

SmartJoist Design Guide



Introducing the SmartFloor®

Another first from SmartFrame

Now your SmartFrame floor system can be supplied precision docked*, with the web penetrations pre-cut to your specifications and even manufactured into cassette systems. Each joist or cassette comes labelled with its identifying number to match the colour layout (up to A1) supplied as part of the order.

This provides the builder with an industry benchmark level of information to aid quick and correct installation, and allows for easy installation of services.

SmartFloor combines the speed and efficiency of SmartJoists with the flexibility of open webbed truss systems, without the need for the installation of strong- backs associated with open webbed trusses.

Now that's a SmartFloor!

We provide the most complete offer in floor systems, and it's totally electronic.

Smart Floor

CASSETTE FLOORING SYSTEMS

Efficiencies & Savings

Precision Docking

Pre-cut Penetrations

Free Take-off Service

Individual Identification

Free Design Software



TEC BEAM



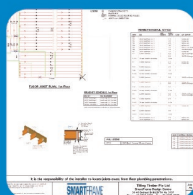
SMARTFRAME®
SMART ENGINEERED SOLUTIONS

Send us your plans, or do it yourself with our free design software. It's the smart thing to do!

Design



Layouts



Docking



Penetrations



Identification



SmartJoist® Design Guide

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Scope of this publication

This Design Guide and Load Tables assists in the selection of SmartJoists for most of the common structural arrangements met in domestic construction. The SmartFrame website (www.tilling.com.au) and SmartFrame software, in conjunction with this manual, provides an unparalleled level of design capacity for SmartFrame engineered timber products.

While specific details are given on suitable methods of developing lateral restraint, the methods of providing adequate support, adequate anchorage against wind uplift and overall structural stability are outside the scope of this publication.

Information on the above matters can be obtained from AS1684 Residential timber-framed construction code or from a structural engineer experienced in timber construction.

Tilling Timber Pty Ltd has structural engineers on staff who can be contacted for advice on matters concerning the use of its engineered timber products in timber construction on the SmartData Customer Helpline on 1300 668 690 or at smartdata@tilling.com.au.

Substitution of other products

All load tables in this document are designed using in-grade tested properties for SmartJoists as manufactured by Pacific Woodtech Corporation of Washington State, USA. Other manufacturers I-Joists may have different properties and, therefore, cannot be designed using these span tables.

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Certification

As a professional engineer, qualified and experienced in timber engineering, I certify that the use of the SmartJoist members as shown in these tables, and installed in accordance with the provisions of this Design Guide, will comply with the requirements of the Building Code of Australia. These span tables have been prepared in accordance with standard engineering principles, the relevant test reports and Australian standards, i.e. -

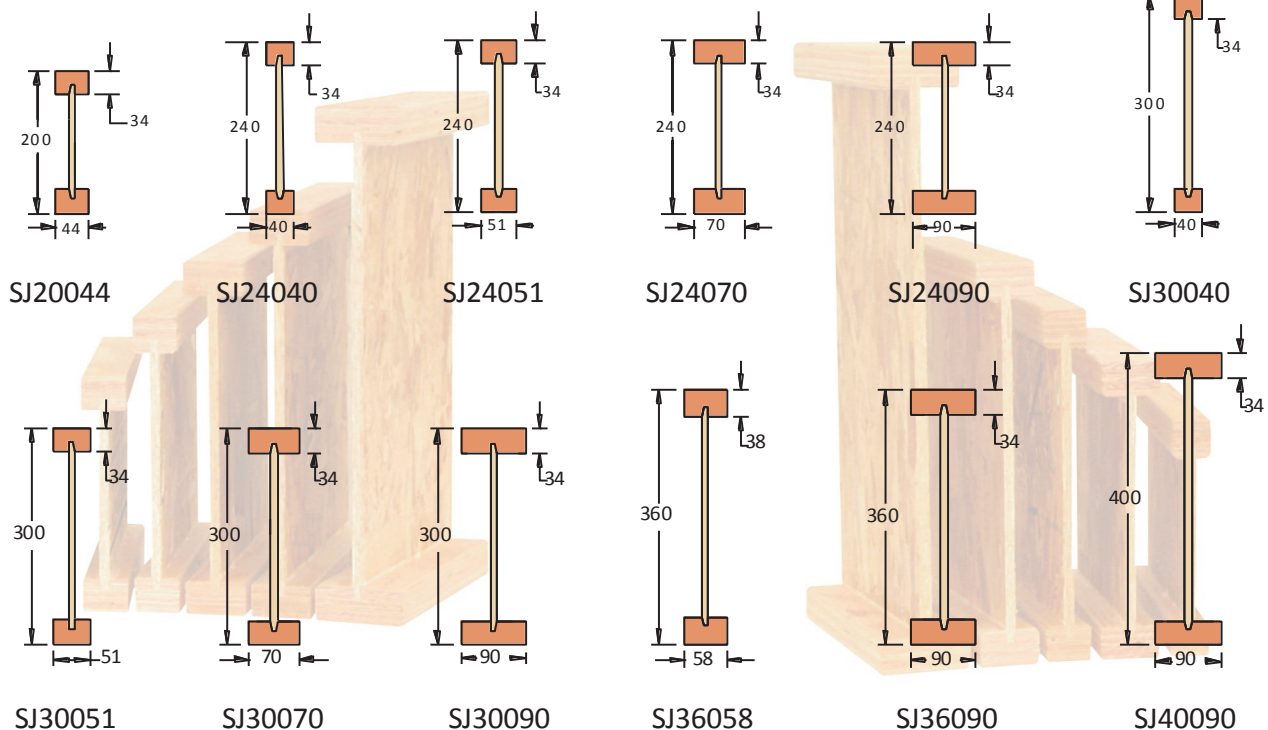
- AS 1684.1 Residential timber-framed construction
- AS 1170.1 Structural Design Actions – Permanent Imposed and other actions
- AS 1720.1 Timber Structures - Design Methods
- AS 4055 Wind loads for Houses
- ASTM D 5055 Standard specification for establishing and monitoring structural capacities of prefabricated wood I-Joists

Craig Kay

Craig Kay PEng, EC-1961, RPEQ-5100, BPB0730, CC5635 C, NPER
National Product Manager - EWP

Flange width 40, 44, 51, 58, 70 and 90 mm web thickness : 9.5 mm, for 40, 44, 51, 58, and 70 mm flanges: 11.5 mm for 90 mm flanges

SmartJoist sizes available in each state may vary from time to time. Check you local stockist before ordering



SmartJoist dimension tolerances: depth: + 0 -3 mm, Flange width: +/- 1 mm, flange thickness: no plus limitation -2 mm.

The information contained in this product brochure is current as at Nov 2014 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 smartdata customer Helpline on 1300 668 690 to confirm that you have the most up to date information available.

- The SmartFrame Engineered Wood System is made up of:
- World class engineered timber products:
 1. SmartJoist
 2. SmartLVL
 3. SmartLam Glulams
 4. TecBeam
 5. CLT
- Unique SmartFrame Structural Design, Detailing and Estimating Software
- Full engineering support and technical advice from experienced engineers and field staff free of charge on our unique SmartData Customer HelpLine 1300 668 690.

SmartJoists

The strength is in the engineering:- Strong. Stiff. Reliable. SmartJoists are engineered for heavy performance. We start with ultrasonically graded LVL, bonded with exterior adhesive for more load carrying capacity.

The webs are made from stable, strong Oriented Strand Board (OSB) for superior strength and consistent performance. SmartJoists are more uniform than solid sawn joists. They stay straighter and are manufactured with no camber, so there is no chance of crown down or upside down installation. They resist shrinking, twisting, warping and splitting for squeak resistant floors and quality roofs and ceilings.

Holes may be easily cut in the web according to the tables on page 30, allowing ducts and utilities to be run through the joists. Pre-punched 40 mm knockout holes are provided in the web for small diameter services or wiring.

Save Time and Money:- Because they weigh less than solid sawn joists, SmartJoists are easier to install, saving construction time and cost. Their greater load carrying capacity allows you to space them further apart, so it takes fewer to build the average floor or roof. And with five (5) depths from 200 to 400 mm, you will never

have to compromise your design. So whether your plans call for cantilever beams in balconies, cathedral roofs or high pitched roof slopes, SmartJoists are the perfect choice.

An Environmentally Sound Choice:- In addition to being cost effective, SmartJoists are also an environmentally sound choice because they are made of a renewable resource – wood. So they are a better choice for building. SmartJoists have a certified Chain of Custody system to PEFC.

SmartFrame Software:- Our unique SmartFrame design, detailing and estimating software offers you unparalleled design and estimating capabilities with engineered timber. You will get accurate designs for a wide variety of applications, printouts and joist layouts.

Limitations of use - SmartJoists.

SmartJoists are to be used in dry interior environments only, fully enclosed from exposure to exterior moisture. SmartJoists are suitable for subfloor applications provided that the subfloor space is ventilated as per the BCA requirements. This means that SmartJoists must not be exposed to environments where the equilibrium moisture content of the joist will exceed 18%. Tilling Timber will not guarantee SmartJoists that have been left exposed to the weather either prior to or during construction for more than 90 days.

Detailing such as cladding or lining must be used in moisture laden environments (commercial kitchens, bathrooms, wet industrial areas, saunas, swimming pool and spa rooms etc.) and constructed in such a way as to prevent exposure of the SmartJoist to moisture.

SmartJoists may be used in applications which are often exposed externally (gable ends, eaves, floor joists applications in elevated houses, cantilevered joists etc.) but must be sufficiently enclosed with a suitable cladding, lining etc. to completely prevent the exposure of the SmartJoist to moisture.

SmartFrame Consumer Product Warranty

Tilling Timber guarantees that SmartFrame Engineered Timber products have been manufactured to exacting standards and are free from defects in workmanship and materials.

At Tilling Timber, we take great pride in SmartFrame products, so if you bring to our attention problems such as squeaks that you believe are caused by our products, we guarantee that a technical representative will contact you promptly to evaluate the issues and provide advice to help solve the problem.

Providing that any SmartFrame product is correctly designed, handled and installed, any problem caused by an unlikely defect will promptly be remedied at no cost to you.

This guarantee remains valid for the expected life of your home.

Tilling Timber Pty Ltd

31-45 Orchard Street

Kilsyth Vic 3137

Priority call: 1300 668 690 e-mail: smartdata@tilling.com.au

General information - about floor performance

The “feeling” that is identified when a person walks on a floor is very subjective. Some people want to feel a very stiff floor and others want some “give” so that it softens the footing. When people say the floor “bounces”, it may be vibrating. This sensation is often caused by lack of dead load such as furniture, direct applied ceilings or other materials to absorb or dampen the vibration.

The AS 1684.1–1999 standard introduced a 1.0 kN static load applied at mid-span as a serviceability equation to simulate the foot force effect on the design of floor joists. The differential deflection caused by this 1 kN load is limited to 2 mm.

This criteria was developed for solid section floor joists up to 6m spans, and in some cases, experience is now showing that at the 2 mm limit, the floor performance of lightweight I-Joist floors (especially without ceilings below e.g. subfloors) may be considered unfit for purpose by some people.

The two (2) alternative SmartJoist Span Table shown in this manual have been designed to meet the strength and serviceability criteria of:

- **Table 1 - AS 1684.1–1999** In this table the strength and serviceability limits of AS 1684.1 - 1999 have been used along with the recommended dynamic requirements.
- **Table 2 - SmartJoist Preferred Dynamics.** In this table the strength and serviceability limits of AS 1684.1 - 1999 have been supplemented with a EN 1995-1-1-2004 serviceability equation to better model foot force effects on I-Joist floors. This approach has been demonstrated to produce stiffer floors for those wanting a firmer feel in their timber floor.

Both tables list MAXIMUM recommended joist spans, and therefore shorter spans in most cases should produce stiffer floors.

Factors that can affect floor dynamic performance

- The choice of flooring system
- The depth, stiffness and mass of the joists
- Spacing of joists
- Fixing of sheathing to joists
- Stiffness and mass of floor sheathing
- Mass and stiffness of ceiling materials
- Method of installation
- Location and type of internal partitions and furniture

Factors that can improve floor dynamic performance

- Glue/nailed and glue/screw floors will perform better than floors secured by nails alone.
- Deflection of the sheathing material between joists can be reduced by decreasing the joist spacing or using a thicker and/or stiffer sheathing.
- Proper installation is essential for dependable performance. Adequate and level support for the joists is necessary, as is correct fastening of the joists and sheathing.
- The installation of a ceiling to the bottom flange of the joists or a similar mass/loading sharing system.

While between joist blocking has been traditionally used to provide some improvement to floor dynamic performance of solid

timber joists, both testing and long experience show limited if any improvement to the dynamic performance by midspan blocking of I-Joist floor systems with simple blocking.

If floor dynamic performance is a concern to either the client, designer or contractor, then the above variables can be altered, or additional methods be incorporated to improve dynamic performance.

Further information on the dynamic performance of lightweight timber floors can be

obtained by calling the SmartData Customer Helpline on 1300 668 or at smartdata@tilling.com.au.

Large area ceramic tiled floors

The modern trend to large size ceramic tiles has introduced a new design challenge for all floor substrates. Smaller numbers of grouted joints between larger tiles means that any deflection of the floor has to be larger per grouted joint, thus increasing the probability of cracking.

AS 3958.1—2007 (includes amendment 1-2010) Ceramic tiles Part 1: Guide to the installation of ceramic tiles limits the total deflection of the floor (Dead Load + Live Load) to $L/360$. This supplementary deflection limit is not one that is normally considered in the design of timber floors.

The spans listed within **Tables 2-4** meets the additional AS 3958.1—2007 Ceramic tiles Part 1: Guide to the installation of ceramic tiles deflection limits.



Designing with SmartJoists®

The design information contained within this Design Guide is for the properties of SmartJoist® I-Joists only. Other manufacturers' I-Joists may have different properties and therefore cannot be designed using this information.

Characteristic properties

| | | |
|-------------------------|---|------------------------|
| Dimensional tolerances: | Length | ± 10 mm |
| | Depth | +0, -3 mm |
| | Flange width | ± 10mm |
| | Flange thickness | No plus limitation, -2 |
| Treatment options: | H2s(standard) and H2 treatment to AS 1604.2 and AS 1604.4 | |

| SmartJoist Code | Depth (mm) | Flange width (mm) | Flange Thickness (mm) | Web thickness (mm) | Self weight (kg/m) | Moment (kN.m) | Shear (kN) | EI x 10 ⁶ (kN.mm ²) | GJ x 10 ⁶ N.mm ²) | GA _w x 10 ⁶ (N.mm ²) | End reaction (kN) | Max interior reactions | |
|-----------------|------------|-------------------|-----------------------|--------------------|--------------------|---------------|------------|--|--|--|-------------------|------------------------|--------------------|
| | | | | | | | | | | | | 42 mm bearing (kN) | 90 mm bearing (kN) |
| SJ20044 | 200 | 44 | 35 | 9.5 | 2.67 | 10.0 | 10.5 | 355 | 997 | 1.78 | 8.60 | 14.7 | 19.64 |
| SJ24040 | 240 | 40 | 35 | 9.5 | 2.75 | 11.1 | 13.1 | 499 | 907 | 2.27 | 8.60 | 14.7 | 19.64 |
| SJ24051 | 240 | 51 | 35 | 9.5 | 3.21 | 14.5 | 13.1 | 635 | 1156 | 2.27 | 9.48 | 17.0 | 22.43 |
| SJ24070 | 240 | 69 | 35 | 9.5 | 3.98 | 19.8 | 13.1 | 852 | 1564 | 2.33 | 11.22 | 20.5 | 25.11 |
| SJ24090 | 240 | 90 | 35 | 11.5 | 5.09 | 25.8 | 16.2 | 1066 | 2017 | 2.27 | 12.10 | 25.7 | 33.17 |
| SJ30040 | 300 | 40 | 35 | 9.5 | 3.12 | 14.4 | 17.0 | 844 | 907 | 3.01 | 8.60 | 14.7 | 19.64 |
| SJ30051 | 300 | 51 | 35 | 9.5 | 3.58 | 18.7 | 17.0 | 1069 | 1156 | 3.01 | 9.48 | 17.0 | 22.43 |
| SJ30070 | 300 | 69 | 35 | 9.5 | 4.35 | 25.6 | 17.0 | 1432 | 1564 | 3.01 | 11.22 | 20.5 | 25.11 |
| SJ30090 | 300 | 90 | 35 | 11.5 | 5.54 | 33.3 | 20.7 | 1790 | 2017 | 3.01 | 12.10 | 25.7 | 33.17 |
| SJ36058 | 360 | 58 | 38 | 9.5 | 4.42 | 28.3 | 20.9 | 1953 | 1683 | 3.67 | 11.23 | 21.4 | 24.1 |
| SJ36090 | 360 | 90 | 35 | 11.5 | 5.98 | 40.8 | 25.2 | 2793 | 2017 | 3.66 | 12.10 | 25.7 | 33.17 |
| SJ40090 | 400 | 90 | 35 | 11.5 | 6.28 | 45.9 | 28.3 | 3541 | 2017 | 4.23 | 12.10 | 25.7 | 33.17 |

Strength reduction factors

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 SmartJoist 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 | 0.90 | 0.80 |

* AS 1720.1:2010 Table 2.1

Duration of load

The duration of load factor k₁ for strength is defined within clause 2.4 of AS 1720.1.

| Duration of action | Bending and shear |
|-----------------------|-------------------|
| Short term ≤ 1 day | 1.0 |
| Long term > 12 months | 2.0 |

Deflection (Bending deflection + shear deflection)

Bending deflection—use standard engineering formula

Shear deflection - for a uniformly distributed load w, over a span L

$$y = j_2 \left(\frac{5wL^4}{384EI_x} + \frac{wL^2}{8G_w A_w} \right)$$

Partial seasoning factor

SmartJoists are a seasoned timber product, generally k₄ equals 1. Where the SmartJoists are 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 k₄ shall be the greater of:

- $k_4 = 1.0 - 0.3 \frac{EMC - 15}{10}$
- $k_4 = 0.7$

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

Length and position of bearing

The k₇ bearing factor is defined is clause 2.4.4 of AS 1720.1

Load sharing

Because of the reduced variability of strength values of SmartJoist compared to solid timber, the load sharing factor k₉ = 1.0.

Stability

The stability factor k₁₂ is defined within Appendix E of AS 1720.1

2.8 Temperature

For covered timber structures under ambient conditions, no modification for strength need be made for the effect of temperature (i.e., k₆ 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 k₆ of 0.9.

Recommended maximum spans for lightweight residential floors

General domestic - 1.5 kPa

Loadings: Permanent Loading G: self weight + 40 kg/m² + 0.5 kPa of live load permanently applied, live load Q: 1.5 kPa or 1.8 kN point live load

In compiling the span tables in this manual, the requirements of the relevant Australian standards and codes along with established Industry standard design guidelines for Residential Construction have been followed. In particular, the following codes and references have been used:

- AS 1684.1 Residential timber-framed construction
- AS 1170.1 Structural design actions – permanent imposed and other actions
- AS 1720.1 Timber Structures - design methods
- AS 4055 Wind loads for houses
- AS/NZS 4063 Characterisation of structural timber
- ASTM D 5055 Standard specification for establishing and monitoring structural capacities of prefabricated wood I-Joists

Serviceability criteria:

Max dead load deflection - lesser of span / 300 or 15 mm ($j_2 = 2$)
 Max live load deflection - lesser of span / 360 or 9 mm

Table 1 - AS 1684.1-1999 Floor dynamics criteria

1. Minimum floor Natural Frequency - 8 Hertz
2. Maximum differential deflection between joists of 2 mm under a concentrated load of 1.0 kN mid-span to simulate the foot force effect on the design of floor joists.

| Joist spacing (mm) | | 300 | 400 | 450 | 600 | 300 | 400 | 450 | 600 |
|--------------------|--------------------|-------------------------------|------|------|------|-----------------|------|------|------|
| SmartJoist code | Self weight (kg/m) | Maximum floor joist span (mm) | | | | | | | |
| | | Single span | | | | Continuous span | | | |
| SJ20044 | 2.8 | 4650 | 4300 | 4050 | 3650 | 5300 | 4900 | 4750 | 4350 |
| SJ24040 | 3.0 | 5100 | 4700 | 4550 | 4150 | 5800 | 5350 | 5200 | 4900 |
| SJ24051 | 3.4 | 5400 | 4950 | 4800 | 4450 | 6200 | 5650 | 5500 | 5200 |
| SJ24070 | 4.0 | 5700 | 5350 | 5150 | 4800 | 6600 | 6050 | 5900 | 5500 |
| SJ24090 | 5.0 | 6100 | 5650 | 5500 | 5050 | 7000 | 6450 | 6300 | 5950 |
| SJ30040 | 3.4 | 5800 | 5350 | 5200 | 4800 | 6600 | 6100 | 5900 | 5650 |
| SJ30051 | 3.9 | 6150 | 5650 | 5550 | 5100 | 7000 | 6500 | 6250 | 5900 |
| SJ30070 | 4.3 | 6600 | 6100 | 5900 | 5400 | 7500 | 6900 | 6700 | 6300 |
| SJ30090 | 5.5 | 6950 | 6450 | 6300 | 5800 | 7950 | 7350 | 7100 | 6700 |
| SJ36058 | 4.8 | 7150 | 6550 | 6350 | 5850 | 8150 | 7500 | 7250 | 6900 |
| SJ36090 | 5.9 | 7700 | 7150 | 6950 | 6400 | 8850 | 8150 | 7900 | 7500 |
| SJ40090 | 6.2 | 8200 | 7500 | 7350 | 6800 | 9400 | 8650 | 8400 | 7800 |

Table 2 - SmartJoist preferred Floor dynamics criteria (modified Eurocode)

1. Minimum floor Natural Frequency - 8 Hertz
2. Maximum differential deflection between joists of:
 - 1.8 mm for spans ≤ 4200 mm
 - $1700/L^{1.1}$ for span ≥ 4200 mm
 under a concentrated load of 1.0 kN mid-span to simulate the foot force effect on the design of floor joists.

| Joist spacing (mm) | | 300 | 400 | 450 | 600 | 300 | 400 | 450 | 600 |
|--------------------|--------------------|-------------------------------|------|------|------|-----------------|------|------|------|
| SmartJoist code | Self weight (kg/m) | Maximum floor joist span (mm) | | | | | | | |
| | | Single span | | | | Continuous span | | | |
| SJ20044 | 2.8 | 4650 | 4100 | 3850 | 3450 | 5200 | 4600 | 4400 | 4000 |
| SJ24040 | 3.0 | 5100 | 4500 | 4300 | 3950 | 5700 | 4950 | 4800 | 4450 |
| SJ24051 | 3.4 | 5400 | 4750 | 4550 | 4200 | 6050 | 5300 | 5150 | 4700 |
| SJ24070 | 4.0 | 5750 | 5100 | 4900 | 4550 | 6400 | 5750 | 5500 | 5100 |
| SJ24090 | 5.0 | 6100 | 5400 | 5250 | 4850 | 6800 | 6100 | 5850 | 5400 |
| SJ30040 | 3.4 | 5800 | 5050 | 4900 | 4550 | 6500 | 5700 | 5450 | 5050 |
| SJ30051 | 3.9 | 6150 | 5400 | 5200 | 4850 | 6900 | 6050 | 5800 | 5300 |
| SJ30070 | 4.3 | 6600 | 5700 | 5550 | 5200 | 7300 | 6450 | 6200 | 5750 |
| SJ30090 | 5.5 | 6950 | 6100 | 5900 | 5500 | 7700 | 6900 | 6600 | 6100 |
| SJ36058 | 4.8 | 7150 | 6200 | 6000 | 5650 | 7900 | 7000 | 6700 | 6200 |
| SJ36090 | 5.9 | 7700 | 6800 | 6550 | 6100 | 8600 | 7600 | 7350 | 6750 |
| SJ40090 | 6.2 | 8200 | 7200 | 6900 | 6500 | 9050 | 8100 | 7750 | 7150 |

Recommended maximum spans for residential floors with ceramic tiles

General domestic - 1.5 kPa

Table 3 - SmartJoist –65 kg/m² - grout and tiled floor

1. Minimum floor Natural Frequency - 8 Hertz
2. Maximum differential deflection between joists of:
 - 1.8 mm for spans ≤ 4200 mm
 - $1700/L^{1.1}$ for span ≥ 4200 mm
 under a concentrated load of 1.0 kN mid-span to simulate the foot force effect on the design of floor joists.
3. Total deflection of the floor (Dead Load + Live Load) to L/360 as per AS 3958.1—2007 (includes amendment 1-2010) Ceramic tiles Part 1: Guide to the installation of ceramic tiles

Loadings: Permanent Loading G: self weight + 65kg/m² + 0.5 kPa of live load permanently applied, live load Q: 1.5 kPa or 1.8 kN point live load

| Joist spacing (mm) | | 300 | 400 | 450 | 600 | 300 | 400 | 450 | 600 |
|--------------------|--------------------|-------------------------------|------|------|------|-----------------|------|------|------|
| SmartJoist code | Self weight (kg/m) | Maximum floor joist span (mm) | | | | | | | |
| | | Single span | | | | Continuous span | | | |
| SJ20044 | 2.8 | 4500 | 4100 | 3800 | 3450 | 5100 | 4550 | 4300 | 3900 |
| SJ24040 | 3.0 | 4900 | 4500 | 4250 | 3900 | 5600 | 4850 | 4700 | 4400 |
| SJ24051 | 3.4 | 5200 | 4700 | 4550 | 4150 | 5950 | 5200 | 5050 | 4600 |
| SJ24070 | 4.0 | 5500 | 5050 | 4850 | 4500 | 6300 | 5700 | 5400 | 5000 |
| SJ24090 | 5.0 | 5850 | 5350 | 5150 | 4750 | 6700 | 6000 | 5800 | 5350 |
| SJ30040 | 3.4 | 5600 | 5100 | 4850 | 4500 | 6400 | 5600 | 5400 | 4950 |
| SJ30051 | 3.9 | 5900 | 5350 | 5100 | 4700 | 6800 | 5950 | 5750 | 5250 |
| SJ30070 | 4.3 | 6300 | 5750 | 5500 | 5100 | 7200 | 6400 | 6150 | 5700 |
| SJ30090 | 5.5 | 6650 | 6100 | 5800 | 5450 | 7600 | 6800 | 6500 | 6050 |
| SJ36058 | 4.8 | 6800 | 6200 | 5950 | 5500 | 7800 | 6900 | 6600 | 6100 |
| SJ36090 | 5.9 | 7350 | 6800 | 6450 | 6000 | 8500 | 7550 | 7300 | 6700 |
| SJ40090 | 6.2 | 7800 | 7100 | 6850 | 6350 | 8900 | 8000 | 7700 | 7100 |

Table 4 - SmartJoist –120 kg/m² - 40 mm grout and tiled floor

1. Minimum floor Natural Frequency - 8 Hertz
2. Maximum differential deflection between joists of:
 - 1.8 mm for spans ≤ 4200 mm
 - $1700/L^{1.1}$ for span ≥ 4200 mm
 under a concentrated load of 1.0 kN mid-span to simulate the foot force effect on the design of floor joists.
3. Total deflection of the floor (Dead Load + Live Load) to L/360 as per AS 3958.1—2007 (includes amendment 1-2010) Ceramic tiles Part 1: Guide to the installation of ceramic tiles

Loadings: Permanent Loading G: self weight + 120 kg/m² + 0.5 kPa of live load permanently applied, live load Q: 1.5 kPa or 1.8 kN point live load

| Joist spacing (mm) | | 300 | 400 | 450 | 600 | 300 | 400 | 450 | 600 |
|--------------------|--------------------|-------------------------------|------|------|------|-----------------|------|------|------|
| SmartJoist code | Self weight (kg/m) | Maximum floor joist span (mm) | | | | | | | |
| | | Single span | | | | Continuous span | | | |
| SJ20044 | 2.8 | 4000 | 3700 | 3550 | 3250 | 4700 | 4350 | 4150 | 3800 |
| SJ24040 | 3.0 | 4350 | 4050 | 3900 | 3550 | 5100 | 4700 | 4550 | 4300 |
| SJ24051 | 3.4 | 4600 | 4300 | 4150 | 3800 | 5400 | 5000 | 4850 | 4500 |
| SJ24070 | 4.0 | 4950 | 4550 | 4400 | 4100 | 5800 | 5350 | 5200 | 4800 |
| SJ24090 | 5.0 | 5200 | 4800 | 4650 | 4350 | 6050 | 5650 | 5500 | 5100 |
| SJ30040 | 3.4 | 5000 | 4600 | 4450 | 4100 | 5850 | 5400 | 5250 | 4800 |
| SJ30051 | 3.9 | 5250 | 4850 | 4700 | 4300 | 6150 | 5750 | 5550 | 5150 |
| SJ30070 | 4.3 | 5600 | 5200 | 5000 | 4650 | 6500 | 6100 | 5950 | 5500 |
| SJ30090 | 5.5 | 5900 | 5500 | 5300 | 4950 | 6900 | 6400 | 6250 | 5800 |
| SJ36058 | 4.8 | 6050 | 5650 | 5450 | 5050 | 7100 | 6600 | 6450 | 5950 |
| SJ36090 | 5.9 | 6500 | 6100 | 5900 | 5450 | 7600 | 7100 | 6900 | 6450 |
| SJ40090 | 6.2 | 6950 | 6500 | 6250 | 5750 | 8100 | 7550 | 7300 | 6800 |

Recommended maximum spans for residential floors (cont'd)

Flooring:

Spans are suitable for solid timber, particle board and ply flooring. Floor sheathing glued and nailed to the joists will improve floor rigidity. Where a heavy overlay material is to be applied, such as thick mortar bed tiled or slate floors, the permanent load allowance should be increased to 1.2 kPa. A reduction of joist spacing can 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 mm and 300 mm spacing respectively.

Continuous spans:

For beams which are continuous over two unequal spans, the design span and the "resultant span description" depend on the percentage difference between the two spans as shown below:

| Span difference | Effective span | Resultant span description |
|-----------------|-----------------|----------------------------|
| 10% max | main span | continuous |
| 10 - 30% | 1.1 x main span | continuous |
| above 30% diff | main span | single |

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



SmartJoist 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 -

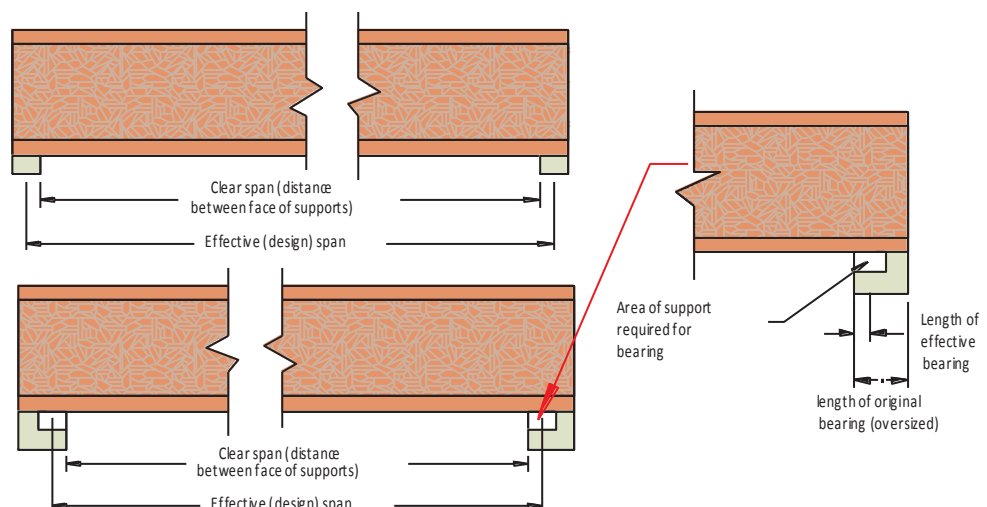
- The centre of the bearing at each end of a beam where the bearing lengths have NOT been conservatively sized
- The centre of notional bearing that have been sized appropriately, where the size of the bearing IS conservative.

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

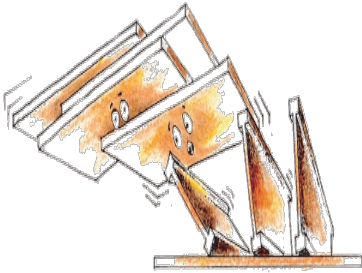
Diagram (b) shows beam where bearings at each end have been oversized. (This is frequently the case for beams that bear onto brickwork or concrete walls where the thickness of the wall is in excess of the area required to give the beam bearing capacity).

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



Safety Warning



Do not allow workers or loads on SmartJoists until all blocking, hangers, rim joists, nailing and temporary bracing are installed as specified below. Serious accidents or injury can result from failure to follow these guidelines.

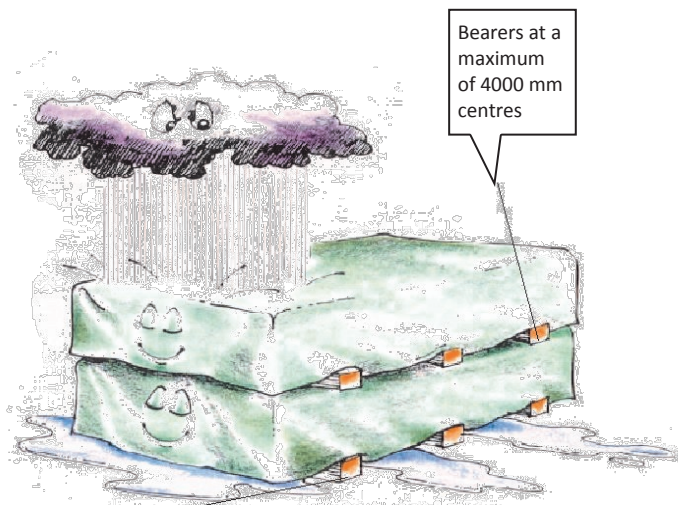


Accidents can be avoided under normal conditions by following these guidelines:

1. Brace each joist as it is erected. Joists must be nailed to supports and all hangers, blocking, rim joists. X - bridging at supports must be completely installed and properly nailed. (see general notes and details)
2. Brace the ends of cantilevers (overhangs) with closure panels, rim joist or x - bridging (see general notes and details)
3. Lateral brace the top flange of each joist, to prevent sideways buckling or rollover which may occur under light construction loads, such as a worker and/or a layer of un-nailed sheathing. Fully installed permanent sheathing or temporary struts to the top flange of each joist (see 'Typical SmartJoist floor framing') can accomplish lateral bracing. Temporary struts must be nailed to a lateral restraint at the end of bay such as a braced wall or temporary (or permanent) sheathing nailed to the first 1200 mm of the joist at the end of the bay (see 'Typical floor or roof framing')
4. Permanent sheathing must be completely installed and properly nailed before additional loads can be placed on the system
5. **The integrity and safe use of these products can be seriously impaired if they are damaged. Do not install any damaged products. Contact your SmartFrame representative or the SmartData Customer Helpline on 1300 668 690 if any product damage is noted.**

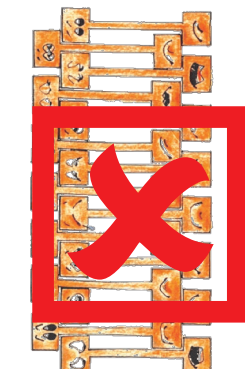
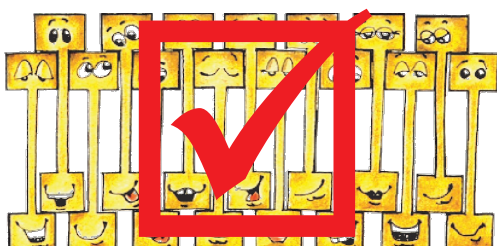
Handling and storage of SmartJoists

- Store SmartJoists 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
- Wood "grows" in thickness and depth when allowed to get wet....KEEP DRY!
- Wood with high MC has short term reduction in Characteristic Strengths KEEP DRY!
- Under NO circumstances are stored SmartJoists to be in contact with the ground.



Use bearers to keep stacked material away from damp surfaces. Align bearer vertically

SmartJoists should be stacked in the upright position to avoid any damage during handling or storage.



Durability and exposure to moisture

SmartJoists are manufactured with Douglas Fir (Oregon) flanges with OSB webs, both having a durability rating of class 4, which is the same rating as some Ash type Eucalypts. Untreated SmartJoists should not be used where the equilibrium moisture content is likely to remain above 18 % for an extended period.

Untreated SmartJoists are suitable in the **internal, fully protected, ventilated** and the **external above ground, protected** zones of the structure as shown in appendix B of AS 1684. Untreated SmartJoist is not suitable for **external above ground, exposed** or humid indoor conditions, such as swimming pool enclosures.

Moisture effects on SmartJoists

SmartJoist is supplied WITHOUT any short term construction sealer, but once framed into a structure may be exposed to the weather for a limited time (not greater than 3 months) without negative affect, BUT, it may exhibit some effects of this exposure.

The wood fibre in SmartJoists, like all wood products, is hygroscopic, which means it has an affinity for water. The wood fibre in SmartJoist will readily take up and release moisture in response to changes in the local environment. Moisture exposure will lead to dimensional change. 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 twisting, bowing or expansion to dimensions to beyond the specified tolerance of the product in the “as-manufactured” condition.

As an organic material, mold 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, which is another reason to follow proper methods of storage and handling of SmartJoists.

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

| Moisture content of wood products % ⁽¹⁾ | | |
|--|---------------|---------|
| Relative Humidity % | LVL Flange MC | OSB web |
| 10 | 1.2 | 0.8 |
| 20 | 2.8 | 1.0 |
| 30 | 4.6 | 2.0 |
| 40 | 5.8 | 3.6 |
| 50 | 7.0 | 5.2 |
| 60 | 8.4 | 6.3 |
| 70 | 11.1 | 8.9 |
| 80 | 15.3 | 13.1 |
| 90 | 19.4 | 17.2 |

(1). Approximate moisture content at 21°C

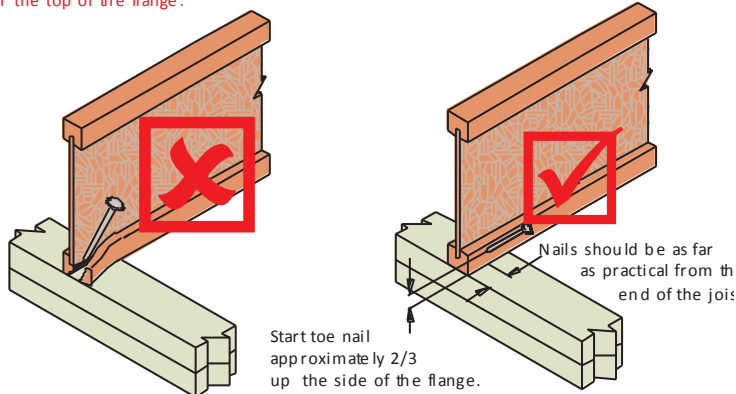
Wetting during construction may lead to temporary elevated moisture content and dimensional changes. Once covered, the SmartJoists will ultimately dry and re-equilibrate to the ambient humidity conditions, but some expansion or swelling may remain after drying.

SmartJoists - General information

- Except where otherwise noted, 30 mm minimum bearing is required at joist ends and 42 mm minimum bearing is required at intermediate supports.
- Nail joists at each bearing with 2 of 3.15 Φ x 65 nails, using one each side placed 30 mm from the end to avoid splitting as per detail below.

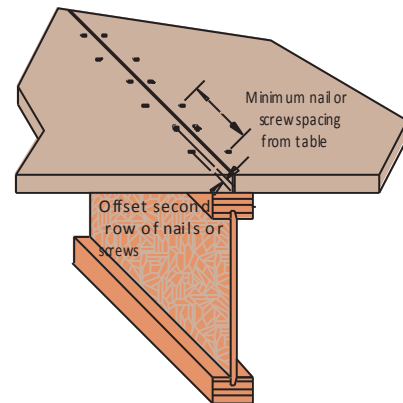
Do NOT start toe nail into the corner of the flange or the top of the flange.

MAXIMUM Nail diameter 3.15 mm



- SmartJoist blocking or SmartRim - face nail to bearing plate with 3.15 Φ x 65 nails at 150 mm centres. Nail rim joist to the end of the top and bottom flange of each SmartJoist with 1 off 3.15 Φ x 65 nail, use 1 off 3.75 Φ x 75 nail top and bottom with joists with 58, 70 or 90 mm wide flanges.
- 17-19 mm SmartRim - toe nail to bearing plate with 3.15 Φ x 65 nails at 150 centres or 4.5 Φ x 75 nails at 300 centres. Nail rim to the end of the top and bottom flanges of each SmartJoist with 1 3.15 Φ x 65 nails.
- Sheathing nailing to top flange (Joists must be fully braced be-

fore sheathing is nailed or screwed) is detailed below



| Minimum single row fastener spacing into SmartJoist flanges | | | | | |
|---|-------------------------|--------------|--------------|-----------------|--------------|
| Fastener type and size | SmartJoist flange width | | | | |
| | 40 mm flange | 44 mm flange | 51 mm flange | 58-70 mm flange | 90 mm flange |
| Nails | | | | | |
| 2.8 x 60 | 75 | 75 | 50 | 50 | 50 |
| 3.15 x 60 | 100 | 90 | 75 | 75 | 75 |
| Screws | | | | | |
| 9g x 45 | 150 | 150 | 75 | 75 | 75 |
| 10g x 50 | 150 | 150 | 100 | 75 | 75 |

- Do not use nails or screws larger than those shown above when attaching sheathing to flanges of SmartJoists
- Minimum nail spacing is shown above, maximum nail spacing is set by the flooring manufacturer, in absence of manufacturers data, 300 mm centres

SmartJoists - General notes (Cont'd)

- Tighter effective nail spacing may be obtained by offsetting nail rows a minimum of 12 mm and maintaining a 10 mm minimum edge distance.
7. All joists require lateral support at end bearings using blocking or rim material.
 8. The top flanges must be kept straight within 10 mm of the true alignment.
 9. All roof details are valid to a maximum angle of 35° (as per AS1684
 10. All nails are steel nails complying with AS 2334 - 1980 Steel nails - Metric series. Nail gun nails of similar length and diameter may be substituted for the above provided that they are manufactured with properties equivalent to the nails in the above code.
 11. Install all hangers to the manufacturers installation instructions, taking particular attention to the use of the correct nails. Never use clouts or brads.
 12. Prescriptive code requirements for mid span blocking of solid timber joists are not applicable to SmartJoists.

Typical SmartJoist floor details

Blocking and lateral restraint

General notes:

SmartJoists designed and constructed as per this Design Guide do not require mid-span blocking. The exception to this is for light-weight subfloors where there is no lining to the underside of the joists. For more information on this topic, see page 3 'ABOUT FLOOR PERFORMANCE'.

Blocking within a structure falls within two (2) quite distinct stages:

Temporary or during construction blocking to prevent roll over of joists before the installation of floor sheeting.

Permanent blocking to provide resistance to racking loads through the floor diaphragm, transfer of vertical wall loads and to provide torsional resistance to the end of the joist.

The provision contained within AS1684 Residential timber-framed construction code dealing with blocking for deep joists, is "during construction" or "temporary" blocking, designed only to prevent the roll over of the deep joists prior to the floor sheeting being attached. This level of blocking can form a part of any overall blocking system, but was never intended to provide the total amount of racking resistance or vertical load transfer requirements within this floor diaphragm.

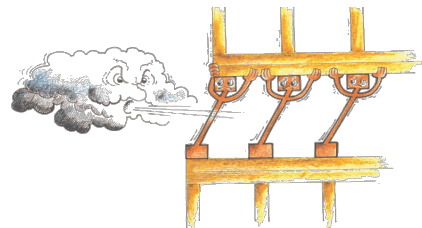
The lateral bracing requirements of the structure, unless there is full blocking of exterior walls, must be calculated in each individual case. Advice on this matter is obtainable from AS1684 Residential timber-framed construction code.

1.0 Joists bearing onto external walls

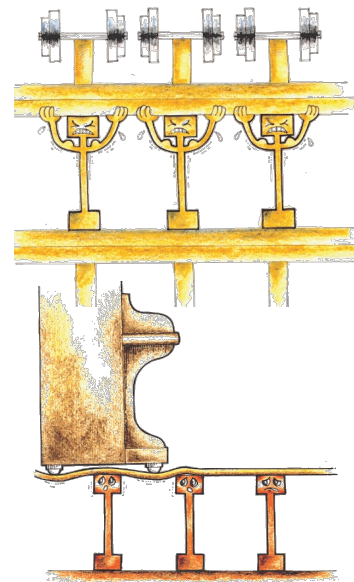
1.1 Loads at joist support connection

The ends of floor joists that bear onto a support experience external loads other than the floor dead and live loads, as shown. Any I-Joist, with its small cross sectional area, needs to have its end bearing capacity considered as part of the design process.

Further, as a holistic approach to the consideration of the lateral stability of the complete structure, it is necessary to consider the availability of racking and shear resistance through the floor diaphragm.



1. Racking and shear effects due to wind and earthquake loads
2. Vertical loads on joists due to upper wall, floors and roof.



3. Unsightly deflections in the edges of unsupported sheet flooring may be experienced if heavy items of furniture are placed close to sheet edges.

Typical SmartJoist Floor details (Cont'd)

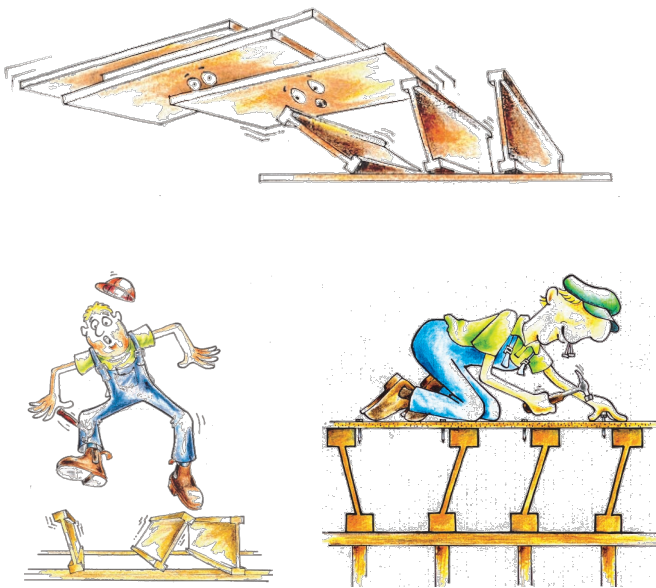
1.2 Stages of blocking/bracing

1.2.1 Temporary (during construction) end blocking

Temporary or during construction blocking of the ends of joists over external wall must comply with the requirements as shown in the "SAFETY WARNING" on page 6 and as shown in the "TYPICAL SmartJoist FLOOR FRAMING" diagram on page 14.

This is summarised as:

- Temporary struts, fastened to top of SmartJoist, connected back to braced supports.
- Temporary floor sheeting nailed to the first 1200 mm of joists at the end of the bay, in combination with struts, if no connection to a braced wall can be made.

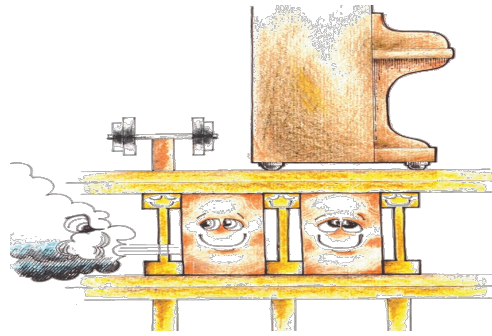


1.2.2 Permanent end blocking/bracing

Permanent blocking (bracing) to be effective in providing adequate transfer of racking and shear loads through the floor diaphragm must comply with the details as shown in "TYPICAL SmartJoist FRAMING" diagram on page 17. In essence, fully block the ends of all joists at their bearing point on external walls, as per one of the options shown in details F1- F4.

This permanent blocking/bracing provides:

1. A satisfactory mechanism to transfer racking loads through the floor diaphragm.
2. Vertical load transfer independent of the floor joist.
3. Support to the end of the floor sheeting (Platform floors only). Heavily loaded furniture legs have been known to cause large deflections and even failures at the edges of sheet flooring.
4. Torsional restraint to the end of floor joists, improving the joists structural performance.



2.0 Interior supports

2.1 Ends of simple spans

Where SmartJoists are discontinuous over interior supports, install the temporary strut bracing as per "SAFETY WARNING" on page 8.

2.2 Continuous spans

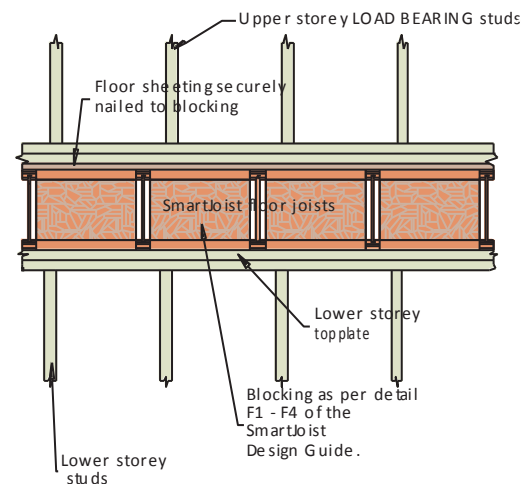
Continuous joists over internal supports do not require blocking, other than the temporary top flange struts as shown in the "SAFETY WARNING" on page 8, except in the following circumstances:

- Load bearing walls bear onto the joists at their support. (Details F7 or F8 apply)
- Shear resistance is required in internal walls (This is a function of shear resistance, and is not related to the structural adequacy of the joist itself.)

3.0 Blocking and wall plates

Wall plates in the frame are required to transfer vertical loads into the support structure below. These wall plates may be supported at 450 or 600 mm ctrs, thus acting as a beam between supports, bending about its weaker axis. When concentrated loads act at the centre of this wall plate, the bending and deflection effects can be quite significant. The full blocking of external and load bearing walls, as shown in details F1-F4, can act as a beam transferring these loads to the support structure below, thus reducing the beam effect of the wall plates.

Unless there is a requirement for double wall plates for a reason OTHER than the beam effect between supports, walls blocked as per detail F1-F4 and general notes #2, #3, and #4 provide sufficient beam action to allow single wall plates.



SmartJoist/SmartRim® Characteristic blocking capacities

SmartRim®

SmartRim rimboard is an alternative solution to blocking with SmartJoists (either long length of cut to length) to support vertical and lateral wall loads as part of a floor or roof framing system.

SmartRim is a 19 or 21 mm LVL (2 veneers are cross laminated for stability) and is sold in 3.6 m lengths, precision ripped to match the height of the SmartJoist range up to and including 360 mm. (400 mm SmartRim in QLD only). Fixing of rimboard is described in detail in **SmartJoist—GENERAL NOTES item 3** on page 8 of this Design Guide.

SmartRim has a joint strength group of JD4 on the wide face for nails, screws and bolts.

| SmartJoist/SmartRim Characteristic capacity (see notes below) | | |
|---|----------|---|
| Vertical load capacity (kN/m) ^{(1) (2)} | | Horizontal load transfer capacity (kN/m) ^{(3) (4)} |
| SmartJoist | SmartRim | 6.9 |
| 29 | 21 | 6.9 |

1. Vertical load capacity above is for instantaneous load conditions and must be multiplied by the appropriate k_1 factor for load condition under consideration
2. Vertical load capacity above already includes the k_{12} factor for up to 400 mm depth as per clause I2.3 of AS 1720.1
3. Horizontal load capacity above is an instantaneous load condition, with the k_1 for lateral bracing loads usually 1.0
4. The above horizontal load capacity is limited by the fixing of the SmartJoist / SmartRim to the frame and can ONLY be achieved if the fixing detail on page 8 of this SmartJoist Design Guide is strictly adhered to.

Penetrations within SmartJoist and SmartRim blocking

The maximum allowable hole size for a SmartJoist/SmartRim shall be $\frac{1}{3}$ of the rim board depth as shown below.

The length of the SmartJoist/SmartRim segment containing a hole shall be at least 8 times the hole size.

| SmartJoist hole sizes and corresponding minimum length | | |
|--|---|---|
| SmartJoist/SmartRim Depth (mm) | Maximum allowable hole size ^{(a) (b)} (mm) | Minimum length of SmartJoist/SmartRim board segment ^(c) for the maximum allowable hole size (mm) |
| 200 | 130 | 1050 |
| 240 | 160 | 1280 |
| 300 | 200 | 1600 |
| 360 | 235 | 1900 |
| 400 | 265 | 2100 |

- (a) These hole provisions do not apply to SmartJoist/SmartRim installed over openings such as doors or windows
- (b) The diameter of the round hole or the longer dimension of the rectangular hole
- (c) The lengths of the SmartJoist/SmartRim segment per wall line. For multiple holes, the minimum length of SmartJoist/SmartRim segment shall be 8 times the sum of all hole sizes

Application Notes

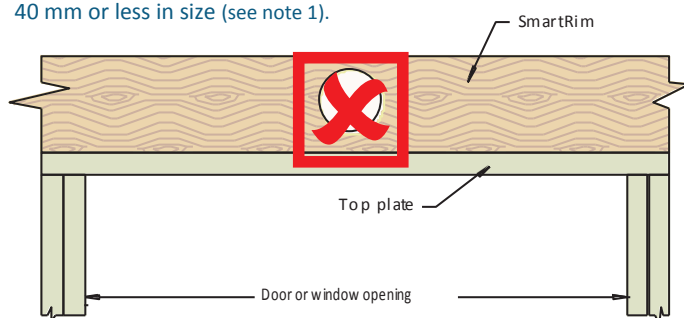
1. Do not cut holes in SmartRim installed over openings, such as doors or windows, where the SmartRim is not fully supported, except that holes of 40 mm or less in size are permitted provided they are positioned at the middle depth and in the middle $\frac{1}{3}$ of the span (see note 5 for minimum hole spacing).

2. Field-cut holes should be vertically centred in SmartRim and at least one hole diameter or 150 mm whichever is less, clear distance away from the end of the wall line. Holes should never be placed such that they interfere with the attachment of the rim board to the ends of the floor joist, or any other code-required nailing.

3. While round holes are preferred, rectangular holes may be used providing the corners are not over-cut. Slightly rounding corners or pre-drilled corners with a 25 mm diameter bit is recommended.

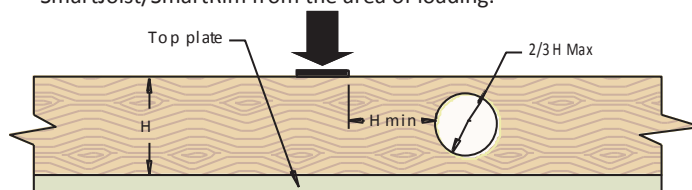
SmartRim over an opening

Do not cut holes in SmartRim over an opening except for holes of 40 mm or less in size (see note 1).



SmartJoist/SmartRim near concentrated vertical load

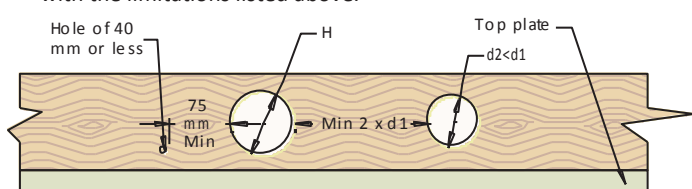
4. When concentrated loads are present on the SmartJoist/SmartRim (loads not supported by any other vertical-load-carrying members such as squash blocks), holes should not be placed in the SmartJoist/SmartRim within a distance equal to the depth of the SmartJoist/SmartRim from the area of loading.



5. For multiple holes, the clear spacing between holes shall be at least two times the diameter of the larger hole, or twice the length of the longest rectangular hole. This minimum hole spacing does not apply to holes of 40 mm or less in diameter, which can be placed anywhere in the rim board (see note 1 for holes over opening) except that the clear distance to the adjacent hole shall be 75 mm minimum.

Multiple holes for SmartJoist/SmartRim

6. All holes shall be cut in a workman-like manner in accordance with the limitations listed above.



Joist hangers

Joist hanger selection

The joist hangers below have been developed specifically for the flange widths for SmartJoists are manufactured using Z275 light-gauge steel, having zinc coating of 275 gsm (total weight). AS1684.2-2010 and AS1684.3-2010-Australian Standards for Residential Timber Frame Construction stipulates a minimum Z275 steel for all sheet metal products used in an internal environment.

Other joist hangers may be used with SmartJoists but it is the responsibility of the specifier of these alternative joists hangers to ensure that:

- they suit the SmartJoist flange widths and do not require any cutting or packing of the flanges
- they are manufacturer from Z275 light-gauge steel
- they have the adequate capacity for the anticipated end reaction

Fixing of joist hangers

- Hand driven nails** - The joist hangers in the table below are supplied by Tilling Timber as part of a SmartFrame order with the manufacturer recommended nails. All holes are to be filled with the specified nails in order to achieve the stated hanger capacity.
- Gun nails** - While the use of gun nails may be common, unless the gun nails are of a minimum

40 x 3.33 diameter, the hanger capacities listed cannot be assumed

- Screws**—The equivalent number of 35 x 6 gauge bugle-head or wafer-head wood screws may be used in lieu of the supplied nails. Increased capacities can be achieved by using screws. Advice on the capacities of the joist hangers listed below with screws replacing the nails can be obtained by contacting the SmartData Customer Helpline on 1300 668 690.

Corrosion protection

The standard range of joist hangers made from Z275 light-gauge steel, having zinc coating of 275 gsm is adequate only for INTERNAL applications in most corrosion environments, except areas that are classified as heavy industrial or those subject to high humidity (e.g. enclosed swimming pools) etc. Under these circumstances, seek advice from experts as special protection will be required.

Note: INTERNAL areas are those within the building envelope that are kept permanently dry. In areas outside the building envelope that are exposed to repeated wetting (EXTERNAL areas), stainless steel products or equivalent should be considered. Some alternatives include hot dip galvanised or powder coated steel, which are not Tilling Timber stock items.

For more detailed information contact the SmartData Customer Helpline on 1300 668 690 or at smartdata@tilling.com.au.

| SmartJoist | face mount code | down hanger capacity ΦkN * | face nails | nail size | top mount code | down hanger capacity ΦkN * | face nails to support | top nails | nails to joist | nail size (mm) |
|--------------------------|-----------------|----------------------------|------------|-----------|-------------------------|----------------------------|-----------------------|-----------|----------------|----------------|
| Single joist face mounts | | | | | Single joist top mount | | | | | |
| SJ20044 | 20044F | 6.2 | 8 | 3.75 x 40 | 20044T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ24040 | 24040F | 7.8 | 10 | 3.75 x 40 | 24040T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ24051 | 24051F | 7.8 | 10 | 3.75 x 40 | 24051T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ24070 | 24070F | 7.8 | 10 | 3.75 x 40 | 24070T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ24090 | 24090F | 7.8 | 10 | 3.75 x 40 | 24090T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ30040 | 30040F | 9.3 | 12 | 3.75 x 40 | 30040T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ30051 | 30051F | 9.3 | 12 | 3.75 x 40 | 30051T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ30070 | 30070F | 9.3 | 12 | 3.75 x 40 | 30070T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ30090 | 30090F | 9.3 | 12 | 3.75 x 40 | 30090T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ36058 | 36058F | 10.9 | 14 | 3.75 x 40 | 36058T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ36090 | 36090F | 10.9 | 14 | 3.75 x 40 | 36090T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| SJ40090 | 40090F | 10.9 | 14 | 3.75 x 40 | 40090T | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| Double joist face mounts | | | | | Double joist top mounts | | | | | |
| 2/SJ20044 | 20044DF | 6.2 | 8 | 3.75 x 40 | N/A | | | | | |
| 2/SJ24040 | N/A | | | | 24040DT | | | | | |
| 2/SJ24051 | 24051DF | 7.8 | 10 | 3.75 x 40 | 24051DT | 4.8 | 2 | 2 | 4 | 3.75 x 40 |
| 2/SJ24070 | 24070DF | 7.8 | 10 | 3.75 x 40 | 24070DT | 4.8 | 2 | 2 | 4 | 3.75 x 40 |
| 2/SJ24090 | 24090DF | 7.8 | 10 | 3.75x40 | 24090DT | 5.7 | 2 | 4 | 2 | 3.75 x 40 |
| 2/SJ30040 | N/A | | | | N/A | | | | | |
| 2/SJ30051 | 30051DF | 8.7 | 12 | 3.75 x 40 | 30051DT | 4.8 | 2 | 2 | 4 | 3.75 x 40 |
| 2/SJ30070 | 30070DF | 8.7 | 12 | 3.75 x 40 | 30070DT | 4.8 | 2 | 2 | 4 | 3.75 x 40 |
| 2/SJ30090 | 30090DF | 8.7 | 12 | 3.75 x 40 | 30090DT | 5.7 | 2 | 4 | 2 | 3.75 x 40 |
| 2/SJ36058 | N/A | | | | 36058DT | 4.8 | 2 | 4 | 2 | 3.75 x 40 |
| 2/SJ36090 | N/A | | | | 36090DT | 5.7 | 2 | 4 | 2 | 3.75 x 40 |

Joist hangers

Specialised joist hangers

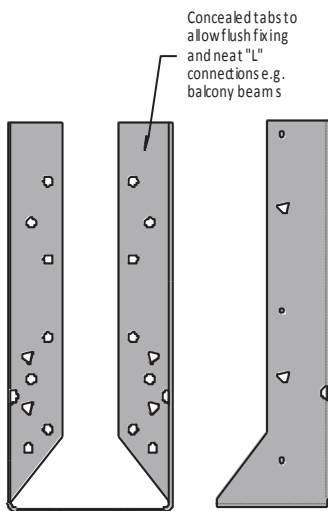
A range of more specialised joist hangers are available from Tilling Timber, some will be stock items and others will have a lead time before they could be supplied.

Specifiers of these more specialised brackets should contact Tilling Timber during the design phase of the project to ascertain:

1. What brackets are available that would best suit the proposed application
2. The lead time before selected joist hangers could be supplied
3. Whether SmartFrame engineers are required to design individual member connections

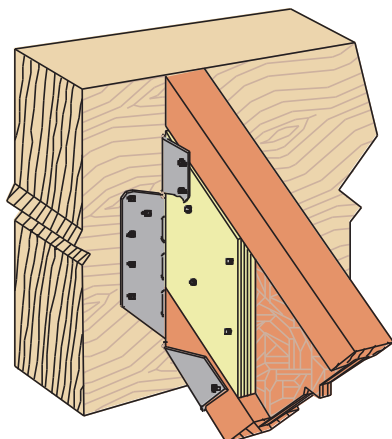
Example specialised brackets/connectors

Internal Flange Hangers - A range of internal flange hanger is available to suit 'L' shape connections and the edge joist in SmartJoist cassette floors



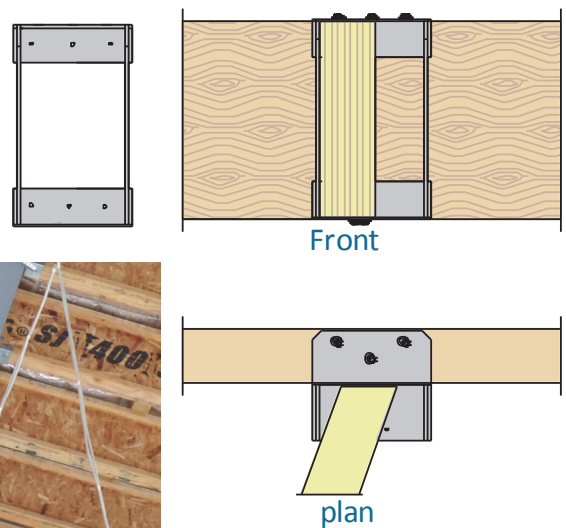
SmartJoist rafter brackets - Access is available to a range of rafter brackets especially designed to make use of the exceptional strength to weight ratio of SmartJoists and apply it to roof member applications. Rafter brackets available include:

1. Variable slope rafter connectors
2. Variable slope and skew rafter connectors
3. Variable ridge connectors



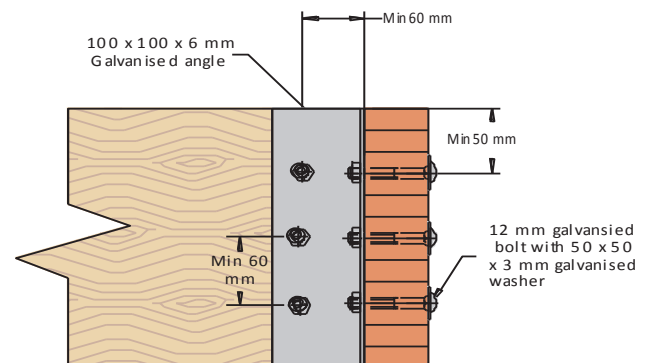
Heavy duty roof beam supports - Tilling Timber has access to a range of heavy duty support brackets for all applications including brackets especially designed to cater for supported beam at a wide range of angles.

An example is the Pryda® BBT125240 shown below



Individual designs - There are occasions where a generic off the shelf bracket is available for a particular application.

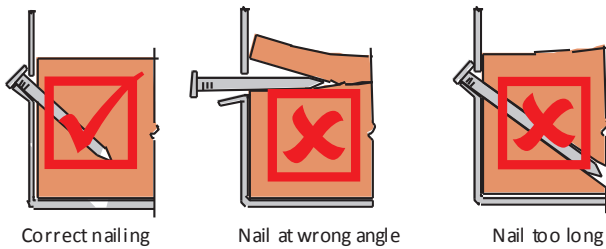
In certain circumstances, SmartFrame engineers may be available to provide individual designs on a fee for service basis for users of SmartFrame product. (conditions apply)



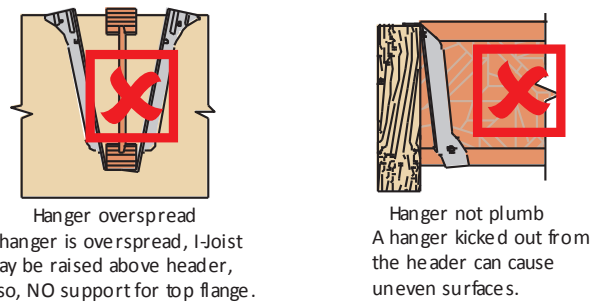
For more detailed information contact the SmartData Customer Helpline on 1300 668 690 or at smartdata@tilling.com.au.

General connector installation details

Positive angle nailing

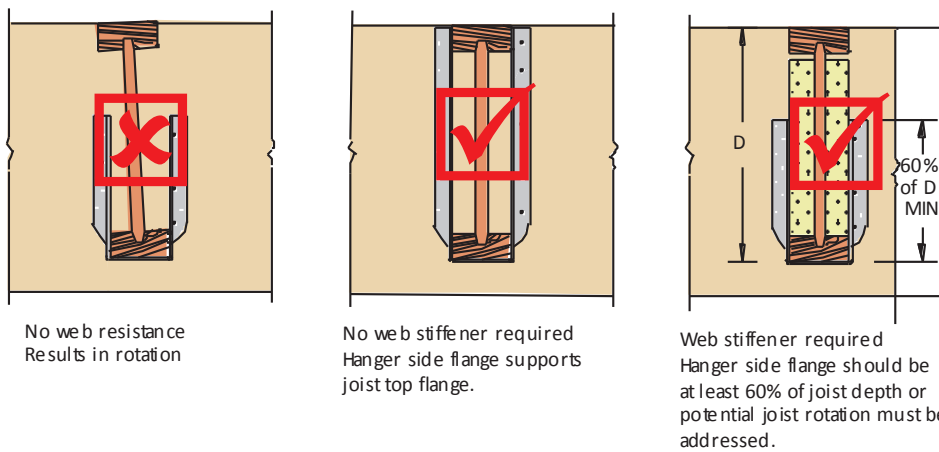


Top mount hangers



Prevent rotation

Hangers provide some joist rotation resistance; however, additional lateral restraint may be required for deep joists.



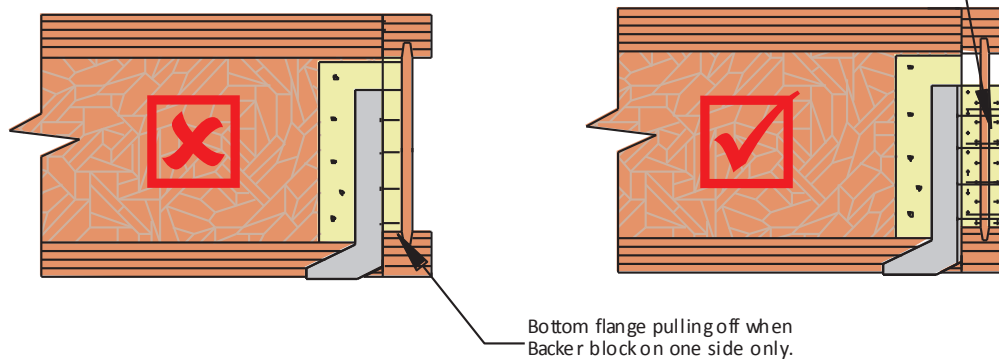
Correct fasteners



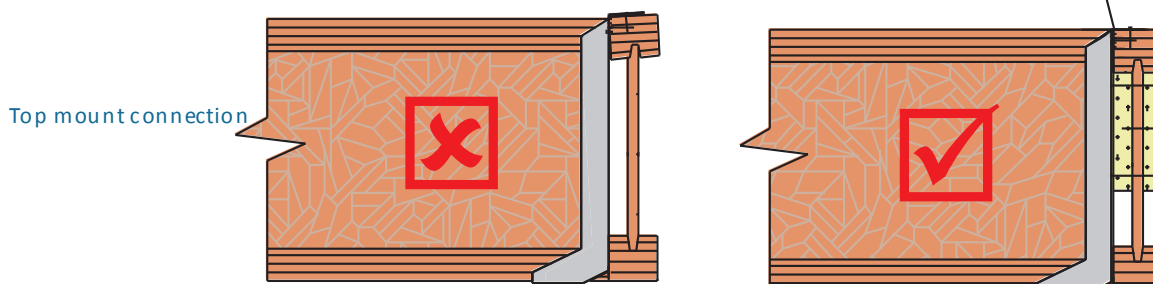
Bracket capacities are based upon using the correct bracket nail as per the table on page 11. Bracket nails have special heads to provide strength. Clouts, brads etc are NOT suitable as bracket nails

SmartJoist headers

Backer blocking each side, hanger nails must extend past the supporting joist's web member into the backer blocking.

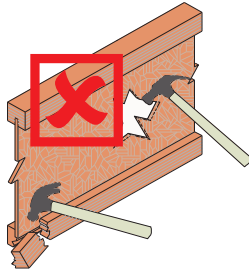


The top flange of the supporting joist must be supported by backer blocks to prevent cross grain bending and rotation.

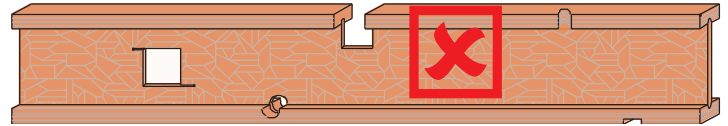


Field repair to damaged SmartJoists

Don't make holes with a hammer other than tapping out pre-punched knockouts



Don't hammer on flanges and damage joist



Do not cut or notch flanges
Do not overcut holes in web

SmartJoists are sophisticated Engineered Timber products, and must be treated accordingly. Damage to key components, while affecting only a small percentage of the cross section may be sufficient to render the SmartJoist unsuitable for the purpose.

It is therefore recommended that damage to joists and the possibility of repair be referred to the SmartData Customer Helpline on 1300 668 690 or at smartdata@tilling.com.au for advice.

Flange damage

- Flange damage becomes more critical the nearer it is to mid-span or an interior support. Flange damage is less critical in close proximity to an end support.
- How much flange damage is acceptable? A rule of thumb is "If you have to ask, it's too much". A saw kerf that knicks the corner of a flange on one lightly-loaded joist could well be acceptable.
- A joist with unacceptable flange damage cannot be repaired, rather a new joist must be added to take its place. The damaged joist does not have to be removed. Consult SmartJoist and SmartLVL tables to find an acceptable new joist that is shallower than the damaged joist so installation is easier. Consider double and triple joists. If the damaged joist is multi-span, the new joist only needs to go across the span(s) where the damage occurs.
- A single damaged joist can sometimes be trimmed off of adjacent undamaged joists (run a calculation within the SmartFrame software).

Web damage

- Web damage becomes more critical the nearer a support. Web damage is less critical near mid-span.
- Web holes can be too big to repair. A flange-to-flange rectangular hole longer than 450 mm located at mid-span probably warrants a new joist. A 150 mm round hole located right by a support probably warrants a new joist. Consult SmartJoist and

SmartLVL tables to find an acceptable new joist that is shallower than the damaged joist so installation is easier. Consider double and triple joists. If the damaged joist is multi-span, the new joist only needs to go across the span(s) where the damage occurs.

- A single damaged joist can sometimes be trimmed off of adjacent undamaged joists (run a calculation within the SmartFrame software)
- Damage that could be confidently repaired in a single, isolated joist, might be judged too severe to repair if several, adjacent joists are involved
- If several small holes violate the 2x diameter proximity rule, but would fit inside a single acceptable hole, then the group of small holes is OK
- Hole repairs generally require a reinforcement that covers the full depth of the web and extends at least 300 mm past each side of the hole.

Damage report information required

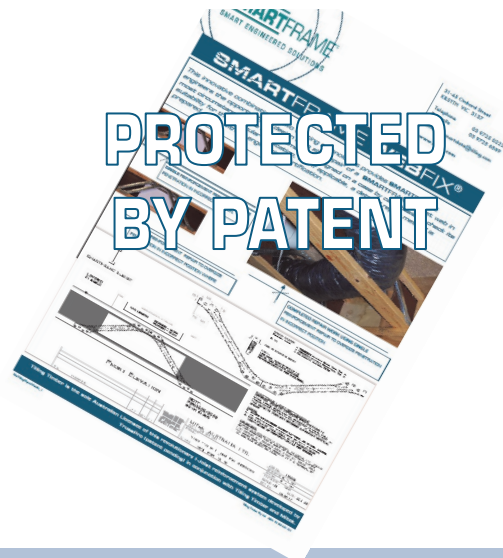
1. In order to design a repair, the SmartFrame engineer will have to know all of the design information that is required to run SmartFrame software.
2. Provide a sketch of the damage showing its size, shape and location on the joist.
3. Indicate whether a pipe, duct, conduit, etc. must remain and be accommodated.
4. Indicate how many adjacent joists are affected in each case.

Field repairs to damaged SmartJoist webs

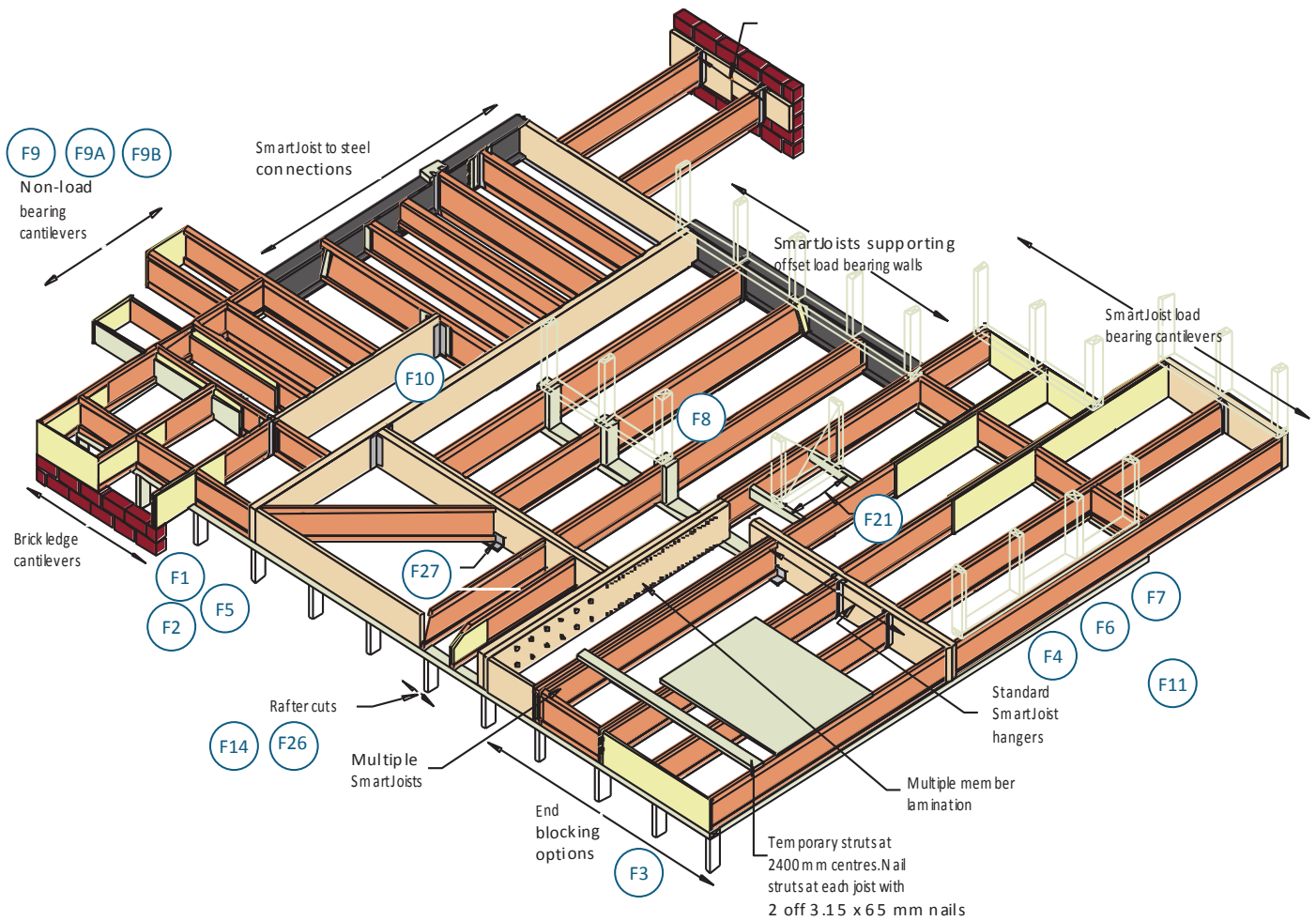
The SmartFrame system now includes the WebFix[®] (web reinforcement) developed to be a rapid "repair" to webs where penetrations have been placed at inappropriate locations, penetrations too large or other web damage which diminishes the strength of the member. This repair system is unique to SmartJoist applications.

Tilling Timber is the SOLE Australian distributor of this PATENTED system, which in most cases can be fixed around services that have been installed through the web penetrations.

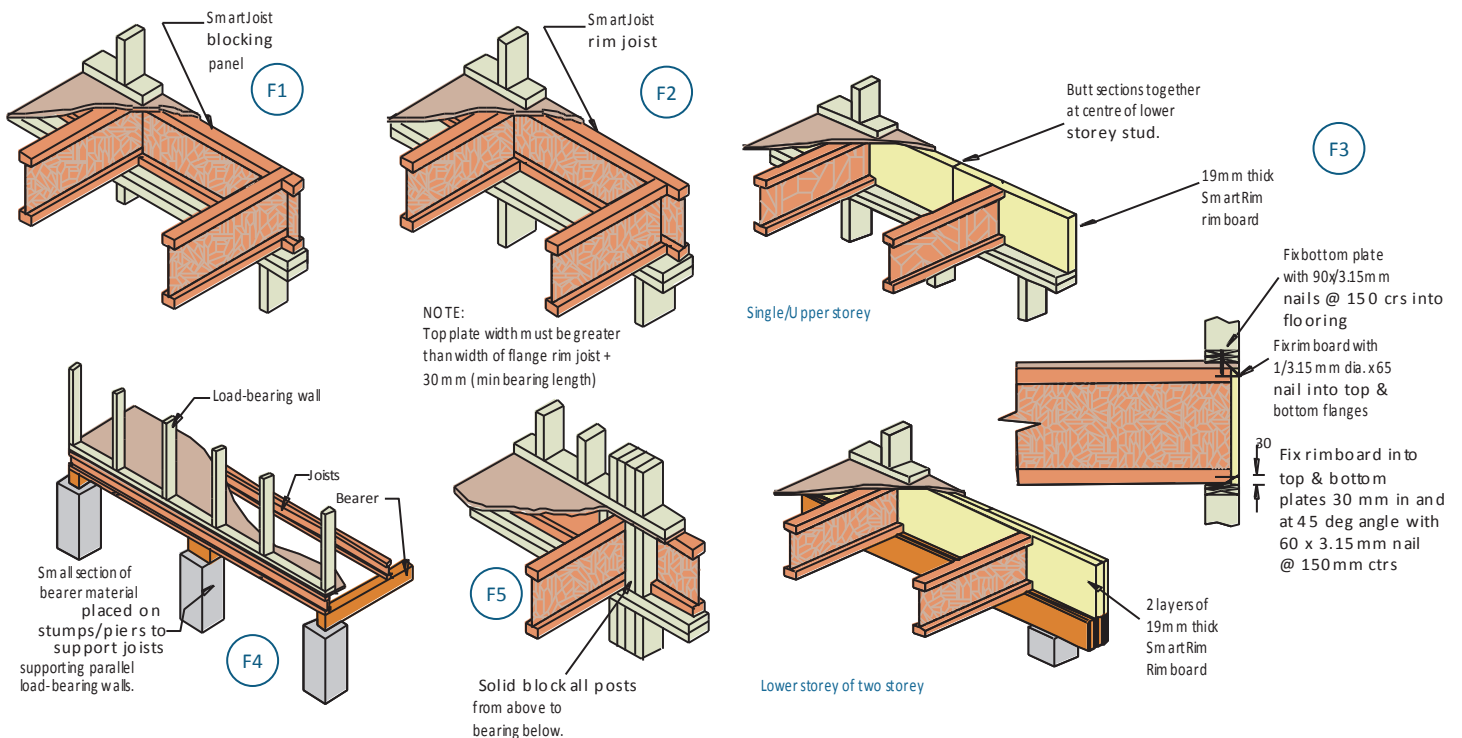
The WebFix[®] does need to be designed into each situation by SmartFrame engineers and can ONLY be purchased from Tilling offices after the structural design is completed.



Typical SmartJoist floor framing



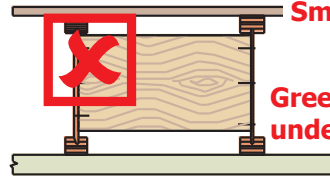
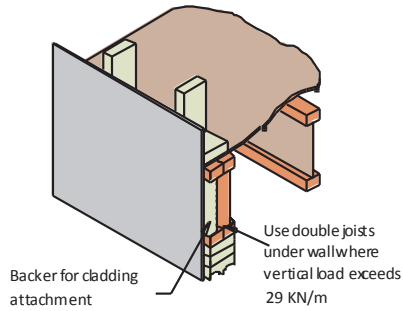
Typical SmartJoist floor construction details



Note:
To achieve the necessary racking resistance through the floor diaphragm, it is important that the nailing provisions of the floor sheeting to the joists as described in AS 1684 (AS 1869 for particle board) be adopted to nail the floor sheeting to the Rim Joist or SmartRim in details F1-F3

Typical SmartJoist floor construction details (cont'd)

F6



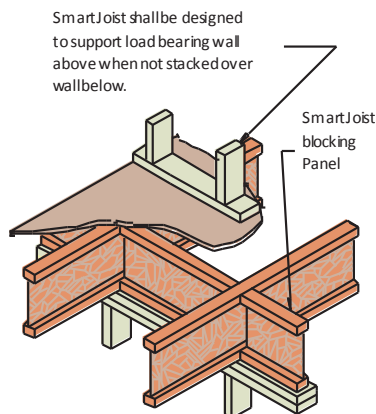
WARNING - Correct blocking for SmartJoists

Green timber shall not be used under any circumstance

All blocking shall be carried out as per details F1-F3, with blocking to extend to both flanges and skew nailed with 3.15 Φ x 65 nails, one each side of top and bottom flange.

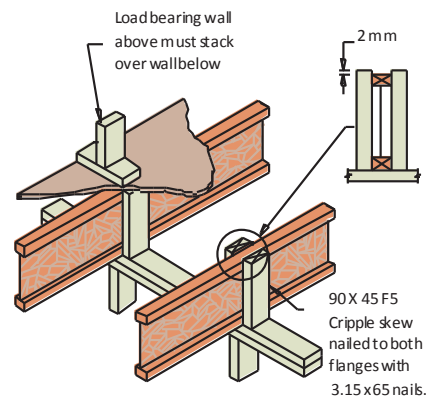
Interior loading bearing and bracing walls

F7



NOTE: Detail F7 with blocking panel is required for bracing walls.

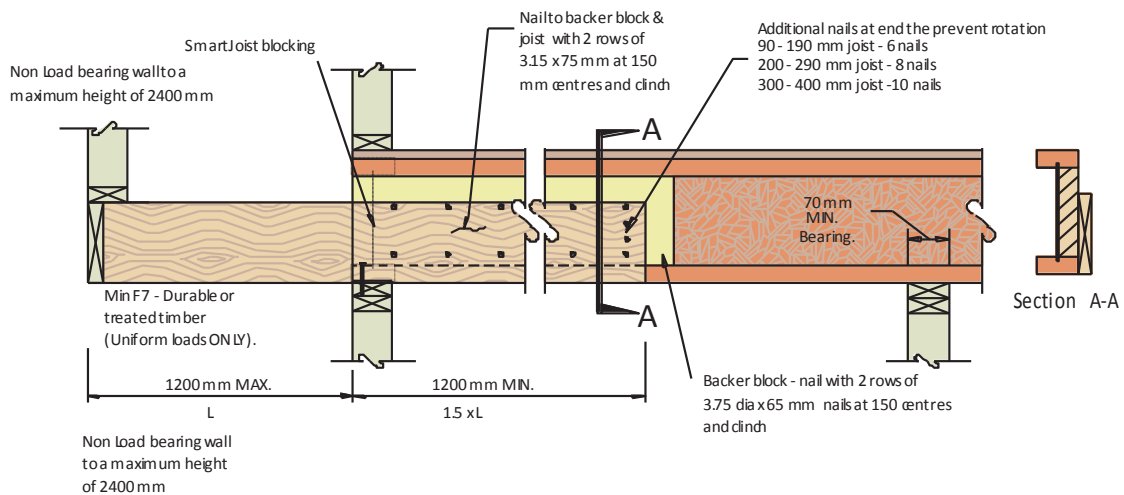
F8



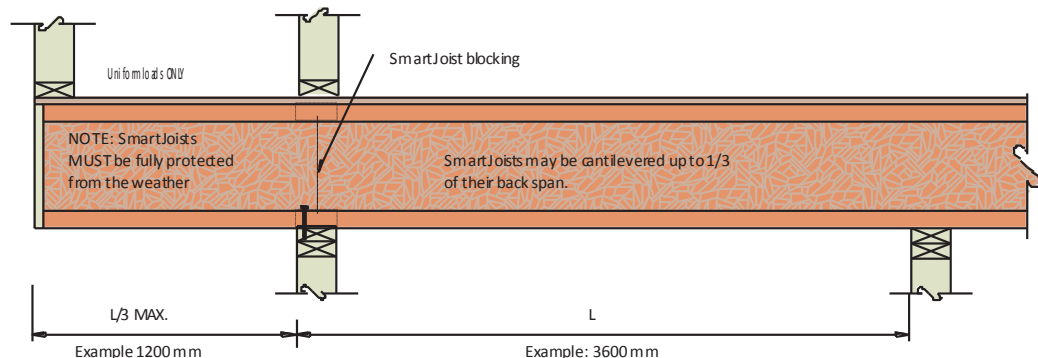
Non load bearing cantilevers (balconies)

Example cantilever spans and minimum back spans for this detail are shown in the table on the next page

F9



F9a



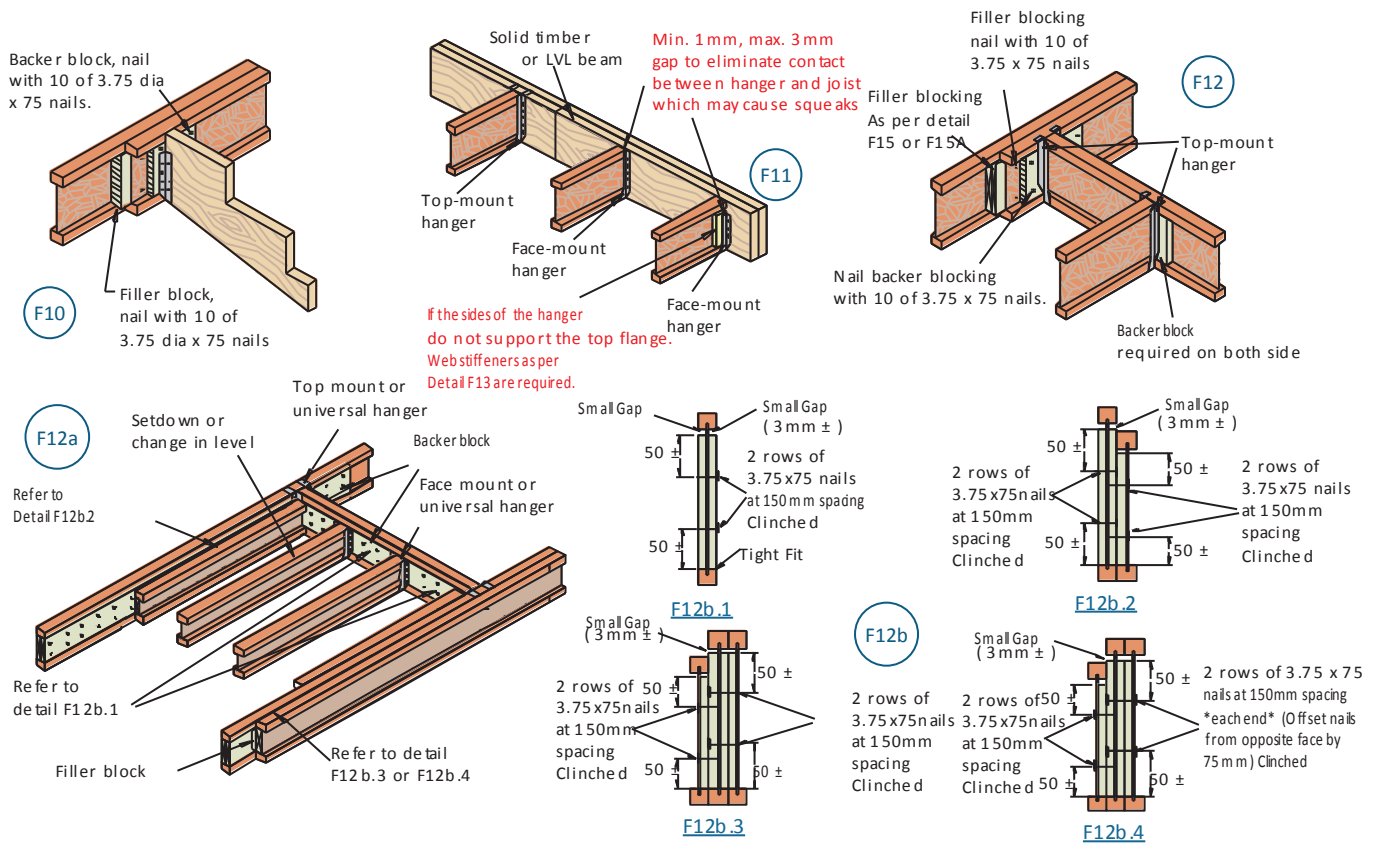
For cantilevered joists supporting load bearing walls see details C1-C4

Cantilevered balconies as per detail F9 and F9A

Loadings: Permanent Loading G: self weight + 40 kg/m² + 0.6 kPa of live load permanently applied,
live load Q: 2.0 kPa or 1.8 kN point live load, 1.5 kN/m acting at end of cantilever

| Cantilever material | Joist spacing (mm) | 300 | | 400 | | 450 | | 600 | |
|---------------------|--------------------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|
| | | Cantilever | Back span | Cantilever | Back span | Cantilever | Back span | Cantilever | Back span |
| H3 SmartLVL 15 | 150 x 42 | 1.0 | 1.5 | 1.0 | 1.5 | 1.0 | 1.5 | 0.9 | 1.4 |
| | 170 x 42 | 1.2 | 1.8 | 1.1 | 1.7 | 1.1 | 1.7 | 1.1 | 1.7 |
| | 200 x 42 | 1.4 | 2.1 | 1.3 | 2.0 | 1.3 | 2.0 | 1.3 | 2.0 |
| | 240 x 42 | 1.7 | 2.6 | 1.6 | 2.4 | 1.6 | 2.4 | 1.5 | 2.3 |
| | 300 x 42 | 2.1 | 3.2 | 2.0 | 3.0 | 2.0 | 3.0 | 1.9 | 2.9 |
| H3 MGP 10 | 140 x 45 | 0.7 | 1.1 | 0.7 | 1.1 | 0.7 | 1.1 | 0.7 | 1.1 |
| | 190 x 45 | 1.1 | 1.7 | 1.1 | 1.7 | 1.1 | 1.7 | 1.1 | 1.7 |
| | 240 x 45 | 1.5 | 2.3 | 1.4 | 2.1 | 1.4 | 2.1 | 1.4 | 2.1 |

Backer and filler blocks

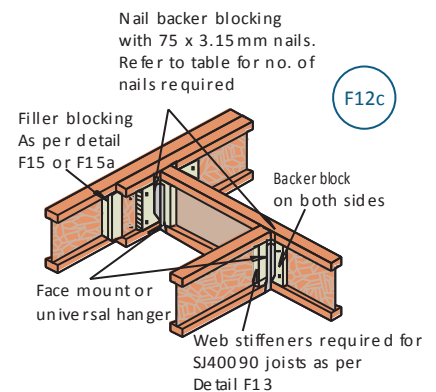


Filler block and web stiffeners

| SmartJoist code | Recommended filler block | Web stiffener material | |
|-----------------|--------------------------|------------------------|-----------|
| | | stiffener | nails |
| SJ20044 | 120x35 | 15x60 mm ply | 4-3.15x65 |
| SJ24040 | 140x35 | 15x60 mm ply | 4-3.15x65 |
| SJ24051 | 140x45 | 19x60 mm ply | 4-3.15x65 |
| SJ24070 | 150x58 LVL | 2/15x60 mm ply | 4-3.15x65 |
| SJ24090 | 2/140x45 | 2/19x60 mm ply | 5-3.15x65 |
| SJ30040 | 190x35 | 15x60 mm ply | 4-3.15x65 |
| SL30051 | 190x45 | 19x60 mm ply | 4-3.15x65 |
| SJ30070 | 150x58 LVL | 2/15x60 mm ply | 4-3.15x65 |
| SJ30090 | 2/190x45 | 2/19x60 mm ply | 5-3.15x65 |
| SJ36058 | 250x50 | 2/12x60 mm ply | 5-3.15x65 |
| SJ36090 | 2/240x45 | 2/19x60 mm ply | 5-3.15x65 |
| SJ40090 | 2/240x45 | 2/ ply | 5-3.15x65 |

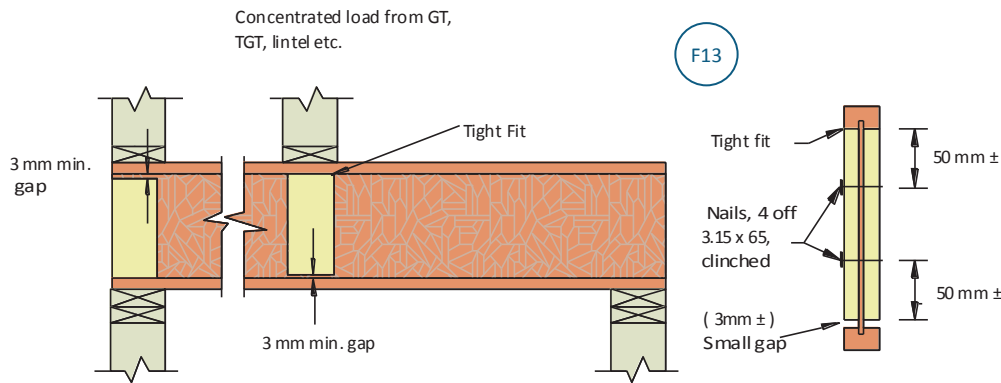
NOTES :

1. Use plywood sheathing for web stiffener with face grain parallel to long axis of the stiffener.
2. Filler blocks noted are for the general requirements of the details within this design guide.
3. Leave 3 mm gap between top of filler blocks and bottom of top flange.



Concentrated loads on SmartJoists

Web stiffeners under concentrated loads are required as shown below for concentrated loads that exceed 6.5 kN ONLY.

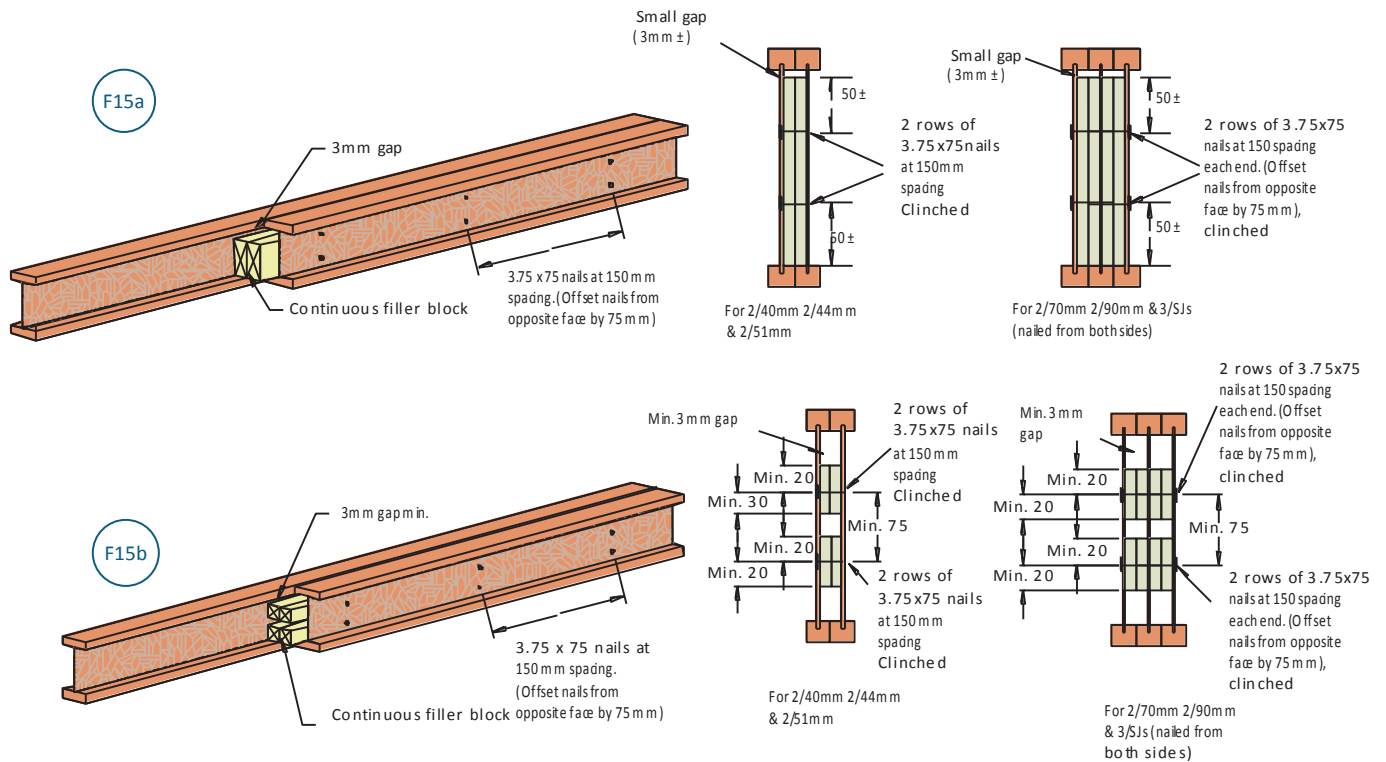


NOTE:

1. Web stiffeners are NOT required at end bearing supports when span length are taken from the SmartJoist Design Guide, except where they are required to prevent rotation if the joist hanger does not laterally restrain the top flange
2. Web stiffeners may be required at inner supports under concentrated loads. Consult the appropriate tables.

Multiple SmartJoist members

(a) filler blocks

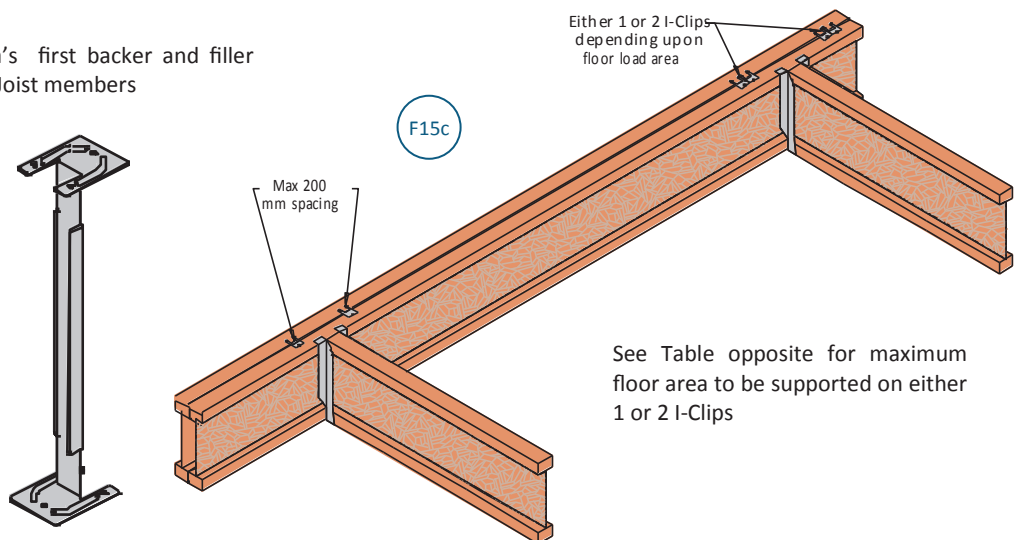


(b) SmartJoist I-Clips

The SmartFrame I-Clip is Australia's first backer and filler free solution to join multiple SmartJoist members

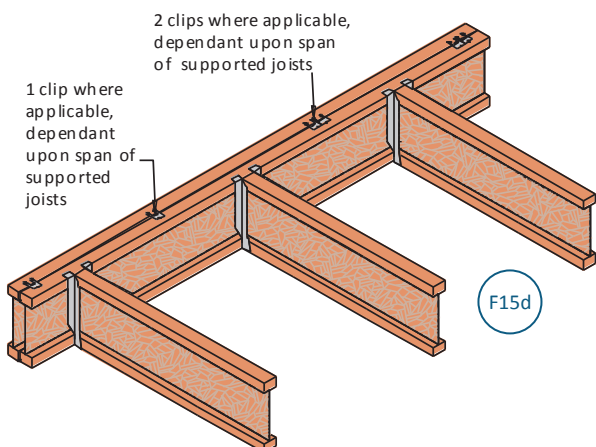
2 ply SmartJoist supporting concentrated loads

| Floor DL (kg/m ²) | Floor live Load (kPa) | Floor area supported (m ²) | |
|----------------------------------|--------------------------|--|---------|
| | | 1 clip | 2 clips |
| 40 | 1.5 | 4.7 | 7.1 |
| 50 | | 4.5 | 6.8 |
| 60 | | 4.3 | 6.5 |
| 75 | | 4.1 | 6.1 |
| 100 | | 3.7 | 5.6 |
| 125 | | 3.4 | 5.2 |



See Table opposite for maximum floor area to be supported on either 1 or 2 I-Clips

(b) SmartJoist I-Clips (cont'd)



Note:

Table assumes uniform distributed loads ONLY on the supported joists. If concentrated point loads are supported by joists then table for "2 ply SmartJoist supporting concentrated loads" on the previous page should be used instead.

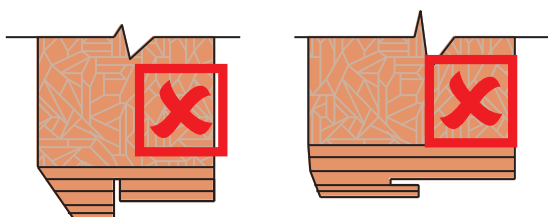
2 ply SmartJoist supporting regular concentrated loads

| Floor DL (kg/m ²) | Floor live Load (kPa) | joist spacing (mm) | Maximum joist span (mm) | |
|----------------------------------|--------------------------|-----------------------|-------------------------|---------|
| | | | 1 clip | 2 clips |
| 40 | 1.5 | 450 | 10500 | 12000 |
| | | 600 | 7900 | 11800 |
| 60 | | 450 | 9600 | 12000 |
| | | 600 | 7200 | 10900 |
| 75 | | 450 | 9100 | 12000 |
| | | 600 | 6800 | 10200 |
| 100 | | 450 | 8300 | 12000 |
| | | 600 | 6200 | 9400 |
| 125 | | 450 | 7700 | 11500 |
| | | 600 | 5700 | 8600 |

Limited end notching at supports

The cutting of notches in the ends of joists may reduce the allowable end reactions of the SmartJoists. The amended end reaction capacities of SmartJoists with a 12 mm notch are as follows:

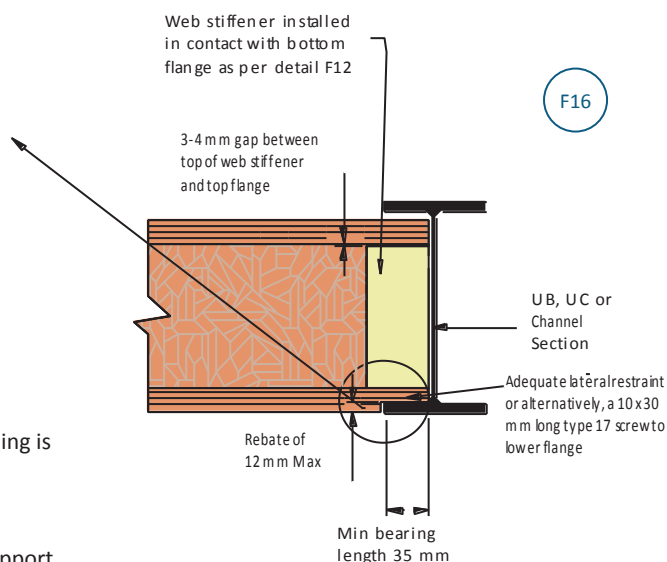
- Without web stiffeners - 80% of allowable end reaction
- With added web stiffeners (as per detail F13) - Full end reaction capacity.



Do not over cut flanges. Substantial reductions in capacity may occur if flanges are over cut.

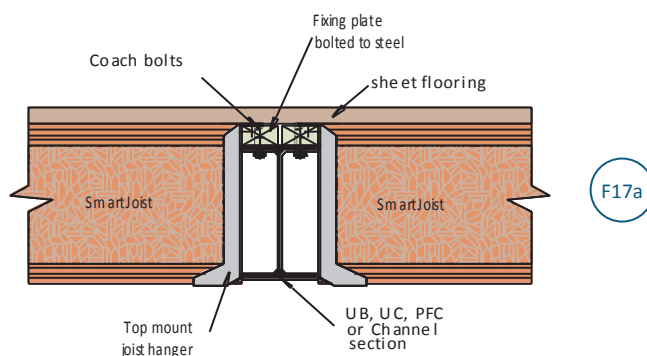
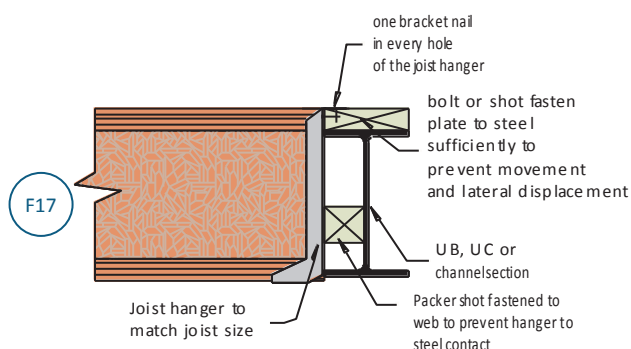
To maintain the end reaction capacities above, end flange notching is strictly limited to:

1. Notch depths NOT greater than 12 mm
2. Notches cleanly cut - NO over cutting
3. Notch length not to exceed more than 5 mm past the support.

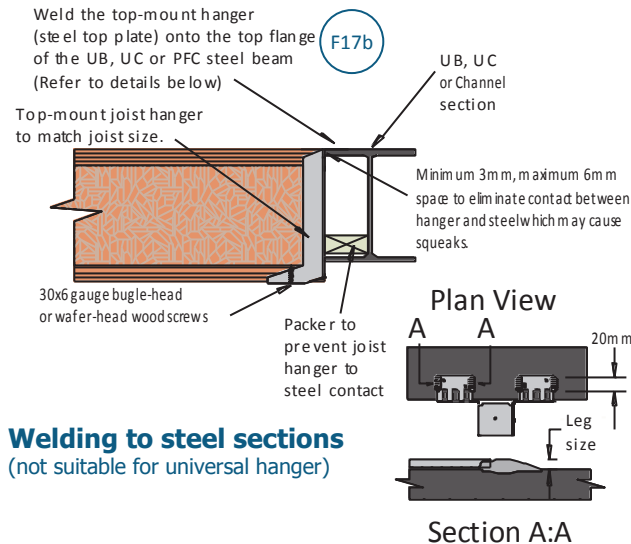


Example fixing of SmartJoists to steel beams

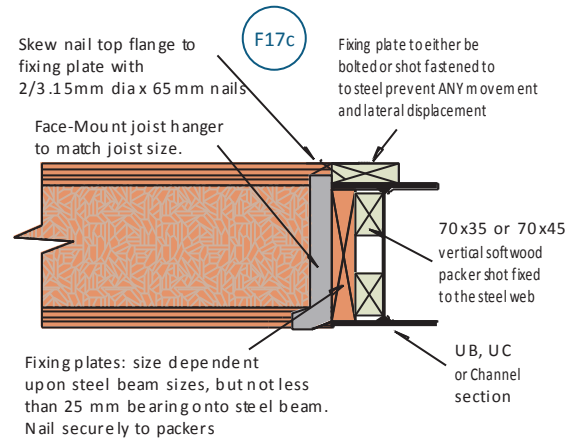
(a) Top mount or universal hangers



Example fixing of SmartJoists to steel beams



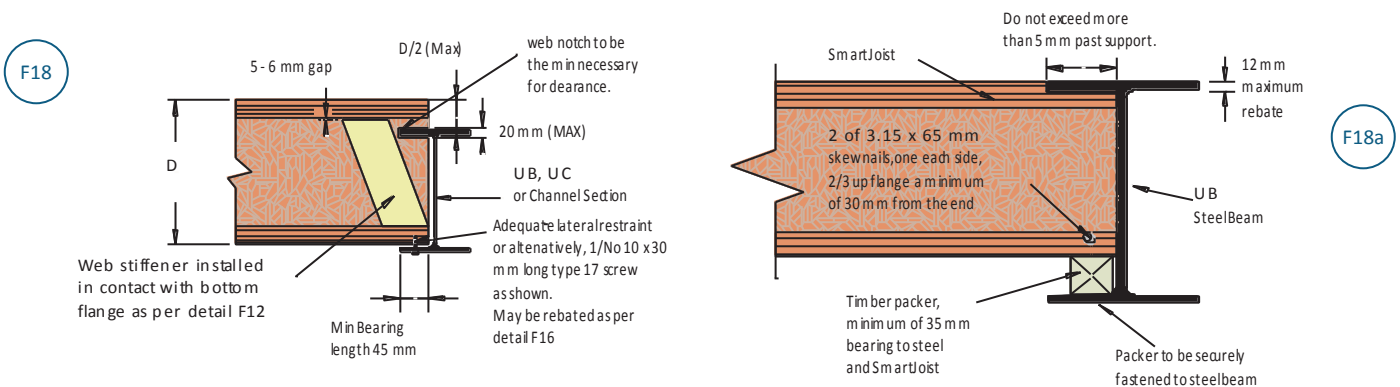
Welding to steel sections (not suitable for universal hanger)



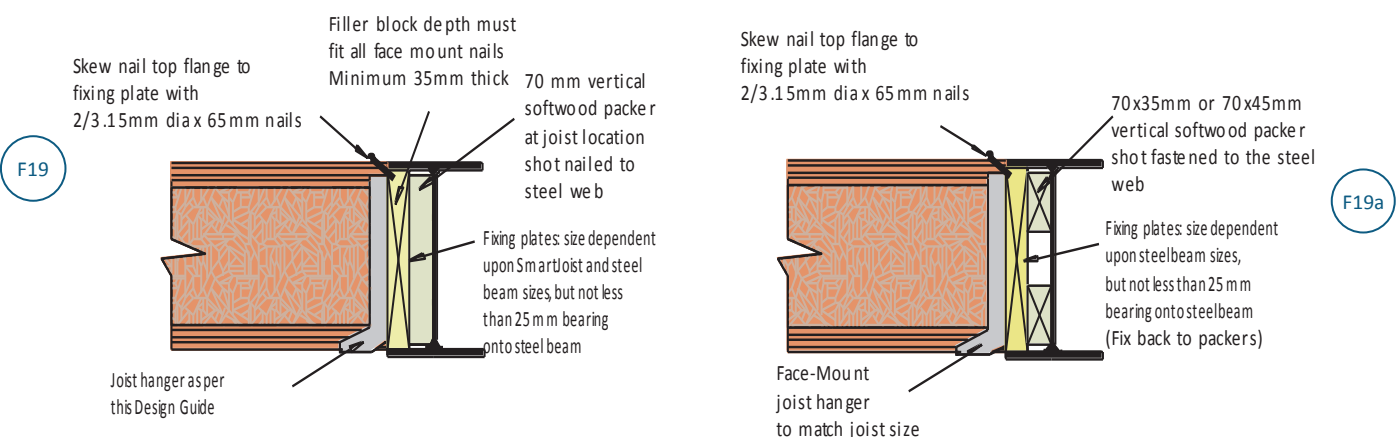
The welding of top mount SmartJoist hangers to common steel sections (UB, UC etc. must be carried out strictly as follows:

1. Supporting steel section must be thoroughly cleaned to remove black scale, rust, paint etc.
2. Clamp top flange of bracket hard up against steel section
3. Apply fillet weld to lap joint with the minimum weld length of 20 mm with a leg size at least the thickness of the metal hanger (see diagram above)
4. Commence weld pool away from the hanger steel to ensure penetration into supporting steel prior to penetration into hanger tab
5. Finish connections with anti-corrosive paint to achieve appropriate corrosion resistance
6. It is essential that welding is conducted under the guidance of an experienced welder

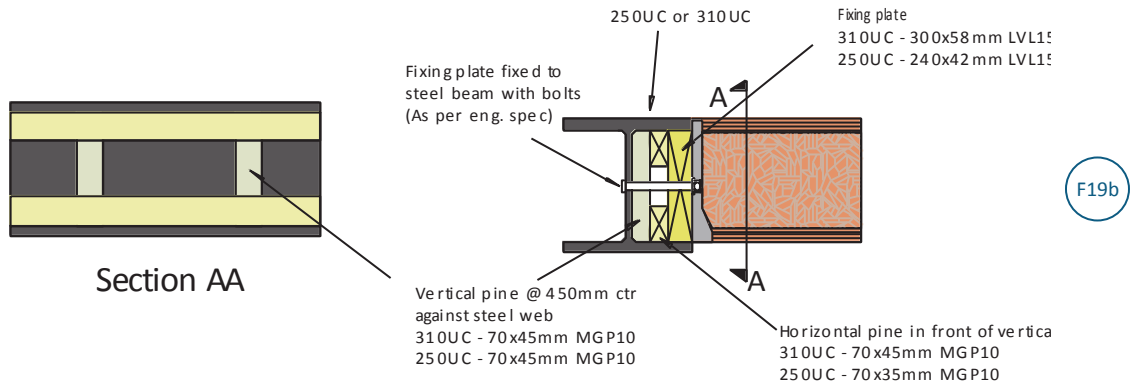
(b) Rebated into steel beam



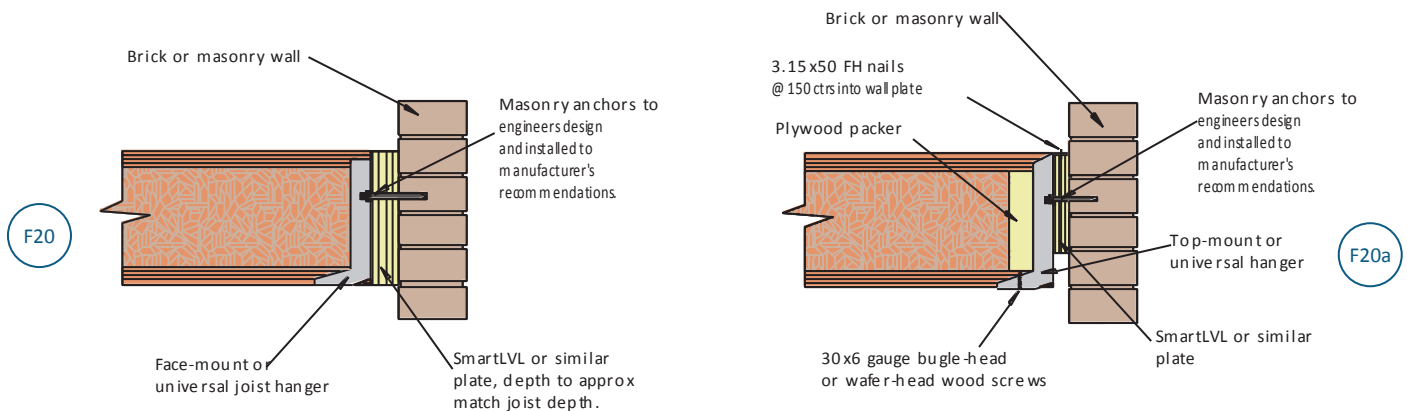
(c) Face mounting to steel



Example fixing of SmartJoists to steel beams (cont'd)



(c) Fixing to masonry walls



Tie down and bracing wall support details

The tie-down needs of the structure are related to the applied wind loads and the effect of bracing walls either parallel or perpendicular to the supporting member. Reference should be made to AS 1684 for further guidance on this issue.

Floor systems are integral in the transfer of all vertical and horizontal loads to the footing system. Methods to transfer both uplifts and bracing loads to the floor system will vary dependent upon:

1. Loads are applied into a structural element that is running parallel to the bracing/tie-down panel
2. Loads are applied into a structural element that is running perpendicular to the bracing/tie-down panel

AS 1684 requires bracing to be approximately evenly distributed and provided in both directions as shown below. Care must be taken with tie down to resist bracing loads because the applied

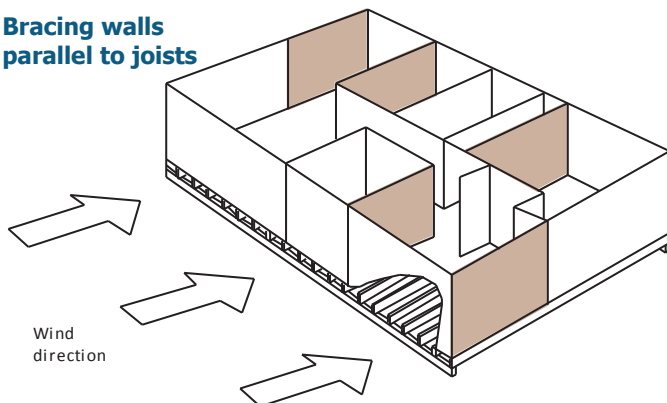
load could be either up or down, whereas the wind uplift forces are always vertically up.

Where the bracing walls are parallel to a floor joist, the joist involved must be designed to resist the applied forces imposed, over and above any gravity and normal live loads associated with the floor system

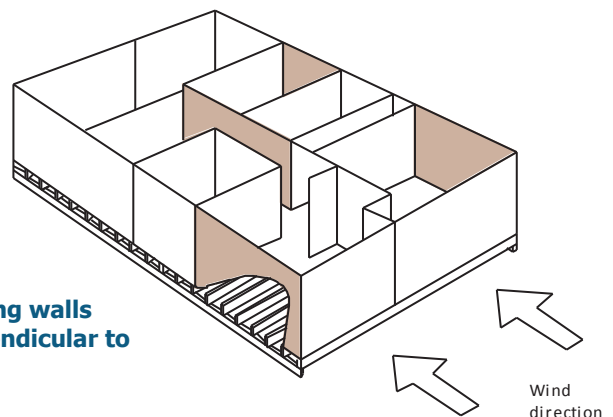
The general details relating to the tie-down provisions of solid end section timber may be adopted for SmartJoists, except that under NO circumstances is it permitted to bolt through either the top or bottom flange, except when the joist is fully supported upon a wall plate or similar as shown below. Care must also be taken to ensure that any bolts etc. drilled through solid timber joists do not compromise the structural integrity of that member.

A conservative solution to bracing walls directly above parallel joists is to adopt a double joist at that location, with the tie down connection bolt running down between the two joists.

Bracing walls parallel to joists



Bracing walls perpendicular to joists



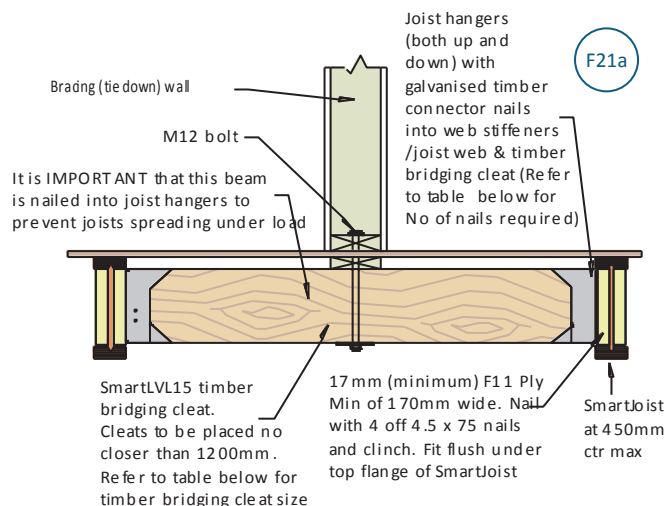
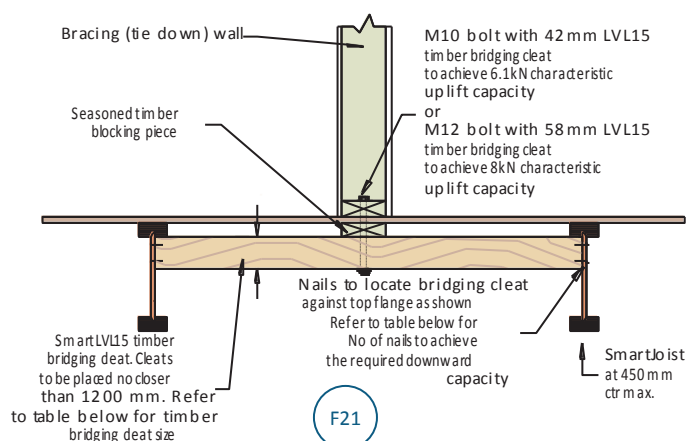
Tie down and bracing wall support details (cont'd)

The tie-down and bracing of any structure is of critical importance to its robustness. While some general guidance on this topic is given in AS 1684 sections 8 and 9 including some specific examples, very little information is provided to designers where the bracing or tie down forces act within a floor diaphragm, or how to transfer the design loads specified in table 8.18 to supporting members.

Below are some examples that may be helpful to designers utilising SmartJoist floor joists but these examples must in no way be a substitute for expert engineering advice from an experienced structural engineer.

Any member, especially tall slender sections typical of floor joists experience significant reduction in strength at the location of a vertical hole. Typically a vertical hole is deemed to have an effect of 1.5 times the diameter of the hole

Bracing walls between parallel joists



Downward force capacities

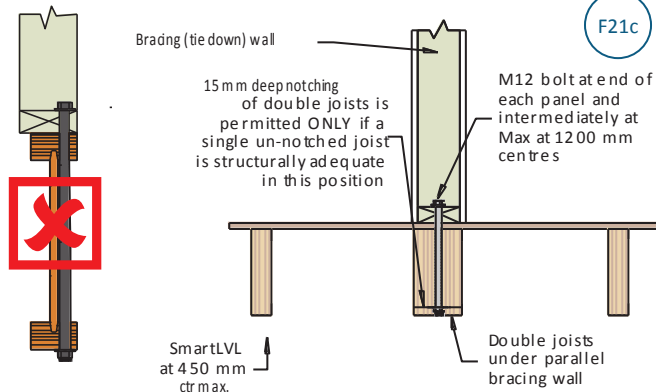
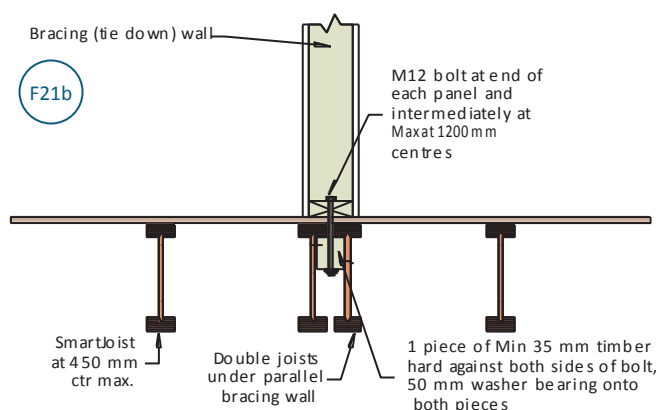
| Timber bridging size (DxB mm) | No of nails through SmartJoist web to bridging | Characteristic capacity (kN) $1.2G + W_{dn}$ |
|-------------------------------|--|---|
| 90x42/58 SmartLVL 15 | 2 | 4.0 |
| 130x42/58 SmartLVL 15 | 3 | 4.9 |
| 170x42/58 SmartLVL 15 | 4 | 5.8 |

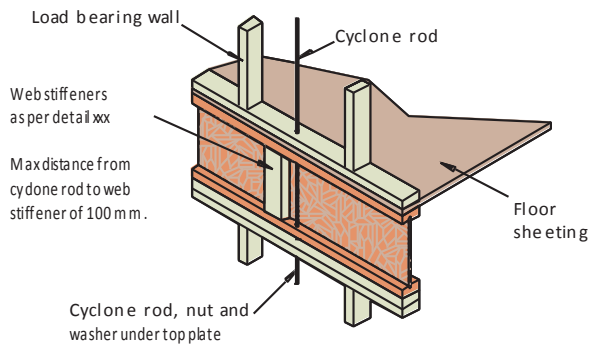
| Timber bridging size (DxB mm) | Hanger code | No of hanger nails into joist | No of hanger nails into bridging | Characteristic uplift and downward capacity (kN) |
|-------------------------------|-------------|-------------------------------|----------------------------------|--|
| 90x58 SmartLVL 15 | FB5890 | 8 | 4 | 9.6 |
| 130x58 SmartLVL 15 | FB58120 | 12 | 6 | 13.6 |
| 170x58 SmartLVL15 | FB58170 | 20 | 10 | 20.0 |

Bracing walls vertically above parallel joists

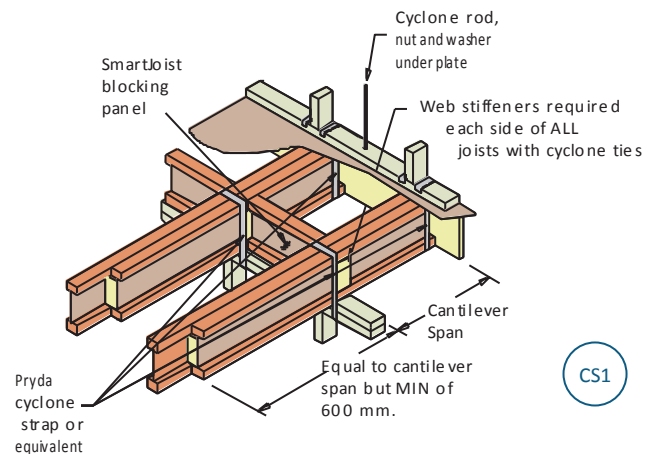
Do not drill through either flange of SmartJoists unless they are fully supported on wall plate or similar

Do not drill through single members unless the whole member is re-analysed with a reduced cross section at the hole location





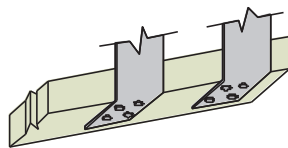
Cyclone rod tie down for cantilevered SmartJoist floors



CS1

Cyclone strap capacities

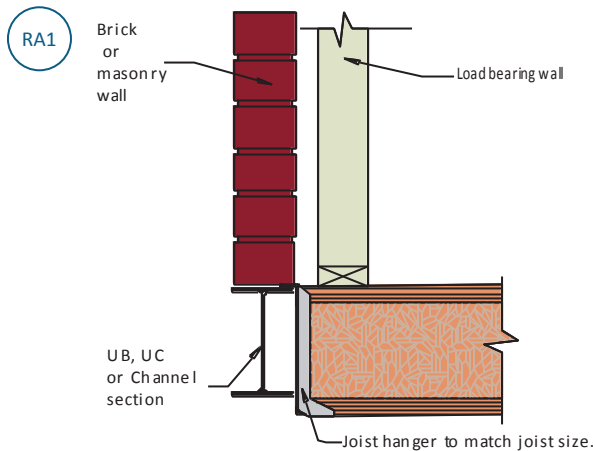
Where the strap ends of the cyclone strap are wrapped around the wall plate or other timber member and are fixed with 4 of 3.15 Ø x 35 nails, the design capacity ϕN_t of 15.3 kN is applicable, regardless of the timber joint group. Tests have proven that bending the legs of cyclone straps around the timber increases the ultimate load capacity.



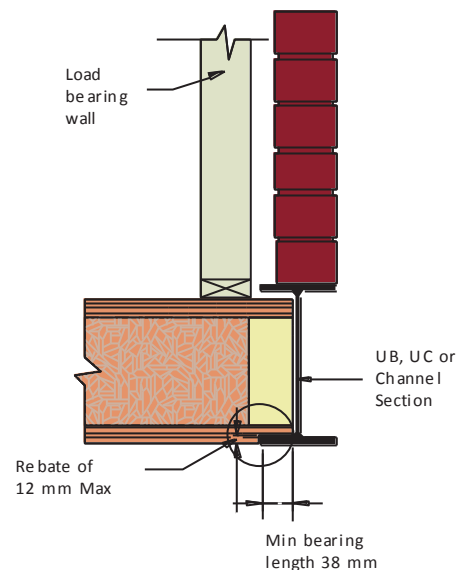
While double joists shown in the above diagram, it is only necessary when loads exceed the capacities of single joist cantilevers.

Joist/beam connections supporting offset load bearing walls

Modern building designs frequently call for the upper storey of a two storey dwelling to be set back from the lower wall to allow sufficient light access to all areas of the building. Provided that the SmartJoists have been designed to support this offset load, no special provisions need to be made for their support EXCEPT in the following support conditions:



RA1



RA2

Maximum Roof Area Supported (m²)

- based upon worst case of 40 mm flange width (conservative for wider flanged joists)

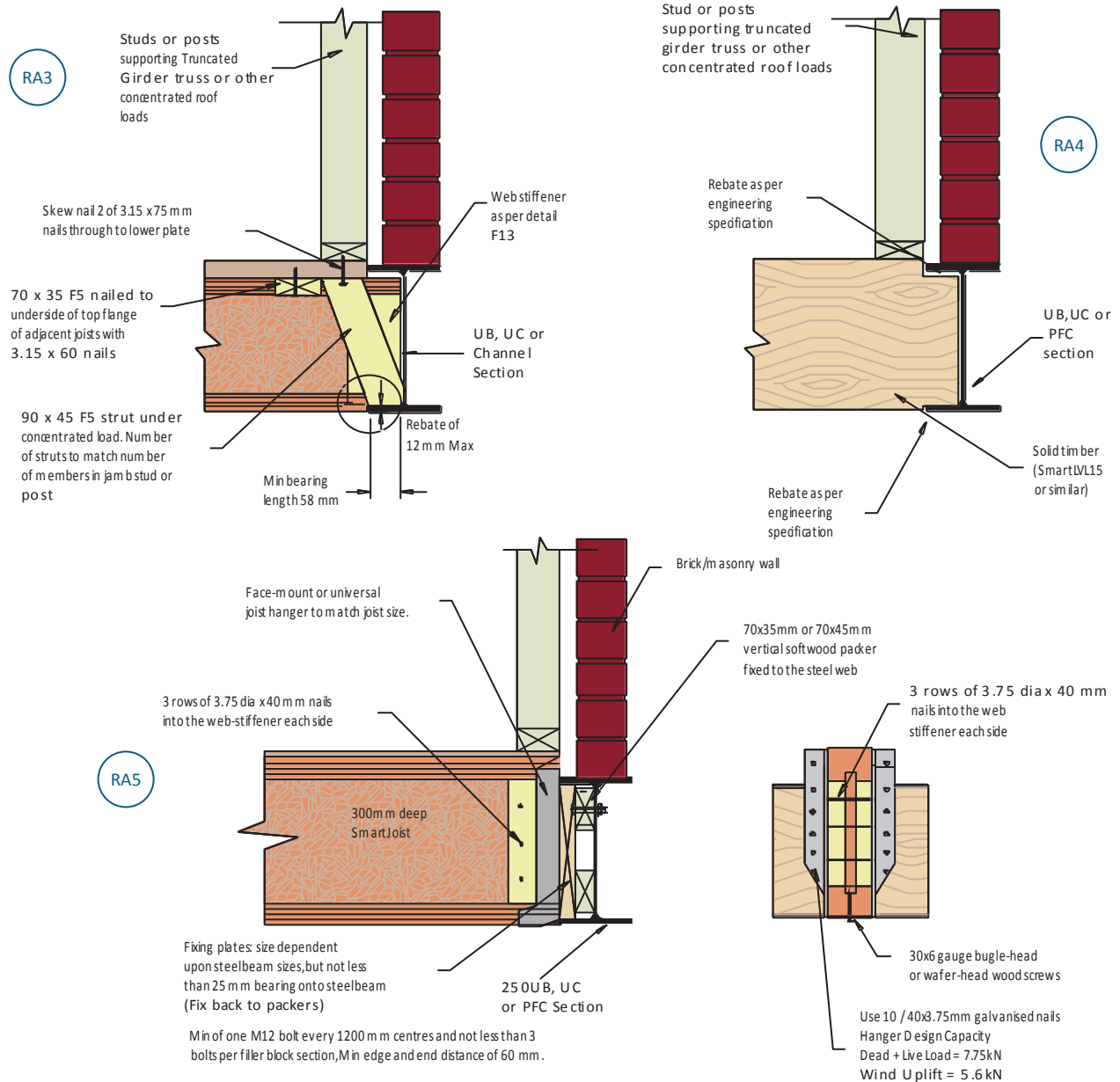
| Joist spacing (mm) | Joist supported on joist hanger RA1 | | | | | | | | Lower flange bearing RA2 | | | | | | | |
|--------------------|-------------------------------------|------|------|-----|------|-----|-----|-----|--------------------------|-----|-----|-----|------|-----|-----|-----|
| | 300 | 400 | 450 | 600 | 300 | 400 | 450 | 600 | 300 | 400 | 450 | 600 | 300 | 400 | 450 | 600 |
| Joist span (mm) | Sheet | | | | Tile | | | | Sheet | | | | Tile | | | |
| 3500 | 21.7 | 15.0 | 12.8 | 8.2 | 9.6 | 6.7 | 5.7 | 3.6 | 6.9 | 6.4 | 6.2 | 5.3 | 3.1 | 2.9 | 2.8 | 2.4 |
| 4000 | 21.1 | 14.5 | 12.3 | 6.9 | 9.4 | 6.4 | 5.5 | 3.1 | 6.7 | 6.2 | 6.0 | 4.6 | 3.0 | 2.8 | 2.7 | 2.0 |
| 4500 | 20.5 | 13.9 | 11.7 | 5.7 | 9.1 | 6.2 | 5.2 | 2.5 | 6.6 | 6.0 | 5.7 | 3.9 | 2.9 | 2.7 | 2.5 | 1.7 |
| 5000 | 20.0 | 13.4 | 10.4 | 4.4 | 8.9 | 5.9 | 4.6 | 2.0 | 6.4 | 5.8 | 5.1 | 3.1 | 2.9 | 2.6 | 2.3 | 1.4 |
| 5500 | 19.4 | 12.1 | 9.1 | 3.2 | 8.6 | 5.4 | 4.1 | 1.4 | 6.3 | 5.3 | 4.6 | 2.4 | 2.8 | 2.4 | 2.0 | 1.1 |

Support for Concentrated loads - Joist/beam connection supporting off-set load bearing walls

Concentrated loads from any source such as girder trusses MUST be transferred through the floor space WITHOUT adding extra vertical loads to the ends of the SmartJoist at its bearing support.

Examples of transferring these loads are shown below RA3 in-

volves the use of inclined timber struts as shown in the detail opposite. Struts must be a tight fit and at a minimum angle of 60° to the horizontal. RA4 uses a solid member in lieu of SmartJoist under large concentrated loads. RA5 involves a face fixing to blocked out steel beam.



Beams supporting SmartJoists – Multiple member laminations

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.

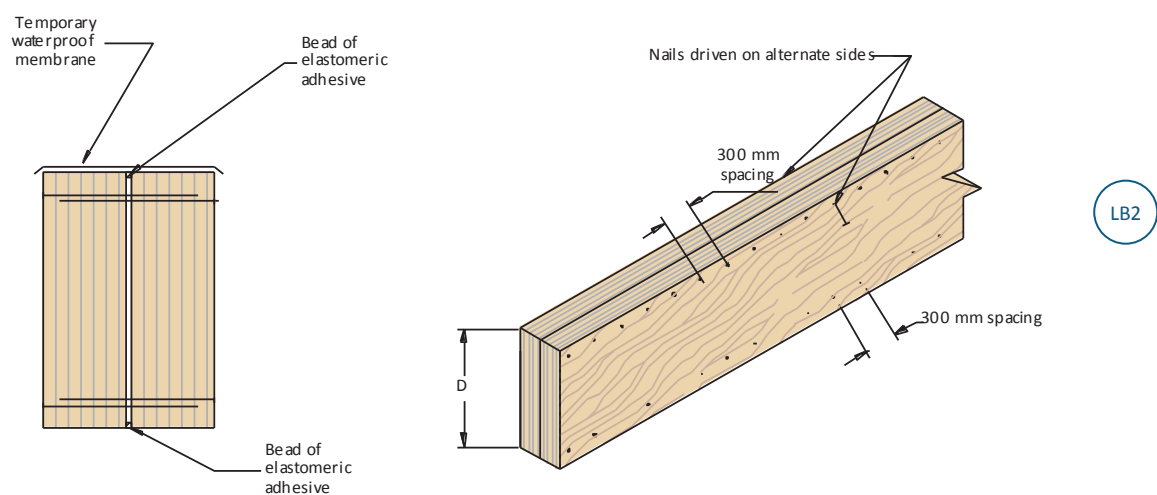
Experience with SmartLVL beams indicates that this degree of fixing may not satisfactorily prevent cupping of individual components as a result of the ingress of moisture between laminates during construction. The suggested method of vertical lamination below provides a greater level of fixity between individual components, and with the use of an elastomeric adhesive, also prevents moisture penetration between the laminates.

Multiple member laminating of top loaded beams (Symmetrical loading)

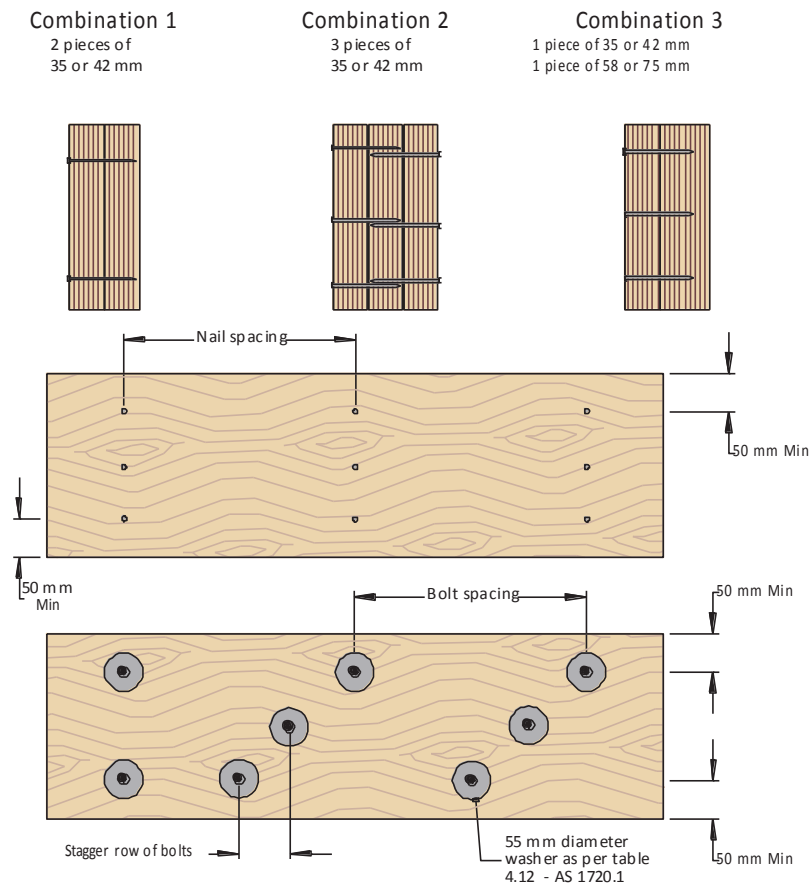
The edges of the individual sections must be carefully aligned to each other so that the composite beam is flat, allowing the applied loads to be equally shared.

- Depths up to and including 300 mm: 2 rows of nails as shown above at 300 mm centre
- Depths in excess of 300 mm: 3 rows of nails as shown above at 300 mm centres.

Beams supporting SmartJoists – Multiple member laminations (Cont’d)



Multiple member lamination of side loaded beams (Non– symmetrical loading)



Maximum floor load width supported by either outside member (mm)

| Combination (see details above) | 3.75Φ x 90 mm nails | | 12 mm Φ bolts | |
|------------------------------------|---------------------|--------------------|--------------------|--------------------|
| | 2 rows at 300 ctrs | 3 rows at 300 ctrs | 2 rows at 600 ctrs | 2 rows at 300 ctrs |
| Combination 1 | 3400 | 5100 | 7500 | 15000 |
| Combination 2 | 2900 | 4000 | 5600 | 11000 |
| Combination 3 | 2900 | 4000 | 4500 | 11000 |

Notes:

- 1. Table values are for 40 kg/m² floors.
- 2. The table values for nails may be doubled for nails at 150 mm centres, and tripled for nails at 100 mm centres

Multiple member lamination of side loaded beams (Non-symmetrical loading) (cont'd)

- The nail schedules shown apply to both sides of a three (3) piece beam
- Bolts are to be grade 4.6 commercial bolts conforming to AS 1111. Bolt holes are to be a maximum of 13 mm diameter and are to be located NOT less than 50 mm from either edge.
- All bolts shall be fitted with a washer at each end, of a size NOT less than that given in AS 1720.1 table 4.11.

How to use the maximum uniform side load table

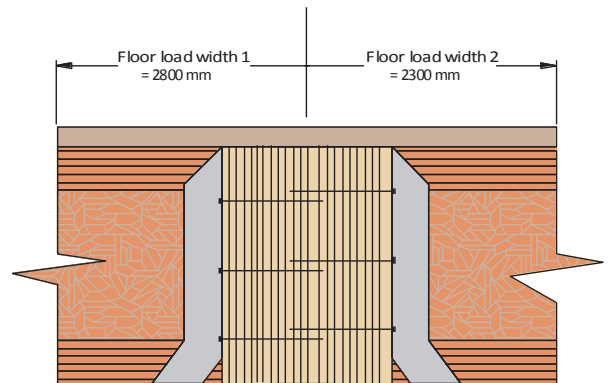
Example: see diagram opposite

Beam of 2 SmartLVL loaded on both side (Combination 1)

FLW 1 = 2800 mm, FLW 2 = 2300 mm

Total FLW = 2800 + 2300 = 5100 mm.

- Use SmartFrame software or SmartLVL safe load tables to size the two member section to support the FLW of 5100 mm.
- Choose the larger of the side FLW's carried by the beam, in this case 2800 mm.
- Enter the table at the "Combination 1" row and scan across to a table value greater than 2800 mm. The first value in the row at 3600 mm is greater than the 2800 mm required.
- Thus adopt 2 rows of 3.75Φ x 90 mm nails at 300 mm centres



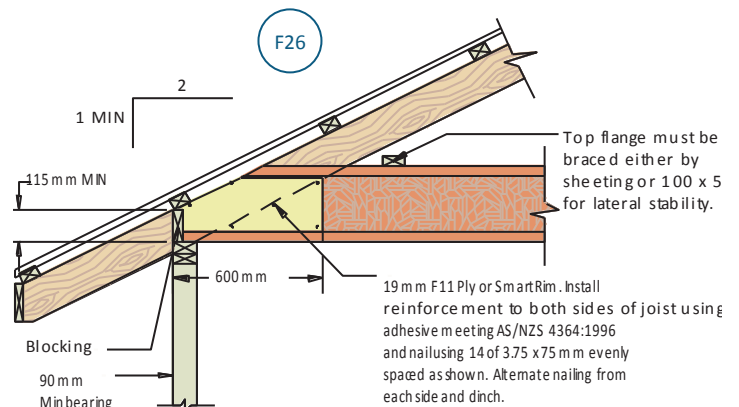
Rafter cuts for SmartJoist floor joists

SmartJoists can be "rafter cut" but only within the limitation shown below.

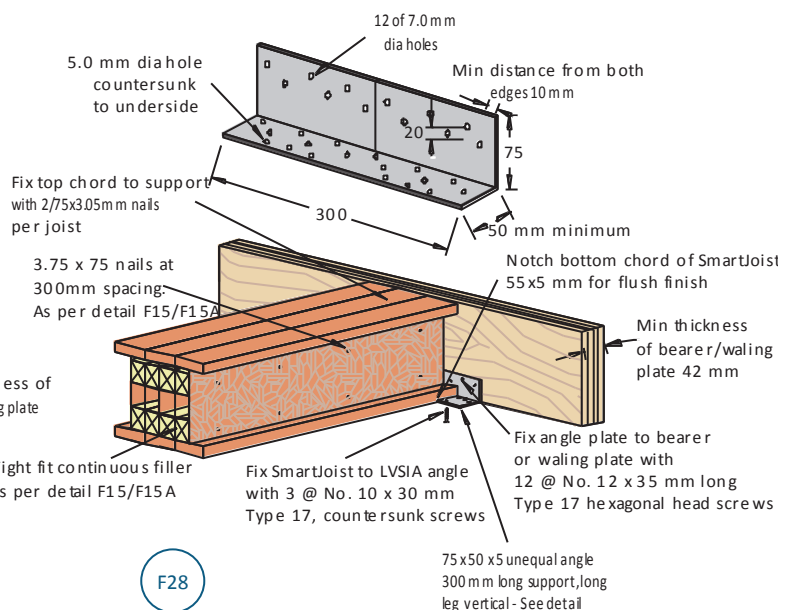
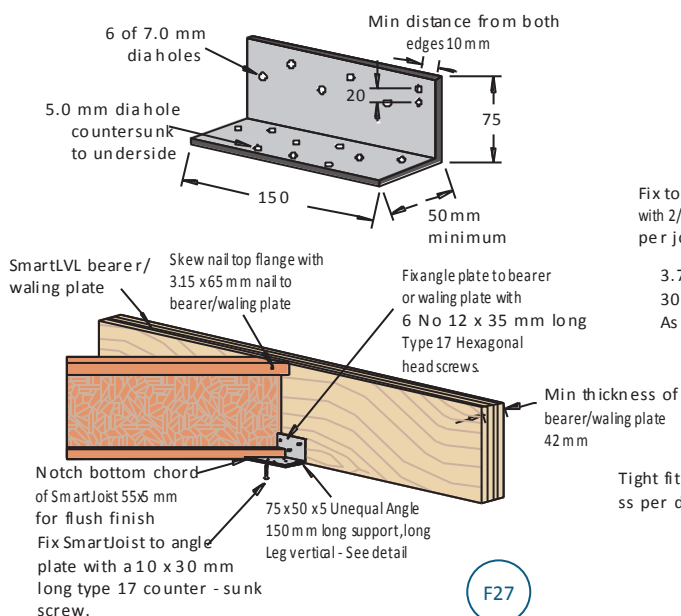
Rafter cuts are limited to:

- 115 mm MINIMUM end height
 - MINIMUM Roof Slopes of 1 in 2 (approximately 26.5°),
- and
- Must be blocked at the end to prevent rotation of the joist.

Joists without reinforcement are limited to design shear and end reactions up to 6.5 kN. Ply reinforcement can be added to joists with rafter cuts to increase the shear and end reaction capacity of the joist. The detail below shows the proper installation of the reinforcement. With the reinforcement added, the end reaction and shear capacity increase to 12.7 kN. Duration of load increases are permitted as per AS1720.1.



Oblique connection options



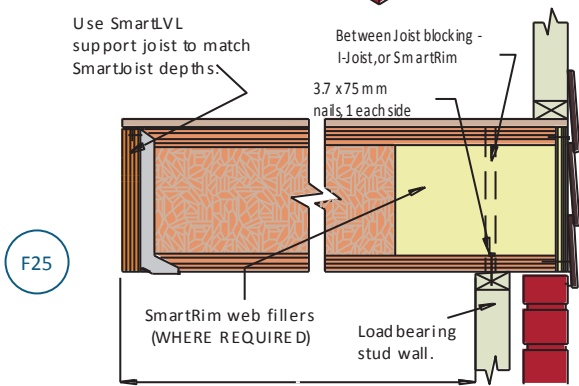
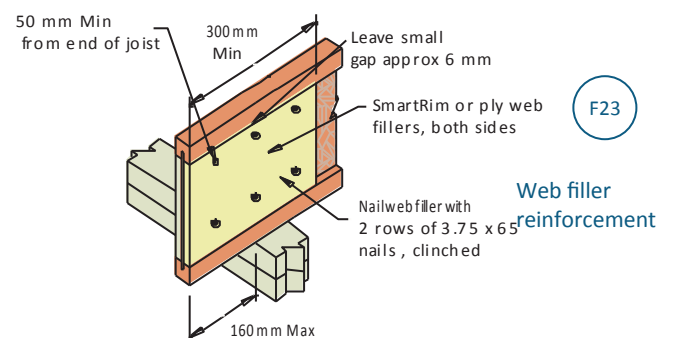
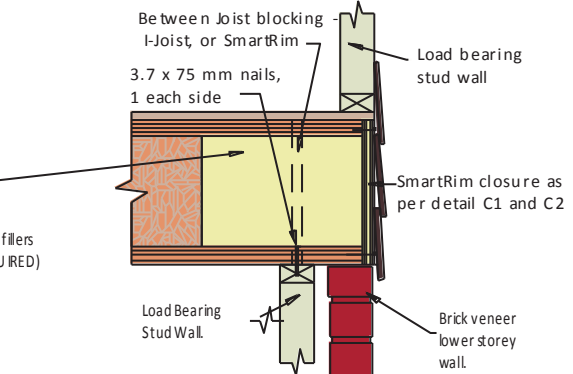
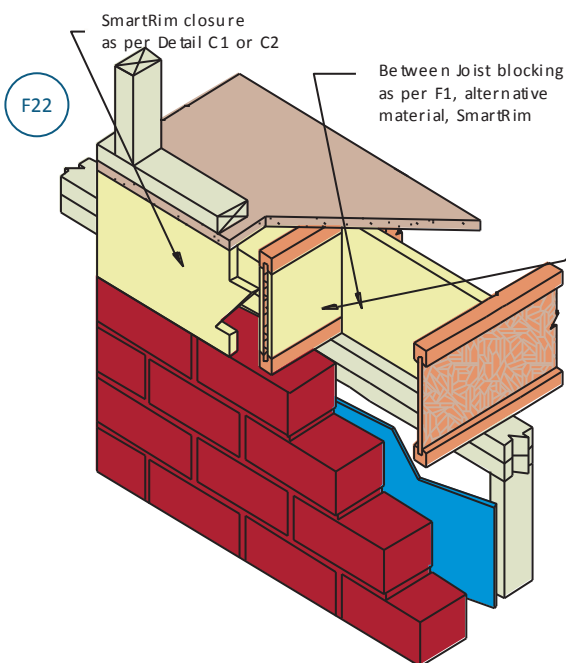
Brick ledge cantilevers construction details

Cantilevered SmartJoists as “brick ledge cantilevers” (Max of 160 mm cantilever) to suit upper storey clad frames DO NOT usually require any special modification (other than the necessary timber or ply/LVL closure member attached to the outer edge as shown in details C1 or C2. The exceptions to this are where concentrated floor loads (e.g. truncated girders, jamb studs) are supported on an Individual cantilevered joist such that the concentrated roof

load area supported exceeds that as shown below for an un-reinforced SmartJoist.

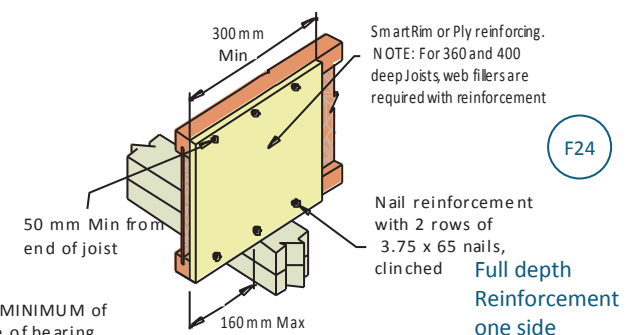
Individual joists may be reinforced, if required, as per details F23 or F24 to support a roof load area (measured in square metres) as shown below.

| Joist spacing (mm) | Un-reinforced SmartJoist | | | | | | Web Filler (F23) | | | | | | Reinforcing one side (F24) | | | | | |
|--------------------|---------------------------------------|------|------|------------|-----|-----|------------------|------|------|------------|------|------|----------------------------|------|------|------------|------|-----|
| | Sheet Roof | | | Tiled Roof | | | Sheet Roof | | | Tiled Roof | | | Sheet Roof | | | Tiled Roof | | |
| | 300 | 450 | 600 | 300 | 450 | 600 | 300 | 450 | 600 | 300 | 450 | 600 | 300 | 450 | 600 | 300 | 450 | 600 |
| SmartJoist | Roof area supported (m ²) | | | | | | | | | | | | | | | | | |
| SJ20044 | 8.8 | 7.1 | 5.4 | 5.1 | 4.2 | 3.2 | 12.2 | 10.5 | 8.8 | 7.2 | 6.2 | 5.2 | 10.2 | 8.6 | 6.9 | 6.0 | 5.0 | 4.0 |
| SJ24040 | 9.7 | 8.0 | 6.3 | 5.7 | 4.7 | 3.7 | 13.1 | 11.4 | 9.7 | 7.7 | 6.7 | 5.7 | 11.1 | 9.4 | 7.7 | 6.5 | 5.5 | 4.5 |
| SJ24051 | 10.6 | 8.6 | 6.9 | 6.0 | 5.0 | 4.1 | 13.7 | 12.0 | 10.3 | 8.0 | 7.0 | 6.1 | 11.8 | 10.1 | 8.4 | 6.9 | 5.9 | 4.9 |
| SJ24070 | 14.2 | 13.2 | 12.2 | 8.3 | 7.6 | 6.9 | 15.6 | 14.5 | 13.3 | 9.1 | 8.5 | 7.8 | 17.6 | 16.4 | 15.2 | 10.3 | 9.6 | 8.9 |
| SJ24090 | 17.9 | 16.2 | 14.5 | 10.5 | 9.5 | 8.5 | 21.3 | 19.6 | 17.9 | 12.5 | 11.5 | 10.5 | 19.3 | 17.6 | 15.9 | 11.3 | 10.3 | 9.3 |
| SJ30040 | 9.6 | 8.0 | 6.3 | 5.6 | 4.7 | 3.7 | 13.1 | 11.4 | 9.7 | 7.6 | 6.7 | 5.7 | 11.1 | 9.4 | 7.7 | 6.5 | 5.5 | 4.5 |
| SJ30051 | 10.3 | 8.6 | 6.9 | 6.0 | 5.0 | 4.0 | 13.7 | 12.0 | 10.3 | 8.0 | 7.0 | 6.0 | 13.6 | 12.3 | 11.2 | 8.0 | 7.2 | 6.6 |
| SJ30070 | 13.7 | 12.4 | 11.2 | 8.0 | 7.3 | 6.6 | 18.9 | 17.6 | 16.4 | 11.1 | 10.3 | 9.6 | 17.2 | 15.8 | 14.6 | 10.0 | 9.3 | 8.6 |
| SJ30090 | 17.8 | 16.2 | 14.5 | 10.4 | 9.5 | 8.5 | 21.3 | 19.6 | 17.9 | 12.4 | 11.5 | 10.5 | 19.3 | 17.6 | 15.9 | 11.3 | 10.3 | 9.3 |
| SJ36058 | 12.9 | 11.2 | 9.5 | 7.5 | 6.5 | 5.5 | 16.3 | 14.6 | 12.9 | 9.5 | 8.5 | 7.6 | 14.3 | 12.6 | 10.9 | 8.4 | 7.4 | 6.4 |
| SJ36090 | 17.8 | 16.1 | 14.4 | 10.4 | 9.4 | 8.5 | 21.2 | 19.6 | 17.9 | 12.4 | 11.4 | 10.5 | 19.3 | 17.6 | 15.9 | 11.3 | 10.3 | 9.3 |
| SJ40090 | 17.8 | 16.1 | 14.4 | 10.4 | 9.4 | 8.4 | 21.2 | 19.5 | 17.9 | 12.4 | 11.4 | 10.5 | 19.3 | 17.6 | 15.9 | 11.3 | 10.3 | 9.3 |



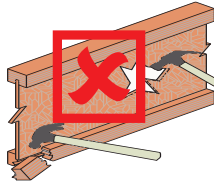
Trimmer joists where main joist are parallel to brick ledge cantilever wall

Trimmer Joists to be MINIMUM of 600 mm from inside of bearing plate to support LVL floor Joist.

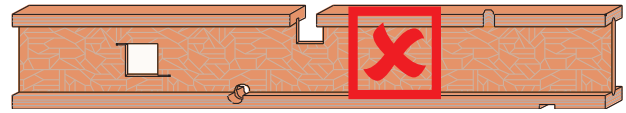


SmartJoist hole and duct charts

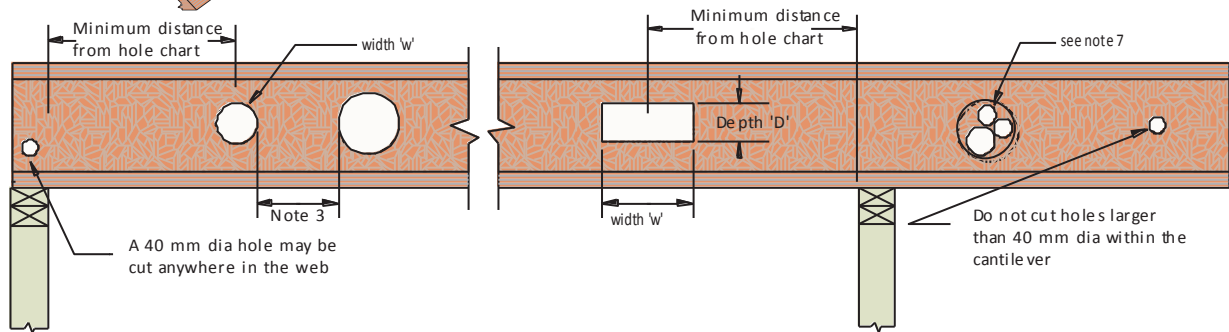
Don't make holes with hammer other than pre-punched knockouts



Don't hammer on flanges and damage joint



**Do not cut or notch flanges
Do not over cut holes in web**



Note: The most accurate method to design the allowable web penetration size and distance from support for SmartJoists is to use the Smart-Frame software. The table below will give conservative results in some instances. Also, advice on hole size and location may be obtained by contacting the SmartData Customer Helpline on 1300 668 690 or at smartdata@tilling.com.au.

Assumed loading (DL = 62 kg/m², FLL = 2 kPa, FPL = 1.8 kN)

| Joist code | Joist span (mm) | Joist spacing (mm) | Circular/square holes | | | | | | | | Rectangular holes | | | |
|------------|--------------------|--------------------------|--|-----|------|--------|-----|-----|-----|-----|--------------------|---------|---------|---------|
| | | | Hole diameter/Square hole width (mm) | | | | | | | | Depth x Width (mm) | | | |
| | | | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 | 125x150 | 150x300 | 175x350 | 200x400 |
| | | | Minimum distance from any support to the centre of the hole (mm) | | | | | | | | | | | |
| SJ20044 | 600-999 | 300 to 600 | 300 | 300 | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 1000-1499 | | 300 | 300 | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 1500-1999 | | 300 | 300 | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 2000-2499 | | 300 | 600 | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 2500-2999 | | 300 | 800 | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 3000-3300 | | 300 | 900 | ns | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| SJ24040 | 600-999 | 300 to 600 | 300 | 300 | 300 | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 1500-1999 | | 300 | 300 | 300 | Span/2 | ns | ns | ns | ns | 750 | Span/2 | ns | ns |
| | 2000-2499 | | 300 | 300 | 300 | Span/2 | ns | ns | ns | ns | 1000 | Span/2 | ns | ns |
| | 2500-2999 | | 300 | 300 | 500 | Span/2 | ns | ns | ns | ns | Span/2 | Span/2 | ns | ns |
| | 3000-3500 | | 300 | 300 | 800 | Span/2 | ns | ns | ns | ns | Span/2 | Span/2 | ns | ns |
| SJ24051 | 600-999 | 300 to 600 | 300 | 300 | 300 | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 1500-1999 | | 300 | 300 | 300 | Span/2 | ns | ns | ns | ns | 750 | Span/2 | ns | ns |
| | 2000-2499 | | 300 | 300 | 300 | Span/2 | ns | ns | ns | ns | 1000 | Span/2 | ns | ns |
| | 2500-2999 | | 300 | 300 | 500 | Span/2 | ns | ns | ns | ns | Span/2 | Span/2 | ns | ns |
| | 3000-3499 | | 300 | 300 | 800 | Span/2 | ns | ns | ns | ns | Span/2 | Span/2 | ns | ns |
| | 3500-3800 | | 300 | 300 | 1000 | Span/2 | ns | ns | ns | ns | Span/2 | Span/2 | ns | ns |
| SJ24070 | 600-999 | 300 to 600 | 300 | 300 | 300 | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | ns | ns | ns | ns | ns | 300 | ns | ns | ns |
| | 1500-1999 | | 300 | 300 | 300 | Span/2 | ns | ns | ns | ns | 600 | Span/2 | ns | ns |
| | 2000-2499 | | 300 | 300 | 300 | Span/2 | ns | ns | ns | ns | 900 | Span/2 | ns | ns |
| | 2500-2999 | | 300 | 300 | 500 | Span/2 | ns | ns | ns | ns | 1250 | Span/2 | ns | ns |
| | 3000-3499 | | 300 | 300 | 800 | Span/2 | ns | ns | ns | ns | 1500 | Span/2 | ns | ns |
| | 3500-3999 | | 300 | 300 | 1000 | Span/2 | ns | ns | ns | ns | Span/2 | Span/2 | ns | ns |
| | 4000-4100 | | 300 | 450 | 1100 | Span/2 | ns | ns | ns | ns | Span/2 | Span/2 | ns | ns |

SmartJoist hole charts (Cont'd)

| Assumed load (DL = 62 kg/m ² , FLL = 2 kPa, FPL = 1.8 kN) | | | | | | | | | | | | | | |
|--|-----------------|--------------------|--|-----|-----|------|------|------|-----|-----|--------------------|---------|---------|---------|
| Joist code | Joist span (mm) | Joist spacing (mm) | Circular/square holes | | | | | | | | Rectangular holes | | | |
| | | | Hole diameter/square hole width (mm) | | | | | | | | Depth x Width (mm) | | | |
| | | | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 | 125x150 | 150x300 | 175x350 | 200x400 |
| | | | Minimum distance from any support to the centre of the hole (mm) | | | | | | | | | | | |
| SJ24090 | 600-999 | 300 to 600 | 300 | 300 | 300 | ns | ns | ns | ns | ns | ns | ns | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | ns | ns | ns | ns | ns | 300 | ns | ns | ns |
| | 1500-1999 | | 300 | 300 | 300 | 700 | ns | ns | ns | ns | 500 | 750 | ns | ns |
| | 2000-2499 | | 300 | 300 | 300 | 1000 | ns | ns | ns | ns | 800 | 1000 | ns | ns |
| | 2500-2999 | | 300 | 300 | 400 | 1150 | ns | ns | ns | ns | 1100 | Span/2 | ns | ns |
| | 3000-3499 | | 300 | 300 | 700 | 1400 | ns | ns | ns | ns | 1400 | Span/2 | ns | ns |
| | 3500-3999 | | 300 | 300 | 800 | 1550 | ns | ns | ns | ns | 1700 | Span/2 | ns | ns |
| | 4000-4100 | | 300 | 300 | 900 | 1600 | ns | ns | ns | ns | 1800 | Span/2 | ns | ns |
| SJ30040 | 600-999 | 300 to 600 | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns | 300 | 300 | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns | 300 | 500 | Span/2 | ns |
| | 1500-1999 | | 300 | 300 | 300 | 300 | 300 | 500 | ns | ns | 300 | Span/2 | Span/2 | Span/2 |
| | 2000-2499 | | 300 | 300 | 300 | 300 | 300 | 700 | ns | ns | 500 | Span/2 | Span/2 | Span/2 |
| | 2500-2999 | | 300 | 300 | 300 | 300 | 400 | 1000 | ns | ns | 900 | Span/2 | Span/2 | Span/2 |
| | 3000-3499 | | 300 | 300 | 300 | 300 | 600 | 1200 | ns | ns | 1300 | Span/2 | Span/2 | Span/2 |
| | 3500-3999 | | 300 | 300 | 300 | 300 | 900 | 1450 | ns | ns | 1750 | Span/2 | Span/2 | Span/2 |
| | 4000-4100 | | 300 | 300 | 300 | 400 | 1000 | 1500 | ns | ns | Span/2 | Span/2 | Span/2 | ns |
| SJ30051 | 600-999 | 300 to 600 | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns | 300 | 300 | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns | 300 | 500 | Span/2 | ns |
| | 1500-1999 | | 300 | 300 | 300 | 300 | 300 | 500 | ns | ns | 300 | 750 | Span/2 | Span/2 |
| | 2000-2499 | | 300 | 300 | 300 | 300 | 300 | 700 | ns | ns | 400 | Span/2 | Span/2 | Span/2 |
| | 2500-2999 | | 300 | 300 | 300 | 300 | 400 | 1000 | ns | ns | 800 | Span/2 | Span/2 | Span/2 |
| | 3000-3499 | | 300 | 300 | 300 | 300 | 600 | 1200 | ns | ns | 1200 | Span/2 | Span/2 | Span/2 |
| | 3500-3999 | | 300 | 300 | 300 | 300 | 900 | 1450 | ns | ns | 1600 | Span/2 | Span/2 | Span/2 |
| | 4000-4300 | | 300 | 300 | 300 | 400 | 1000 | 1600 | ns | ns | 1800 | Span/2 | Span/2 | ns |
| SJ30070 | 600-999 | 300 to 600 | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns | 300 | 300 | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns | 300 | 500 | Span/2 | ns |
| | 1500-1999 | | 300 | 300 | 300 | 300 | 300 | 500 | ns | ns | 300 | 750 | Span/2 | Span/2 |
| | 2000-2499 | | 300 | 300 | 300 | 300 | 300 | 700 | ns | ns | 400 | 1000 | Span/2 | Span/2 |
| | 2500-2999 | | 300 | 300 | 300 | 300 | 400 | 950 | ns | ns | 700 | 1250 | Span/2 | Span/2 |
| | 3000-3499 | | 300 | 300 | 300 | 300 | 600 | 1200 | ns | ns | 1000 | Span/2 | Span/2 | Span/2 |
| | 3500-3999 | | 300 | 300 | 300 | 300 | 900 | 1450 | ns | ns | 1400 | Span/2 | Span/2 | Span/2 |
| | 4000-4499 | | 300 | 300 | 300 | 500 | 1100 | 1700 | ns | ns | 1800 | Span/2 | Span/2 | Span/2 |
| SJ30090 | 4500-4600 | 300 to 600 | 300 | 300 | 300 | 700 | 1200 | 1800 | ns | ns | 1900 | Span/2 | Span/2 | Span/2 |
| | 600-999 | | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns | 300 | 300 | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns | 300 | 400 | Span/2 | ns |
| | 1500-1999 | | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns | 300 | 750 | Span/2 | Span/2 |
| | 2000-2499 | | 300 | 300 | 300 | 300 | 300 | 600 | ns | ns | 300 | 950 | Span/2 | Span/2 |
| | 2500-2999 | | 300 | 300 | 300 | 300 | 300 | 800 | ns | ns | 500 | 1200 | Span/2 | Span/2 |
| | 3000-3499 | | 300 | 300 | 300 | 300 | 400 | 1100 | ns | ns | 800 | 1500 | Span/2 | Span/2 |
| | 3500-3999 | | 300 | 300 | 300 | 300 | 700 | 1300 | ns | ns | 1200 | 1750 | Span/2 | Span/2 |
| SJ30090 | 4000-4499 | | 300 | 300 | 300 | 300 | 950 | 1600 | ns | ns | 1600 | Span/2 | Span/2 | Span/2 |
| | 4500-4900 | | 300 | 300 | 300 | 500 | 1100 | 1800 | ns | ns | 1800 | Span/2 | Span/2 | Span/2 |

SmartJoist hole charts (Cont'd)

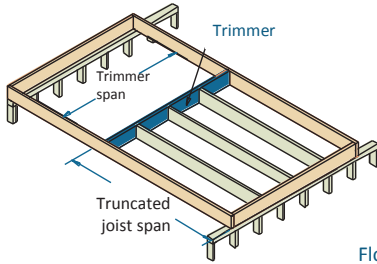
| Assumed load (DL = 62 kg/m ² , FLL = 2 kPa, FPL = 1.8 kN) | | | | | | | | | | | | | | |
|--|-----------------|--------------------|--|-----|-----|-----|-----|-----|------|------|--------------------|---------|---------|---------|
| Joist code | Joist span (mm) | Joist spacing (mm) | Circular/square holes | | | | | | | | Rectangular holes | | | |
| | | | Hole diameter/square hole width (mm) | | | | | | | | Depth x Width (mm) | | | |
| | | | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 | 125x150 | 150x300 | 175x350 | 200x400 |
| | | | Minimum distance from any support to the centre of the hole (mm) | | | | | | | | | | | |
| SJ36058 | 600-999 | 300 to 600 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 400 | ns |
| | 1500-1999 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 400 | 300 | 300 | 700 | Span/2 |
| | 2000-2499 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 700 | 300 | 550 | 900 | Span/2 |
| | 2500-2999 | | 300 | 300 | 300 | 300 | 300 | 300 | 400 | 900 | 300 | 850 | 1200 | Span/2 |
| | 3000-3499 | | 300 | 300 | 300 | 300 | 300 | 300 | 650 | 1200 | 300 | 1200 | 1500 | Span/2 |
| | 3500-3999 | | 300 | 300 | 300 | 300 | 300 | 400 | 900 | 1400 | 300 | 1500 | 1750 | Span/2 |
| | 4000-4499 | | 300 | 300 | 300 | 300 | 300 | 600 | 1100 | 1700 | 300 | 1800 | Span/2 | Span/2 |
| | 4500-5000 | | 300 | 300 | 300 | 300 | 300 | 800 | 1400 | 1900 | 300 | 2200 | Span/2 | Span/2 |
| SJ36090 | 600-999 | 300 to 600 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | ns |
| | 1500-1999 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 450 | 700 |
| | 2000-2499 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 400 | 300 | 300 | 750 | 1000 |
| | 2500-2999 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 650 | 300 | 450 | 1000 | 1250 |
| | 3000-3499 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 900 | 300 | 800 | 1300 | 1500 |
| | 3500-3999 | | 300 | 300 | 300 | 300 | 300 | 300 | 500 | 1150 | 300 | 1100 | 1600 | Span/2 |
| | 4000-4499 | | 300 | 300 | 300 | 300 | 300 | 300 | 750 | 1400 | 300 | 1450 | 1900 | Span/2 |
| | 4500-4999 | | 300 | 300 | 300 | 300 | 300 | 400 | 1000 | 1650 | 300 | 1800 | 2200 | Span/2 |
| | 5000-5400 | | 300 | 300 | 300 | 300 | 300 | 600 | 1200 | 1800 | 300 | 2100 | 2500 | Span/2 |
| SJ40090 | 600-999 | 300 to 600 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | ns | ns |
| | 1000-1499 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | ns |
| | 1500-1999 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 400 |
| | 2000-2499 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 600 |
| | 2500-2999 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 900 |
| | 3000-3499 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 600 | 1200 |
| | 3500-3999 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 400 | 300 | 300 | 1000 | 1500 |
| | 4000-4499 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 600 | 300 | 300 | 1300 | 1800 |
| | 4500-4999 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 800 | 300 | 500 | 1700 | 2100 |
| | 5000-5499 | | 300 | 300 | 300 | 300 | 300 | 300 | 400 | 900 | 300 | 1000 | 2000 | 2500 |
| | 5500-5700 | | 300 | 300 | 300 | 300 | 300 | 300 | 500 | 1100 | 300 | 1200 | 2200 | 2750 |

Notes:

1. The hole chart is generated on a maximum floor dead load of 62 kg/m² with no wall or roof loads. It therefore does not apply for joists supporting either parallel or perpendicular load bearing walls. These scenarios can be analysed by using the appropriate model within the SmartFrame software. Help can be obtained by contacting the SmartFrame Customer Helpline on 1300 668 690 or at smartdata@tilling.com.au
2. Hole locations are suitable for joist spacings up to 600 mm centres. Holes may be permitted closer to supports for some member when spacings of 450 or 300 mm are used
3. The clear distance between holes must equal or exceed twice the diameter of the largest hole, or twice the longest side of a rectangular hole and no more than 3 holes in excess of 75 mm are allowed in any span
4. Do not cut or damage flanges under any circumstances
5. Except as noted in 1 and 2 above, a 40 mm hole at a minimum of 450 mm centres is allowed to be drilled anywhere in the web EXCEPT in cantilevered spans
6. If possible, holes in web should be positioned mid height, minimum edge clearance from any flange is 6 mm
7. A group of round holes at approximately the same location shall be permitted if they meet the requirements for a single round hole circumscribed around them.

Openings within SmartFrame floors

Opening trimmer



Floor live load 1.5 kPa

The tables below are for trimmer members of SmartJoists and LVL. Other SmartFrame engineered timber products may also be used for this member, the designs for each of these other material types can be simply calculated by using the SmartFrame software or by contacting the SmartData Customer Helpline on 1300 668 690 or at smartdata@tilling.com.au.

| SmartJoist | Maximum trimmer span (mm) | | | | |
|------------|---------------------------|------|------|------|------|
| | Truncated joist span (mm) | | | | |
| | 1.5 | 3.0 | 4.5 | 6.0 | 7.2 |
| SJ20044 | 3700 | 3000 | 2600 | 2300 | 2100 |
| SJ24040 | 4000 | 3300 | 2900 | 2600 | 2400 |
| SJ24051 | 4300 | 3500 | 3100 | 2800 | 2500 |
| SJ24070 | 4600 | 3800 | 3400 | 3000 | 2800 |
| SJ24090 | 4800 | 4000 | 3500 | 3300 | 3000 |
| SJ30040 | 4600 | 3800 | 3400 | 3100 | 2800 |
| SJ30051 | 4900 | 3900 | 3600 | 3300 | 3100 |
| SJ30070 | 5200 | 4300 | 3800 | 3500 | 3300 |
| SJ30090 | 5500 | 4500 | 4000 | 3700 | 3500 |
| SJ36058 | 5600 | 4700 | 4200 | 3800 | 3600 |
| SJ36090 | 6100 | 5000 | 4500 | 4100 | 3900 |
| SJ40090 | 6500 | 5400 | 4800 | 4400 | 4100 |

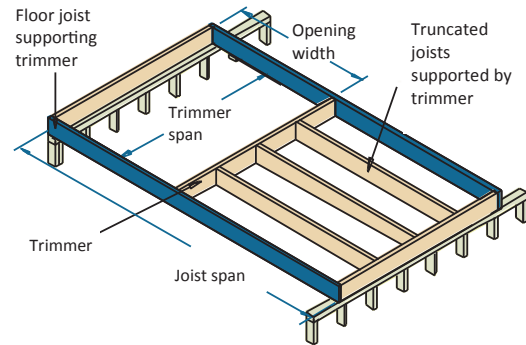
Trimmer Joists

Trimming joists at floor opening often support the loads from stair stringers, as well as the concentrated load from the trimmer. The table below has been set up to allow a load from stairs equally supported from the floor below (or above) and the trimmer joists. In many cases this will provide a conservative result. Alternative designs can be readily obtained by using the SmartFrame software or by contacting the SmartData Customer Helpline on 1300 668 690 or at smartdata@tilling.com.au

Floor live load 1.5 kPa

| SmartLVL 15 | Maximum trimmer span (mm) | | | | |
|-------------|---------------------------|------|------|------|------|
| | Truncated joist span (mm) | | | | |
| | 1.5 | 3.0 | 4.5 | 6.0 | 7.2 |
| 200x42 | 3900 | 3200 | 2800 | 2500 | 2300 |
| 240x42 | 4500 | 3800 | 3300 | 3000 | 2800 |
| 300x42 | 5300 | 4500 | 4000 | 3700 | 3500 |
| 360x42 | 6100 | 5100 | 4600 | 4300 | 4100 |
| 200x58 | 4300 | 3600 | 3100 | 2800 | 2600 |
| 240x58 | 4900 | 4100 | 3700 | 3400 | 3100 |
| 300x58 | 5800 | 4900 | 4400 | 4100 | 3900 |
| 360x58 | 6600 | 5600 | 5000 | 4700 | 4400 |
| 400x58 | 7100 | 6000 | 5400 | 5000 | 4800 |

Floor live load 1.5 kPa



Note: Based on spacing of 600 mm and maximum of 10 mm DL deflection

| SmartFrame engineered timber | Maximum trimming joist span (m) | | | | | | | | | | | |
|------------------------------|---------------------------------|------|------|------|-------------------------|------|------|------|-------------------------|------|------|------|
| | Opening width 900 (mm) | | | | Opening width 1800 (mm) | | | | Opening width 2700 (mm) | | | |
| | Trimmer span (mm) | | | | Trimmer span (mm) | | | | Trimmer span (mm) | | | |
| | 2 | 3 | 4 | 5 | 2 | 3 | 4 | 5 | 2 | 3 | 4 | 5 |
| SJ20044 | 3300 | 3100 | 2800 | 2600 | 3400 | 3200 | 3100 | 3000 | 3700 | 3600 | 3600 | 3500 |
| SJ24040 | 3700 | 3400 | 3200 | 3000 | 3600 | 3400 | 3100 | 3000 | 4000 | 3800 | 3700 | 3700 |
| SJ24051 | 3900 | 3600 | 3400 | 3200 | 3800 | 3600 | 3400 | 3300 | 4100 | 4000 | 3900 | 3800 |
| SJ24070 | 4200 | 3900 | 3700 | 3500 | 4100 | 3800 | 3600 | 3500 | 4400 | 4200 | 4000 | 4000 |
| SJ24090 | 4500 | 4100 | 3900 | 3700 | 4300 | 4000 | 3800 | 3600 | 4500 | 4300 | 4200 | 4000 |
| SJ30040 | 4300 | 4000 | 3700 | 3500 | 4100 | 3900 | 3700 | 3500 | 4400 | 4200 | 4100 | 3900 |
| SJ30051 | 4500 | 4200 | 3900 | 3700 | 4300 | 4000 | 3800 | 3700 | 4600 | 4400 | 4200 | 4100 |
| SJ30070 | 4900 | 4500 | 4200 | 4000 | 4600 | 4300 | 4100 | 3900 | 4800 | 4600 | 4400 | 4300 |
| SJ30090 | 5100 | 4800 | 4500 | 4200 | 4900 | 4500 | 4300 | 4100 | 5100 | 4700 | 4500 | 4400 |
| SJ36058 | 5300 | 4900 | 4700 | 4400 | 5000 | 4600 | 4400 | 4200 | 5200 | 4800 | 4600 | 4400 |
| SJ36090 | 5700 | 5300 | 5000 | 4800 | 5400 | 5000 | 4800 | 4400 | 5500 | 5100 | 4900 | 4700 |
| SJ40090 | 6100 | 5800 | 5500 | 5200 | 5800 | 5300 | 5000 | 4800 | 5800 | 5400 | 5100 | 4900 |
| 200x42 | 3600 | 3200 | 2900 | 2700 | 3600 | 3300 | 3100 | 3000 | 4000 | 3900 | 3700 | 3600 |
| 240x42 | 4200 | 3800 | 3500 | 3300 | 4100 | 3800 | 3600 | 3400 | 4400 | 4200 | 4000 | 3900 |
| 300x42 | 5100 | 4600 | 4300 | 4100 | 4800 | 4400 | 4100 | 4000 | 5000 | 4700 | 4500 | 4300 |
| 360x42 | 6000 | 5400 | 5100 | 4800 | 5500 | 5000 | 4700 | 4500 | 5600 | 5200 | 5000 | 4800 |
| 200x58 | 3900 | 3600 | 3300 | 3000 | 3900 | 3600 | 3400 | 3200 | 4200 | 4000 | 3900 | 3900 |
| 240x58 | 4600 | 4200 | 3900 | 3700 | 4400 | 4100 | 3800 | 3700 | 4700 | 4400 | 4200 | 4100 |
| 300x58 | 5600 | 5100 | 4800 | 4500 | 5200 | 4800 | 4500 | 4300 | 5300 | 5000 | 4800 | 4600 |
| 360x58 | 6600 | 6000 | 5600 | 5300 | 6000 | 5500 | 5100 | 4900 | 6000 | 5600 | 5300 | 5100 |
| 400x58 | 7200 | 6600 | 6200 | 5700 | 6500 | 6000 | 5600 | 5300 | 6500 | 6000 | 5700 | 5400 |

SmartJoist cantilevers supporting load bearing walls

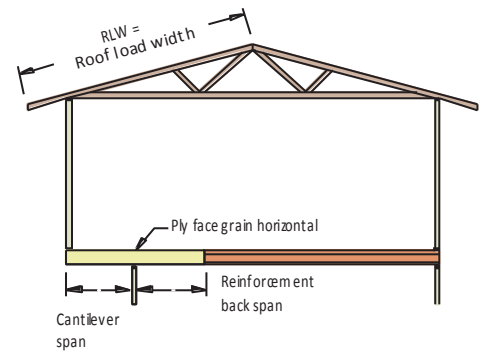
SmartJoist cantilevers may need to be reinforced to support load bearing walls at the end of the cantilever. The table below lists the allowable roof load widths with un-reinforced and reinforced SmartJoists.

Reinforcement Description:

- 0 - Reinforcement not required
- 1 - Install 15 mm F11 x 1200 mm min structural ply on one side of joist
- 2 - Install 15 mm F11 x 1200 mm min structural ply on both sides of joist or double joist at cantilever
- x - Not suitable

Tables assume a 0.8 kN/m wall dead load, sheet roof dead load of 40 kg/m² and tiled roof dead load of 90 kg/m².

Serviceability Limits on Cantilever - DL: 6.0 mm Max
- LL: 4.5 mm Max



***Important :** See notes on next page on the use of this table

Reinforcement requirements for cantilevered floor joists supporting load bearing walls *

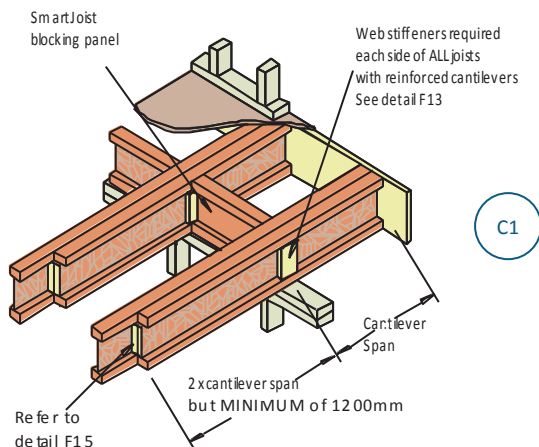
NOTE - Total length cantilever reinforcement must be a minimum of 1200 mm but NEVER be less than twice the cantilever span. i.e. Reinforcement back span ≥ cantilever span.

| Max Cantilever (mm) | RLW (m) | Sheet roof 40 kg/m ² | | | | | | | | | Tiled roof 90 kg/m ² | | | | | | | | | | | |
|---------------------------|---------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | | 4.0 | | | 6.0 | | | 8.0 | | | 2.0 | | | 4.0 | | | 6.0 | | | 8.0 | | |
| | | SmartJoist | 300 | 450 | 600 | 300 | 450 | 600 | 300 | 450 | 600 | 300 | 450 | 600 | 300 | 450 | 600 | 300 | 450 | 600 | 300 | 450 |
| 300 | SJ20044 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| | SJ24040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| | SJ24051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| | SJ24070 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| | SJ24090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | SJ30040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ30051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ30070 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ30090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ36058 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ36090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SJ40090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 600 | SJ20044 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| | SJ24040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | SJ24051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x |
| | SJ24070 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x |
| | SJ24090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x |
| | SJ30040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ30051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ30070 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ30090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ36058 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ36090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SJ40090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 900 | SJ20044 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | x | 0 | 0 | 0 | 0 | 2 | x | 1 | x | x | x | x | x |
| | SJ24040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | x | 1 | x | x |
| | SJ24051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | x | 1 | x | x |
| | SJ24070 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | x | x | x | x |
| | SJ24090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x | 0 | 1 | x |
| | SJ30040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | x |
| | SJ30051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | x |
| | SJ30070 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| | SJ30090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ36058 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SJ36090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SJ40090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 1200 | SJ20044 | 0 | 1 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| | SJ24040 | 0 | 0 | x | x | x | x | x | x | x | 0 | x | x | x | x | x | x | x | x | x | x | x |
| | SJ24051 | 0 | 0 | 0 | 1 | 2 | x | x | x | x | 0 | 0 | x | x | x | x | x | x | x | x | x | x |
| | SJ24070 | 0 | 0 | 0 | 0 | 1 | 2 | X | X | X | 0 | 0 | x | x | x | x | x | x | x | x | x | x |
| | SJ24090 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | x | 0 | 0 | 0 | 0 | 0 | x | x | x | x | x | x | |
| | SJ30040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x | 0 | 0 | 0 | 0 | 1 | 2 | x | x | x | x | x | x |
| | SJ30051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | x | x | x | x | x | x |
| | SJ30070 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | x | x | x | x | x | x |
| | SJ30090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | x | x | x |
| | SJ36058 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | x | x | x |
| | SJ36090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | x |
| SJ40090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | |

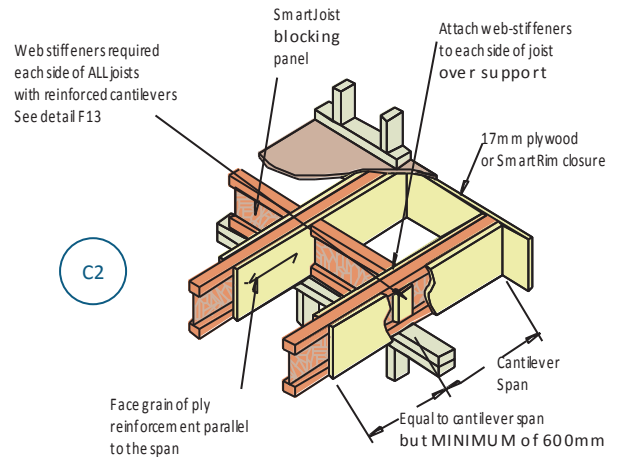
Spans in the preceding table are based upon a uniform roof load width at the cantilever end of each joist. The presence of large windows or openings within the load bearing wall supported by these cantilevered joists create concentrated loads at the edges of such openings. The joists supporting the concentrated loads will require special engineering consideration to avoid excess loads and differential deflections between adjacent joists. It is strongly recommended that where concentrated loads occur on cantilevered joists that advice be sought from the SmartData Customer HelpLine on 1300 668 690 or at smartdata@tilling.com.au.

Example construction details for load-bearing cantilevers

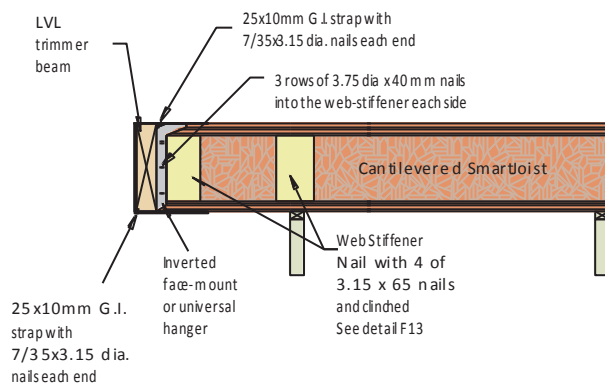
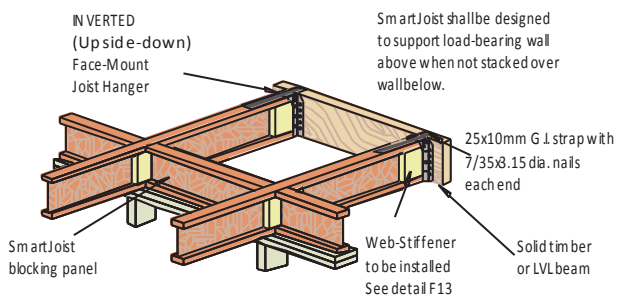
Note: Option 1 with cantilever reinforced with an extra SmartJoist is equivalent to option 2 with 2 sheets of ply reinforcement.



NOTE:
Block together full length with filler blocks as per detail F15 of the SmartJoist Design Guide



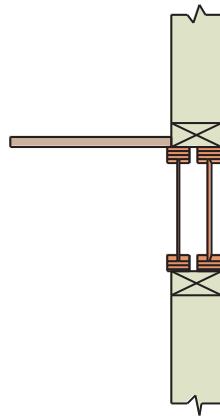
NOTE:
15 mm F11 structural ply is required on one or both sides of the joist (See Tables). Depth shall match the full height of the Smartjoist. Nail with 3.15 x 65 nails at 100mm ctrs in a staggered pattern.



SmartJoists supporting parallel load-bearing walls

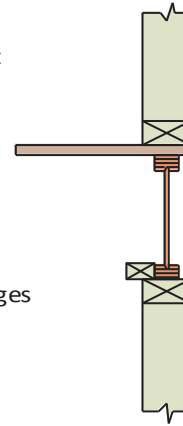
Fitted floors

Double SmartJoists required for fixing of floor and ceiling, and when required by table below
AND
for SmartJoists with 40 mm wide flanges

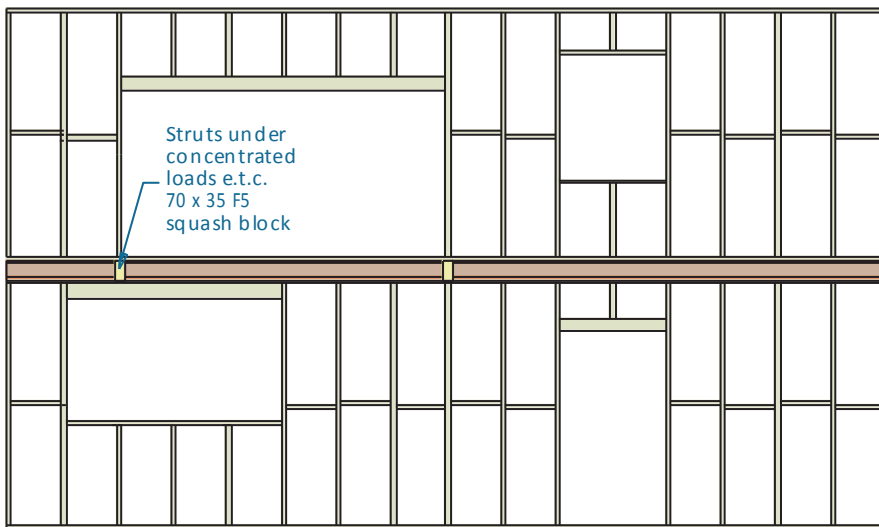


Platform floors

Single SmartJoist with flange > 50 mm may be used, but requires alternative fixing for ceiling.
NOT suitable for SmartJoists with 40 mm wide flanges e.g. SJ24040

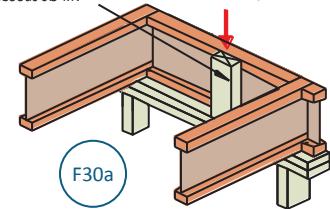


Joists continuously supported by lower walls



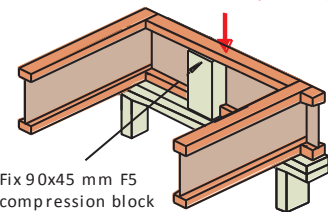
Fix 90x45 mm F5 compression block to SmartJoist where load exceeds 6.5 kN*

Concentrated point loads (eg, girder trusses, TG's all beams & jamb studs)



Single SmartJoists with flange width < plate width

Concentrated point loads (eg, girder trusses, TG's all beams & jamb studs)

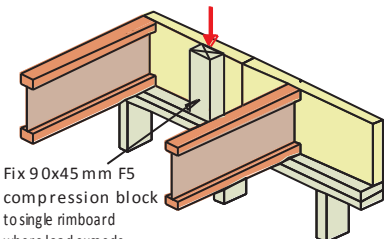


Fix 90x45 mm F5 compression block to SmartJoist where load exceeds 6.5 kN*

F30b

Single SmartJoists with flange width >= plate width

Concentrated point loads (eg, girder trusses, TG's all beams & jamb studs)

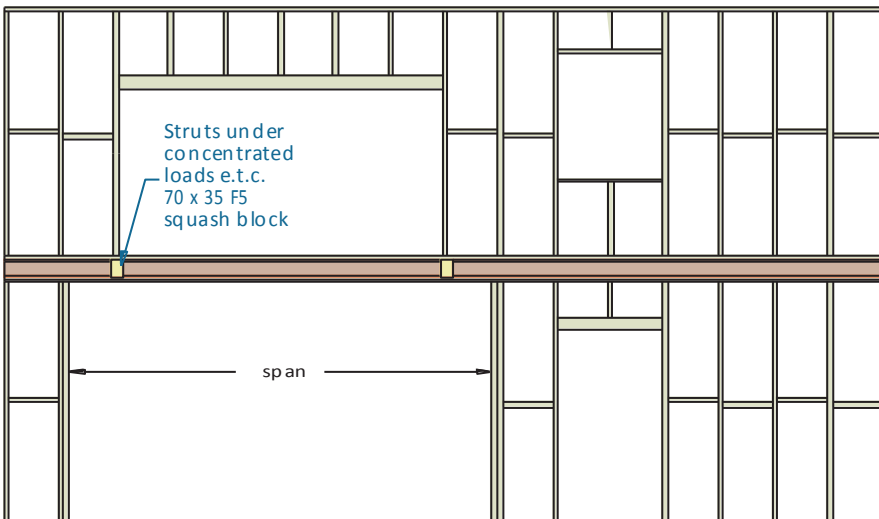


Fix 90x45 mm F5 compression block to single rimboard where load exceeds 26.0 kN*

F30c

Single SmartRim

Joist non-continuously supported by lower wall



Single (and double) SmartJoists are adequate to transfer uniformly distributed compression loads up to 29 kN/m per joist from loadbearing walls to a continuous rigid support below. Detail F5 and F8 are used to transfer concentrated loads where walls are perpendicular to the joists. Details F30a, F30b and F30c above must be used to transfer concentrated loads through parallel SmartJoists where the instantaneous reaction exceeds

6.5 kN and exceeds 26.0 kN for single SmartRim (reaction needs to be factored for load duration)

The table below gives allowable spans for single and double joists NOT continuously supported by a parallel wall. Care must always be taken to adequately support the web of the joists from concentrated point loads from above by adopting details F13.

Single SmartJoists supporting parallel load bearing walls

| Floor load width (mm) | | 900 | | | 1200 | | | 1500 | | |
|-----------------------|-----------------------------------|------------------------------|------|------|------|------|------|------|------|------|
| Roof load width (mm) | Roof mass (kg/m ²) | 1500 | 3000 | 5000 | 1500 | 3000 | 5000 | 1500 | 3000 | 5000 |
| SmartJoist | | Maximum single span (mm) | | | | | | | | |
| SJ20044 | 40 | 2800 | 2400 | 2100 | 2600 | 2300 | 2000 | 2400 | 2400 | 1900 |
| | 90 | 2400 | 1900 | 1600 | 2200 | 1900 | 1500 | 2100 | 1800 | 1400 |
| SJ24040 | 40 | 3100 | 2800 | 2400 | 2900 | 2600 | 2300 | 2700 | 2500 | 2200 |
| | 90 | 2700 | 2200 | 1900 | 2500 | 2100 | 1800 | 2400 | 2100 | 1800 |
| SJ24051 | 40 | 3200 | 2900 | 2600 | 3100 | 2800 | 2500 | 2900 | 2700 | 2400 |
| | 90 | 2900 | 2400 | 2000 | 2700 | 2300 | 1900 | 2600 | 2200 | 1800 |
| SJ24070 | 40 | 3500 | 3100 | 2900 | 3300 | 3000 | 2700 | 3100 | 2900 | 2600 |
| | 90 | 3100 | 2600 | 2200 | 3000 | 2500 | 2100 | 2900 | 2400 | 2000 |
| SJ24090 | 40 | 3700 | 3200 | 3000 | 3500 | 3200 | 2900 | 3300 | 3100 | 2800 |
| | 90 | 3300 | 2800 | 2300 | 3100 | 2700 | 2300 | 3000 | 2600 | 2200 |
| SJ30040 | 40 | 3600 | 3200 | 2900 | 3300 | 3100 | 2800 | 3200 | 3000 | 2900 |
| | 90 | 3100 | 2700 | 2300 | 3000 | 2600 | 2200 | 2900 | 2500 | 2100 |
| SJ30051 | 40 | 3700 | 3400 | 3100 | 3500 | 3200 | 3000 | 3300 | 3100 | 2900 |
| | 90 | 3300 | 2900 | 2400 | 3200 | 2900 | 2400 | 3100 | 2700 | 2300 |
| SJ30070 | 40 | 4000 | 3600 | 3300 | 3800 | 3500 | 3200 | 3600 | 3300 | 3100 |
| | 90 | 3500 | 3100 | 2700 | 3400 | 3000 | 2600 | 3300 | 2900 | 2500 |
| SJ30090 | 40 | 4200 | 3800 | 3500 | 4000 | 3700 | 3400 | 3800 | 3500 | 3300 |
| | 90 | 3700 | 3200 | 2900 | 3600 | 3200 | 2800 | 3500 | 3100 | 2700 |
| SJ36058 | 40 | 4300 | 3900 | 3600 | 4100 | 3800 | 3500 | 3900 | 3600 | 3400 |
| | 90 | 3800 | 3400 | 3000 | 3700 | 3300 | 2900 | 3600 | 3200 | 2700 |
| SJ36090 | 40 | 4700 | 4200 | 3900 | 4400 | 4100 | 3700 | 4200 | 3900 | 3600 |
| | 90 | 4200 | 3600 | 3200 | 4000 | 3500 | 3100 | 3900 | 3400 | 3100 |
| SJ40090 | 40 | 5000 | 4500 | 4100 | 4700 | 4300 | 4000 | 4500 | 4200 | 3900 |
| | 90 | 4400 | 3900 | 3400 | 4300 | 3800 | 3300 | 4100 | 3700 | 3300 |
| | | Maximum Continuous span (mm) | | | | | | | | |
| SJ20044 | 40 | 3700 | 3300 | 2900 | 3500 | 3200 | 2800 | 3200 | 3000 | 2600 |
| | 90 | 3300 | 2500 | 1800 | 3100 | 2400 | 1700 | 2900 | 2200 | 1600 |
| SJ24040 | 40 | 3800 | 3300 | 2800 | 3400 | 3100 | 2700 | 3100 | 2900 | 2600 |
| | 90 | 3200 | 2600 | 2100 | 3000 | 2500 | 2100 | 2800 | 2400 | 2100 |
| SJ24051 | 40 | 4200 | 3800 | 3400 | 4000 | 3700 | 3200 | 3700 | 3500 | 3100 |
| | 90 | 3800 | 3100 | 2300 | 3600 | 2900 | 2200 | 3400 | 2800 | 2100 |
| SJ24070 | 40 | 4500 | 4100 | 3800 | 4300 | 3900 | 3600 | 4100 | 3800 | 3500 |
| | 90 | 4000 | 3500 | 2500 | 3900 | 3200 | 2400 | 3700 | 3000 | 2300 |
| SJ24090 | 40 | 4800 | 4300 | 4000 | 4500 | 4200 | 3800 | 4300 | 4000 | 3700 |
| | 90 | 4300 | 3700 | 2700 | 4100 | 3500 | 2600 | 4000 | 3300 | 2500 |
| SJ30040 | 40 | 3900 | 3300 | 2900 | 3500 | 3100 | 2800 | 3200 | 3000 | 2700 |
| | 90 | 3200 | 2600 | 2200 | 3100 | 2500 | 2200 | 2900 | 2500 | 2100 |
| SJ30051 | 40 | 4700 | 4100 | 3500 | 4300 | 3800 | 3400 | 3900 | 3600 | 3200 |
| | 90 | 4000 | 3200 | 2700 | 3700 | 3100 | 2600 | 3500 | 3000 | 2500 |
| SJ30070 | 40 | 5100 | 4700 | 4300 | 4900 | 4500 | 4200 | 4700 | 4300 | 4000 |
| | 90 | 4600 | 4000 | 3200 | 4400 | 3800 | 3000 | 4300 | 3700 | 2900 |
| SJ30090 | 40 | 5400 | 5000 | 4500 | 5100 | 4800 | 4400 | 4900 | 4600 | 4300 |
| | 90 | 4900 | 4200 | 3500 | 4700 | 4100 | 3300 | 4500 | 4000 | 3200 |
| SJ36058 | 40 | 5600 | 4900 | 4300 | 5200 | 4600 | 4100 | 4700 | 4400 | 3900 |
| | 90 | 4800 | 3900 | 3300 | 4500 | 3800 | 3200 | 4300 | 3600 | 3000 |
| SJ36090 | 40 | 6000 | 5500 | 5000 | 5700 | 5300 | 4900 | 5500 | 5100 | 4700 |
| | 90 | 5400 | 4700 | 3900 | 5200 | 4600 | 3800 | 5000 | 4500 | 3600 |
| SJ40090 | 40 | 6400 | 5800 | 5300 | 6100 | 5600 | 5200 | 5800 | 5400 | 5000 |
| | 90 | 5700 | 5000 | 4200 | 5500 | 4900 | 4000 | 5300 | 4800 | 3900 |

NOTES:

- Bearing lengths - minimum of 30 mm
- Wall loads assumed 0.37 kPa
- Floor load loads 1.5 kPa or 1.8 kN point live load
- Upper floor dead load 40 kg/m².
- deflection limits: permanent load - span/300 or 12 mm max LL - span/360 or 9 mm max.

Single SmartJoists supporting parallel load bearing walls

| Floor load width (mm) | | 900 | | | 1200 | | | 1500 | | |
|------------------------------|--------------------------------|--------------------------|------|------|------|------|------|------|------|------|
| Roof load width (mm) | Roof mass (kg/m ²) | 1500 | 3000 | 5000 | 1500 | 3000 | 5000 | 1500 | 3000 | 5000 |
| SmartJoist | | Maximum single span (mm) | | | | | | | | |
| 2/SJ20044 | 40 | 3500 | 3200 | 2900 | 3300 | 3100 | 2800 | 3200 | 3000 | 2700 |
| | 90 | 3100 | 2700 | 2300 | 3000 | 2600 | 2200 | 2900 | 2500 | 2200 |
| 2/SJ24040 | 40 | 3800 | 3500 | 3200 | 3600 | 3400 | 3100 | 3500 | 3300 | 3000 |
| | 90 | 3400 | 3000 | 2600 | 3300 | 3000 | 2600 | 3200 | 2900 | 2500 |
| 2/SJ24051 | 40 | 4000 | 3700 | 3400 | 3800 | 3600 | 3300 | 3700 | 3400 | 3200 |
| | 90 | 3600 | 3200 | 2800 | 3500 | 3100 | 2700 | 3400 | 3000 | 2700 |
| 2/SJ24070 | 40 | 4300 | 4000 | 3600 | 4100 | 3800 | 3500 | 3900 | 3700 | 3400 |
| | 90 | 3900 | 3400 | 3000 | 3700 | 3300 | 3000 | 3600 | 3300 | 2900 |
| 2/SJ24090 | 40 | 4600 | 4200 | 3800 | 4300 | 4000 | 3700 | 4200 | 3900 | 3600 |
| | 90 | 4100 | 3600 | 3200 | 4000 | 3500 | 3200 | 3800 | 3400 | 3100 |
| 2/SJ30040 | 40 | 4400 | 4000 | 3700 | 4100 | 3800 | 3600 | 4000 | 3700 | 3500 |
| | 90 | 3900 | 3500 | 3100 | 3800 | 3400 | 3000 | 3700 | 3300 | 3000 |
| 2/SJ30051 | 40 | 4600 | 4200 | 3900 | 4400 | 4100 | 3800 | 4200 | 3900 | 3700 |
| | 90 | 4100 | 3700 | 3300 | 4000 | 3600 | 3200 | 3900 | 3500 | 3200 |
| 2/SJ30070 | 40 | 4900 | 4500 | 4100 | 4700 | 4300 | 4000 | 4500 | 4200 | 3900 |
| | 90 | 4400 | 3900 | 3500 | 4300 | 3800 | 3400 | 4100 | 3700 | 3400 |
| 2/SJ30090 | 40 | 5200 | 4800 | 4400 | 5000 | 4600 | 4200 | 4700 | 4400 | 4100 |
| | 90 | 4700 | 4100 | 3700 | 4500 | 4000 | 3600 | 4400 | 3900 | 3500 |
| 2/SJ36058 | 40 | 5300 | 4900 | 4500 | 5100 | 4700 | 4400 | 4800 | 4500 | 4200 |
| | 90 | 4800 | 4200 | 3800 | 4600 | 4100 | 3700 | 4500 | 4000 | 3600 |
| 2/SJ36090 | 40 | 5800 | 5300 | 4900 | 5500 | 5100 | 4700 | 5300 | 4900 | 4600 |
| | 90 | 5200 | 4600 | 4100 | 5000 | 4500 | 4000 | 4800 | 4400 | 3900 |
| 2/SJ40090 | 40 | 6100 | 5600 | 5200 | 5800 | 5400 | 5000 | 5600 | 5200 | 4900 |
| | 90 | 5500 | 4900 | 4300 | 5300 | 4700 | 4300 | 5100 | 4600 | 4200 |
| Maximum Continuous span (mm) | | | | | | | | | | |
| 2/SJ20044 | 40 | 4400 | 4000 | 3500 | 4100 | 3700 | 3300 | 3800 | 3500 | 3200 |
| | 90 | 3900 | 3100 | 2600 | 3600 | 3000 | 2600 | 3500 | 2900 | 2500 |
| 2/SJ24040 | 40 | 4100 | 3600 | 3100 | 3800 | 3400 | 3000 | 3500 | 3200 | 2900 |
| | 90 | 3500 | 2900 | 2400 | 3300 | 2800 | 2300 | 3100 | 2700 | 2300 |
| 2/SJ24051 | 40 | 5100 | 4500 | 3900 | 4700 | 4200 | 3700 | 4300 | 4000 | 3600 |
| | 90 | 4300 | 3600 | 3000 | 4100 | 3400 | 2900 | 3900 | 3300 | 2800 |
| 2/SJ24070 | 40 | 5400 | 5000 | 4600 | 5200 | 4800 | 4400 | 5000 | 4600 | 4300 |
| | 90 | 4900 | 4300 | 3800 | 4700 | 4200 | 3700 | 4600 | 4100 | 3600 |
| 2/SJ24090 | 40 | 5800 | 5300 | 4800 | 5500 | 5100 | 4700 | 5300 | 4900 | 4600 |
| | 90 | 5200 | 4600 | 4100 | 5000 | 4500 | 4000 | 4800 | 4400 | 3900 |
| 2/SJ30040 | 40 | 4100 | 3500 | 3100 | 3700 | 3300 | 2900 | 3400 | 3100 | 2800 |
| | 90 | 3400 | 2800 | 2400 | 3200 | 2700 | 2300 | 3100 | 2600 | 2300 |
| 2/SJ30051 | 40 | 5000 | 4400 | 3800 | 4600 | 4100 | 3700 | 4300 | 3900 | 3500 |
| | 90 | 4300 | 3500 | 2900 | 4000 | 3400 | 2900 | 3800 | 3300 | 2800 |
| 2/SJ30070 | 40 | 6200 | 5700 | 5000 | 5900 | 5400 | 4700 | 5500 | 5100 | 4600 |
| | 90 | 5500 | 4500 | 3800 | 5200 | 4400 | 3700 | 5000 | 4200 | 3600 |
| 2/SJ30090 | 40 | 6600 | 6000 | 5500 | 6300 | 5800 | 5400 | 6000 | 5600 | 5200 |
| | 90 | 5900 | 5200 | 4600 | 5700 | 5100 | 4600 | 5500 | 5000 | 4500 |
| 2/SJ36058 | 40 | 6100 | 5300 | 4600 | 5500 | 5000 | 4400 | 5100 | 4700 | 4200 |
| | 90 | 5100 | 4200 | 3500 | 4800 | 4100 | 3500 | 4600 | 3900 | 3400 |
| 2/SJ36090 | 40 | 7300 | 6700 | 6100 | 6900 | 6400 | 6000 | 6600 | 6200 | 5700 |
| | 90 | 6600 | 5700 | 4800 | 6300 | 5500 | 4700 | 6100 | 5300 | 4600 |
| 2/SJ40090 | 40 | 7700 | 7100 | 6200 | 7400 | 6700 | 5900 | 6900 | 6400 | 5700 |
| | 90 | 7000 | 5700 | 4700 | 6600 | 5400 | 4600 | 6200 | 5300 | 4500 |

NOTES:

- bearing lengths - minimum of 30 mm
- wall loads assumed 0.37 kPa
- floor load Loads 1.5 kPa or 1.8 kN point live load.
- upper floor dead load 40 kg/m²
- deflection limits: permanent load - span/300 or 12 mm max LL - span/360 or 9 mm max.

SmartJoist as rafters

About roofs

Roof members are subject to dead and live loads as well as wind loads. These wind loads can act either down onto the roof, or can create an uplift effect. For roofs of light construction, the uplift loads generally control the maximum span, whereas it is usual for dead and live loads to be the controlling factors for heavier roofs (e.g. tiles). SmartJoists, by their large depth to width ratio, perform well in roof situations providing that their upper and lower flanges have adequate lateral support provided by battens and/or ceiling materials. Due to this fact, the spans in the table below only apply for roofs which meet the following criteria:

- Enclosed building

- Ceiling fastened to the underside of bottom flange or adequate lateral supports to bottom flange at a minimum of 600 mm centres
- Roofs are constructed as per details R1 to R9 of this manual
- Batten spacing at a maximum of 1200 centres.

Tie downs

Wind loadings on light roofs can produce net uplift pressures. The same requirements and methods of tie down apply to SmartJoists as for solid timber roof members except that any tie down system must extend over the top flange. Guidance for tie down requirements are provided in AS1684.

Wind Classification N1 - N3

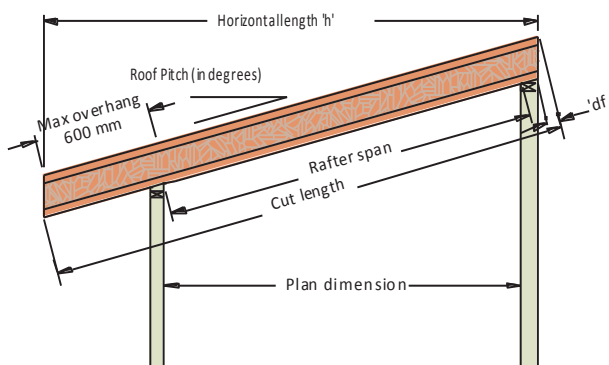
Max Deflections DL: Span/300 LL: Span/250 WL: Span/150. Max Slope = 25°.

| Joist Code | Roof mass (kg/m ²) | Single span @ 25° pitch | | | | Continuous 2 span @ 25° pitch | | | |
|------------|-----------------------------------|---|------|------|------|-------------------------------|--------------------|--------------------|--------------------|
| | | Rafter/roof beam spacing (mm) | | | | | | | |
| | | 450 | 600 | 900 | 1200 | 450 | 600 | 900 | 1200 |
| | | Recommended maximum rafter span - Plan dimension (mm) | | | | | | | |
| SJ20044 | 40 | 5000 | 4600 | 4000 | 3650 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | 4550 |
| | 90 | 3850 | 3500 | 3050 | 2750 | N/A ⁽¹⁾ | 4900 | 4250 | 3800 |
| SJ24040* | 40 | 5600 | 5150 | 4500 | 4100 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | 4850 | 4300 |
| | 90 | 4350 | 3950 | 3450 | 3100 | N/A ⁽¹⁾ | 4750 | 4050 | 3550 |
| SJ24051 | 40 | 6000 | 5550 | 4850 | 4450 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | 5200 |
| | 90 | 4700 | 4250 | 3700 | 3350 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | 4950 | 4350 |
| SJ24070 | 40 | 6600 | 6050 | 5350 | 4850 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| | 90 | 5100 | 4650 | 4050 | 3650 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| SJ24090 | 40 | 7000 | 6500 | 5750 | 5250 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| | 90 | 5500 | 5050 | 4400 | 3950 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| SJ30040* | 40 | 6600 | 6100 | 5400 | 4850 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| | 90 | 5200 | 4700 | 4100 | 3700 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| SJ30051 | 40 | 7100 | 6550 | 5800 | 5300 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| | 90 | 5600 | 5050 | 4450 | 4000 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| SJ30070 | 40 | 7800 | 7200 | 6350 | 5800 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| | 90 | 6100 | 5550 | 4850 | 4400 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| SJ30090 | 40 | 8250 | 7700 | 6800 | 6250 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| | 90 | 6550 | 6000 | 5200 | 4700 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| SJ36058 | 40 | 8450 | 7950 | 7000 | 6400 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| | 90 | 6750 | 6150 | 5400 | 4850 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| SJ36090 | 40 | 9150 | 8650 | 7800 | 7150 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| | 90 | 7550 | 6900 | 6000 | 5450 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| SJ40090 | 40 | 9650 | 9150 | 8350 | 7750 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |
| | 90 | 8150 | 7450 | 6500 | 5900 | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ | N/A ⁽¹⁾ |

NOTE: ⁽¹⁾ Maximum Continuous spans exceed the maximum available length of the SmartJoist

*Product not currently available in NSW—check before ordering

Sloped roof span and cut lengths



| Roof slope degrees | Slope factor 's _f ' | Depth factor 'd _f ' | | | | |
|--------------------|--------------------------------|--------------------------------|-----|-----|-----|-----|
| | | Joist depth (mm) | | | | |
| | | 200 | 240 | 300 | 360 | 400 |
| 15.0 | 1.04 | 54 | 64 | 80 | 96 | 107 |
| 17.5 | 1.05 | 63 | 76 | 95 | 113 | 126 |
| 20.0 | 1.06 | 73 | 88 | 109 | 131 | 146 |
| 22.5 | 1.08 | 83 | 99 | 124 | 149 | 166 |
| 25.0 | 1.10 | 93 | 112 | 140 | 168 | 187 |
| 27.5 | 1.13 | 104 | 125 | 156 | 187 | 208 |
| 30.0 | 1.15 | 115 | 139 | 173 | 208 | 231 |
| 35.0 | 1.22 | 140 | 168 | 210 | 252 | 280 |

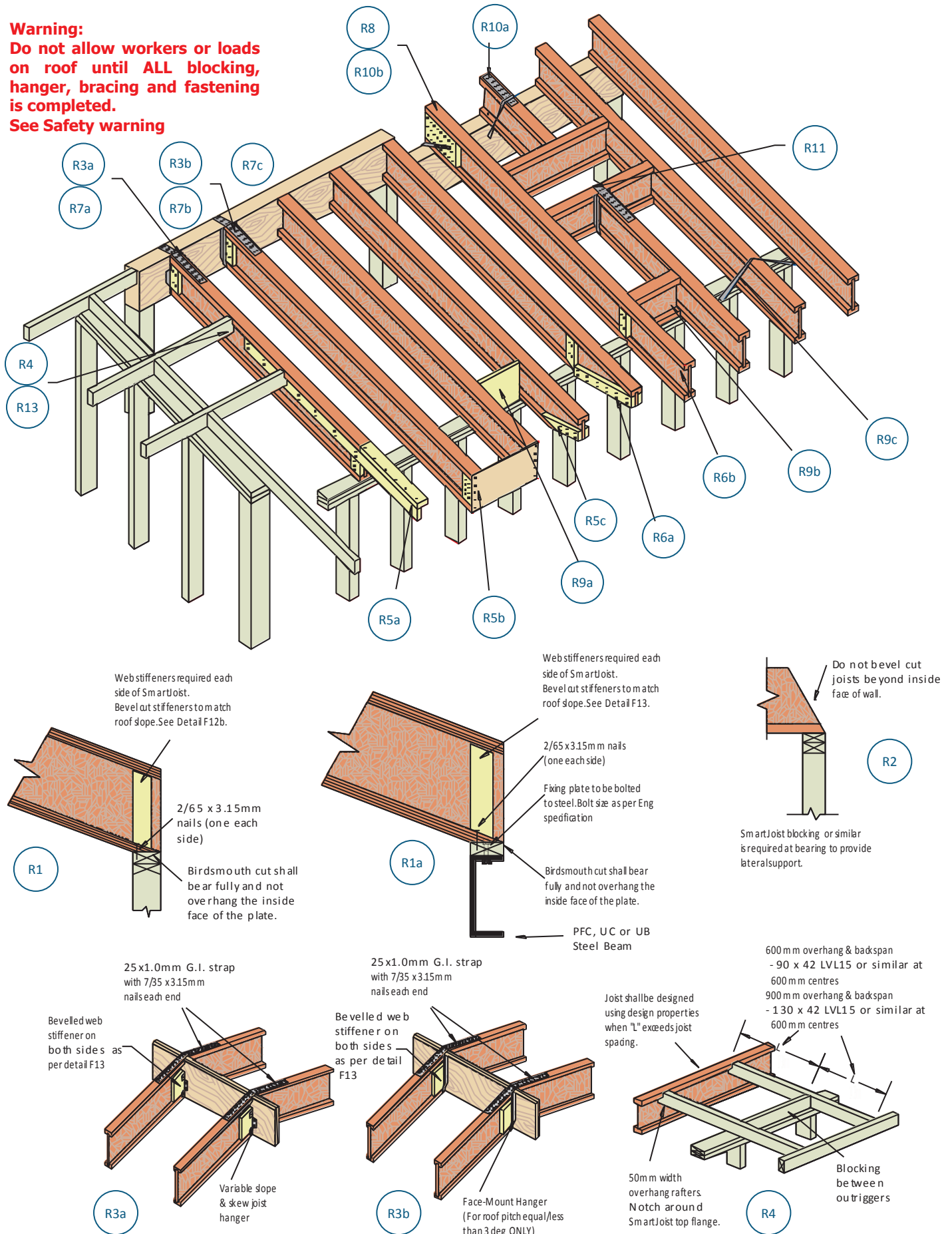
span (mm) = plan dimension x slope factor (s_f)

Cut length (mm) = horizontal length (h) x slope factor (s_f) + depth factor (d_f) = h x s_f + d_f

Typical SmartJoist Roof details

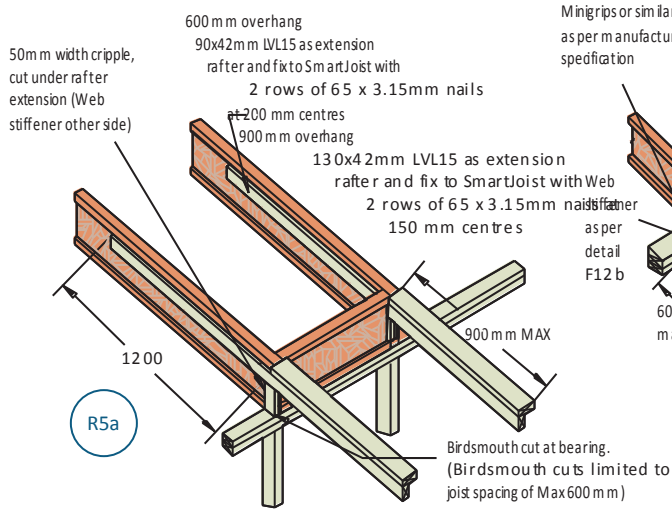
Warning:
Do not allow workers or loads on roof until ALL blocking, hanger, bracing and fastening is completed.

See Safety warning

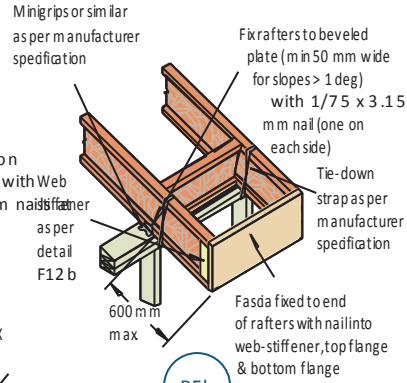


Note: Tiedown details to be designed to AS 1684.2 for the respective wind loads with the SmartFrame software

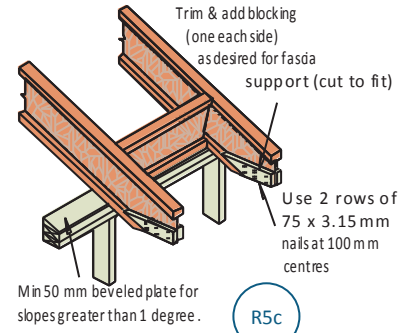
Typical SmartJoist Roof details (cont'd)



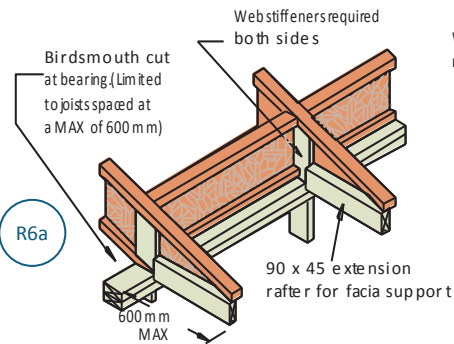
R5a



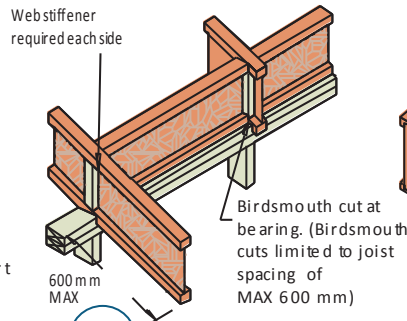
R5b



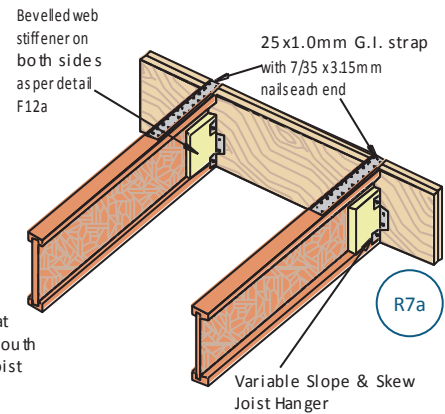
R5c



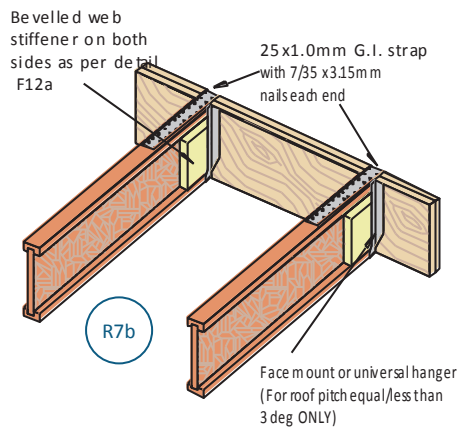
R6a



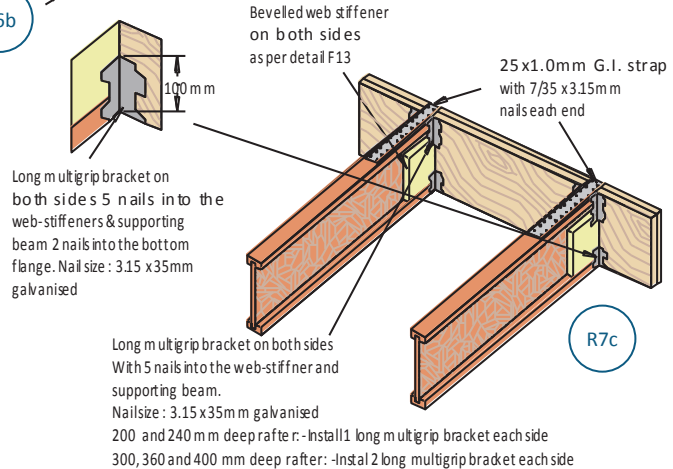
R6b



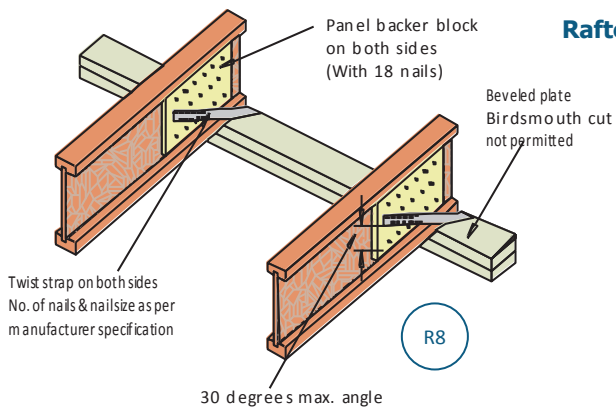
R7a



R7b

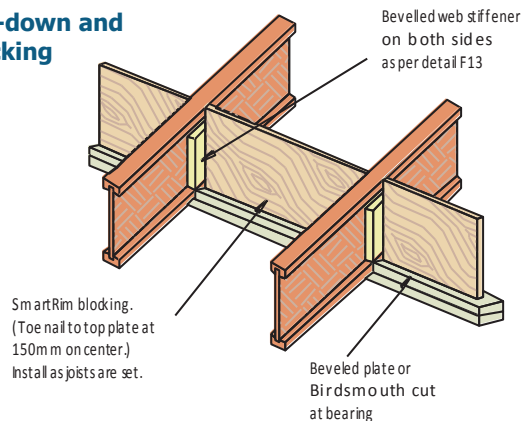


R7c



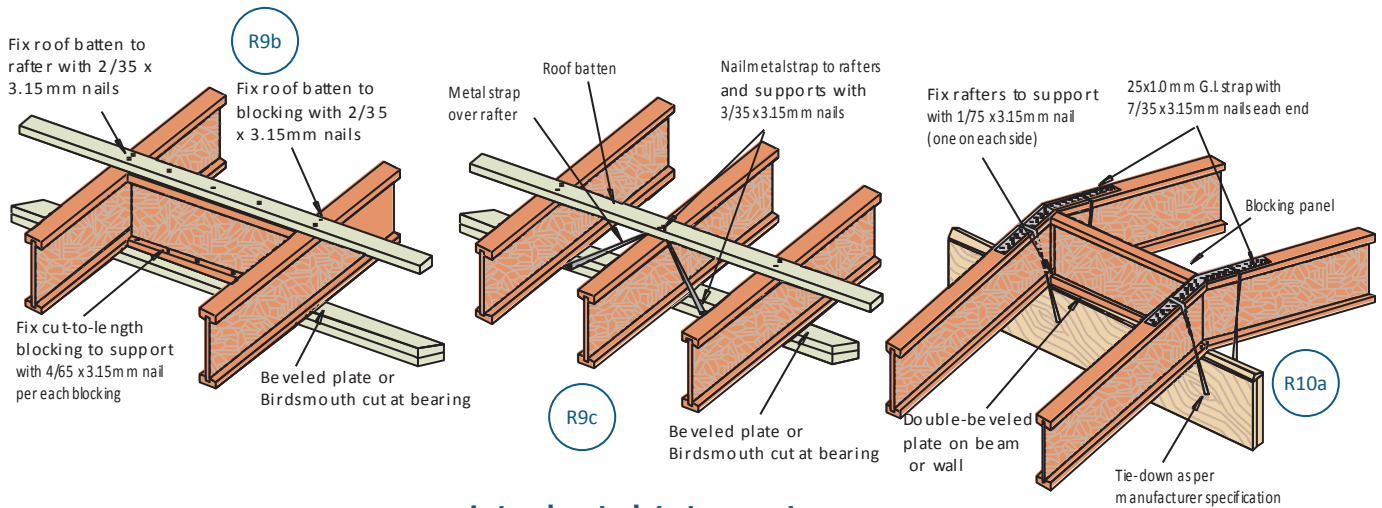
R8

Rafter tie-down and blocking

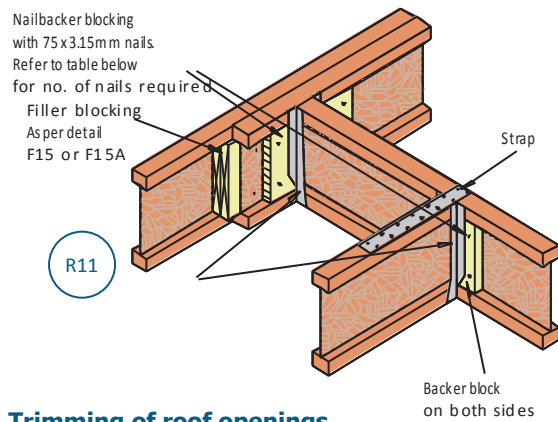
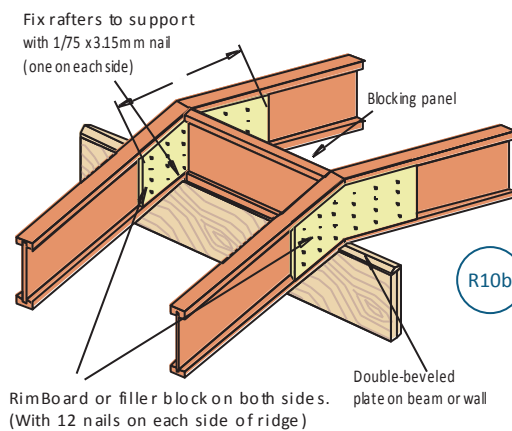


R9a

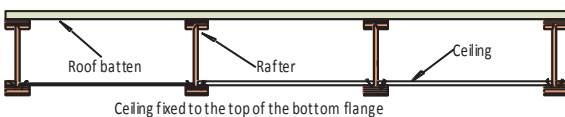
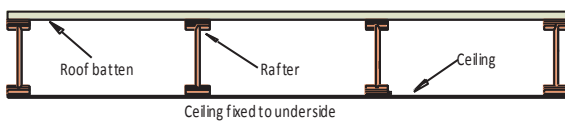
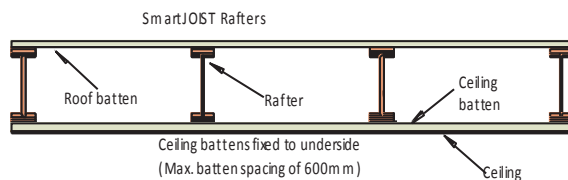
Typical SmartJoist Roof details (cont'd)



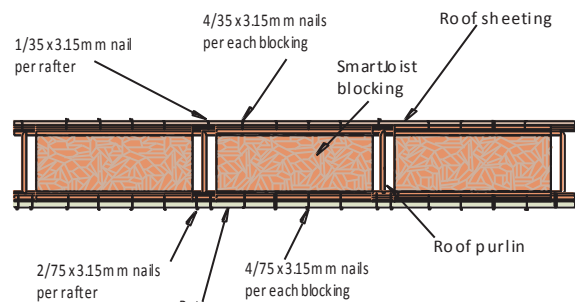
Lateral restraint at supports



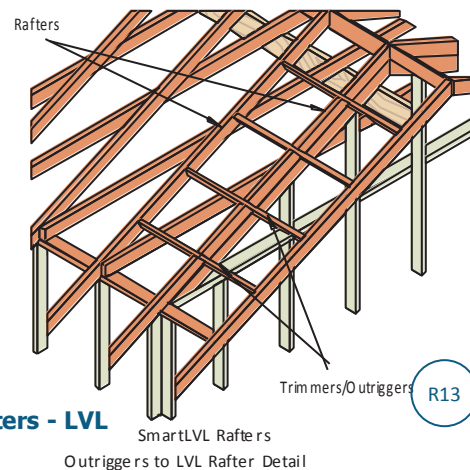
Trimming of roof openings



Lateral restraint for rafters - Use of ceiling options to provide lateral support



Lateral restraint - SmartJoist blocking fixing



Outrigger rafters - LVL

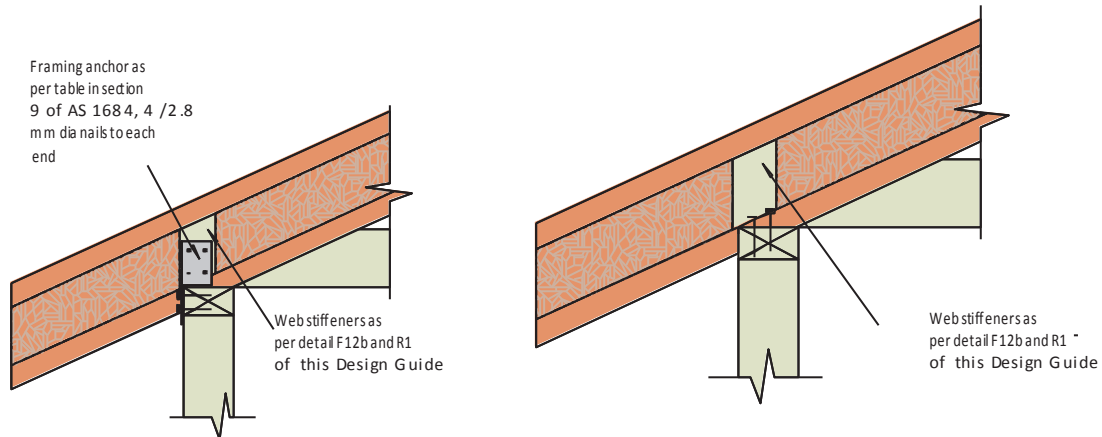
SmartJoist rafter tie down

SmartJoist rafters need to be tied down in wind uplift situations in a similar manner to solid timber as shown in section 9 of AS 1684. It is beyond the scope of this document to show tie down requirements for every case.

The examples shown in this section are equally applicable to SmartJoists except that web stiffeners as per detail F12a and R1 must be installed to the SmartJoists where either skewed nails or framing anchors are chosen as the tie down method before the uplift capacities in the tables in section 9 of AS 1684 can be adopted.

All tie down types that involve a strap over the top of the SmartJoist rafters, or involving the bolting down of a member above the rafter running in the perpendicular direction, require no modification to the SmartJoist and therefore uplift capacities in the tables in section 9 of AS 1684 may be used.

The SmartFrame software has a tie-down module in which the development of tie down systems complying with section 9 of AS 1684 can be easily designed.



Typical SmartJoist rafter box gutter details

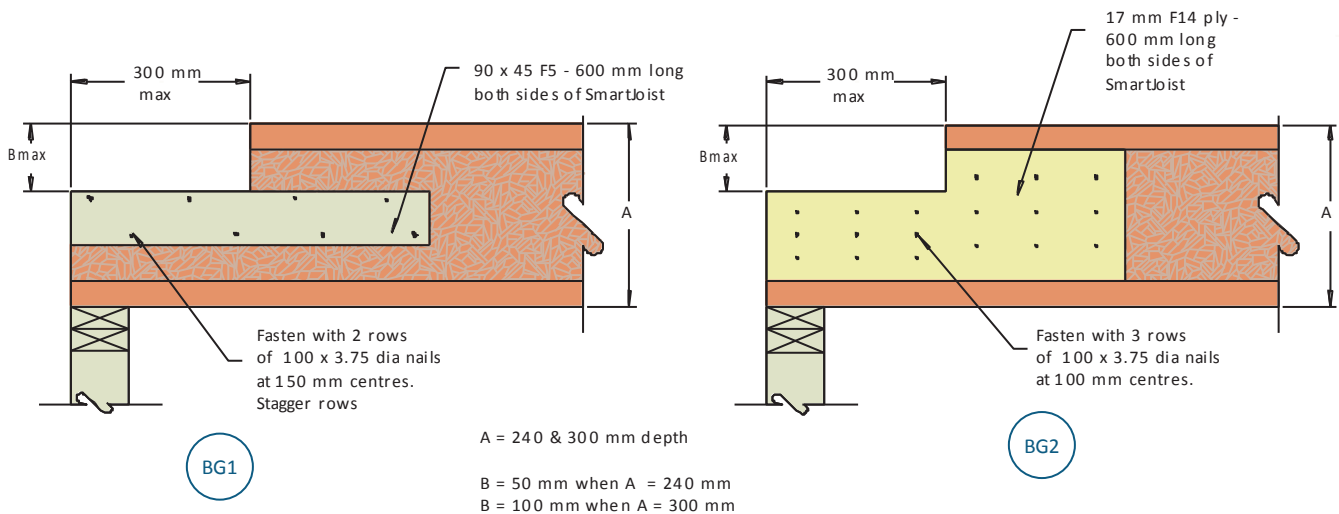
Box gutter details

Rebates for box gutters are permissible within a roof constructed with SmartJoist rafters to the MAXIMUM rebate limits as shown below.

- Fig BG1 with 2 pieces of 90 x 45 nailed to the web reduces shear capacity by 40%
- Fig BG2 with 2 pieces of 17 mm F14 ply nailed to the web maintains full shear capacity

Given that the design shear values at the end of rafters with light-weight roofs are usually very low compared to the allowable shear, in most instances figure BG1 is satisfactory to provide a box gutter rebate within the SmartJoist rafters, however the remaining shear capacity MUST be checked.

It is recommended that designers wishing to cut box gutter rebates in SmartJoist rafter contact the SmartData Customer Help-line on 1300 668 690 or at smartdata@tilling.com.au for further advice on this issue.



Building envelope watertightness - decks

Deck ledger attachments

Many houses have decks attached to them. They are usually attached by first installing a deck ledger to the side of a house. The ledger carries the load for one end of the floor joists of the deck. The ledger and its attachment points penetrate the exterior cladding and must be flashed to protect the wall from rain water running down the cladding.

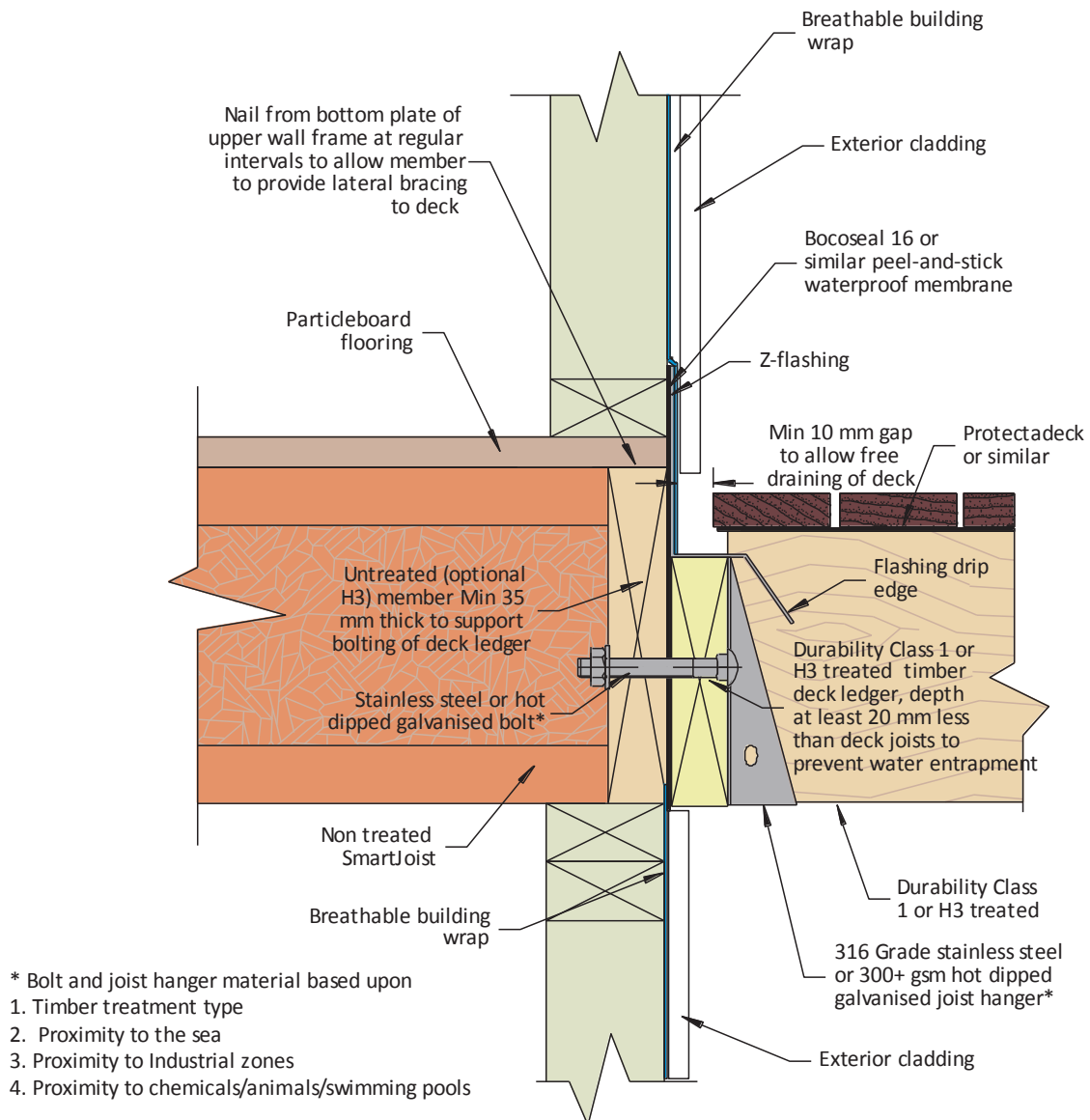
This area of the wall experiences more rain exposure than most others because rain hitting the deck next to the wall splashes against the wall. "Free-standing" decks avoid this problem because they do not penetrate the cladding envelope.

As with window and door installations in walls, paying careful attention to flashing details is critical to avoid potential rot and mould of inner non treated wall frames and floor systems. Water from direct rainfall, splash from decks and runoff from incorrectly sloped deck surfaces can leak into the exterior wall where the deck attaches to the house.

Several conditions contribute to the water problem:

- The ledger board is simply attached to the house with numerous lag screws or other hardware that penetrate the wall's cladding and drainage plane, but no flashing has been installed to protect these areas
- Water is often trapped behind the ledger board
- Upward splashing of rain from the deck adds significant wetting to the cladding, and inadequate flashing results in wetting and rot in the wall's framing and other internal elements.
- Integrating the attachment of the ledger board with the drainage plane behind the wall's cladding and adding proper flashing will maintain the integrity of the drainage plane and channel water away from the wall's surface.

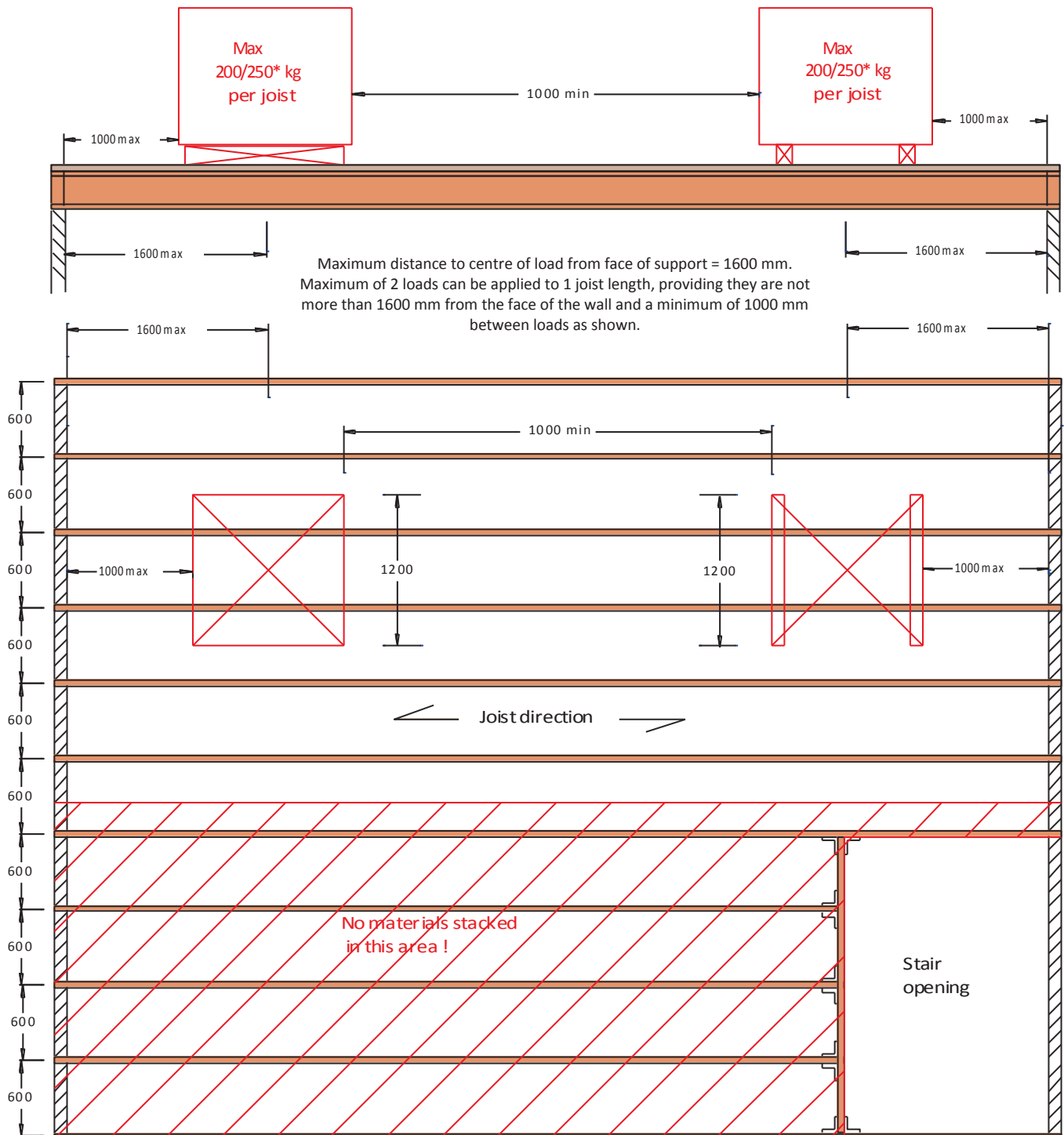
Example flashing of deck ledger connection to un-treated house frame



Safe loading of materials on a SmartJoist working platform

IMPORTANT!! Joists must be fully braced or have floor sheeting installed before applying any of the following loads.

- * 200 kg per joist for joists less than 240 mm deep
- * 250 kg per joist for joists 240 mm and greater



Notes:

1. Deflection limit is taken as span/200
2. All timber must be kept dry when applying maximum temporary loading
3. Loads are to be spread equally over a minimum of 2 joists, using timber bearers at a minimum of 1200 mm in length or a standard 1200 x 1200 pallet
4. NO loads are to be stacked over any part of the lengths of the joists fixed to an opening header or trimmer joist such as a stair trimmer
5. If no plasterboard is in place under the joists, the bottom flange requires temporary bracing
6. Joists on hangers may require propping
7. If unsure about stacking concentrated loads on SmartJoist working platforms, please contact the SmartFrame Design Centre on 1300 668 690.

Fire safety and sound transmission

Fire safety

The Building code of Australia became a performance-based code in 1996 (BCA96). The introduction of the BCA along with the changes to AS1530.4 has seen Australia brought into line with international standards for fire resistance testing. The principle modification has been to express the test result in terms of the performance of the specimen Fire Resistance Level (FRL) rather than to assign a single rating as had been the established practice. The outcome of the test is expressed as the number of minutes for which the specimen fulfils the requirements of each of the three criteria, being:

- Structural adequacy
- Integrity; and
- Insulation, and expressed in that order

The performance of a specimen is then given as the actual time for which the specimen satisfied these criteria, but rounded down to the nearest regulatory requirements. E.g. 60/60/60.

Ceiling systems may also be required to provide “Resistance to the Incipient Spread of fire” for a given period of time. This requires the ceiling system to prevent the spread of fire within a roof/ceiling or floor/ceiling cavity by providing adequate thermal insulation to combustibles in this area, avoiding the danger of them igniting. To coincide with the changes, the FWPA produced a set of Wood Solutions manuals “*Design and construction guide for BCA compliant fire-rated construction*” which outlined the BCA requirements for all classes of buildings, design criteria and construction details which were designed to satisfy the BCA requirements.

Fire rated floors/ceilings

The best information available at this time concludes that the fire resistance for ceiling and floor/ceilings is achieved by the lining material and that alternative joist sizes and material can be substituted in the various certified systems, providing they are designed to support the full loads. The thickness of the fire grade ceiling lining for the relevant FRL is the same as required in the tested systems using solid timber joists.

Additional testing have concluded that the following layers of fire rated plasterboard can achieve the FRL and incipient spread of fire as listed in the following table:

| Fire grade plasterboard | FRL | Incipient spread of fire |
|-------------------------|-------------|--------------------------|
| 1 x 13 mm | 30/30/30 | 0 |
| 1 x 16 mm | 60/60/60 | 30 |
| 2 x 13 mm | 60/60/60 | 30 |
| 2 x 16 mm | 90/90/90 | 60 |
| 3 x 16 mm | 120/120/120 | 60 |

The above ratings can be achieved using standard fire grade plasterboard from some sheet manufacturers. Other manufacturers may however require the use of special fire rated board or may still require the number of layers outlined in the Wood Solutions

Design and construction guide for BCA compliant fire-rated construction.

For further details on the various certified systems, see the Wood Solution website www.woodsolutions.com.au or contact the engineers on the SmartData Customer HelpLine on 1300 668 690.

Sound transmission

The ability of walls and floors to reduce noise is measured over the most important part of the hearing range (from 125 to 4000 cycles per second), and the results reduced to a “weighted sound reduction index” or R_w value. In 2004, the BCA introduced the addition of a Spectrum Adaption factor. This C_{tr} factor takes into account lower frequency level sounds, and has been chosen in large part, in recognition of the problem of the high bass frequency outputs of modern home theatre systems and amplified music systems. Therefore, both the C_{tr} and the R_w of the building element will now need to be considered.

In addition to being rated for airborne sound transmission, floors are also rated by “Impact sound pressure level” or $L'_{n,w}$ plus the spectrum adaption factor C_i values that rate the capacity of floor assemblies to control impact noise such as footfalls. The lower the $L'_{n,w} + C_i$ of the floor, the better the performance of the floor in terms of impact sound insulation

The BCA now requires a $R_w + C_{tr}$ of 50 in floors between sole occupancy units and between dwellings and a plant room, lift shaft, stairway, public corridor, public lobby or similar.

In 2004, the BCA introduced Deemed-to-satisfy provisions which require the $L'_{n,w} + C_i$ of a floor to be determined by testing in the laboratory. The impact sound insulation requirements for floors in the BCA is $L'_{n,w} + C_i$ not more than 62 for floor separating dwellings and floor separating dwellings from a plant room, lift shaft, stairway, public corridor, public lobby or similar.

The use of light-frame construction systems challenges designers to insulate against noise rather than simply relying on the massiveness of heavy walls and floors. Excellent levels of noise control can be achieved with good acoustics in wood framed structures surfaced with wood structural panels. Sound control can be achieved by applying floor and wall materials over isolated air spaces that absorb sound. The addition of resilient channels to support the ceiling system independently increases the $R_w + C_{tr}$ and $L'_{n,w} + C_i$ ratings.

The best current understanding indicates that the systems – walls, floors and ceiling” as detailed in the Wood Solutions manuals “*Design and construction guide for BCA compliant fire-rated construction*” can be used to closely approximate the $R_w + C_{tr}$ and $L'_{n,w} + C_i$ rating of floor/ceiling systems with SmartJoist floor joists. Work is under way to further investigate the link between joist types and impact sound insulation.

For further details on the various certified systems see www.woodsolutions.com.au or contact the engineers on the SmartData Customer HelpLine on 1300 668 690 or at smartdata@tilling.com.au

SmartGuard® preservative treatment

The treatment of timber to extend its service life is covered by AS/NZS 1604. This code identifies the various biological hazards by a hazard class number, with hazard class numbers from H1 - H6. The higher the hazard class number, the greater the severity of the biological hazard. A complete table listing the 6 hazard classes is contained within AS/NZS 1604.1.

All SmartJoists are supplied H2s treated per the table below, or alternatively may be after-market LOSP SmartGuard H2 treated by an experienced and approved timber preserver.

Water borne treatments are NOT suitable for SmartJoists. It is also NOT recommended that SmartJoists be specified for use outside above ground, even if H3 treated. This is predominately due to the geometric shape of the I-Joist which will not shed water effectively.

Further information on SmartGuard treated I-Joists can be obtained on 1300 668 690 or at smartdata@tilling.com.au

| 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, stair cases, stringers |
| H2s | inside, above ground | South of the Tropic of Capricorn ONLY Protected from weather, Nil leaching | Borers and termites | Interior joists, rafters and roof beams |
| H2 | inside, above ground | Protected from weather, Nil leaching | Borers and termites | Interior joists, rafters and roof beams |

* All SmartJoists are manufactured from materials not susceptible to Lyctid attack

Adhesive and formaldehyde emission facts sheet

Q. Are the glues used in SmartFrame Engineered Wood Products safe?

A. Yes, they are safe, Phenolic resins used in our Engineered Wood Products are stable, polymerised materials. The polymerisation reaction is non-reversible (i.e. once the polymer is formed, it doesn't break down). A wood dust warning label is provided for all SmartFrame wood products to alert our customers that wood dust can be generated by sawing, sanding, or machining wood and wood products.

Q. What is the level of formaldehyde emission from our phenolic-bonded Engineered Wood Products?

A. Independent third party testing has confirmed that formaldehyde emissions from our phenolic-bonded products (i.e. OSB, LVL, and I-Joists) are below 0.5 mg/L under reasonably foreseeable conditions of use, which meets or exceeds the E₀ Formaldehyde Emission Class

In short, all available information indicates that formaldehyde levels associated with phenolic resin-bonded wood products are similar to those of the dimension lumber veneer or other forms of wood used to make the products.

Q. How much formaldehyde is in our phenolic-bonded, Engineered Wood Products?

A. The amount of formaldehyde in our Engineered Wood Products is less than 0.1 percent of the dry weight.

Q. What is being done to reduce the exposure to formaldehyde?

A. Formaldehyde is normally present at low levels, usually lower than 0.03 ppm, in both outdoor and indoor air. Efforts have been made by both government and industry to reduce exposure to formaldehyde. A 1985 regulation by the US Department of Housing and Urban Development (HUD), covering the use of manufactured pressed wood products in housing was designed to ensure that indoor levels were below 0.4 ppm. Product standards established for plywood and particleboard led to significant reductions in formaldehyde emissions from those products. Furthermore, HUD acknowledged that phenolic resin bonded wood products emitted such small quantities of formaldehyde that these products were exempted from all the testing and certification requirements of the standards. In Germany, the German Hazardous Materials regulation, better known as the "E1" Standard, sets a limit of 1.0 mg/L for formaldehyde emissions from some wood-based composite products. All available data indicates that our phenolic bonded Engineered Wood Products meet the more stringent E₀ level.

Q. What affects formaldehyde levels in a home?

A. Formaldehyde levels in the indoor air depend mainly on what is releasing the formaldehyde, the temperature, the humidity, and the air exchange rate (i.e. the amount of outdoor air entering or leaving the indoor area) Levels of formaldehyde decrease with increasing air exchange rate, decreasing temperature, and decreasing humidity.



SMARTFRAME DESIGN COMPENDIUM

Design Compendium Contents

Specification Software

- Technical Support

Design Guides (pdf)

Technical Illustrations (dxf/dwg for CAD)

Fixing Details - fixing details/hangers (jpg)

Video Clips - installation/company (mpg)

Software Tutorial

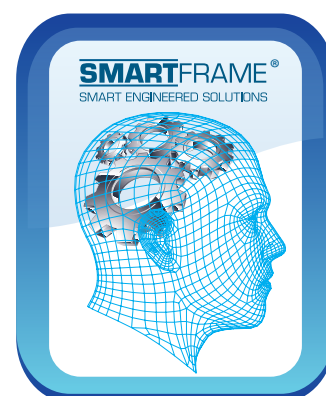
Interactive



Printable



PC



Never before has so much user friendly computer power been unleashed into the hands of building industry professionals to allow the design and detailing of engineered timber products. This software, in conjunction with the SmartFrame Design Centre and SmartFrame engineered timber products themselves, combines to form the most sophisticated structural timber option ever available to the Australian market. The SmartFrame Engineered Timber Solution represents an entirely new and revolutionary concept in the delivery of 21st century technology and service to the building industry.

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