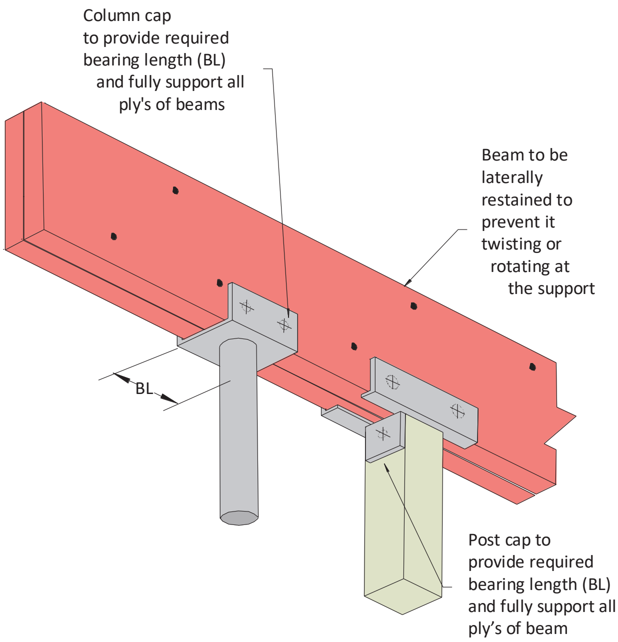
Protection of onsite-cut notches and holes

Frequently, LVL beams are provided by the manufacturer with the ends sealed by a protective coating. This sealer is applied to the end grain of the LVL to retard the migration of moisture in and out of the beam ends during transit and job site storage. Onsite cutting a notch at the end of a beam can change the moisture absorption characteristics of LVL at the notch location. This can result in localized splitting at the corners of the notch. To minimize this possibility, all notches should be sealed with a water-repellent sealer immediately after cutting. Sealing other onsite cuts as well as onsite-drilled holes is also recommended. These sealers can be applied with a brush, swab, roller or spray gun.

Further Information

Further information about the provision of larger holes, or advice about dealing with holes that have been cut into the LVL that are outside these guideline can be obtained by contacting the techsupport helpline on 1300 668 690 or at techsupport@tilling.com.au.

1.6 Steel and timber post fixing to SmartLVL



1.7 Fire resistance

The Fire Resistance Level (FRL) is the performance criteria for fire resistance, i.e. the grading periods (in minutes) for the following criteria as specified in the BCA:

a. Structural adequacy: (the duration for which the elements can carry its designated load)

b. Integrity: (the duration for which the element can

maintain its integrity to prevent the spread of fire to/ from the compartment)

and

c. Insulation: (the duration for which the element is insulating the adjacent space from excessive temperature rise)

and is expressed in that order e.g. 30/30/30. The method for determining the structural component of the Fire Resistance Period for timber (including LVL and Glulam) is described in AS / NZS 1720.4 - 2019 Timber Structures Part 4: Fire resistance of timber elements.

$$c = 0.4 + \left(\frac{280}{\delta}\right)^2 \qquad \text{Equation 2.5.2}$$

where:

c = notional charring rate, in mm per minute

d = timber density of Red Alert LVL - ~ 600 kg/m^3

The effective depth of charring (d_c) after a period of time (t) shall be calculated in accordance with Clause 2.6.1 for surfaces exposed to fire and in accordance with Clause 2.6.2 for surfaces behind fire- resistant protective insulation.

. The examples detailed below contain generic fire detailing principles related to a non-rated floor abutting a rated wall where separation walls require a FRL not less than 60/60/60, commonly found in class 1a applications.

They have been included only to demonstrate that the type of joists within the non-rated floor do not effect the FRL of the rated wall junction, provided the wall is correctly detailed.

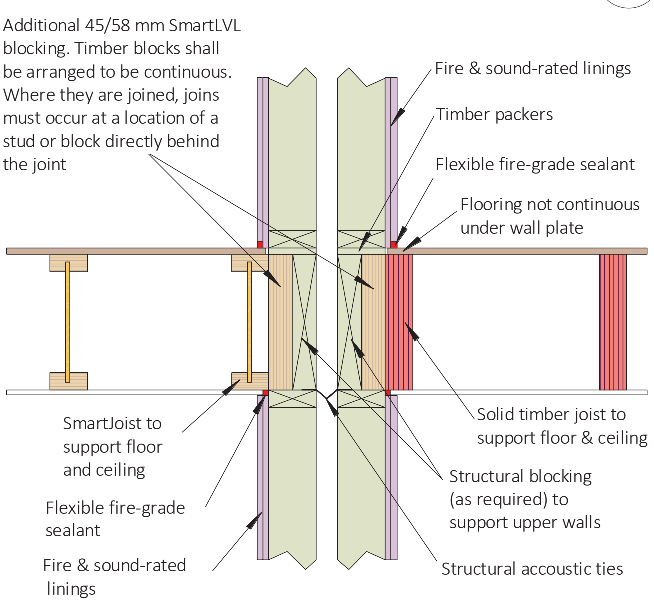
It is mandatory that those designing fire separation walls seek out and specify the latest relevant details either from a Fire Engineer, WoodSolutions® Technical Design Guides available at www.woodsolutions.com.au and Regulatory Authorities.

If using a tested and certified proprietary system, that system must be followed without variation.

Further information about using SmartFrame product in fire rated applications can be obtained by contacting the Techsupport Helpline on 1300 668 690.

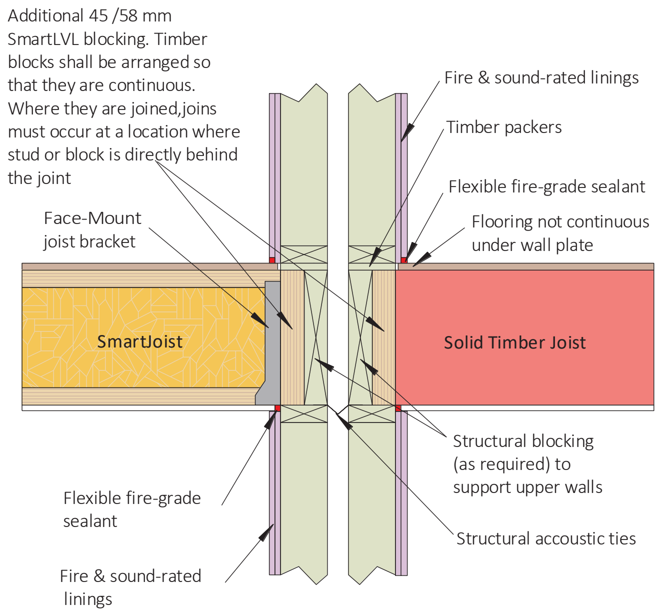
Floor joists parallel to the wall

CB2

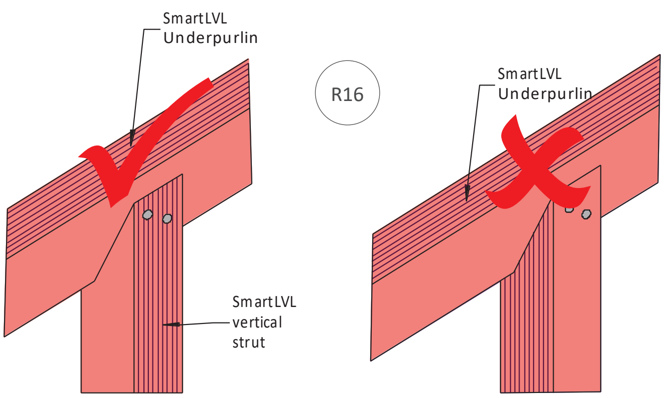


Floor joists perpendicular to the wall

CB1

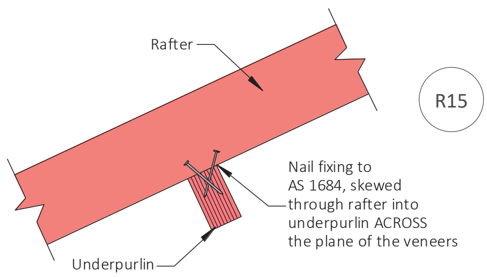


1.8 Roof construction detailing



DO NOT cut the birdsmouth in the direction of the SmartLVL veneers

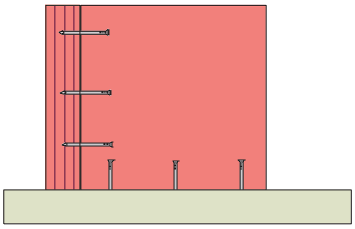
Vertical SmartLVL roof struts



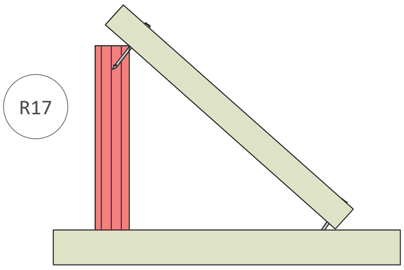
Rafters are NOT to be skew nailed to the underpurlin with the nails parallel to the direction of the veneers

Rafter underpurlin fixing

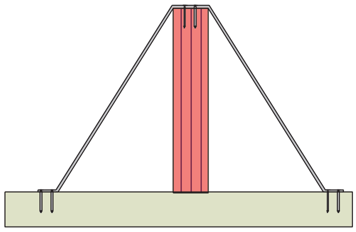
1.9 Lateral restraint of Hanging, Counter, Strutting, Strutting/hanging beams, Strutting/counter beams



(a) Block skew nailed to beam and to support with 3/75 mm skew nails to each member.



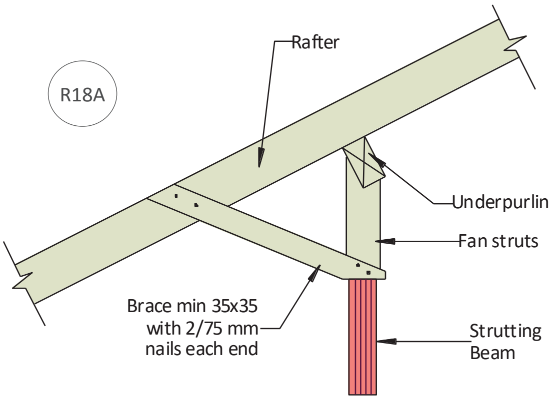
(b) Min 35 x 32 mm tie nailed to top of beam and to support with 2/75 mm nails at each end.

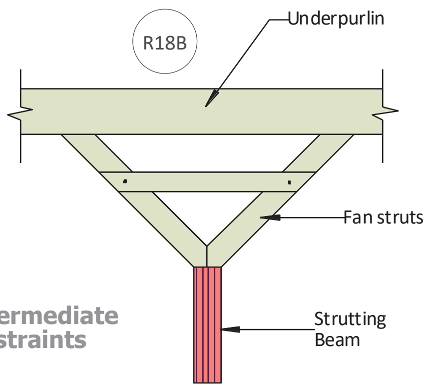


(c) Galvanised strap nailed to support and top of beam with 2/30 x 2.8 ϕ mm nails each end and to beam.

Notes:

1. Method used depends upon whether ceiling joists are perpendicular or parallel to the beam
2. Methods given in (b) and (c) are particularly suitable for restraining strutting beams and strutting/hanging beams at the intermediate points where the beams are supported, as they also permit these beams to be supported up clear of the ceiling joists by packing under at their supports.





Example intermediate lateral restraints

1.10 Chemical resistance

SmartLVL (wood in general) has a definite advantage over steel members when exposed to corrosive environments. Timber and wood products are able to withstand mild acid conditions and are more resistant to degradation.

The behaviour of SmartLVL in chemical environments depends upon a number of factors, including PH and temperature. Wood essentially responds by either swelling (Category S), similar to moisture response, or by chemical degradation (Category D). Damage due to swelling is essentially reversible, but chemical degradation results in breakdown of the wood structure and is non-reversible. Category S agents include alcohol and other polar agents. These agents swell dry wood causing a strength (and stiffness) loss proportional to the swelling.

Category D agents include acids, alkalis and salts and result in a loss of strength and stiffness directly related to the loss of member cross-section. The table below provides a rough guide to performance of SmartLVL in chemical environments.

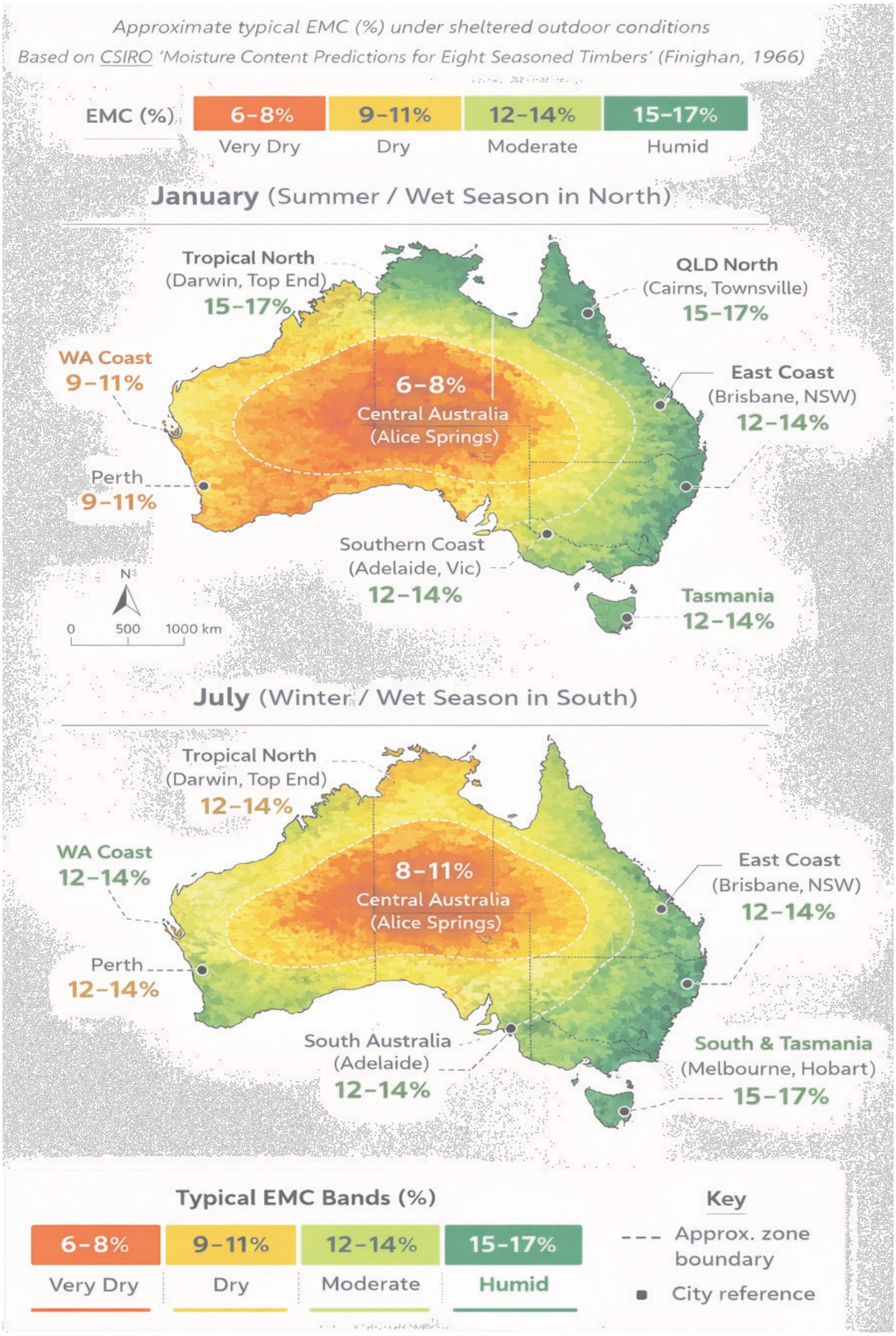
The effect of chemicals on wood will generally be worsened by increased exposure time, temperature, extremes of pH and chemical concentration. Wood generally offers considerably less resistance to alkalis than acids. Softwoods (includes SmartLVL) generally have better resistance to acids than hardwoods.

Where there is the possibility of chemical attack on SmartLVL members, designers should seek expert advice.

Agent category	Chemical agent	Mode of attack	Damage - reversible or permanent	Severity - (loss of strength and/or stiffness)
Neutral	Non-polar liquids such as petroleum hydrocarbons	None	Negligible	Negligible
S (swelling)	Alcohol and other polar solvents	Swelling	Reversible	Proportional to volumetric swelling
D (degrading)	Inorganic acids	Hydrolysis of cellulose	Permanent	Slight to moderate
D	Organic acids such as: Formic, acetic, propionic and lactic acid	Hydrolysis of cellulose	Permanent	Slight (pH 3-6)
D	Alkalis such as: sodium, calcium and magnesium hydroxide	De-lignification of wood and dissolving of hemicellulose	Permanent	Moderate (pH > 9.5) Severe (pH > 11)
D	Salts (considered as weak acids)	Hydrolysis of cellulose	Permanent	Slight

Table reference Williamson T.G. 2002 APA Engineered Wood Handbook

Timber equilibrium moisture content (EMC) zones in Australia



Climate description (engineering interpretation)

Term	Meaning for timber	Term	Meaning for timber
Arid	Very low EMC, minimal shrink/swell	Humid coastal	High EMC, low seasonal variation
Semi-arid maritime	Moderated, but still relatively dry	Tropical	High EMC, wet-season driven
Mediterranean	Large seasonal swing	Temperate	Moderate–high EMC, winter dominant

Predicted EMC range of timber for sheltered outdoor conditions by City

City	State	Jan EMC (%)	Jul EMC (%)	EMC band (%)	Climate description
Darwin	NT	16–18	14–16	14–18	Tropical monsoonal (wet/dry season)
Alice Springs	NT	6–8	8–10	6–10	Arid desert interior
Perth	WA	9–11	12–14	9–14	Mediterranean coastal
Carnarvon	WA	9–11	11–13	9–13	Semi-arid maritime coast
Broome	WA	13–15	12–14	12–15	Tropical coastal (monsoonal influence)
Albany	WA	11–13	14–16	11–16	Cool temperate coastal
Geraldton	WA	9–11	12–14	9–14	Semi-arid maritime transition
Kalgoorlie	WA	7–9	10–12	7–12	Arid inland
Adelaide	SA	9–11	13–15	9–15	Mediterranean temperate
Port Lincoln	SA	10–12	14–16	10–16	Southern coastal temperate
Whyalla	SA	8–10	12–14	8–14	Semi-arid coastal
Broken Hill	NSW	6–8	11–13	6–13	Arid inland
Mildura	VIC	8–10	12–14	8–14	Semi-arid inland
Melbourne	VIC	10–12	15–17	10–17	Temperate coastal
Geelong	VIC	10–12	15–17	10–17	Temperate coastal
Ballarat	VIC	10–12	15–17	10–17	Cool inland temperate
Hobart	TAS	11–13	15–17	11–17	Cool temperate maritime
Launceston	TAS	11–13	15–17	11–17	Cool temperate inland
Canberra	ACT	9–11	14–16	9–16	Temperate inland
Sydney	NSW	12–14	14–16	12–16	Humid coastal
Wollongong	NSW	13–15	15–17	13–17	Humid coastal
Newcastle	NSW	12–14	14–16	12–16	Humid coastal
Dubbo	NSW	8–10	13–15	8–15	Inland temperate
Bathurst	NSW	9–11	14–16	9–16	Inland temperate
Brisbane	QLD	14–16	13–15	13–16	Subtropical humid
Gold Coast	QLD	14–16	13–15	13–16	Subtropical coastal
Townsville	QLD	14–16	13–15	13–16	Tropical coastal (seasonal dry)
Cairns	QLD	15–17	14–16	14–17	Tropical humid
Mackay	QLD	15–17	14–16	14–17	Tropical coastal
Rockhampton	QLD	14–16	13–15	13–16	Subtropical transitional
Toowoomba	QLD	11–13	13–15	11–15	Elevated inland subtropical

1.11 Durability and exposure to moisture

1.11.1 Basis of EMC zone maps

Timber is a hygroscopic material that exchanges moisture with surrounding air until an equilibrium condition is reached. This equilibrium moisture content (EMC) depends primarily on the relative humidity (RH) and temperature of the surrounding environment.

The city-based EMC table has been developed using the CSIRO dataset "Moisture Content Predictions for Eight Seasoned Timbers under Sheltered Outdoor Conditions in Australia and New Guinea" (Finighan, 1966), which provides predicted monthly timber moisture contents for a wide range of Australian localities.

In that study, timber specimens of multiple species and thicknesses were exposed under sheltered outdoor conditions, and their moisture contents were correlated with long-term meteorological data, primarily dry-bulb temperature and relative humidity using regression equations.

The resulting tables present monthly mean moisture contents representative of typical in-service conditions for protected structural timber.

For each city, January and July EMC ranges were derived to capture seasonal variation, recognising that Australia exhibits two distinct moisture regimes: a monsoonal pattern in the north where summer (wet season) EMC exceeds winter values, and a temperate pattern in the south where winter EMC is higher due to increased relative humidity. The ranges presented are not single-point estimates but envelopes that account for inter-species variation, short-term climatic fluctuation, and the statistical spread inherent in the CSIRO regression models.

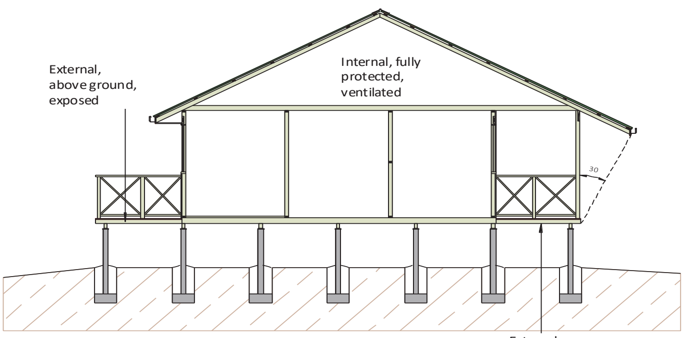
This approach aligns with the original study, which demonstrated that predicted moisture contents typically fall within a narrow band (generally within ±1–2%) of observed values under comparable conditions.

Finally, an annual EMC band has been assigned to each location, representing the practical range between seasonal minima and maxima. These bands are intended for design application, such as assessing timber shrinkage, serviceability, and durability risk. The associated climate descriptions further group cities into coherent moisture regimes, enabling designers to extrapolate beyond individual locations and apply EMC assumptions at a regional scale.

1.11.2 LVL Durability and exposure to moisture

SmartLVL is manufactured from softwood veneers which have a durability rating of class 4, which is the same rating as some Ash type Eucalypts.

Definitions of exposure zones within a structure



External timbers are regarded as protected in AS 1684 if they are covered by a roof projection (or similar) at 30° to the vertical and they are well detailed and maintained (painted and kept well ventilated).

Untreated SmartLVL should not be used where the equilibrium moisture content is likely to remain above 20% for an extended period.

Untreated and H2s SmartLVL is suitable in the ***internal, fully protected, ventilated*** and the ***external above ground, protected*** zones of the structure as shown below. Untreated or H2s SmartLVL is not suitable for ***external above ground, exposed*** or humid indoor conditions, such as swimming pool enclosures.

SmartLVL, like all wood products, is hygroscopic, which means it has an affinity for water, and being a LVL, should be considered as a composite of many pieces of wood, each with different potential swelling. Moisture exposure will ultimately lead to dimensional change.

SmartLVL is supplied WITH a new generation short term construction water repellent (H_2O Shield™) and once framed into a structure may be exposed to the weather for a limited time (usually not greater than 3 months) without negative affect, BUT, it may exhibit some effects of this exposure such as swelling and checking (especially at cut ends), depending upon the weather conditions.

While offering significant water short term repellency comparable to wax coatings, the H_2O Shield™ does NOT totally WATER PROOF the LVL. While the products will withstand normal exposure, excessive exposure during distribution, storage or construction may lead to dimensional changes that affect serviceability. These changes include cupping, bowing or expansion to dimensions to beyond the specified tolerance of the product in the "as-manufactured" condition.

Individual members of a vertically laminated multi member may exhibit some cupping if water becomes trapped between the laminates. This cupping produces more of a visual and possible fixity problem rather than being structurally significant. If not properly dried out, this moisture between laminated members may lead to decay. To prevent this effect, use construction details as shown on page 2.

As an organic material, mould and mildew may grow on untreated wood products if moisture is present. Prolonged periods of high moisture may also support the growth of wood decay fungi. The H_2O Shield™ does provide some resistance to mould and fungi attack, but it is NOT equivalent to H3 treatment.

In critical applications where dimensional change due to moisture exposure is to be absolutely minimised ((e.g. truss applications in wet humid conditions) it is recommended that the remedial H_2O shield available from Tilling Timber in spray cans (or bulk for airless spray guns) be used to recoat any cut ends or notches etc.

The table below shows the moisture content of LVL as a function of humidity.

Moisture content of wood products % (1)	
Relative Humidity %	LVL MC
10	1.2
20	2.8
30	4.6
40	5.8
50	7.0
60	8.4
70	11.1
80	15.3
90	19.4

1. Approx. moisture content at 21^0C

1.11.3 Dimensional Change

SmartLVL will shrink and swell in proportion to the moisture content between 0 and 28% fibre saturation point.

1.11 Durability and exposure to moisture

The most significant moisture movement will occur across the grain (tangential and radial directions within a log). Longitudinal (movement in the grain direction) may be a factor depending upon the type of structure. Detailing of SmartLVL to be used where moisture contents will cycle should allow for dimensional instability.

The AVERAGE amount of dimensional change in a piece of LVL changes in moisture content can be APPROXIMATED by the following formula:

$\Delta D = D_i S\ (MC_i - MC_f)/FSP$

Where:

ΔD = change in dimension

D_i = Initial dimension

S = Shrinkage coefficient = approximately 6%

MC_i = Initial moisture content

MC_f = final moisture content

FSP = fibre saturation point approximately 28%

HOWEVER, these dimensional effects are quite variable. Thickness swell in LVL is erratic along the length because of the densification of the lap joints during manufacture tends to “relieve” when saturated and the total swell in sections containing two (2) laps can be as much as 3 mm.

Worked example

Estimating timber movement from EMC change

If a 300 × 63 LVL13 roof beam that is at equilibrium in Perth is instead used in Broome in January, how much increase in depth and width could be expected?

Step 1 — EMC difference

Use the midpoint of the two EMC bands:

- Perth January EMC ≈ 10 %
- Broome January EMC ≈ 12.%

So:

$\Delta MC = 12 - 10 = 2.0\%$

That means the LVL would be expected to gain moisture and therefore swell slightly in Broome relative to Perth.

Step 2 — Movement formula

Use:

$\Delta d = d \times 0.0027 \times \Delta MC$

where d is the relevant cross-sectional dimension in mm.

Step 3 — Change in depth

For the 300 mm depth:

$\Delta d = 300 \times 0.0027 \times 2.0 = 1.62$ mm

Expected increase in depth ≈ 1.6 mm

Step 4 — Change in width

For the 63 mm width:

$\Delta b = 63 \times 0.0027 \times 2.0 = 0.34$ mm

Expected increase in width ≈ 0.3 mm

For a 300 × 63 LVL13 roof beam moving from Perth January conditions to Broome January conditions, a reasonable worked-example estimate is:

- Depth increase: about 1.6 mm
- Width increase: about 0.3 mm

Because the EMC values are bands, there is a reasonable range around that midpoint result:

- If the EMC difference were only 1%, the beam would increase by about 0.8 mm in depth and 0.2 mm in width
- If the EMC difference were 3%, the beam would increase by about 2.4 mm in depth and 0.5 mm in width

1.11.4 Change in characteristic strengths

Changes in moisture content in wood results in changes in mechanical properties, with higher properties at lower moisture contents. Estimates of the effect of moisture differentials on the properties of clear wood may be obtained by the following equation:

$$P = P_{12}\left(\frac{P_{12}}{P_g}\right)^{\left(\frac{12-M}{M_p-12}\right)}$$

Where:

P= Characteristic property at moisture content

P_{12} = same Characteristic property at 12% moisture content

P_g = same Characteristic property for Green wood

M_p = Intersection moisture content = 24%

APPROXIMATE affect upon key characteristic design properties of LVL by changes in MC are outlined in the table below:

Characteristic Property		% Reduction in Characteristic strength at % MC					
		14	16	18	20	22	24
MOE (Stiffness)	E	3.3	6.5	9.7	12.7	15.6	18.4
MOR (Bending)	F'_b	8.4	16.1	23.1	29.6	35.5	40.9
Compression perpendicular to grain	f'_p	9.9	18.9	27.0	34.2	40.8	46.7
Compression parallel to grain	f'_c	11.0	20.7	29.4	37.2	44.1	50.2
Shear	f'_s	6.6	12.8	18.6	24.0	29.0	33.7

The design Characteristic properties of SmartLVL can therefore be considerably reduced by severe increase in MC of the LVL.

If the SmartLVL is being built into structures (such as Prefabricated trusses) that are:

1. Likely to experience large increase in MC due to weather exposure or stored on the ground
2. Likely to be loaded to at/or close to design loads while in the high MC state

then the reduced Characteristic Strengths as detailed above NEED to be used in the design or members may require temporary propping.

Once covered, the SmartLVL will ultimately dry and re-equilibrate to the ambient humidity conditions, but some expansion or swelling will remain after re-drying. The thickness swelling in laps will never fully shrink back and a large piece of LVL can have a final thickness variation along the length of 3-4 mm.

Estimating timber deflection change from EMC change

For a 300 × 63 timber member designed in Perth to have a long-term deflection of 10 mm under $G=0.4$ and $Q=1.5$, with j_2=2, corresponding member in Broome may be expected to deflect about 11.0 mm under the same loading.

Worked example:

Summary- In this worked estimate, the increase arises from two sources: a small increase in immediate elastic deflection due to reduced stiffness at higher service moisture content, and a larger increase in the mechano-sorptive / creep component associated with the wetter Broome service environment.

The net increase is about 0.95 mm, or about 10%.

Step 1 — Back-calculate the Perth load-deflection constant

Item	Perth	Broome	Comment
Member size	300 × 63	300 × 63	Same section
Permanent action, G	0.4	0.4	Same load
Imposed action, Q	1.5	1.5	Same load
Adopted creep factor j_2	2.0	2.35	Broome increased for higher EMC
Representative service EMC	11.5%	13.5%	From the Perth/Broome climate bands previously derived
Relative stiffness factor	1.00	0.96	Assumed 4% lower E in Broome
Assumed long-term Deflection (mm)	10.00	—	

Given:

$10=k[Q+(1+j_2)G]$

$10 = k[1.5+(1+2)x0.4]$

$10=k(2.7)$

$k=3.7037$ mm per load unit

Step 2 — Split the Perth deflection into elastic and mechano-sorptive parts

Perth component	Calculation	Deflection
Immediate dead-load deflection	$0.4×3.7037$	1.48 mm
Immediate live-load deflection	$1.5×3.7037$	5.56 mm
Total immediate elastic deflection	$1.48+5.56$	7.04 mm
Mechano-sorptive / creep increment	$j_2×\Delta G_{inst}=2×1.48$	2.96 mm
Total long-term deflection	$7.04+2.96$	10.00 mm

Step 3 — Adjust the elastic part for Broome

Assume Broome service EMC is about 2 percentage points higher, giving a 4% reduction in stiffness:

$E_{Broome}=0.96 \; x \; E_{Perth}$

So deflection increases by:

$1/0.96=1.0417$

Broome elastic component	Calculation	Deflection
Immediate dead-load deflection	$1.48×1.0417$	1.54 mm
Immediate live-load deflection	$5.56×1.0417$	5.79 mm
Total immediate elastic deflection	$7.04×1.0417$	7.33 mm

Step 4 — Adjust the mechano-sorptive part for Broome

Using the EMC ratio:

$13.5/11.5=1.174$

$J_{2,Broome}=2.0×1.174≈2.35$

Then:

$\Delta_{ms,Broome}=2.35×1.54=3.62 \; mm$

Step 5 — Total Broome long-term deflection

Broome total	Calculation	Deflection
Immediate elastic	—	7.33 mm
Mechano-sorptive / creep increment	—	3.62 mm
Total long-term deflection	$7.33+3.62$	10.95 mm

Note: These example are illustrative only.

The assumed relationship between EMC, dimensional change, stiffness reduction and creep / mechano-sorptive behaviour is simplified for worked-example purposes and should not be taken as a product-specific design rule.

Actual values may vary with species, product type, load duration, moisture cycling amplitude, and service exposure.

1.11.5 Design for durability

1. The use of building overhangs and other structures which protect the beams from excessive moisture movement and sun exposure.
2. All beams should be provided with adequate ventilation so that moisture content within beams will not exceed 15% and moisture gradients across the beam will not occur.
3. The use of arrised or round edges on beams to reduce the likelihood of coating failures on sharp edges.
4. The use of drip edges or other devices which provide a path for free moisture flow away from the timber beam.
5. Joint detailing should, wherever possible, comply with the following:
    - I. Keep horizontal contact areas to a minimum, in favour of self draining vertical surfaces.
    - II. Ventilate joint surfaces by using spacers, wherever possible
    - III. Always use compatible fasteners which have adequate corrosion protection and do not cause splitting during installation e.g. hot dipped galvanic coatings or stainless steel
    - IV. Ensure any moisture entering a joint is not trapped but can adequately drain away from the joint.

Allow for thermal expansion/contraction in the joint design.

1.11.6 Post-Production treatment

SmartLVL is supplied glue-line H2S* treated or can be supplied either LOSP treated or Tru-Core® treated to either H2 or H3 hazard class levels, as per AS/NZS 1604.4. (Tru-Core® is a registered trade mark of Kop-Coat Australia PTY Limited)

To maintain effective treatment it is a requirement that any cuts, notches or penetrations made in post production treated LVL be painted with a suitable “brush/spray on” preservative.

The hazard class number selected is based upon the specific exposure condition for the proposed end use of the SmartLVL, as shown in the table on the next page.

1.11 Durability and exposure to moisture (Cont'd)

Hazard class selection guide				
Hazard class	Exposure	Specific service conditions	Biological hazard	Typical uses
H1†	Inside, above ground	Completely protected from the weather and well ventilated, and protected from termites	Lyctid borers	Interior beams, staircases, stringers
H2S*	Inside, above ground	Protected from wetting Nil leaching	Borers and termites	Interior beams, staircases, trusses, joists
H2	Inside, above ground	Protected from wetting Nil leaching	Borers and termites	Interior beams, staircases, trusses, joists
H3	External, above ground	Subject to periodic moderate wetting and leaching	Moderate decay, borers and termites	Exterior beams (1)

† The timber species in SmartLVL are not susceptible to Lyctid Borer attack

* H2S treatment is only suitable South of the Tropic of Capricorn

A more comprehensive Hazard Class Table is available in AS/NZS 1604.4, but it is NOT recommended that SmartLVL be used in end uses with exposures requiring treatment in excess of H3.

Experience is showing that post production treated LVL in the **external above ground, exposed** (H3 Hazard Class) may experience some leaching of the active ingredients of the treatment. To minimise the possibility of timber degradation in these situations, it is recommended that H3 treated Smart LVL NOT be used where the surface is horizontally exposed AND unprotected from water entrapment OR where post-treatment protection cannot be maintained.

Post treatment protection may include:

I. Protectadeck or Vapour Seal high density water proof joist/ bearer cover or malthoid capping

and

I. An impervious membrane such as regularly maintained painting or staining

II. Construction detailing to prevent water entrapment.

H3 treated SmartLVL is NOT recommended for fascia's, pergolas or other similar external above ground, exposed applications due to mechanical degradation of the wood fibre causing checking and cracking which is both aesthetically unacceptable and allows ingress of water to inner veneers.

1.11.7 Fasteners for H3 LVL

For any H3 Smart LVL to be used in exposed exterior applications, it is recommended that either hot dipped galvanised or stainless steel fasteners are used.

Specifically, If the Tru-Core® Copper Quat H3 treatment process is used, high grades (304, 305 and 316) of stainless steel materials perform the best.

1.11.8 Painting of treated SmartLVL

General

To provide the longest service life of the SmartLVL it is recommended the LVL is painted with an exterior paint with a Light Reflectance Value (LRV) greater than 30%. Heat reduction exterior paints should be used where the desired colour is dark or has a LRV of less than 30% The heat reflective paint's colours should be limited to a Total Solar Reflectance (TSR) value greater than 29%.

Any paint or stain must be recommended by the manufacturer as being suitable for the proposed application and must be applied in a manner in strict compliance to the manufacturer's recommendations.

LOSP Treated

Wait until excess solvents have evaporated and timber is dry. The pressure of the solvent (white spirits) from the LOSP treatment may affect the drying and hardening of paints if there has been insufficient evaporation time after the treatment. It is strongly recommended that the treated timber is left to recondition for at least 7 days in the end use situation before painting.

One coat of premium quality primer as a minimum should be applied to all surfaces prior to erection of beam and to any cuts or holes drilled. If the first coat of primer, sealant paint or stain fails to dry or adhere within the time expected, do not proceed to any further coats until the first coat has achieved satisfactory dryness and adhesion. If the first coat fails to dry it may be necessary to strip back to bare timber and allow it to weather for another week or two.

a. Paint

Exterior solid colour acrylic finish. One coat of oil based primer followed by one or two coats of the exterior acrylic finish as required.

or

Exterior solid colour oil based enamel. One coat of oil based primer followed by one coat of oil based under-coat (if required) then two coats of the oil based enamel.

b. Stains

Exterior semi-transparent or solid colour penetrating oil based stain or similar. Two or three coats of the stain as required or recommended by the manufacturer.

Water based stains and un-pigmented sealants, oil or water repellents are NOT recommended.

Tru-Core® Treated

1. The wood must be dry and clean prior to applying any finish coating. If initial cleaning of the treated wood is needed, it is recommended that the project be cleaned with a deck cleaning product and allow to fully dry.

2. At this time, a clear water repellent may be added to the project. If applied, allow 8 weeks prior to the application of a semi-transparent stain or paint

3. If no water repellent is added, an oil based stain can be applied to the clean, dry wood in 30-60 days from treatment date. A water based stain can be applied to the clean, dry wood in 45-70 days from treatment date.

4. Depending on the treatment method used, if the wood is left uncoated and without UV protection:

    I. The typical brown colour of the Copper Quat treated wood will naturally weather to a grey colour over long-term exposure to the sun

    II. The Azole treated wood has no colouration so it will naturally weather to a grey colour over long-term exposure to the sun.

Users must always conduct their own tests on coatings in inconspicuous areas of the project to determine acceptability of colour, adhesion and appearance.

1.13 Designing with Red Alert LVL

The design information contained within this Design Guide is for the properties of Red Alert LVL only. Other manufacturers' LVL may have different properties and therefore cannot be designed using this information.

1. Product Specification

Veneer:	Thickness:	1.9-3.0 mm
	Species:	Mixed species, Masson pine, Eucalyptus, Spruce
	Strength Group	SD6
	Joints:	Scarf joint
Dimensional tolerances:	Length:	± 10 mm
	Depth:	≤ 400 mm +2,-3 mm ≥ 400 mm +5, -0 mm
	Thickness:	- 0, +4 mm at 12% moisture content
Adhesive:	Complies with AS/NZS 4364:2010	
Treatment: options:	Manufactured as H2S, H2 and H3 available on request	

2. Limit State design characteristic properties

Timber Strength Properties:(1)			
Bending	f'_b	46	MPa
Tension Parallel to grain	f'_t	20	MPa
Tension Perpendicular to grain	f'_{tp}	0.5	MPa
Compression Parallel to grain	f'_c	30	MPa
Compression Perpendicular to grain - Edge	f'_p	10	MPa
Shear	f'_s	5.0	MPa
Average Elastic Modulus	E	12,000	MPa
Average Modulus of Rigidity	G	600	MPa
Average Density		600	kg/m^3
Moisture Content		12-15%	

(1) Dry conditions

3. Strength reduction factor

The strength reduction factor for calculating the design capacities of structural members shall be taken from the table below, referenced from AS 1720.1 –2010.

Application of Red Alert LVL as a structural member		
Category 1	Category 2	Category 3
Structural members for houses for which failure would be unlikely to affect an area greater than 25 m^2; OR secondary members in structures other than houses	Primary structural members in structures other than houses; OR elements in houses for which failure would be likely to affect an area* greater than 25 m^2	Primary structural members in structures intended to fulfil essential services or post disaster function
Strength reduction factor Ø *		
0.95	0.85	0.75

* AS 1720.1:2010 Table 2.1

4. Duration of load

The duration of load factor k_1 for strength and j_2 for creep deformation are defined within clause 2.4 of AS 1720.1.

5. Partial seasoning factor

Red Alert LVL is a seasoned timber product, generally k_4 equals 1. Where the LVL is subjected to conditions in which the average moisture content for a 12 month period is expected to exceed 15%, the characteristic capacity shall be decreased. The value of k_4 shall be the greater of:

a. $k_4 = 1 - 0.3\frac{EMC - 15}{10}$;

b. $k_4 = 0.7$

Where EMC is the highest value of the annual moisture content (percent) that the timber will attain in service.

6. Length and position of bearing

The k_7 bearing factor is defined is clause 2.4.4 of AS 1720.1

7. Load sharing

Because of the reduced variability of strength values of LVL compared to solid timber , the load sharing factor k_9 = 1.0 as defined in clause 7.4.3 of AS 1720.1.

8. Stability

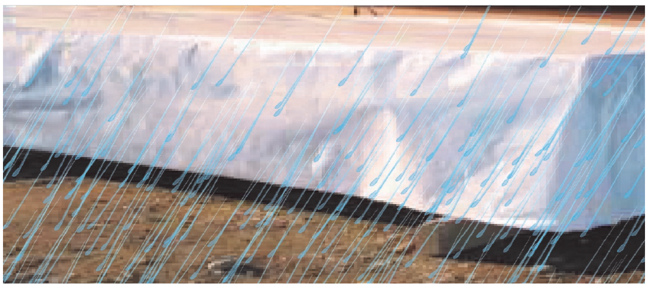
The stability factor k_{12} is defined within section 7 of AS 1720.1 beams. The methods for calculating k_{12} for solid wood in section 3 of AS 1720.1 shall generally apply except that the material constant (ρ_b or ρ_c) for beams and column shall be as given in Tables 7.2(A) and 7.2(B)

9. Temperature

For covered timber structures under ambient conditions, no modification for strength need be made for the effect of temperature (i.e., k_6 equals 1.0) except that where seasoned timber is used in structures erected in coastal regions of Queensland north of latitude 25°S, and all other regions of Australia north of latitude 16°S, the strength shall be modified by a factor k_6 of 0.9.

1.14 Storage and handling of SmartLVL

- Store SmartLVL flat on a hard, dry surface
- If surface isn't paved, the ground should be covered with a polythene film
- Keep covered with waterproof material that allows bundles to "breathe"
- Use bearers (bolsters) between the ground and the first bundle (4 metre max spacing)
- Use 100 x 50 timber flat between bundles at same spacing as bolsters
- Take great care to rewrap remaining material after opening bundles
- LVL "grows" in thickness and depth when allowed to get wet....KEEP DRY!
- LVL with high MC has short term reduction in Characteristic Strengths …. KEEP DRY!
- Under NO circumstances is stored SmartLVL to be in contact with the ground.



1.15 Red Alert LVL hanger details

Given the high load carrying capacity of SmartLVL, it is essential that the connection of SmartLVL to other structural members is considered carefully, with the industry practice of simple skew or end nailing of SmartLVL not recommended for anything but the lightest loads.

The list below contains the common light to medium duty SmartLVL framing brackets stocked by Tilling Timber.

Member connections requiring capacities greater than those listed below can be designed by your own Engineer or SmartFrame Engineers, but any non-standard connection system designed by your own engineer or SmartFrame Engineers may take some time to be fabricated.

				Wind Uplift (k_1 = 1.14)			
Tilling framing bracket code	Fixing to SUPPORTING beam	Design Capacity $ØN_j$ (kN) $1.2G+1.5Q_f$ (DL + FLL) JD4	Fixing to SUPPORTED beam	Design Capacity $ØN_j$ (kN) $1.2G+1.5Q_f$(DL + RLL) for Joint group			
				JD5	JD4	JD3	Max.
SLF3590, SLF4590	8 Nails	4.6	4 nails	3.2	3.7	5.3	6.0
	4 Screws	6.1	2 screws	3.5	5.0	5.0	5.0
SLF35120, SLF45120	12 Nails	6.4	6 nails	4.7	5.7	7.9	9.0
	6 Screws	9.1	4 screws	7.1	10.0	10.0	10.0
SLF35140, SLF45140	16 Nails	8.4	8 nails	6.2	7.5	10.6	12.0
	6 Screws	9.1	4 screws	7.1	10.0	10.0	10.0
SLF35180, SLF45180	20 Nails	10.3	10 nails	7.4	8.9	12.4	15.0*
	8 Screws	12.1	6 Screws	10.6	15.0*	15.0*	15.0*
SLF45220	26 Nails	13.1	13 nails	9.5	11.3	15.0*	15.0*
	10 Screws	14.2	8 Screws	14.2	15.0*	15.0*	15.0*
SLF60130	12 Nails	6.4	3 nails	2.4	2.8	3.9	4.5
	4 screws	6.1	7 nails	5.4	6.6	9.3	10.5
			4 screws	7.1	10.0	10.0	10.0
SLF65170	18 Nails	9.3	6 nails	4.7	5.7	7.9	9.0
	6 screws	9.1	11 nails	8.1	9.8	13.6	15.0*
			6 screws	10.6	15.0*	15.0*	15.0*
SLF90200	26 Nails	12.9	3 nails	2.4	2.8	3.9	4.5
	10 Screws	14.2	13 nails	9.6	11.6	15.0*	15.0*
			8 screws	14.2	15.0*	15.0*	15.0*
SPH180 (pair)	6 No 14 x 30 screws‡	119	6 No 14 x 30 screws‡	13.3	18.8	20.4	20.4
	12 No 14 x 30 screws‡	29.3	12 No 14 x 30 screws‡	24.5	34.6	37.8	37.8
SPH220 (pair)	10 No 14 x 30 screws‡	13.4	10 No 14 x 30 screws‡	15.7	22.1	25.5	25.5
	20 No 14 x 30 screws‡	25.6	20 No 14 x 30 screws‡	30.0	42.3	46.0	46.0
SPH300 (pair)	14 No 14 x 30 screws‡	18.5	14 No 14 x 30 screws‡	19.3	30.6	49.2	49.2
	28 No 14 x 30 screws‡	37.0	28 No 14 x 30 screws‡	38.7	61.2	65.0	65.0
SPH360 (pair)	16 No 14 x 30 screws‡	21.6	16 No 14 x 30 screws‡	22.6	35.8	57.5	57.5
	32 No 14 x 30 screws‡	43.3	32 No 14 x 30 screws‡	45.3	65.0	65.0	65.0

‡ in each face of joist hanger

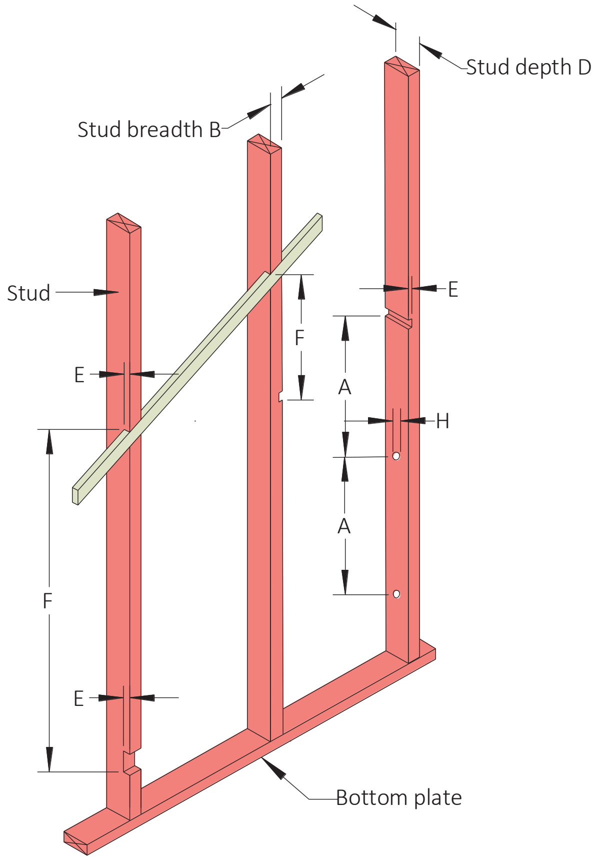
Notes:

1. For this table, SmartLVL has been given a uniform JD4 Joint Strength Group. For more detailed calculations of joint strength group in particular planes contact the Techsupport Helpline on 1300 668 690
2. The above tabulated capacities are for a minimum beam thickness of 35 mm
3. Wind uplift capacities apply to designs in accordance with AS/NZS 1170:2002
4. SLF Framing Bracket capacity has been limited to 15.0 kN shown *
5. These capacities apply directly for joints in houses and on secondary beams in other structures. For joints on primary beams in structures other than houses, reduce the capacity by 0.85/0.95 = 0.89
6. Multiple laminated supporting beams - fasteners with longer lengths are required when Joist Hangers are fixed into a multiple laminated supporting beam. For double laminates, use 65 long nails or screws. Alternatively, for double or triple laminated supporting beams, additional fixings may be provided at hanger locations to laminate plies. Seek advice from the Engineer.

Notching and holes in Red Alert LVL studs

The following diagram and tables are reproduced from AS 1684.2: 2021, and focused where necessary to only deal with studs.

The paragraph (b) below was introduced into the 2021 edition of AS 1684 to allow for larger holes/notches in non loadbearing walls, and given the higher characteristic strength values of Red Alert LVL over solid sawn timber studs provides a conservative solution.



Symbol	Description	Limits	
		Notched	Not notched
A	Distance between holes and/ or notches in stud breadth	Min. 3D	Min. 3D
H	Hole diameter (studs and plates)	Max. 25 mm (wide face only)	Max. 25 mm (wide face only)
C	Notch into stud breadth	Max. 10 mm	Max. 10 mm
E	Notch into stud depth	Max. 20 mm (for diagonal cut in bracing only) (see Notes 1 and 2)	Not permitted (see Note 1)
F	Distance between notches in stud depth	Min. 12B	N/A

NOTES

1. A horizontal line of notches up to 25 mm may be provided for the installation of baths
2. Except as permitted for diagonal cut in bracing, notches up to 20 mm may occur in every fifth individual stud.
3. For additional jamb stud requirements, see Figures 6.5, 6.9(A) and 6.9(B) of AS 1684.2:2021
4. Top and bottom plates in internal non-loadbearing and non-bracing walls may be discontinuous up to 60 mm (cut or drilled) to permit installation of services provided that, at the discontinuity, the plates are trimmed or otherwise reinforced either side of the discontinuity to maintain the lateral and longitudinal integrity of the wall.

(a) General (external walls, loadbearing walls and braced sections of internal non-loadbearing walls)

The maximum size and spacing of cuts, holes, notches and similar section reductions in studs shall be in accordance with the above diagram.

i) Holes in studs and plates shall be located within the middle half of the depth and breadth of the member, respectively.

ii) A longitudinal groove up to 18 mm wide × 10 mm deep may be machined into the middle third depth of a stud to accept full-length anchor rods. Where the groove exceeds this dimension, the remaining net breadth and depth of the stud shall be not less than the minimum size required.

iii) Studs may be designed as notched or not-notched. For common studs, the maximum notch depth for single or upper storey or lower storey construction shall be 20 mm.

iv) Jamb studs in external walls and other loadbearing walls shall not be notched within the middle half of their height or within the height of the opening. A notch up to a maximum of 20 mm in depth is permissible outside this region at the top and/or the bottom of the stud.

(b) Internal non-loadbearing walls (excluding sections of wall that have diagonal or structural sheet bracing installed)

The general requirements for internal non-loadbearing walls (excluding sections of wall that have diagonal or structural sheet bracing installed) shall be as specified in Item (a) above. The following additional allowances are permitted:

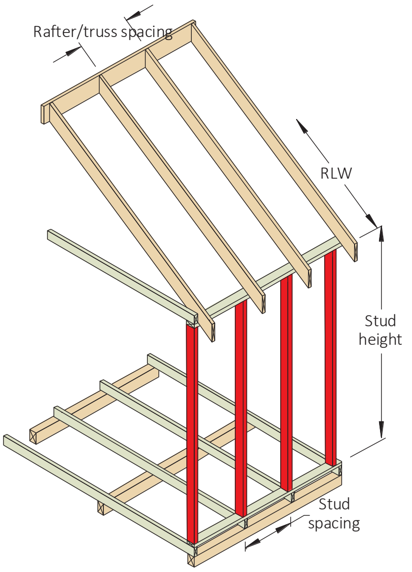
i) Holes in plates and noggings of diameter up to 52 mm may be located on the centre-line of the wide face provided they are spaced a minimum of 1 800 mm apart and are not located adjacent to significant timber defects.

ii) A single hole in a stud of diameter up to 52 mm may be located on the centre-line of the wide face provided they are not located adjacent to significant timber defects and can only occur not closer than in every fourth stud.

iii) A single notch in a stud up to 50 % of the stud depth may be used. The notch can only occur not closer than in every fourth stud.

Index of span tables

Common stud at 450 mm ctrs - single/upper storey walls - un-notched
AS 4055 Classification N1 - N4



EXAMPLE:

Sheet roof

Stud spacing = 450 mm

Rafter truss spacing = 600 mm

Stud height = 2700 mm

Roof load width = 6500 mm

Enter sheet roof column, 600 mm in rafter/truss spacing column, read down to a span roof load width of 6500 mm in a 2700 mm stud height.

ADOPT:

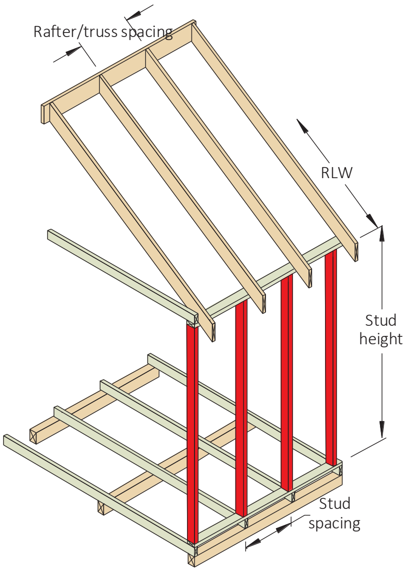
Red Alert LVL - 70 x 35

Rafter/truss spacing (mm)		450	600	900	1200	450	600	900	1200
Size DxB (mm)	Stud height (mm)	Maximum recommended roof load width (mm)							
		Sheet roof				Tile roof			
Stud spacing 450 mm									
70x35	2400	7500	7500	7500	5500	7500	7500	5500	4500
	2700	7500	7500	4500	3500	6500	5000	3500	2500
	3000	5500	4000	2500	2000	3500	3000	2000	1500
90x35	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	6500	7500	7500	6500	5000
	3600	7500	5500	3500	2500	5500	4500	2500	1500
140x35	3600	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	6500	5000
	3600	7500	6500	4500	3500	6500	4500	3500	2500
2/90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	7500	7500	7500	7500	6500
70x45	2400	7500	7500	7500	7500	7500	7500	7500	6500
	2700	7500	7500	7500	5500	7500	7500	5500	4000
	3000	7500	6500	4500	3500	6500	5000	3500	2500
	3600	3500	2500	1500	NS	2500	1500	NS	NS
90x45	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	7000
	3600	7500	7500	6500	4500	7500	6500	4500	3500
2/70x45	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	6500
	3600	7500	7500	5500	4500	6500	6500	3500	2500
2/90x45	3600	7500	7500	7500	7500	7500	7500	7500	7500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum wall mass of 37 kg/m^2
3. Multiple studs to be laminated as per AS 1684
4. Stud not notched
5. Maximum tension load in stud not to exceed 8.5 kN. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
6. If design stud length (not gable end walls) is > 3000 mm, as a minimum, the DTS provisions within AS 1684 for the racking force (clause 8.3.4), fixing of bottom plate (clause 8.3.6.10), uplift and shear force provisions (clause 9.7.6 and Table 9.2) need to be modified to allow for the extra wall height - See page 4
7. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering

Common Stud at 600 mm ctrs - single/upper storey walls - un-notched
AS 4055 Classification N1 - N4



EXAMPLE:

Sheet roof

Stud spacing = 600 mm

Rafter truss spacing = 600 mm

Stud height = 2700 mm

Roof load width = 6500 mm

Enter sheet roof column, 600 mm in rafter/truss spacing column, read down to a span roof load width of 6500 mm in a 2700 mm stud height.

ADOPT:

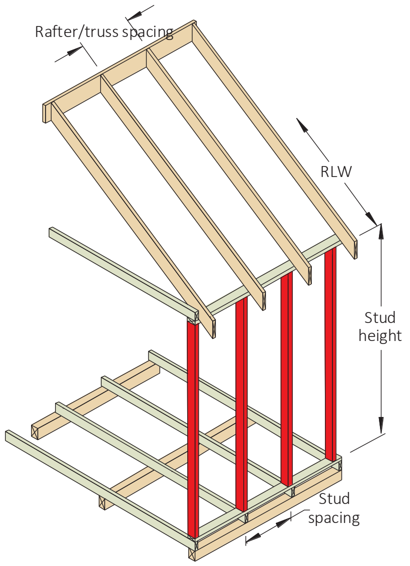
Red Alert LVL - 90x35 or 70 x 45

Rafter/truss spacing (mm)		450	600	900	1200	450	600	900	1200
Size DxB (mm)	Stud height (mm)	Maximum recommended roof load width (mm)							
		Sheet roof				Tile roof			
Stud spacing 600 mm									
70x35	2400	7500	7500	6500	4500	6500	6500	4500	3500
	2700	4500	4500	3000	2500	3500	3500	2000	1500
	3000	1500	1500	NS	NS	1500	1500	NS	NS
90x35	2400	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	7500	7500	7500	7500	6500
	3000	7500	7500	7500	5500	7500	7500	5500	4000
	3600	3500	3500	2500	1500	2500	2500	1500	NS
140x35	3600	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	2400	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	7500	7500	7500	7500	6500
	3000	7500	7500	7500	6500	7500	7500	6000	4500
	3600	5500	5500	3500	2500	3500	3500	2500	1500
2/90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	7500	7500	7500	7500	5500
70x45	2400	7500	7500	7500	7500	7500	7500	6500	5500
	2700	7500	7500	5500	4500	6500	6500	4000	3000
	3000	4500	4500	3000	2500	3500	3500	2200	1800
90x45	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	6000
	3600	7500	7500	4500	3500	5500	5500	3500	2500
2/70x45	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	6500
	3600	7500	7500	5500	4500	6500	6500	3500	2500
2/90x45	3600	7500	7500	7500	7500	7500	7500	7500	7500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum wall mass of 37 kg/m^2
3. Multiple studs to be laminated as per AS 1684
4. Stud not notched
5. Maximum tension load in stud not to exceed 8.5 kN. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
6. If design stud length (not gable end walls) is > 3000 mm, as a minimum, the DTS provisions within AS 1684 for the racking force (clause 8.3.4), fixing of bottom plate (clause 8.3.6.10), uplift and shear force provisions (clause 9.7.6 and Table 9.2) need to be modified to allow for the extra wall height - See page 4
7. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering

Common Stud at 450 mm ctrs - single/upper storey walls - un-notched
AS 4055 Classification C1 - C3



EXAMPLE:

Sheet roof

Stud spacing = 450 mm

Rafter truss spacing = 600 mm

Stud height = 2700 mm

Roof load width = 6300 mm

Enter sheet roof column, 600 mm in rafter/truss spacing column, read down to a span roof load width of 6300 mm in a 2700 mm stud height.

ADOPT:

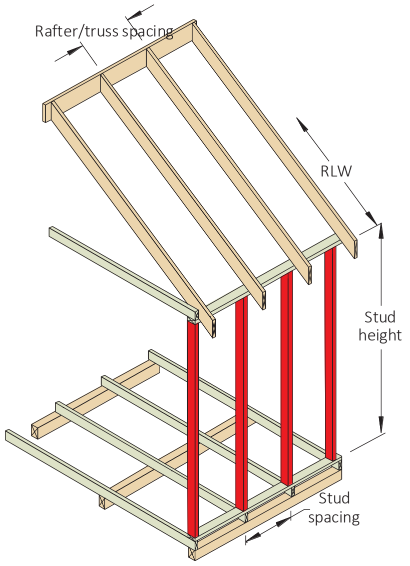
Red Alert LVL - 90 x 35

Rafter/truss spacing (mm)		450	600	900	1200	450	600	900	1200
Size DxB (mm)	Stud Height (mm)	Maximum recommended roof load width (mm)							
		Sheet Roof				Tile Roof			
Stud spacing 450 mm									
70x35	2400	3500	2500	1500	NS	2500	2000	1500	NS
90x35	2400	7500	7500	7500	5500	7500	7500	6500	4500
	2700	7500	6500	4500	3500	7500	5500	3500	2500
	3000	4500	3500	2500	1500	3500	2500	2000	1500
140x35	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	6500	7500	7500	7500	5500
2/70x35	2400	7500	7500	7500	6500	7500	7500	7500	5500
	2700	7500	7500	5500	4000	7500	6500	4500	3500
	3000	6500	5000	3500	2500	5500	4000	2500	2200
	3600	1500	1500	NS	NS	1500	NS	NS	NS
2/90x35	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	6500
	3600	7500	7500	4500	3500	7500	5500	3500	2500
70x45	2400	7500	5500	3500	2500	6500	4500	3000	2200
	2700	3500	2500	1500	NS	2500	2000	1500	NS
90x45	2400	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	5500	7500	7500	6500	4500
	3000	7500	6500	4500	3500	7500	5500	3500	3000
	3600	2500	1500	NS	NS	1500	1500	NS	NS
2/70x45	2400	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	6500	7500	7500	6500	5500
	3000	7500	7500	5500	4000	7500	6500	4500	3500
2/90x45	3600	4500	2500	1500	1500	3500	2500	1500	NS
	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	5500	7500	7500	5500	4500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum wall mass of 37 kg/m^2
3. Multiple studs to be laminated as per AS 1684
4. Stud not notched
5. Maximum tension load in stud not to exceed 8.5 kN. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
6. If design stud length (not gable end walls) is > 3000 mm, as a minimum, the DTS provisions within AS 1684 for the racking force (clause 8.3.4), fixing of bottom plate (clause 8.3.6.10), uplift and shear force provisions (clause 9.7.6 and Table 9.2) need to be modified to allow for the extra wall height - See page 4
7. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering.

Common Stud at 600 mm ctrs - single/upper storey walls - un-notched
AS 4055 Classification C1 - C3



EXAMPLE:

Sheet roof

Stud spacing = 600 mm

Rafter truss spacing = 600 mm

Stud height = 2700 mm

Roof load width = 6300 mm

Enter sheet roof column, 600 mm in rafter/truss spacing column, read down to a span roof load width of 6300 mm in a 2700 mm stud height.

ADOPT:

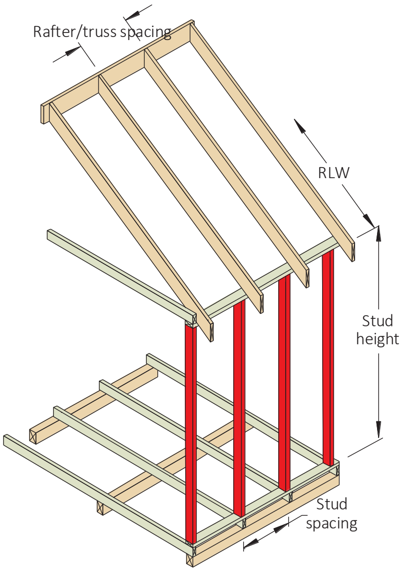
Red Alert LVL - 2/70 x 35

Rafter/truss spacing (mm)		450	600	900	1200	450	600	900	1200
Size DxB (mm)	Stud height (mm)	Maximum recommended roof load width (mm)							
		Sheet roof				Tile roof			
Stud spacing 600 mm									
90x35	2400	7500	7500	5500	4500	7500	7500	4500	3500
	2700	3500	3500	2500	1500	2500	2500	1500	1500
140x35	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	6500	4500	7500	7500	5500	3500
2/70x35	2400	7500	7500	7500	5500	7500	7500	5500	4500
	2700	6500	6500	4000	3000	4500	4500	3500	2500
	3000	2500	2500	2000	1500	2500	2500	1500	NS
2/90x35	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	6500	7500	7500	7500	5500
	3600	4500	4500	3500	2500	3500	3500	2500	1500
70x45	2400	2500	2500	1500	1500	2000	2000	1500	NS
90x45	2400	7500	7500	7500	7500	7500	7500	7500	6500
	2700	7500	7500	5500	3500	6500	6500	4500	3500
	3000	3500	3500	2500	2000	3500	3500	2000	1500
140x45	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	7500	7500	7500	7500	6500
2/70x45	2400	7500	7500	7500	7500	7500	7500	7500	6500
	2700	7500	7500	6500	5000	7500	7500	5500	4500
	3000	6500	6500	4000	3000	4500	4500	3500	2500
	3600	1500	1500	NS	NS	NS	NS	NS	NS
2/90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	5500	4500	7500	7500	4500	3500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum wall mass of 37 kg/m^2
3. Multiple studs to be laminated as per AS 1684
4. Stud not notched
5. Maximum tension load in stud not to exceed 8.5 kN. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
6. If design stud length (not gable end walls) is > 3000 mm, as a minimum, the DTS provisions within AS 1684 for the racking force (clause 8.3.4), fixing of bottom plate (clause 8.3.6.10), uplift and shear force provisions (clause 9.7.6 and Table 9.2) need to be modified to allow for the extra wall height - See page 4
7. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering.

Common Stud at 450 mm ctrs - single/upper storey walls - 20 mm notched
AS 4055 Classification N1 - N4



EXAMPLE:

Sheet roof

Stud spacing = 450 mm

Rafter truss spacing = 600 mm

Stud height = 2700 mm

Roof load width = 6300

Enter sheet roof column, 600 mm in rafter/truss spacing column, read down to a span roof load width of 6300 mm in a 2700 mm stud height.

ADOPT:

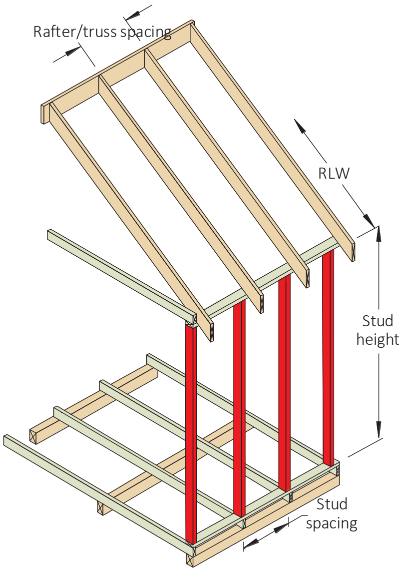
Red Alert LVL - 90x 35

Rafter/truss spacing (mm)		450	600	900	1200	450	600	900	1200
Size DxB (mm)	Stud height (mm)	Maximum recommended roof load width (mm)							
		Sheet roof				Tile roof			
Stud spacing 450 mm									
70x35	2400	7500	7500	6500	4500	7500	7500	4500	3500
	2700	7500	5500	3500	2500	5500	4000	2500	2000
90x35	2400	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	7500	7500	7500	7500	6500
	3000	7500	7500	7500	5500	7500	7500	5500	4000
140x35	3600	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	2400	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	7500	7500	7500	7500	5500
	3000	7500	7500	7500	5500	7500	7500	5500	4000
2/90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	7500	7500	7500	6500	4500
70x45	2400	7500	7500	7500	7500	7500	7500	6500	5000
	2700	7500	7500	5500	4500	7500	6500	4000	3000
	3000	6500	4500	3500	2500	4500	3500	2500	1800
90x45	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	5500
2/70x45	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	5500
2/90x45	3600	7500	7500	7500	7500	7500	7500	7500	7500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum wall mass of 37 kg/m^2
3. Multiple studs to be laminated as per AS 1684
4. Stud notch 20 mm maximum
5. Maximum tension load in stud not to exceed 8.5 kN. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
6. If design stud length (not gable end walls) is > 3000 mm, as a minimum, the DTS provisions within AS 1684 for the racking force (clause 8.3.4), fixing of bottom plate (clause 8.3.6.10), uplift and shear force provisions (clause 9.7.6 and Table 9.2) need to be modified to allow for the extra wall height - See page 4
7. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering.

Common Stud at 600 mm ctrs - single/upper storey walls - 20 mm notched AS 4055 Classification N1 - N4



EXAMPLE:

Sheet roof

Stud spacing = 600 mm

Rafter truss spacing = 600 mm

Stud height = 2700 mm

Roof load width = 6300

Enter roof column, 600 mm in rafter/truss spacing column, read down to a span roof load width of 6300 mm in a 2700 mm stud height.

ADOPT:

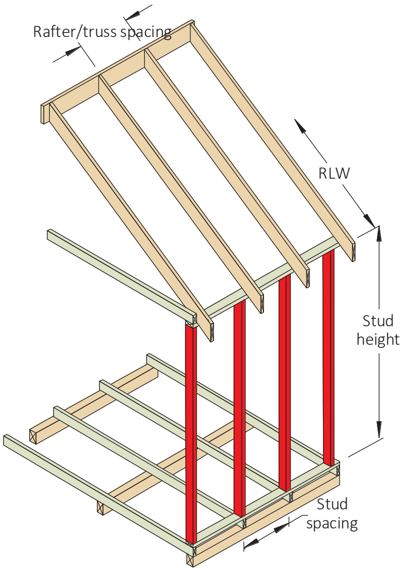
Red Alert LVL - 90 x 35

Rafter/truss spacing (mm)		450	600	900	1200	450	600	900	1200
Size DxB (mm)	Stud height (mm)	Maximum recommended roof load width (mm)							
		Sheet Roof				Tile Roof			
Stud spacing 600 mm									
70x35	2400	7500	7500	5500	4000	5500	5500	3500	2500
	2700	3500	3500	2500	2000	2500	2500	1500	1500
90x35	2400	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	7500	7500	7500	7500	5500
	3000	7500	7500	5500	4500	6500	6500	4000	3000
140x35	3600	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	2400	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	7500	7500	7500	7500	5500
	3000	7500	7500	6500	4500	6500	6500	4500	3500
2/90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	5500	7500	7500	5500	4500
70x45	2400	7500	7500	7500	6500	7500	7500	5500	4500
	2700	6500	6500	4500	3500	4500	4500	3500	2500
90x45	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	6500	7500	7500	6500	4500
140x45	3600	7500	7500	7500	7500	7500	7500	7500	7500
190x45	3600	7500	7500	7500	7500	7500	7500	7500	7500
2/70x45	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	6500	7500	7500	6500	5000
2/90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	7500	7500	7500	7500	6500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum wall mass of 37 kg/m^2
3. Multiple studs to be laminated as per AS 1684
4. Stud notch 20 mm maximum
5. Maximum tension load in stud not to exceed 8.5 kN. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
6. If design stud length (not gable end walls) is > 3000 mm, as a minimum, the DTS provisions within AS 1684 for the racking force (clause 8.3.4), fixing of bottom plate (clause 8.3.6.10), uplift and shear force provisions (clause 9.7.6 and Table 9.2) need to be modified to allow for the extra wall height - See page 4
7. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering.

Common Stud 450 ctrs - single/upper storey walls - 20 mm notched
AS 4055 Classification C1 – C3



EXAMPLE:

Sheet roof

Stud spacing = 450 mm

Rafter truss spacing = 600 mm

Stud height = 2700 mm

Roof load width = 6500 mm

Enter sheet roof column, 600 mm in rafter/truss spacing column, read down to a span roof load width of 6500 mm in a 2700 mm stud height.

ADOPT:

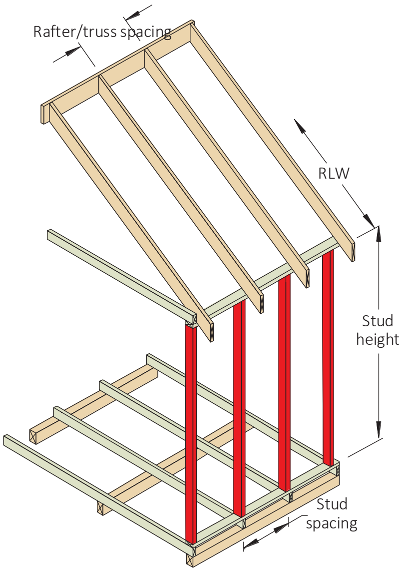
Red Alert LVL - 90x35

Rafter/truss spacing (mm)		450	600	900	1200	450	600	900	1200
Size DxB (mm)	Stud height (mm)	Maximum recommended roof load width (mm)							
		Sheet roof				Tile roof			
Stud spacing 450 mm									
70x35	2400	3500	2500	1500	1500	2500	2500	1500	NS
90x35	2400	7500	7500	7500	5500	7500	7500	6500	4500
	2700	7500	6500	3500	3000	6500	4500	3500	2500
	3000	3500	2500	1500	NS	2500	2000	1500	NS
140x35	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	6500	4500	7500	7500	5500	3500
190x35	3600	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	2400	7500	7500	7500	5500	7500	7500	6500	4500
	2700	7500	6500	4500	3500	7500	5500	3500	2500
	3000	4500	3500	2500	1800	3500	3000	2000	1500
2/90x35	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	6500	7500	7500	7500	5500
	3600	6500	4500	2500	1500	4500	3500	2500	1500
70x45	2400	7500	5500	3500	2500	5500	4500	2500	2000
	2700	2500	2000	1500	NS	2500	1500	NS	NS
90x45	2400	7500	7500	7500	7500	7500	7500	7500	6500
	2700	7500	7500	6500	4500	7500	7500	5500	4000
	3000	7500	5500	3500	2500	5500	4500	3000	2000
140x45	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	7500	7500	7500	7500	6500
190x45	3600	7500	7500	7500	7500	7500	7500	7500	7500
2/70x45	2400	7500	7500	7500	7500	7500	7500	7500	6500
	2700	7500	7500	6500	5000	7500	7500	5500	4000
	3000	7500	5500	4000	3000	6500	4500	3500	2500
2/90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	5500	3500	7500	6500	4500	2500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum wall mass of 37 kg/m^2
3. Multiple studs to be laminated as per AS 1684
4. Stud notch 20 mm maximum
5. Maximum tension load in stud not to exceed 8.5 kN. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
6. If design stud length (not gable end walls) is > 3000 mm, as a minimum, the DTS provisions within AS 1684 for the racking force (clause 8.3.4), fixing of bottom plate (clause 8.3.6.10), uplift and shear force provisions (clause 9.7.6 and Table 9.2) need to be modified to allow for the extra wall height - See page 4
7. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering.

Common Stud at 600 mm ctrs - single/upper storey walls - 20 mm notched AS 4055 Classification C1 – C3



EXAMPLE:

Sheet roof

Stud spacing = 600 mm

Rafter truss spacing = 600 mm

Stud height = 2700 mm

Roof load width = 6500 mm

Enter sheet roof column, 600 mm in rafter/truss spacing column, read down to a span roof load width of 6500 mm in a 2700 mm stud height.

ADOPT:

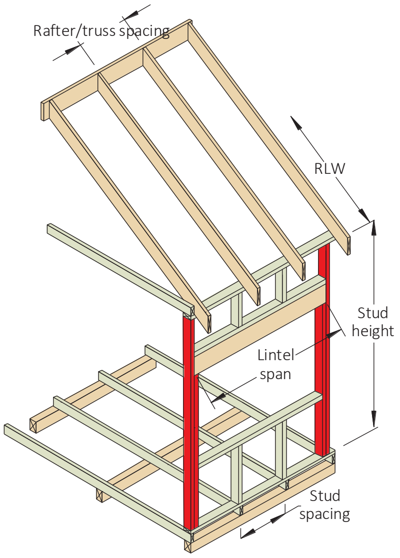
Red Alert LVL - 2/90 x 35

Rafter/truss spacing (mm)		450	600	900	1200	450	600	900	1200
Size DxB (mm)	Stud height (mm)	Maximum recommended roof load width (mm)							
		Sheet Roof				Tile Roof			
Stud spacing 600 mm									
90x35	2400	7500	7500	5500	4500	7500	7500	4500	3500
	2700	3500	3500	2500	1500	2500	2500	1500	1500
140x35	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	5500	5500	3500	2500	4500	4500	2500	1500
190x35	3600	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	2400	7500	7500	6500	4500	7500	7500	5500	3500
	2700	4500	4500	3500	2500	3500	3500	2500	2000
	3000	1500	1500	NS	NS	1500	1500	NS	NS
2/90x35	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	6500	5500	7500	7500	5500	4500
70x45	2400	3500	3500	2000	1500	2500	2500	1500	NS
90x45	2400	7500	7500	7500	7500	7500	7500	7500	5500
	2700	7500	7500	4500	3500	5500	5500	3500	2500
	3000	2500	2500	1500	1500	2500	2500	1500	NS
140x45	3000	7500	7500	7500	7500	7500	7500	7500	7500
	3600	7500	7500	7500	5500	7500	7500	6500	4500
190x45	3600	7500	7500	7500	7500	7500	7500	7500	7500
2/70x45	2400	7500	7500	7500	7500	7500	7500	7500	5500
	2700	7500	7500	5500	4000	6500	6500	4500	3500
	3000	4500	4500	2500	2000	3500	3500	2500	1500
2/90x45	2700	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	6500
	3600	5500	5500	3500	2500	4500	4500	2500	1500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum wall mass of 37 kg/m^2
3. Multiple studs to be laminated as per AS 1684
4. Stud notch 20 mm maximum
5. Maximum tension load in stud not to exceed 8.5 kN. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
6. If design stud length (not gable end walls) is > 3000 mm, as a minimum, the DTS provisions within AS 1684 for the racking force (clause 8.3.4), fixing of bottom plate (clause 8.3.6.10), uplift and shear force provisions (clause 9.7.6 and Table 9.2) need to be modified to allow for the extra wall height - See page 4
7. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering.

Jamb Stud - single of upper load bearing walls
AS 4055 Classification N1 - N4



EXAMPLE:

Sheet roof

Stud wall thickness = 90 mm

Width of opening = 1800 mm

Jamb stud height = 2700 mm

Roof load width = 4100 mm

Enter table at 4500 mm roof load width, sheet roof column, read down to a width of opening of 1800 mm in a 2700 mm stud height row with a roof mass of 40 kg/m^2 and a depth of 90 mm.

ADOPT:

Red Alert LVL - 2/90 x 35

Roof load width (mm)		1500	3000	4500	6000	7500	1500	3000	4500	6000	7500
Size DxB (mm)	Stud height (mm)	Sheet roof					Tile roof				
		Width of opening (mm)					Width of opening (mm)				
90x35	2400	2700	2400	2000	1700	1500	2700	2200	1700	1400	1200
	2700	1600	1600	1400	1300	1000	1600	1600	1300	1000	NS
	3000	900	900	900	900	NS	900	900	900	NS	NS
140x35	2400	4500	4500	4500	4500	4500	4500	4500	4500	4500	4200
	2700	4500	4500	4500	4500	3900	4500	4500	4500	3900	3400
	3000	4500	4500	3900	3400	3200	4500	4200	3600	3000	2700
	3600	1800	1800	1800	1800	1800	1800	1800	1800	1800	900
190x35	3000	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
	3600	4500	4500	4500	4500	4500	4500	4500	4500	4500	3600
2/70x35	2400	2200	2200	2100	1800	1500	2200	2200	1800	1500	1300
	2700	1400	1400	1400	1300	1200	1400	1400	1300	1200	900
2/90x35	2400	4500	4500	4500	3900	3300	4500	4500	4000	3300	2700
	2700	4000	4000	3600	3000	2500	4000	4000	3200	2500	2200
	3000	2700	2700	2700	2200	2000	2700	2700	2400	2000	1600
2/140x35	3000	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
	3600	4500	4500	4500	4500	4500	4500	4500	4500	4500	3600
2/190x35	3600	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
70x45	2400	1200	1200	1100	1000	NS	1200	1100	1100	NS	NS
90x45	2400	3600	3300	2700	2200	2000	3600	3000	2200	1800	1600
	2700	2200	2200	2000	1600	1500	2200	2100	1600	1500	1200
	3000	1400	1400	1400	1200	1200	1400	1400	1200	1100	NS
140x45	2700	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
	3000	4500	4500	4500	4500	4000	4500	4500	4500	3900	3600
	3600	2700	2700	2700	2700	2700	2700	2700	2700	2700	1800
190x45	3600	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
2/70x45	2400	3200	3200	3000	2500	2000	3200	3200	2500	2000	1700
	2700	2100	2100	2100	1800	1500	2100	2100	2000	1500	1300
	3000	1200	1200	1200	1100	1000	1200	1200	1200	1000	900
2/90x45	2400	4500	4500	4500	4500	4500	4500	4500	4500	4500	3600
	2700	4500	4500	4500	3900	3400	4500	4500	4200	3400	2700
	3000	3600	3600	3600	3200	2700	3600	3600	3300	2700	2200
	3600	900	900	900	900	900	900	900	900	900	900
2/140x45	3600	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
2/190x45	3600	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500

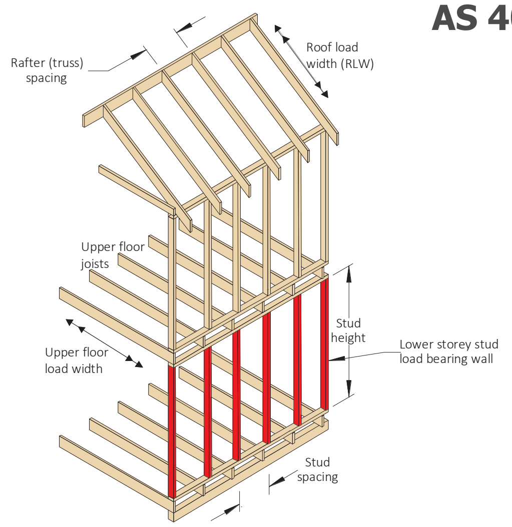
Jamb Stud—Single of upper load bearing walls
AS 4055 Classification C1 - C3

Roof load width (mm)		1500	3000	4500	6000	7500	1500	3000	4500	6000	7500
Size DxB (mm)	Stud height (mm)	Sheet roof					Tile roof				
		Width of opening (mm)					Width of opening (mm)				
90x35	2400	900	900	NS	NS	NS	900	900	NS	NS	NS
140x35	2400	4200	3600	3000	2500	2300	4200	3300	2700	2300	2200
	2700	3300	2700	2300	2000	1800	3300	2500	2200	1800	1700
	3000	2400	2200	1800	1500	1500	2400	2000	1600	1500	1300
190x35	2400	4500	4500	4500	4500	4300	4500	4500	4500	4500	4000
	2700	4500	4500	4500	4000	3600	4500	4500	4500	3800	3400
	3000	4500	4500	3800	3400	3100	4500	4200	3600	3200	2900
	3600	2700	2700	1800	1800	1800	2700	2700	1800	1800	1800
2/90x35	2400	2700	2700	2200	1800	1600	2700	2400	2000	1700	1400
	2700	1600	1600	1600	1400	1200	1600	1600	1400	1300	1000
	3000	900	900	900	900	900	900	900	900	900	NS
2/140x35	2400	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
	2700	4500	4500	4500	4500	4200	4500	4500	4500	4500	3900
	3000	4500	4500	4500	3900	3400	4500	4500	4200	3600	3200
	3600	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
2/190x35	3600	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
90x45	2400	1400	1400	1200	1000	NS	1400	1300	1100	900	NS
140x45	2400	4500	4500	3900	3400	3000	4500	4500	3600	3200	2700
	2700	4500	3600	3200	2700	2300	4200	3400	2900	2500	2200
	3000	3200	2900	2500	2200	1800	3200	2700	2300	2000	1700
	3600	900	900	900	900	900	900	900	900	900	900
190x45	2700	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
	3000	4500	4500	4500	4500	4000	4500	4500	4500	4300	3800
	3600	4500	3600	3600	2700	2700	4500	3600	2700	2700	2700
2/70x45	2400	1200	1200	1100	1100	900	1200	1200	1100	1000	NS
2/90x45	2400	3600	3600	3000	2500	2000	3600	3600	2700	2200	1800
	2700	2200	2200	2100	1800	1500	2200	2200	2000	1600	1500
	3000	1400	1400	1400	1300	1200	1400	1400	1400	1200	1100
2/140x45	2700	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
	3000	4500	4500	4500	4500	4500	4500	4500	4500	4500	4200
	3600	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700
2/190x45	3600	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum wall mass of 37 kg/m^2
3. Multiple studs to be laminated as per AS 1684
4. Stud not notched
5. Maximum tension load in stud not to exceed 8.5 kN. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
6. If design stud length (not gable end walls) is > 3000 mm, as a minimum, the DTS provisions within AS 1684 for the racking force (clause 8.3.4), fixing of bottom plate (clause 8.3.6.10), uplift and shear force provisions (clause 9.7.6 and Table 9.2) need to be modified to allow for the extra wall height - See page 4
7. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering.

Wall studs - lower storey load bearing walls - non notched
AS 4055 classification N1 - N4



EXAMPLE:

Sheet roof
Un - notched stud
Wall thickness = 90 mm
Stud spacing = 450 mm
Floor joist spacing = 600 mm
Stud height = 3000 mm
Floor load width = 4100 mm
Roof load width = 7500 mm
Enter table at 450 mm stud spacing column, 600 mm joist spacing column, 4800 floor load width column, read down to a roof load width of 7500 mm in a 3000 mm stud height row in a 90 mm stud

ADOPT:

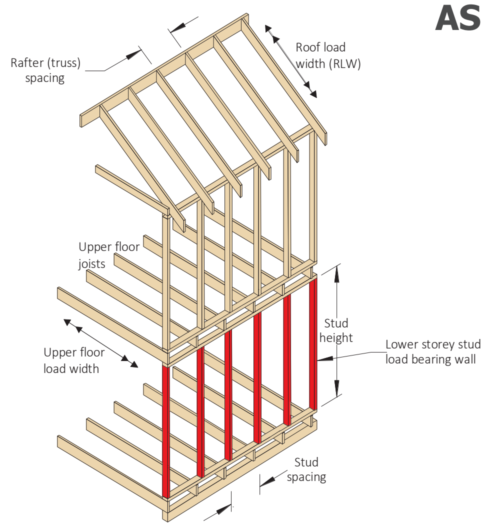
Red Alert LVL- 90x35

Sheet roof 40 kg/m^2													
Stud spacing (mm)		450						600					
Floor joist spacing (mm)		450			600			450			600		
Upper floor load width (mm)		1800	3600	4800	1800	3600	4800	1800	3600	4800	1800	3600	4800
Size DxB (mm)	Stud height (mm)	Roof load width (RLW) (mm)											
70x35	2400	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	7500	7500	7500	7500	7500	6500	7500	7500	6500
	3000	7500	7500	5500	6500	4500	3500	NS	NS	NS	NS	NS	NS
90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
140x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
190x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
70x45	2700	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	6500	7500	6500	5500	7500	6500	5500
90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
140x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
190x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/70x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
Tiled roof 90 kg/m^2													
70x35	2400	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	7500	5500	4500	6500	4500	3500	6500	4500	3500
	3000	5500	4500	3500	4500	2500	1500	NS	NS	NS	NS	NS	NS
90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
140x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
190x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
70x45	2400	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	7500	7500	7500	7500	7500	6500	7500	7500	6500
	3000	7500	7500	6500	6500	4500	3500	5500	4500	3500	5500	4500	3500
90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
140x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
190x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/70x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500

NOTES :

1. D = member depth, B = member breadth, NS = not suitable.
2. Total upper floor mass of 40 kg/m^2, total wall mass of 37 kg/m^2, floor live load of 1.5 kPa
3. Stud not notched. Maximum tension load in stud not to exceed 8.5 kN.
4. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
5. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering

Wall studs - lower storey load bearing walls - non notched
AS 4055 classification C1 - C3



EXAMPLE:

Sheet roof

Un - notched stud

Wall depth 90 mm

Stud spacing = 450 mm

Floor joist spacing = 600 mm

Stud height = 3000 mm

Floor load width = 4100 mm

Roof load width = 7500 mm

Enter table at 450 mm stud spacing column, 600 mm joist spacing column, 4800 mm floor load width, read down to a roof load width of 7500 mm in a 3000 mm stud height row in a 90 mm stud

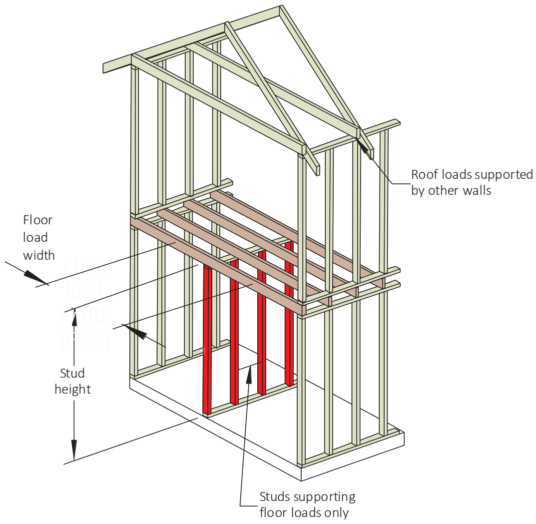
ADOPT: Red Alert LVL 2/90 x 35

Sheet roof 40 kg/m^2													
Stud spacing (mm)		450						600					
Floor joist spacing (mm)		450			600			450			600		
Upper floor load width (mm)		1800	3600	4800	1800	3600	4800	1800	3600	4800	1800	3600	4800
Size DxB (mm)	Stud height (mm)	Roof load width (RLW) (mm)											
70x35	2400	7500	7500	7500	7500	6500	6500	5500	5500	4500	5500	5500	4500
	2700	5500	4500	3500	3500	2500	2500	NS	NS	NS	NS	NS	NS
90x35	2700	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	6500	5500	4500	4500	5500	4500	4500
140x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
190x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	2700	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	6500	5500	7500	6500	5500
2/90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
70x45	2400	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	2700	7500	7500	7500	6500	5500	4500	4500	3500	3500	4500	3500	3500
90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
140x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
190x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/70x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
Tile roof 90 kg/m^2													
70x35	2400	7500	7500	7500	6500	5500	4500	4500	3500	3500	4500	3500	3500
	2700	4500	3500	2500	3000	2500	1500	NS	NS	NS	NS	NS	NS
90x35	2700	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	6500	5500	4500	4500	3500	3500	4500	3500	3500
140x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
190x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/70x35	2700	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	6500	6500	5500	5500	4500	4500	5500	4500	4500
2/90x35	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
70x45	2400	7500	7500	7500	7500	7500	7500	7500	7500	6500	7500	7500	6500
	2700	7500	6500	5500	5500	4500	3500	3500	2500	2500	3500	2500	2500
90x45	2700	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
	3000	7500	7500	7500	7500	7500	7500	7500	7500	6500	7500	7500	6500
140x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
190x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/70x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2/90x45	3000	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500

NOTES:

1. D = member depth, B = member breadth, NS = not suitable.
2. Total upper floor mass of 40 kg/m^2 ,total wall mass of 37 kg/m^2, floor live load of 1.5 kPa
3. Stud not notched. Maximum tension load in stud not to exceed 8.5 kN.
4. Where studs are nailed laminated the tension load in each stud shall not exceed 8.5 kN.
5. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering

Studds lower storey of two (2) storey walls
Supporting floor loads only



EXAMPLE:

Un - notched stud

Stud spacing = 450 mm

Floor joist spacing = 600 mm

Stud height = 2700 mm

Floor load width = 4100 mm

Enter table at 450 mm stud spacing column, 600 mm joist spacing column, read down to a floor load width of 4100 mm in a 2700 mm stud height row.

ADOPT:

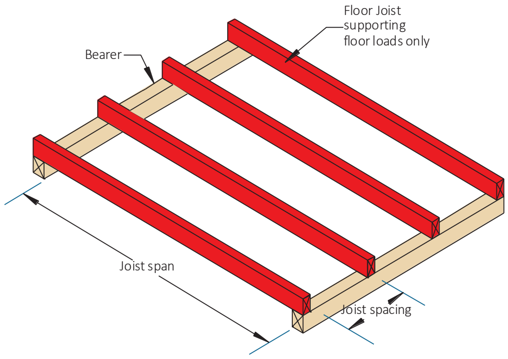
Red Alert LVL - 70 x 35

Un-notched					
Stud spacing (mm)		450		600	
Floor joist spacing (mm)		450	600	450	600
Size DxB (mm)	Stud height (mm)	Maximum recommended floor load width (mm)			
70x35	2400	8000	8000	8000	8000
	2700	8000	6000	NS	NS
90x35	3000	8000	8000	8000	8000
140x35	3000	8000	8000	8000	8000
2/70x35	3000	8000	8000	8000	8000
2/90x35	3000	8000	8000	8000	8000
2/140x35	3000	8000	8000	8000	8000
70x45	2700	8000	8000	8000	8000
90x45	3000	8000	8000	8000	8000
140x45	3000	8000	8000	8000	8000
2/70x45	3000	8000	8000	8000	8000
2/90x45	3000	8000	8000	8000	8000
2/140x45	3000	8000	8000	8000	8000
20 mm notch					
70x35	2400	6000	6000	6000	6000
2/70x35	3000	6000	6000	6000	6000
70x45	2700	6000	6000	6000	6000
2/70x45	3000	6000	6000	6000	6000
90x35	3000	6000	6000	6000	6000
2/90x35	3000	6000	6000	6000	6000
90x45	3000	6000	6000	6000	6000
2/90x45	3000	6000	6000	6000	6000
140x35	3000	6000	6000	6000	6000
2/140x35	3000	6000	6000	6000	6000
140x45	3000	6000	6000	6000	6000
2/140x45	3000	6000	6000	6000	6000

NOTES :

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based on a maximum upper floor mass of 40 kg/m^2, total wall mass of 15 kg/m^2, floor live load of 1.5 kPa
3. Multiple studs to be nail laminated as per AS 1684
4. Wall stud notched to a maximum depth of 20 mm.
5. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering

Floor joists supporting floor loads only



Floor mass - 40 kg/m^2

EXAMPLE:

Domestic floor loads

Continuous span

Joist spacing = 450 mm

Joist span = 2000 mm

Enter continuous span table at 450 mm in joist spacing column, read down to the lowest depth with a span equal to or greater than 2000 mm

ADOPT:

Red Alert LVL - 100x45

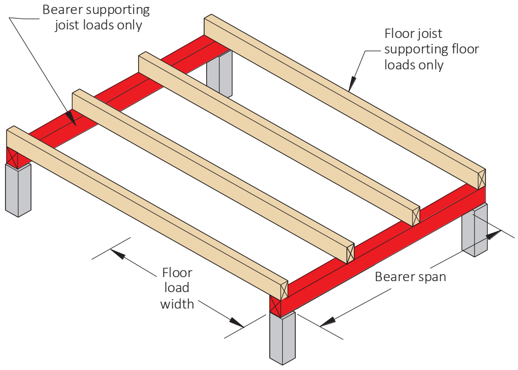
Loadings: permanent - self weight + 40 kg/m^2 + 0.5 kPa of the live load, live load - 1.5 kPa or floor point load of 1.8 kN

Joist spacing (mm)	300	450	600	300	450	600
Member size DxB (mm)	Maximum recommended span (mm)					
	Single span			Continuous span		
90x35	1600	1500	1400	2000	1800	1600
140x35	3400	2500	2300	4000	3000	2700
190x35	4400	3600	3200	5100	4400	3800
100x45	2200	1900	1700	2800	2200	2000

NOTES:

1. D = member depth, B = member breadth, NS = not suitable
2. Spans are suitable for solid timber, particle board and ply flooring. floor sheeting glued and nailed to joists will improve floor rigidity. Where heavy overlay material is to be applied, such as a mortar bed tiled or slate floor, the permanent load allowance should be increased to 1.2 kPa. A reduction of joist spacing may be used to accommodate this extra permanent load. A satisfactory result can be achieved by adopting the maximum spans for 600 mm and 450 mm spacing but installing the joists at 450 and 300 mm spacing respectively
3. For beams which are continuous over two unequal spans, the design span and the 'resultant span description' depend upon the percentage span differences between the two spans as shown below
4. End bearing lengths = 42 mm at end supports and 58 mm at internal supports for continuous members
5. Not all sizes of Red Alert LVL this table are stocked in each state. Please check with your supplier before ordering.

Floor bearers supporting floor loads only



Floor mass

- 40 kg/m^2

EXAMPLE:

Domestic floor loads

Single span

Bearer span = 1800 mm

Floor load width = 2400 mm

Enter single span table at 2400 mm floor load width column and read down to a span equal to or greater than 1800 mm

ADOPT:

Red Alert LVL - 2/100x45

Loadings: permanent - self weight + 40 kg/m^2 + 0.5 kPa of the live load, live load - 1.5 kPa or floor point load of 1.8 kN

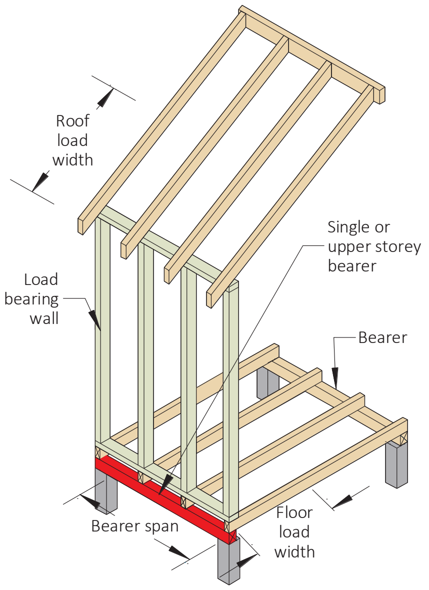
Floor load width (mm)	1200	1800	2400	3000	3600	4200	4800	5400	6000	6600
Size DxB (mm)	Maximum recommended bearer span (mm)									
	Single span									
100x45	1700	1500	1300	1200	1100	1100	1000	1000	NS	NS
2/100x45	2100	1800	1700	1500	1400	1400	1300	1200	1200	1100
100x75	2000	1700	1600	1400	1300	1300	1200	1200	1100	1100
Continuous Span										
100x45	2100	1800	1700	1500	1400	1300	1200	1100	1000	1000
2/100x45	2700	2300	2100	1900	1800	1700	1700	1600	1500	1500
100x75	2500	2200	2000	1800	1700	1600	1500	1400	1400	1300

NOTES:

1. D = member depth, B = member breadth, NS = not suitable
2. The above table was based upon a maximum DL of 40 kg/m^2 + 0.5 kPa of LL, Floor live load of 1.5 kPa, floor point load of 1.8 kN
3. End bearing lengths = 42 mm at end supports and 58 mm at internal supports for continuous members. Subscript values indicate the minimum additional bearing length required to be greater at 42 mm end supports and 58 mm internal supports
4. Restraint values for slenderness calculation is 600 mm (floor joist at 600 mm centres Max)
5. Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering

Floor bearers supporting single storey load bearing wall - sheet and tiled roof

Floor mass - 40 kg/m²



EXAMPLE:

sheet roof - 40 kg/m²

roof load width = 1950 mm

bearer span = 1200 mm (single span)

floor load width = 1000 mm

Enter single span table at 2400 mm in floor load width column, 4500 roof load width column, read down to a span equal to or greater than 1200 mm in the 40 kg/m² row.

ADOPT:

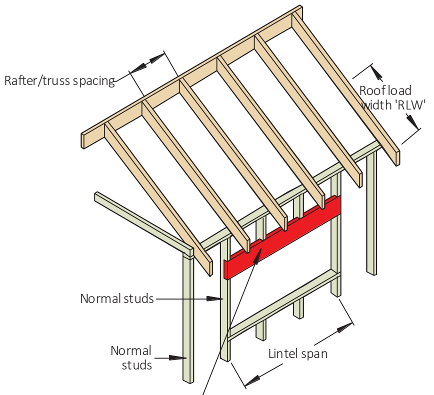
Red Alert LVL —2/100x45

Floor load width (mm)		1200			2400			4800		
Roof load width (mm)		1500	4500	7500	1500	4500	7500	1500	4500	7500
Member size DxB (mm)	Roof mass (kg/m²)	Maximum recommended single span floor bearer supporting single storey load bearing wall span (mm)								
100x45	40	1200	1100	NS	1100	1000	NS	NS	NS	NS
	90	1100	NS	NS	1000	NS	NS	NS	NS	NS
2/100x45	40	1600	1300	1200	1400	1200	1100	1200	1100	1000
	90	1400	1200	1000	1300	1100	1000	1100	1000	NS
100x75	40	1500	1300	1100	1300	1200	1000	1100	1000	NS
	90	1400	1100	1000	1200	1000	NS	1100	NS	NS
	Maximum recommended continuous span floor bearer supporting single storey load bearing wall span (mm)									
100x45	40	1700	1400	1300	1500	1300	1200	1100	1000	1000
	90	1500	1200	1100	1400	1200	1000	1100	1000	NS
2/100x45	40	2100	1800	1600	1900	1700	1500	1600	1500	1400
	90	2000	1600	1400	1800	1500	1300	1500	1400	1200
100x75	40	2000	1700	1500	1800	1600	1400	1400	1400	1300
	90	1800	1500	1300	1700	1400	1200	1400	1300	1100

NOTES:

1. D = member depth, B = member breadth, NS = not suitable.
2. The above table was based on total ground floor mass of 40 kg/m² + 0.5 kPa of LL, wall mass of 37 kg/m², floor live load of 1.5 kPa, floor point load of 1.8 kN
3. The above table was based on a wall height of 2700 mm
4. End bearing lengths = 70 mm at end supports and 70 mm at internal supports for continuous members. Subscript values indicate the minimum additional bearing length where required to be greater than 70 mm at end supports and 70 mm at internal supports.
5. Restraint value for slenderness calculations is 600 mm
6. **Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering**

Single span lintels in single/upper storey walls
AS 4055 classification N1-N4



Single/Upper storey lintel

EXAMPLE:

wind speed = N3

sheet roof - 40 kg/m^2

rafter/truss spacing = 600 mm

lintel span = 1300 mm

roof load width = 3900 mm

Enter span table at 4500 roof load width column, rafter/truss spacing 600 mm, and read down to a span equal to or greater than 1300 mm in the 40 kg/m^2 row

ADOPT:

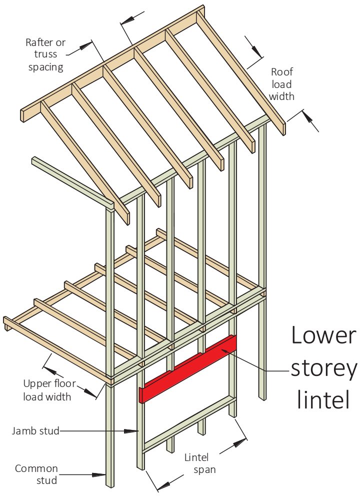
Red Alert LVL - 140 x 35

Wind classification N1-N4											
Roof load width (mm)		1500		3000		4500		6000		7500	
Rafter/truss spacing (mm)		600	1200	600	1200	600	1200	600	1200	600	1200
Size DxB (mm)	Roof mass (kg/m^2)	Maximum recommended lintel span (mm)									
90x35	40	1600	1500	1300	1100	1100	NS	NS	NS	NS	NS
	90	1300	1100	1000	NS	NS	NS	NS	NS	NS	NS
140x35	40	2600	2700	2000	2000	1700	1700	1500	1300_{5}	1400_{15}	1000_{10}
	90	2000	2000	1600	1500	1400	1200	1200_{10}	NS	1100_{5}	NS
190x35	40	3400	3300	2800	2800	2400_{10}	2400_{15}	2100_{15}	2100_{20}	1900_{15}	1700_{20}
	90	2700	2800	2200	2100	1800	1800_{10}	1700_{10}	1600_{30}	1500_{30}	1300_{25}
2/90x35	40	2100	2100	1600	1500	1400	1200	1300	1100	1100	NS
	90	1600	1500	1300	1100	1100	NS	1000	NS	NS	NS
2/140x35	40	3200	3100	2600	2600	2200	2200	1900	1900	1800	1700
	90	2500	2600	2000	2000	1700	1700	1500	1400	1400	1300
2/190x35	40	4000	4000	3300	3300	3000	3000	2700	2700_{5}	2400	2400_{10}
	90	3300	3300	2700	2700	2300	2300	2100	2100	1900	1900_{5}
100x45	40	2000	2000	1500	1500	1300	1200	1200	NS	1100	NS
	90	1500	1400	1200	1000	1000	NS	NS	NS	NS	NS
2/100x45	40	2500	2600	2000	2000	1700	1600	1500	1400	1400	1200
	90	2000	2000	1500	1400	1300	1100	1200	1000	1100	NS
Wind classification C1-C3											
90x35	40	1500	1000	1000	NS	NS	NS	NS	NS	NS	NS
	90	1300	1100	1000	NS	NS	NS	NS	NS	NS	NS
140x35	40	2300	2200	1600	1100	1300_{10}	NS	NS	NS	NS	NS
	90	2000	2000	1600_{5}	1200_{5}	1300_{20}	NS	NS	NS	NS	NS
190x35	40	3100	2900	2200_{10}	2000_{15}	1700_{15}	1300_{15}	1500_{40}	NS	1100_{20}	NS
	90	2700	2800_{5}	2200_{15}	2100_{20}	1700_{20}	1400_{25}	1400_{50}	NS	1200_{55}	NS
2/90x35	40	2100	2100	1600	1200	1300	NS	1100	NS	NS	NS
	90	1600	1500	1300	1100	1100	NS	1000	NS	NS	NS
2/140x35	40	3200	3100	2500	2400	2000	1800	1700	1300	1500_{10}	NS
	90	2500	2600	2000	2000	1700	1700_{5}	1500_{5}	1300_{5}	1400_{15}	NS
2/190x35	40	4000	4000	3300	3100	2700_{10}	2600_{15}	2400_{20}	2200_{15}	2000_{25}	1700_{20}
	90	3300	3300	2700	2700_{5}	2300_{10}	2300_{20}	2100_{20}	2100_{20}	1900_{15}	1800_{30}
100x45	40	1900	1600	1300	NS	1000	NS	NS	NS	NS	NS
	90	1500	1400	1200	NS	1000	NS	NS	NS	NS	NS
2/100x45	40	2500	2600	2000	1900	1600	1200	1400	NS	1300	NS
	90	2000	2000	1500	1400	1300	1100	1200	NS	1100	NS

NOTES:

1. D = member depth, B = member breadth, NS = not suitable.
2. Minimum bearing length = 35 mm at end supports. Subscript values indicate the minimum additional bearing length where required to be greater than 35 mm.
3. Restraint value for slenderness calculations is 600 mm.
4. **Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering**

Single span lintels in lower storey walls
AS 4055 classification up to C3



EXAMPLE:

wind speed = N3

sheet roof - 40 kg/m^2

rafter/truss spacing = 600 mm

lintel span = 1100 mm

roof load width = 2900 mm

floor load width = 1200 mm

Enter span table at 3000 roof load width column, floor load width 1200 mm, and read down to a span equal to or greater than 1100 mm in the 40 kg/m^2 row

ADOPT:

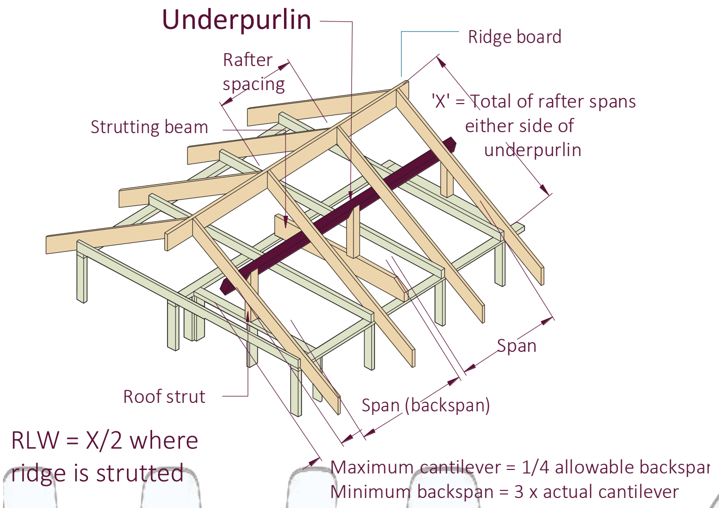
Red Alert LVL 140 x 35

Roof load width (mm)		1500			3000			4500			6000		
Upper floor load width (mm)		1200	2400	3600	1200	2400	3600	1200	2400	3600	1200	2400	3600
Size DxB (mm)	Roof mass (kg/m^2)	Maximum recommended lintel span (mm)											
90x35	40	1000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	90	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
140x35	40	1500	1400	1300	1500	1300	1200	1400	1300	1200	1300	1200	1200
	90	1400	1300	1200	1300	1200	1100	1200	1100	1100_{5}	1100	1100_{5}	1000_{10}
190x35	40	2100	1900	170010	2000	1800	1700_{10}	1900	1800_{5}	1600_{10}	1800	1700_{5}	1600_{10}
	90	2000	1800	170010	1800	1700_{5}	1600_{10}	1700_{10}	1600_{15}	1500_{15}	1600_{15}	1500_{15}	1400_{20}
2/90x35	40	1200	1100	1000	1200	1100	1000	1100	1000	NS	1100	1000	NS
	90	1200	1100	1000	1000	1000	NS	1000	NS	NS	NS	NS	NS
2/140x35	40	2000	1800	1600	1800	1700	1600	1800	1600	1500	1700	1600	1500
	90	1800	1700	1600	1700	1500	1500	1500	1400	1400	1400	1400	1300
2/190x35	40	2700	2400	2200	2500	2300	2100	2400	2200	2100	2300	2100	2000
	90	2500	2300	2100	2300	2100	2000	2100	2000	1900	2000	1900	1800
100x45	40	1200	1100	1000	1100	1000	NS	1100	1000	NS	1000	NS	NS
	90	1100	1000	NS	1000	NS	NS	NS	NS	NS	NS	NS	NS
100x75	40	1400	1300	1200	1300	1200	1100	1300	1200	1100	1200	1100	1100
	90	1300	1200	1100	1200	1100	1000	1100	1000	1000	1000	1000	NS

NOTES:

1. D = member depth, B = member breadth, NS = not suitable.
2. Minimum bearing length = 35 mm at end supports. Subscript values indicate the minimum additional bearing length where required to be greater than 35 mm.
3. Restraint value for slenderness calculations is 600 mm.
4. **Not all sizes of SmartLVL in this table are stocked in each state. Please check with your supplier before ordering.**

Red Alert LVL
Underpurlins – sheet and tiled roof
AS 4055 wind classification N1 - N4 and C1-C3



EXAMPLE:

Single span
Wind classification - N2
Sheet roof - 20 kg/m^2
Rafter spacing = 1200 mm
Underpurlin span = 1800 mm
X = 2800 mm
Roof load width = X/2 = 1400
Enter single span table at 1800 roof load width column, 1200 rafter spacing and read down to span equal to or greater than 1800 mm

<u>ADOPT</u>

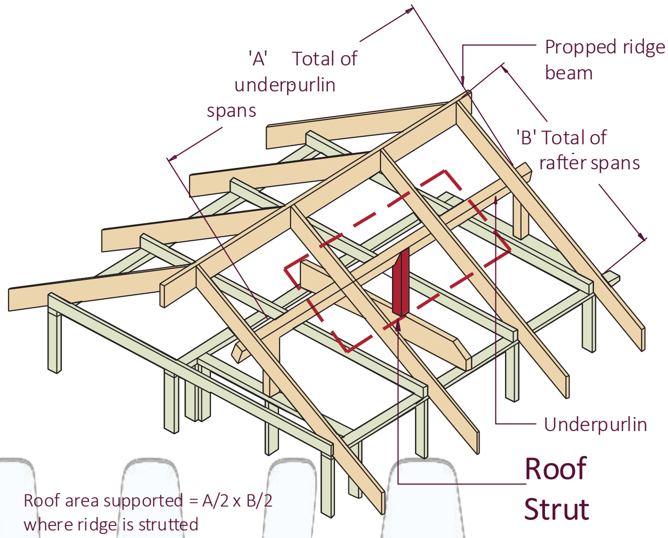
SmartLVL 12- 96 x 51

		AS 4055 wind classification N1-N4																			
Roof load width (mm)		1800		2400		2700		3000		3600		1800		2400		2700		3000		3600	
Rafter spacing (mm)		600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200
Size DxB (mm)	Roof mass (kg/m^2)	Maximum recommended underpurlin span (mm)																			
		Single span										Continuous span									
96x51	10	2800	2700	2400	2400	2300	2200	2200	2000	1900	1700	2800	2800	2500	2600	2300	2500	2200	2100	2000	1900
	20	2300	2300	2100	2100	2000	2000	1900	1900	1800	1800	2900	2900	2500	2600	2400	2500	2200	2200	2100	2000
	40	1800	1800	1600	1500	1600	1500	1500	1400	1400	1300	2500	2500	2200	2100	2100	2000	2100	2000	1900	1900
	60	1600	1500	1400	1300	1400	1200	1300	1100	1300	1000	2100	2000	1900	1900	1800	1800	1800	1800	1700	1500
		AS 4055 wind classification C1-C3																			
96x51	10	1800	1500	1500	1100	1500	1000	1400	NS	1300	NS	1900	1900	1600	1600	1500	1400	1500	1200	1300	1000
	20	1800	1600	1600	1200	1500	1000	1400	NS	1300	NS	1900	1900	1600	1600	1500	1400	1500	1200	1400	1000
	40	1800	1700	1600	1200	1500	1100	1400	1000	1300	NS	2000	1900	1700	1700	1600	1600	1500	1300	1400	1000
	60	1600	1500	1400	1300	1400	1200	1300	1000	1300	NS	2000	2000	1700	1700	1600	1600	1500	1400	1400	1100

NOTES:

1. D = member depth, B = member breadth, NS = not suitable.
2. Minimum bearing length = 45 mm at end and internal supports

Red Alert LVL
Roof struts – sheet and tiled roof
AS 4055 wind classification N1 - N4 and C1-C3



EXAMPLE:

Sheet roof - 20 kg/m^2

Strut length = 1500 mm

Total of underpurlin span A = 4.5 m

Total of rafter span B = 4.0 m

Roof area supported = A/2 x B/2 =

4.5/2 x 4.0/2 = 4.25 m^2

Enter table at 5.4 roof area supported column and read down to span equal to or greater than 1500 mm

ADOPT

Smart LVL 12 - 65 x 63

		AS 4055 Wind classification N1-N4						
Roof area supported (m^2)		4	5	5.4	6	8	10	12
Size DxB (mm)	Roof mass (kg/m^2)	Maximum recommended strut length (mm)						
63x65	10	4600	4100	4000	3800	3300	2900	2600
	20	4400	3900	3800	3600	3100	2800	2500
	40	4100	3600	3500	3300	2900	2600	2300
	60	3800	3400	3300	3100	2700	2400	2200
		AS 4055 Wind classification C1-C3						
63x65	10	4600	4100	4000	3800	3300	2900	2600
	20	4400	3900	3800	3600	3100	2800	2500
	40	4100	3600	3500	3300	2900	2600	2300
	60	3800	3400	3300	3100	2700	2400	2200

NOTES:

1. Tables assume strut is vertical. Struts lengths will reduce with increased angle from the vertical
2. D = member depth, B = member breadth, NS = not suitable.
3. Minimum bearing length = 70 mm at end supports The strutting tables in AS 1684 are based upon the load associated with an underpurlin span of 1.8 m and a roof load width of 3.0 m. To compare to AS 1684.2 Table 7.6, use a roof area of 5.4 m^2 in the above table
4. Fixing of SmartLVL roof struts as per detail on page 8

Notes:

SmartFrame Warranty

All SmartFrame Engineered Wood Products (EWP) are covered by our SmartFrame warranty against material and workmanship defects and are guaranteed to perform as specified when stored, installed, and finished in accordance with SmartFrame installation instructions.

Scan for more Red Alert 12 information

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