

# SmartForm® Bearer and Joist Design Guide



# SmartForm<sup>®</sup>

## Description

SmartForm LVL is a softwood structural laminated veneer lumber (LVL) manufactured for Tilling Timber by world class LVL manufacturers to meet the quality controlled process requirements of AS/NZS 4357 - Structural Laminated Veneer Lumber. It is produced in industry standard sizes, painted orange for easy visual identification, and is intended for use as concrete formwork support structures such as joists, bearers, walers and soldiers.

## Quality

Compliance with process based quality control requirements is third party audited these audits, together with end product testing is used as the basis for Product Certification.

## Marking

Each piece of SmartForm is branded at least once with the SmartForm branding compliant with AS/NZS 4357 structural LVL standard for identification and evidence of compliance with manufacturing control standards and product quality certification. It is also sealed with a water resistant orange coating to increase its durability, providing the user with extended lifecycles and superior performance.

## Scope of these tables

This Design Guide and load tables assist in the selection of SmartForm formwork materials in standard applications. All load tables in this document are developed using in-grade tested characteristic properties of SmartForm as distributed by Tilling Timber. Other look-alike substitution LVL formwork products manufactured by different producers may have different properties, and their specification from these tables may create an unsafe support system or unsatisfactory performance.

This publication is therefore strictly limited to the design of joists and bearers in common formwork applications. Reference should

be made to AS 3610-1995 plus supplements 1 and 2 and an experienced structural engineer for methods and details of developing lateral restraint, providing suitable vertical support to joists and bearers in the above tables as well as the robustness and stability of the formwork system as a whole.

## Technical Support

This Design Guide covers only the most common formwork applications. For applications, service classes not covered in this Design Guide and/or general product enquiries about SmartForm, please contact Tech support on 1300 668 690 or at techsupport@tilling.com.au

## Storage and Handling

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

## SmartForm specifications

### Veneer:

- Species	Picea Abies (Spruce) and/or Larix sibirica (Larch)
- Thickness (normal)	2.5-3.6 mm
- Joints	Scarf/overlap

### Adhesive:

Phenolic – Type A AS 2754.1

### Density:

Average value 540 - 590 kg/m<sup>3</sup>

### Finish:

Un-sanded faces, arised edges– painted distinctive “safety” Orange

### Dimensional tolerances:

- Depth	-0, +2.0 mm
- Thickness	±2.0, mm
- Length	-0, +10 mm

### Standard supply lengths:

6.0, 5.4, 4.8, 4.2, 3.6 and 3.0 metres

## SmartForm - "F" grade timber comparison

LVL is an engineered timber product whose characteristic strength properties are derived by in-grade testing to AS/NZS 4063. "F" grades are assigned after visual grading of the solid timber to the appropriate standards.



There is no direct link between "F" graded timber and in-grade tested timber.

Notwithstanding the above, SmartForm may be used to safely substitute "F" graded material up to and including F8.

SmartForm section properties				
SmartForm size D x B mm	Self weight kg/m	Rigidity EI $\times 10^9$ N.mm <sup>2</sup>	Design capacity	
			Bending $\phi M$ kN.m	Shear $\phi V$ kN
95 x 45	23	38.6	2.6	10.9
95 x 63	3.2	54.0	3.7	15.3
130 x 75	5.3	164.8	8.3	24.9
150 x 75	6.1	253.1	11.0	28.7

Design capacities for the table are based upon the following criteria:

- Capacity reduction factor  $\phi = 0.90$  (Primary Structural elements other than houses table 2.5 AS 1720.1)
- $k_1 = 0.94$  (duration of 5 days) AS 1720.1
- Full lateral restraint

## Formwork Design Process

The design of formwork always starts with defining the quality of the finished concrete surface. This is usually communicated through the project documents. Surface quality is effected by the extent to which the formwork components deflect under the applied loadings. Physical quality and tolerances, detailed in AS 3610 tables 3.3.1 and 3.4.2 guide the formwork designer in the selection of formface material and deflection limits for the framing members for soffits and wall forms. The tables include the deflection criteria for the most common classes of finish, namely: **Class 3 - Maximum of 3 mm or span/270**

Span tables for alternative deflection limits are available by contacting the Tech Support Customer Helpline on 1300 668 690 or at techsupport@tilling.com.au

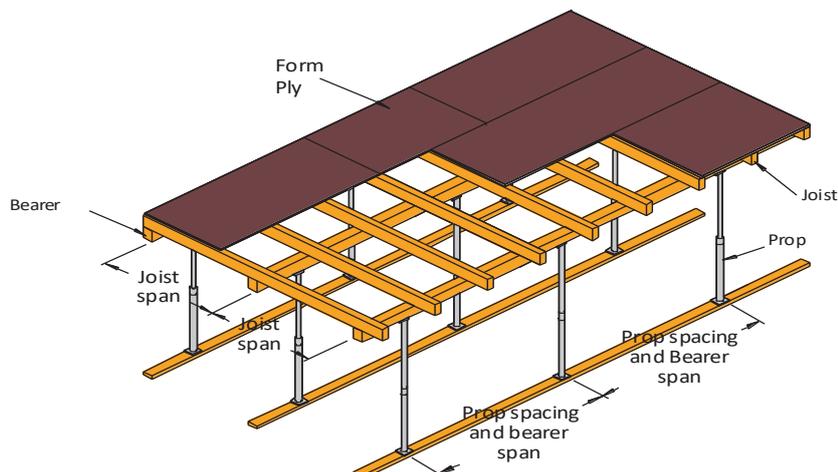
The design aids in this design guide are confined to the selection of SmartForm LVL members which ensure that the formwork provides the strength and rigidity necessary to meet both

structural safety and surface quality requirements. Structural safety is limited to the selection of individual structural components subject to normal concrete pressures. This design guide does NOT address the structural safety of the system that may be subject to a wide range of abnormal and accidental loads. Methods for developing lateral restraint, providing adequate support as well as the overall stability of the structure are outside the scope of this publication.

The members in this table have been designed based upon the addition of the "Global load factor for primary member" introduced into AS 3610 - 1995 with Amendment 1 - 2003.

For horizontal members such as bearers and joists for soffits, both the joists and bearers have been considered primary members. For vertical forms, the soldiers have been considered primary members.

## Conventional soffit formwork for slabs



## SmartForm joists for concrete slab soffits

Concrete slab depth (mm)	SmartForm size DxB (mm)	Joist spacing (mm)											
		225	300	400	450	480	600	225	300	400	450	480	600
		Maximum single span (mm)						Maximum continuous span (mm)					
100	95 x 45	1800	1700	1500	1500	1400	1300	2300	2100	1900	1800	1800	1600
	95 x 63	2100	1900	1700	1600	1600	1500	2500	2300	2100	2000	2000	1800
	130 x 75	3000	2700	2500	2400	2300	2200	3700	3400	3000	2900	2900	2700
	150 x 75	3400	3100	2800	2700	2700	2500	4300	3900	3500	3400	3300	3100
150	95 x 45	1700	1600	1400	1400	1400	1300	2200	2000	1800	1700	1700	1600
	95 x 63	2000	1800	1600	1600	1500	1400	2400	2200	2000	1900	1900	1700
	130 x 75	2800	2600	2300	2200	2200	2000	3500	3200	2900	2800	2700	2500
	150 x 75	3300	3000	2700	2600	2500	2400	4000	3700	3300	3200	3100	2900
200	95 x 45	1700	1500	1400	1300	1300	1200	2100	1900	1700	1600	1600	1500
	95 x 63	1900	1700	1500	1500	1400	1300	2300	2100	1900	1800	1800	1700
	130 x 75	2700	2500	2200	2100	2100	1900	3300	3000	2800	2600	2600	2400
	150 x 75	3100	2800	2600	2500	2400	2200	3800	3500	3200	3100	3000	2800
300	95 x 45	1500	1400	1300	1200	1200	1100	1900	1700	1600	1500	1500	1300
	95 x 63	1700	1600	1400	1400	1300	1200	2100	1900	1800	1700	1700	1500
	130 x 75	2500	2300	2100	2000	1900	1800	3100	2800	2500	2400	2400	2200
	150 x 75	2900	2600	2400	2300	2200	2100	3600	3200	2900	2800	2800	2600
400	95 x 45	1400	1300	1200	1100	1100	1000	1800	1600	1500	1400	1400	1200
	95 x 63	1600	1500	1300	1300	1300	1200	2000	1800	1700	1600	1600	1400
	130 x 75	2300	2100	1900	1900	1800	1700	2900	2600	2400	2300	2300	2100
	150 x 75	2700	2500	2200	2100	2100	2000	3300	3000	2800	2700	2600	2400
600	95 x 45	1300	1200	1100	1000	1000	900	1600	1500	1300	1200	1200	1100
	95 x 63	1500	1300	1200	1200	1100	1100	1800	1600	1500	1400	1400	1300
	130 x 75	2100	1900	1800	1700	1700	1500	2600	2400	2200	2100	2000	1900
	150 x 75	2500	2200	2000	1900	1900	1800	3000	2800	2500	2400	2400	2100
1000	95 x 45	1100	1000	900	900	900	800	1400	1300	1100	1100	1000	900
	95 x 63	1300	1200	1100	1000	1000	900	1600	1400	1300	1200	1200	1100
	130 x 75	1900	1700	1500	1500	1400	1300	2300	2100	1900	1800	1700	1500
	150 x 75	2100	1900	1800	1700	1700	1500	2600	2400	2200	2000	2000	1800

## SmartForm bearers for concrete slab soffits

Concrete slab depth (mm)	SmartForm size DXB (mm)	Bearer spacing (mm)											
		900	1200	1500	1800	2100	2400	900	1200	1500	1800	2100	2400
		Maximum single span (mm)						Maximum multiple span (mm)					
100	95 x 63	1300	1200	1100	1000	1000	900	1600	1400	1200	1100	1000	1000
	130 x 75	1900	1700	1600	1500	1400	1400	2300	2000	1800	1700	1500	1400
	150 x 75	2200	2000	1800	1700	1600	1600	2700	2300	2100	1900	1700	1600
150	95 x 63	1200	1100	1000	1000	900	900	1500	1300	1200	1100	1000	900
	130 x 75	1800	1600	1500	1400	1300	1300	2200	1900	1700	1600	1400	1300
	150 x 75	2100	1900	1700	1600	1600	1500	2500	2200	1900	1800	1600	1500
200	130 x 75	1700	1500	1400	1400	1300	1200	2100	1800	1600	1500	1400	1300
	150 x 75	2000	1800	1700	1600	1500	1400	2400	2000	1800	1700	1500	1400
300	130 x 75	1600	1400	1300	1300	1200	1100	1900	1600	1500	1300	1200	1200
	150 x 75	1800	1700	1500	1400	1400	1300	2100	1900	1700	1500	1400	1300
400	130 x 75	1500	1300	1200	1200	1100	1100	1700	1500	1300	1200	1100	1100
	150 x 75	1700	1600	1400	1400	1300	1200	2000	1700	1500	1400	1300	1200
600	130 x 75	1300	1200	1100	1100	1000	900	1500	1300	1200	1100	1000	900
	150 x 75	1500	1400	1300	1200	1100	1100	1700	1500	1300	1200	1100	1100
1000	130 x 75	1200	1100	1000	900	800	800	1300	1100	1000	900	800	700
	150 x 75	1300	1200	1100	1000	900	900	1400	1200	1100	1000	900	900

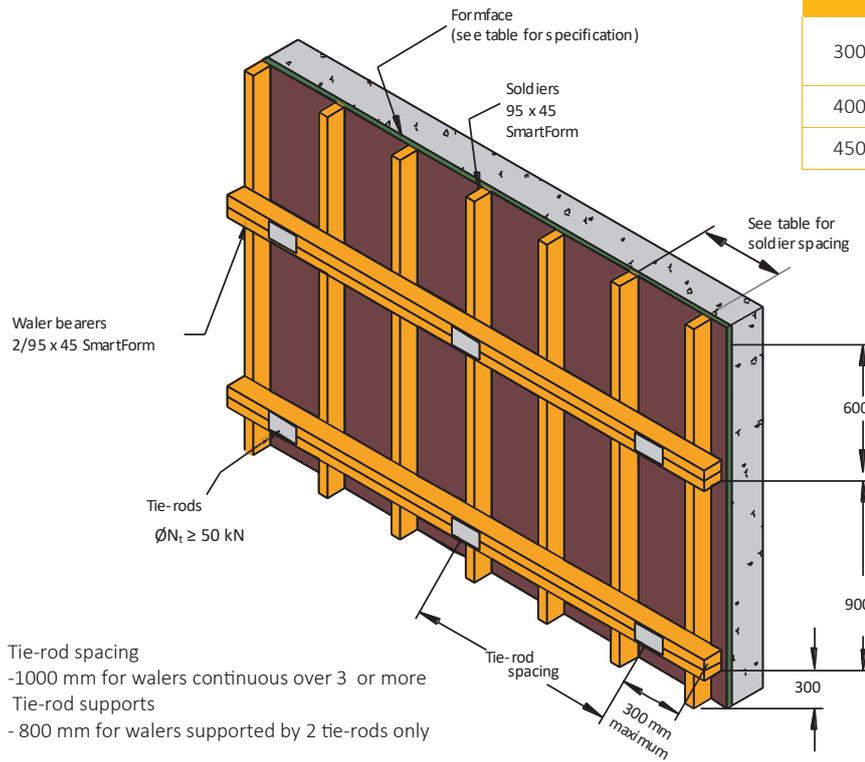
### Notes for use with table

- Minimum bearing length = 45 mm at end supports.
- Spans in tables have been designed as per section 4 of AS 3610-1995, **including Amendment 1:2003** for all stage 1, 2 and 3 loadings. This allows for a 4.0 KPa imposed load due to stacked material as a stage 3 loading. This load is considered to be additional to other live loads. If the project designer applies limitations to restrict these material loads to a lesser amount (as specified in Clause 2.3(b) of AS 3610 - 1995), then larger spans will be achieved.
- Since the finish quality is dependent upon a number of factors including the formface used and the accuracy of the setup, a class 3 finish cannot be guaranteed.
- For multiple spans, the design has assumed the most conservative of 2 and 3 spans and that all spans are essentially equal.
- The design has assumed that the joists are continually restrained by the sheeting and the bearers are restrained by the joists.
- The design tables are only suitable for horizontal forms. For angled soffits, consult a formwork designer.
- To satisfy the bearing requirements of the timber, the breadth of the bearer must be equal to or greater than the breadth of the joists it is supporting.

# Example vertical forms using SmartForm bearers and joists

## Vertical formface up to 1800 mm

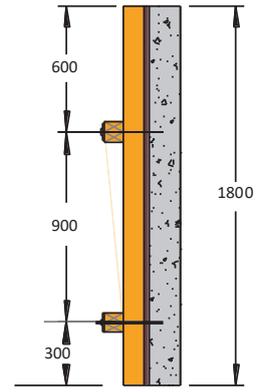
Soldier spacing (mm)	Formface specifications (Max 1800 mm high)		
	Plywood construction	Stress grade	Orientation *
300	17-10-7	F11	H or V
	17-16-7	F14	H Only
400	17-10-7	F17	H or V
450	17-10-7	F27	H or V



Tie-rod spacing  
 - 1000 mm for walers continuous over 3 or more  
 Tie-rod supports  
 - 800 mm for walers supported by 2 tie-rods only

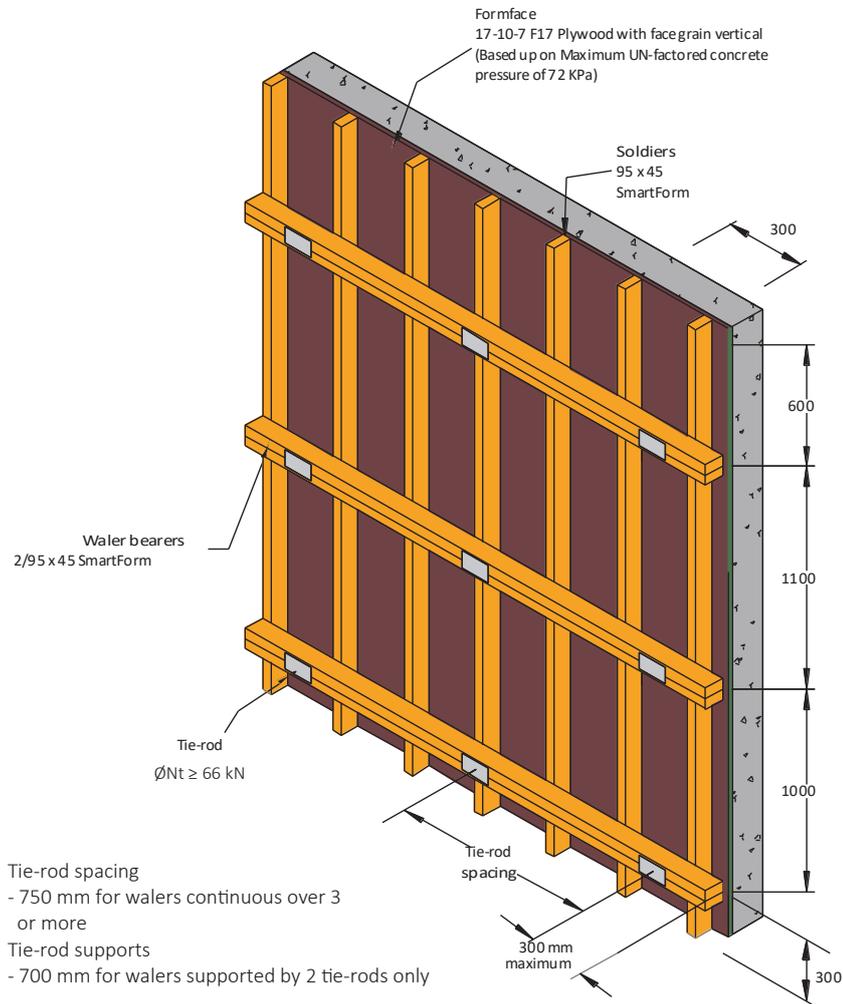
**Notes:**

- \* - H denotes face grain horizontal
- V denotes face grain vertical
- Maximum un-factored concrete pressure - 43 KPa

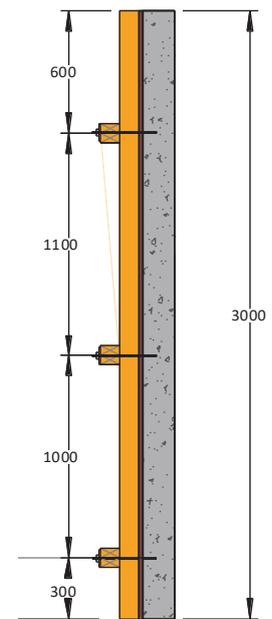


Section

## Vertical formface up to 3000 mm



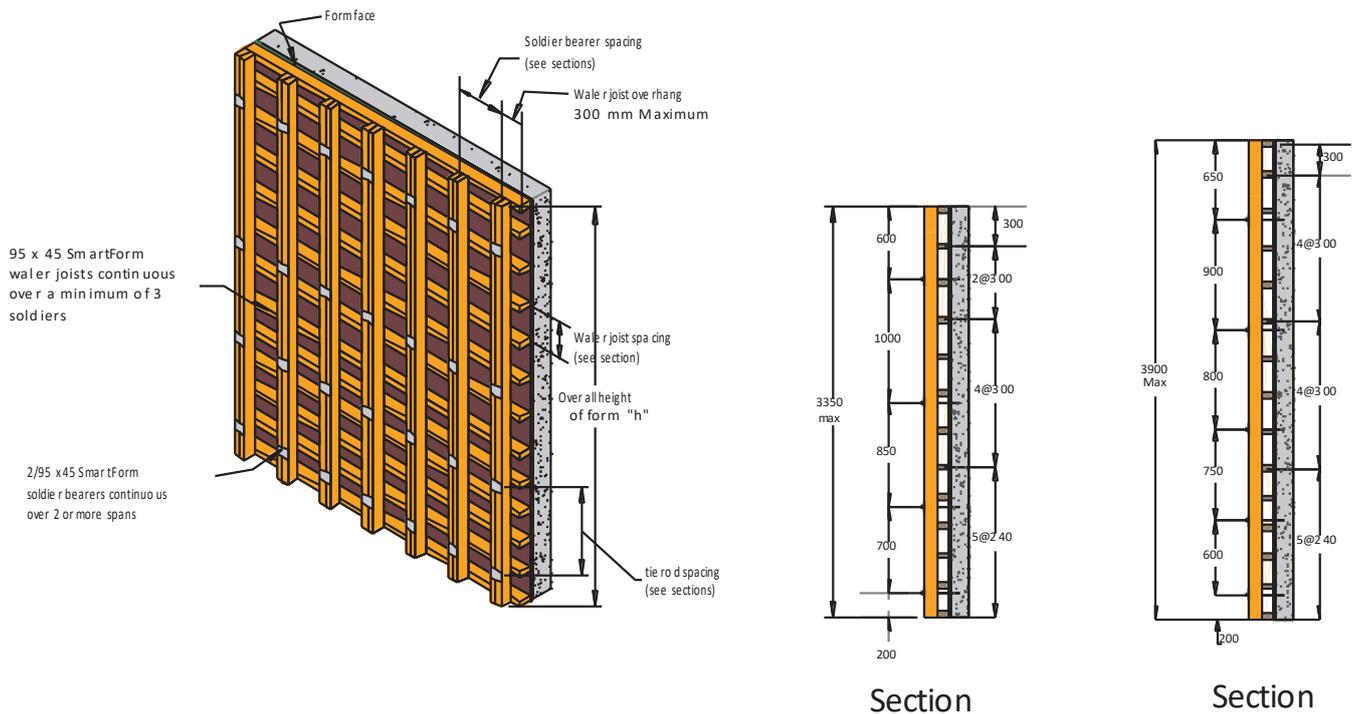
Tie-rod spacing  
 - 750 mm for walers continuous over 3 or more  
 Tie-rod supports  
 - 700 mm for walers supported by 2 tie-rods only



Section

## Example vertical forms using SmartForm bearers and joists (Cont'd)

### Vertical formface up to 3900 mm



### Standard vertical Forms

1. The design of the vertical forms is based upon a hydrostatic pressure distribution
2. Deflections of soldiers and walers have been limited to the greater of span/270 or 3 mm complying with class 3 finish in AS 3610 - 1995. Since the finish quality is dependent upon a number of factors including the formface used and the accuracy of the setup, a class 3 finish cannot be guaranteed
3. Tie bolt holes are not to be drilled through ANY of the soldier or waler members
4. The distance from the top of the form to the nearest tie rod must be a maximum of 650 mm
5. The design of the above forms are NOT suitable for:
  - Grout injected concrete
  - Concrete pumped from below
  - Deep vibration of concrete
  - External concrete vibration

The information contained in this product brochure is current as at July 2021 and is based on data available to Tilling Timber Pty Ltd at the time of going to print. Tilling Timber Pty Ltd has used its reasonable endeavours to ensure the accuracy and reliability of the information contained in this document and, to the extent permitted by law, will not be liable for any inaccuracies, omissions or errors in this information nor for any actions taken in reliance on this information. Tilling Timber Pty Ltd reserves the right to change the information contained in this document without prior notice. It is important that you call the Tech Support Customer Helpline on 1300 668 690 to confirm that you have the most up to date information available.



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POWERED BY INNOVATION

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