WESBEAM TOWNHOUSE FLOOR DESIGN GUIDE

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INTRODUCTION

Trends in Townhouse and Multi Unit Development in Australia

- **Rising Housing Demand Meets Growing Shortfall**
  The UDIA's 2025 State of the Land[1] report projects a national shortfall of nearly 400,000 dwellings across major capital cities by 2029, falling well short of the federal target of 1.2 million new homes. In 2024, just 135,640 new dwellings were completed, only a 2.4% increase over 2023.]

  Urban density and infill present a critical opportunity, but multi-unit developments such as townhouses are lagging behind. Nationally, new multi unit sales volumes dropped 8% and completions fell 4% in 2024 compared to 2023, leaving multi unit output 53% below the decade average.

Drivers of Townhouse Development

- **Medium Density Infill Demand**
  With unfeasible greenfield expansion and infill options tightening due to planning restrictions, townhouses are becoming a pivotal form of medium density housing to meet demand.
- **Narrow Frontages and Compact Design**
  Constraints on land and infill feasibility push developers toward designs that maximise yield on narrow frontages, a hallmark of townhouse layouts.
- **Government Targets and Support for Medium Density Housing**
  Australia's national housing strategy hinges on delivering 1.2 million homes by 2029, including multi unit stock, making townhouses central to policy and planning frameworks.
- **Affordability and Rental Pressures**
  The mismatch between explosive population growth and constrained housing delivery drives affordability pressures, especially in the rental market.

The Role of I-Joist Floor Systems

This increasing emphasis on townhouses opens a strategic window for I-joist floor systems, which are among the most economic and versatile timber flooring solutions available:

- **Improve Build Speed:** I joists simplify on site assembly and without the requirement for off-site fabrication reduces construction timelines, which is critical when supply demand is high and speed counts.
- **Product availability:** Wesbeam LVL and I-joists are an "off the shelf" structural material, stocked in Wesbeam distribution centres in every Australian capital city and available on short notice.
- **Enhanced Serviceability:** The range of I-joist depths and design of the OSB web allows for simple penetrations for integration of mechanical, electrical and plumbing services, enabling efficient fit out and future adaptability without requiring deeper floor containers.
- **Cost efficiency:** With a wide range of I-joist depths and widths available, your solution can be tailored to the project, often using less timber than a conventional timber truss of solid timber floor design.

Wesbeam's Leadership in Timber Floor Design

Wesbeam is at the forefront of timber floor design for Australia's townhouse sector. As the only Australian manufacturer of both LVL and LVL I joists, Wesbeam combines local supply security with unmatched expertise.

With the largest team of structural engineers, estimators and detailers of any LVL and I joist supplier in the country, Wesbeam provides the technical capability and design support needed to deliver fit for purpose, efficient and compliant floor systems that meet the unique challenges of medium density living.

1 Urban Development Institute of Australia (UDIA), State of the Land Report 2025, UDIA National, Sydney, 2025

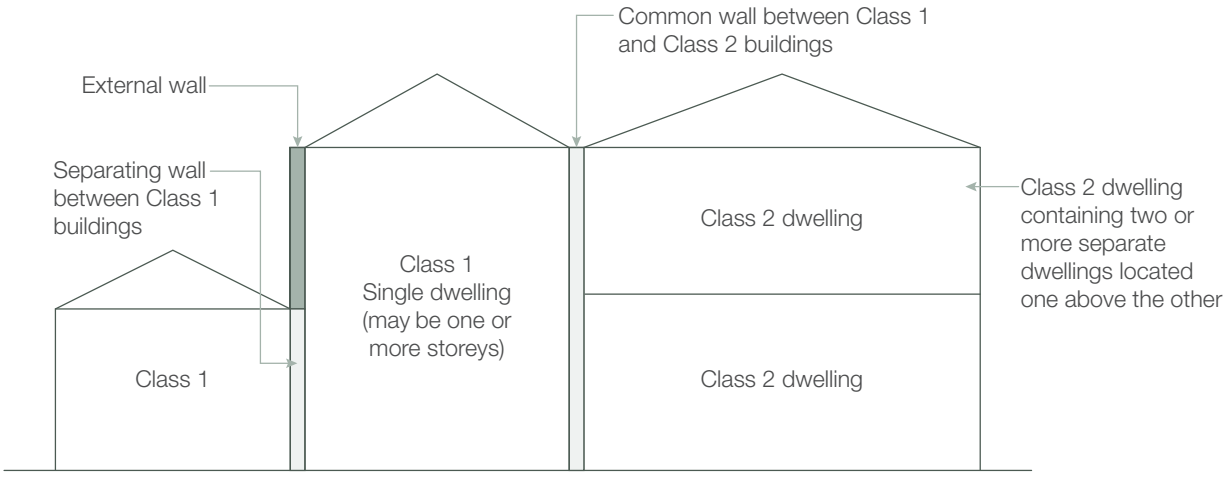
CONSIDERATIONS UNIQUE TO TOWNHOUSE CONSTRUCTION

NCC Building Classes and Townhouses

The National Construction Code (NCC) groups buildings into classes based on their use.

- Class 1: Houses. Typically, these are standalone single dwellings of a domestic or residential nature.
  - Class 1a: A single dwelling, or one of a group of attached dwellings such as townhouses, row houses, terrace houses or villa units, separated by a fire resisting wall.
  - Class 1b: Small boarding houses, guest houses or hostels (refer to the NCC for specific limitations).
- Class 2: Multi unit residential buildings, typically apartments, where dwellings are located above or below one another. The National Construction Code (NCC) groups buildings into classes based on their use. The following is a summary of some classes (refer to the NCC for exact definations).

Townhouses therefore fall under Class 1a. This classification shapes the requirements for fire resistance, acoustic performance, and structural detailing, particularly at the separating walls between dwellings.



Elevation

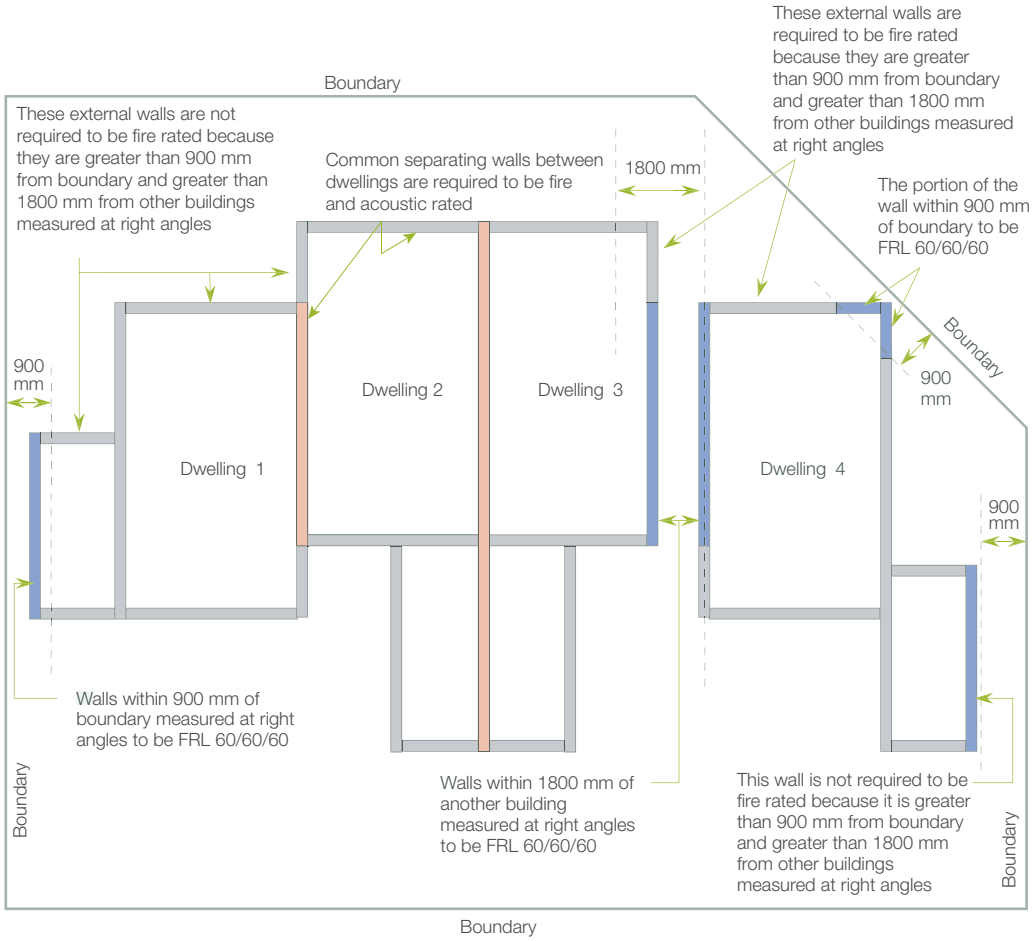
Identification of Class 1 buildings (Source: NCC 2022)

KEY FLOOR DESIGN CONSIDERATIONS FOR TOWNHOUSES

NCC Class 1a Requirements for Separating Walls

Each dwelling must meet fire resistance and acoustic performance requirements at shared or adjoining walls. These walls are the primary compliance element for townhouse construction.

The figure below illustrates the fire resistance requirements for walls in a case where 4 separate dwellings occupy a single lot.



Plan view showing examples of separating walls and external walls – (Adapted from Wood Solutions Technical Design Guide 01, FWPA 2015)

Requirements for Vertical Fire Separation

Unlike apartments, townhouses are self contained dwellings. There is no requirement for vertical fire separation between upper and lower floors within the same townhouse unit.

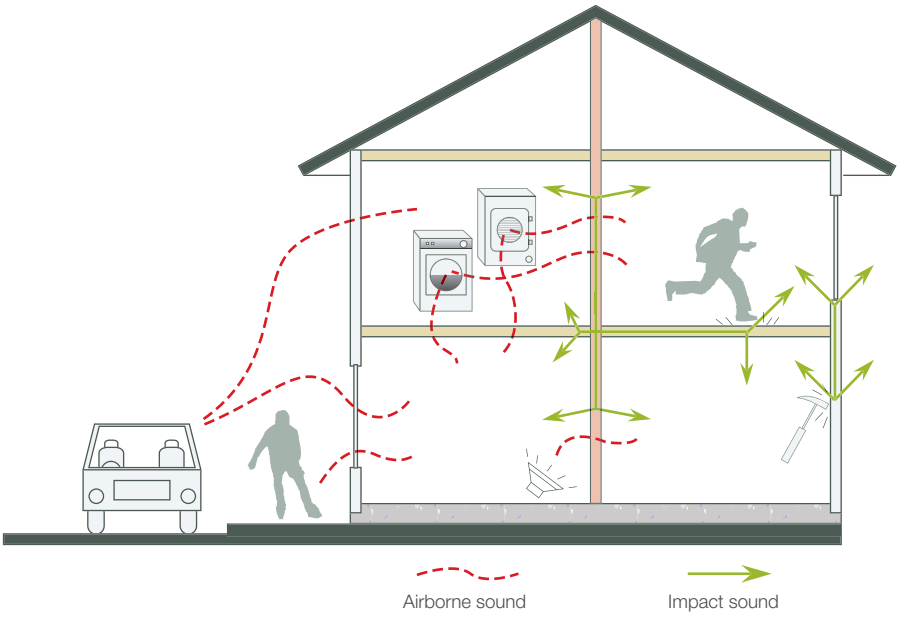
Interface at Fire Rated Walls, Garages, Eaves and Services

Careful detailing is required where floor systems and walls intersect with fire rated elements, particularly at garages, eaves, and service penetrations. Compliance with the NCC and manufacturer's guidelines for these area is essential to maintaining fire separation and to ensure successful certification can be achieved.

Acoustics and the Floor Design

The floor system is a common source of sounds transfer from one dwelling or room to another dwelling or room via flanking noise. Flanking noise occurs where sound (airborn or impact noise as demonstrated in the below) travels through connected building elements. Separation of building elements is vital, and care should be taken to maintain this seperation when running services.

While there are no strict requirements for noise transfer within the same dwelling (e.g. ensuring televsion or bathroom noise does not transfer to through to bedrooms) consideration should be given to details and materials that reduce or prevent noise transfer between rooms. There are a range of ceiling systems and products on the market that can prevent unwanted noise transfer. Just ensure that the chosen system is compatible with your bracing system chosen by your bracing specifier.



Examples of impact and airborne sound. (Source: Wood Solutions Technical Design Guide 01)

Requirements for Joist Discontinuity at Separating Walls

To prevent vibration transfer between dwellings, joists must be discontinuous at separating walls. This is both a compliance requirement and a practical step toward improving occupant comfort.

WESBEAM E-JOIST FLOOR SYSTEMS OVERVIEW

e-Joist Products and Benefits in Townhouse Applications

Wesbeam's **e-joist** is an engineered I-joist manufactured in Australia from LVL flanges and structural web material. In townhouse construction, e-joists provide:

- **Economy and Versatility** – lightweight, high-strength members with efficient spanning capacity.
- **Service Integration** – the open web form allows for easy drilling and notching, making it simple to run plumbing, electrical, and HVAC services through the floor zone without compromising strength.
- **Acoustic Performance** – when combined with insulation batts and ceiling systems, e-joists provide robust solutions to meet NCC Class 1a acoustic requirements.
- **Speed and Accuracy** – consistent dimensions and straightness reduce installation time and improve fit-up compared with traditional solid timber joists.
- **Local Supply Advantage** – Wesbeam is the only Australian manufacturer of both LVL and LVL I-joists, ensuring security of supply and technical support.

Designing for Townhouse Applications

In the event of fire in one dwelling, floor systems must be designed so that fire does not spread to adjacent dwellings.

When designing Wesbeam e-joist floor systems for townhouse projects, one of the more critical detailing considerations is the relationship between joist direction and the fire-separating wall.

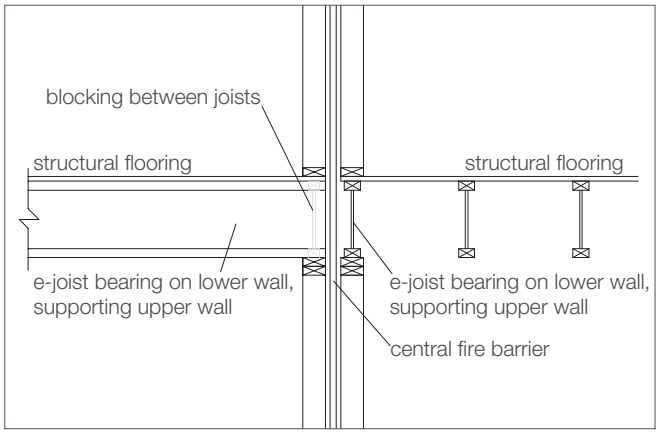
In accordance with NCC requirements, separating walls between attached dwellings must achieve a minimum Fire Resistance Level (FRL) of 60/60/60.

Wesbeam's Design Centre can detail various e-joist solutions for fire-walls with different wall configurations, proprietary systems, and joist directions

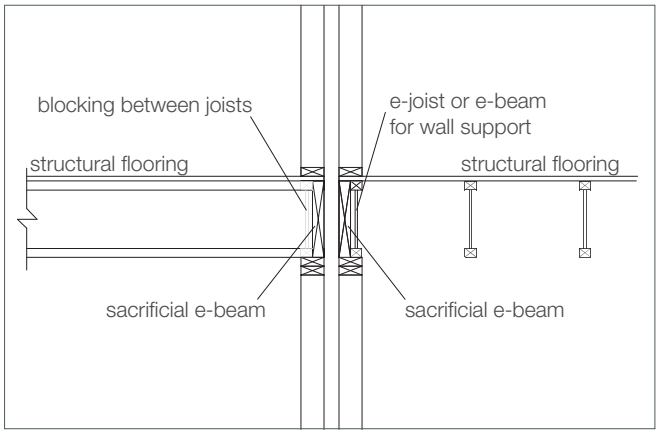
	Walls discontinuous	Full height continuous walls
Joists perpendicular to wall	✓	✓
Joists parallel to wall	✓	✓

Common e-Joist Configurations at Separating Walls

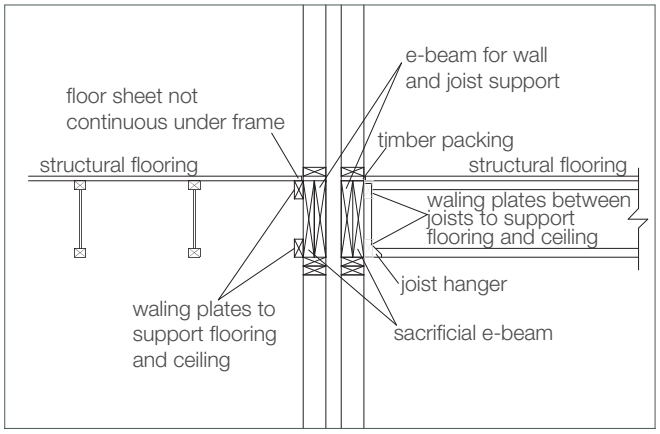
The following configurations illustrate typical ways Wesbeam e-joist floor systems can be detailed to comply with NCC fire and acoustic requirements at separating walls between attached dwellings. These are intended as a general guide only - refer to the system manufacturer for details on requirements.



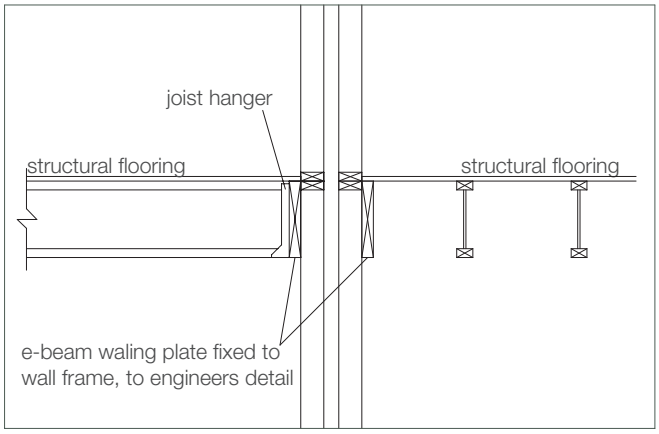
CENTRAL FIRE BARRIER TYPE
DISCONTINUOUS WALLS



CHAR BEAM TYPE
DISCONTINUOUS WALLS



LINED TYPE
DISCONTINUOUS WALLS



FULL HEIGHT WALLS

COMMON CONSTRUCTION DETAILS FOR E-JOIST FLOORS

Wesbeam has developed a comprehensive library of townhouse construction details covering the most common situations, from joist-to-beam connections to floor-to-wall interfaces and acoustic separation. Here are just some of the specific details developed by Wesbeam's design and engineering team.

Every townhouse floor design produced through the Wesbeam Design Centre is tailored to the project, with detailing provided for joist connections, load transfer, fire and acoustic performance, and any unique structural requirements. This ensures that each design not only complies with the NCC but also meets the exact performance expectations of the builder, architect, and end user.

Details include:

- Beam to joist connections (top-mount, face-mount, uni-ledger)
- e-Joist to steel beams (various steel sizes with packers or brackets)
- Joist discontinuity at fire-separating walls
- Floor-to-wall junctions (internal and external walls)
- Joist to bracing wall details
- Wet area set-down details
- Rim board and edge blocking details
- Stair and large opening trimmer details
- Service penetration guidelines (plumbing, HVAC, electrical)
- Fire and acoustic treatment at floor–wall junctions

SPAN TABLES FOR TOWNHOUSE FLOORS

Design Criteria and Terminology

The span tables provided in this document are intended for domestic residential applications in non-cyclonic areas only, in non-cyclonic area, in line with the criteria set out in AS1684.2 - Residential timber-framed construction, Part 2: Non-cyclonic areas.

The terminology, definitions and notations used in this brochure are similar to and consistent with those used and listed in AS1720.3 - Timber structures, Part 3: Design criteria for timber-framed residential buildings, as well as AS1684.2 - Residential timber-framed construction, Part 2: Non-cyclonic areas.

Because townhouses fall under Class 1a construction in the NCC, the load combinations, strength requirements, and serviceability limits from these standards are deemed directly applicable.

Basis for Design

The design criteria used to develop the Span Tables contained in this brochure are based on the assumptions listed in AS1720.3 - Timber structures, Part 3: Design criteria for timber-framed residential buildings.

The design loads and load combinations considered in the calculations are typically as per AS1720.3, which includes:

- Permanent loads
- Imposed loads
- Wind loads
- Snow loads
- Earthquake loads, and
- Load Combinations of the above loads

Where scenarios or loads outside of these criteria are used, these will be noted in the respective tables.

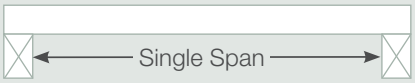
Design Loads

Design load limitations for each of the above load or load combination cases are also as per AS1720.3 - Timber structures, Part 3: Design criteria for timber-framed residential buildings.

The floor design live loads used in the span tables are 1.5kPa / 1.8kN.

Span Assumptions

Single span: Measured as the span between supports of a joist with only 2 supports. This also applies to joists that are partially cut over intermediate supports to remove spring.



Continuous Spans: Joists with multiple supports may be considered continuous if the major span (Span 1) is no more than 2 times the minor span (Span 2) - see diagram below

Where this criteria is met, please refer to the **continuous span** tables in this document using the major span (Span 1) of the joist.

Otherwise, please refer to the **single span** tables in this document using the major span (Span 1) of the joist.

(Span 1) =< 2 x (Span 2) for the floor joist to be considered continuous

E-JOIST FLOOR JOIST SPAN TABLES

40KG/M2 FLOOR WEIGHT

Joist Code	Max Span (single)			Max Span (continuous)		
	Floor joist spacing (c/c)					
	300mm	450mm	600mm	300mm	450mm	600mm
ej-20045	4400	3500	3200	5000	4200	3700
ej-24045	4900	4200	3700	5600	4600	4300
ej-24063	5400	4600	4300	6200	5100	4700
ej-24090	5900	5000	4700	6800	5600	5200
ej-25545	5000	4300	3900	5800	4800	4400
ej-25563	5600	4800	4400	6400	5300	4900
ej-25590	6100	5200	4900	7000	5800	5300
ej-26563	5700	4900	4500	6500	5400	5000
ej-26590	6200	5300	5000	7200	5900	5500
ej-30045	5500	4700	4400	6300	5200	4800
ej-30063	6100	5200	4900	7000	5800	5300
ej-30090	6700	5700	5300	7600	6400	5800
ej-36063	6700	5700	5300	7700	6400	5900
ej-36090	7400	6300	5900	8400	7000	6300
ej-40063	7100	6000	5600	8100	6700	6100
ej-40090	7800	6600	6100	8900	7300	5800

60KG/M2 FLOOR WEIGHT

Joist Code	Max Span (single)			Max Span (continuous)		
	Floor joist spacing (c/c)					
	300mm	450mm	600mm	300mm	450mm	600mm
ej-20045	4400	3500	3200	5000	4200	3700
ej-24045	4900	4200	3700	5600	4600	4300
ej-24063	5400	4600	4300	6200	5100	4700
ej-24090	5800	5000	4700	6800	5600	5200
ej-25545	5000	4300	3900	5800	4800	4400
ej-25563	5600	4800	4400	6400	5300	4900
ej-25590	6000	5200	4900	7000	5800	5300
ej-26563	5700	4900	4500	6500	5400	5000
ej-26590	6100	5300	5000	7200	5900	5500
ej-30045	5500	4700	4400	6300	5200	4500
ej-30063	6100	5200	4900	7000	5800	5300
ej-30090	6600	5700	5300	7600	6400	5800
ej-36063	6700	5700	5300	7700	6400	5900
ej-36090	7300	6300	5900	8400	7000	5900
ej-40063	7100	6000	5600	8100	6700	5600
ej-40090	7700	6600	5600	8900	6800	5400

80KG/M2 FLOOR WEIGHT

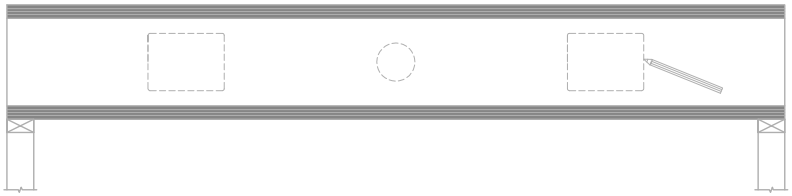
Joist Code	Max Span (single)			Max Span (continuous)		
	Floor joist spacing (c/c)					
	300mm	450mm	600mm	300mm	450mm	600mm
ej-20045	4200	3500	3200	5000	4200	3700
ej-24045	4700	4200	3700	5600	4600	4300
ej-24063	5200	4600	4300	6200	5100	4700
ej-24090	5600	5000	4700	6800	5600	5200
ej-25545	4900	4300	3900	5800	4800	4400
ej-25563	5400	4800	4400	6400	5300	4900
ej-25590	5800	5200	4900	7000	5800	5300
ej-26563	5500	4900	4500	6500	5400	5000
ej-26590	5900	5300	5000	7200	5900	5500
ej-30045	5300	4700	4400	6300	5200	4200
ej-30063	5900	5200	4900	7000	5800	5300
ej-30090	6300	5700	5300	7600	6400	5800
ej-36063	6500	5700	5300	7700	6400	5500
ej-36090	7000	6300	5900	8400	7000	5500
ej-40063	6800	6000	5500	8100	6700	5300
ej-40090	7400	6600	5200	8900	6400	5100

100KG/M2 FLOOR WEIGHT

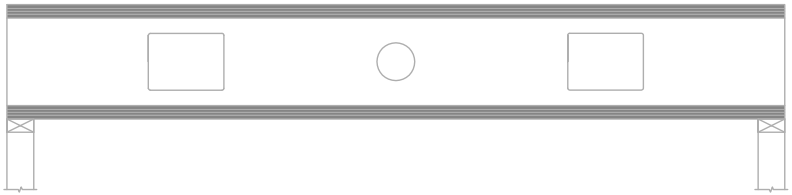
Joist Code	Max Span (single)			Max Span (continuous)		
	Floor joist spacing (c/c)					
	300mm	450mm	600mm	300mm	450mm	600mm
ej-20045	4000	3400	3100	5000	4200	3700
ej-24045	4600	4000	3600	5600	4600	4300
ej-24063	5000	4500	4100	6200	5100	4700
ej-24090	5400	4900	4500	6800	5600	5200
ej-25545	4700	4200	3800	5800	4800	4400
ej-25563	5200	4700	4300	6400	5300	4900
ej-25590	5600	5100	4700	7000	5800	5300
ej-26563	5300	4800	4400	6500	5400	5000
ej-26590	5700	5200	4800	7100	5900	5500
ej-30045	5200	4700	4200	6300	5100	4000
ej-30063	5700	5100	4800	7000	5800	5300
ej-30090	6100	5600	5200	7600	6400	5500
ej-36063	6200	5700	5300	7700	6400	5200
ej-36090	6800	6100	5500	8400	6600	5200
ej-40063	6600	6000	5100	8100	6300	5000
ej-40090	7200	6400	4900	8400	6000	4800

SERVICE HOLES GUIDE

1 All holes to be considered before cutting



2 Maximum of 3 holes per span

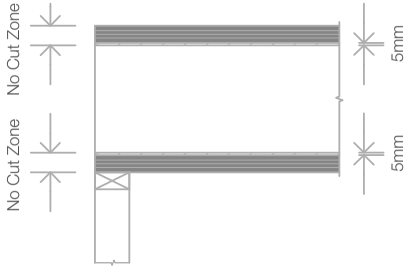


*All holes <75mm are excluded from this total

3 Grouping of holes

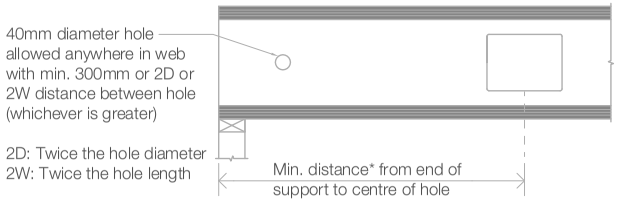
*Smaller holes can be grouped into a larger hole subject to the maximum size being within the service hole guide limits

4 Don't cut the blue flanges



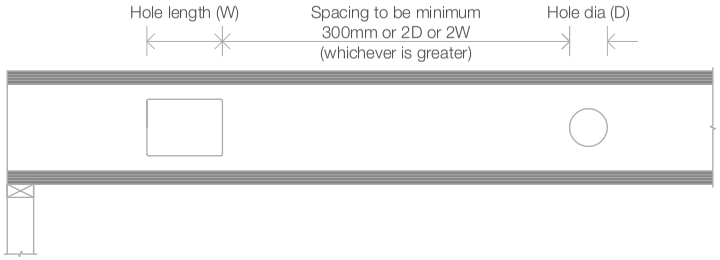
*Flanges can be notched at supports as per installation guide, but no cuts on or within 5mm of the flange are allowed

5 Distance from end of support to centre of hole



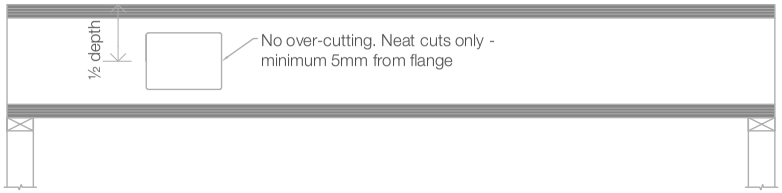
*Refer to service hole guide for minimum distance from supports

6 Minimum hole spacing



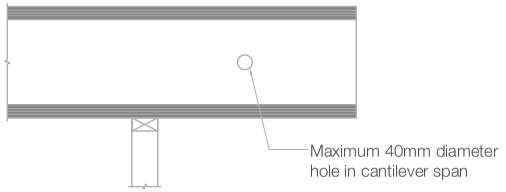
*Minimum spacing between holes must be at least 300mm or twice the diameter or length of the largest opening (whichever is greater)

7 Position and neatness



*Holes recommended to be mid height of joist

8 Cantilever holes



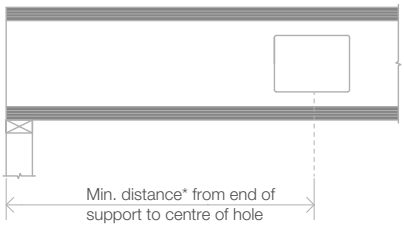
SERVICES HOLE GUIDE
(CIRCULAR HOLES)

Floor Joist Applications in Domestic Residences ONLY

Note:

1. Distance from support is measured from the end of the support to the centre of the hole.
2. Web hole locations can be interpolated for intermediate spans.
3. Web hole depth may be limited by depth of joist and 5mm clearance requirement to flange.
4. NS - Not Suitable.

Distance from end of support to centre of hole



*Refer to service hole guide for minimum distance from supports

e-joist Section Code	Installed Span (mm)	Circular Holes						
		ø75	ø100	ø125	ø150	ø175	ø200	ø250
		Minimum distance from end of support to centre of hole (mm)						
ej20045	3000	390	390	600	NS	NS	NS	NS
	4000	390	500	1100	NS	NS	NS	NS
	5000	390	1000	1600	NS	NS	NS	NS
ej24045	3500	390	390	390	490	NS	NS	NS
	4500	390	390	390	990	NS	NS	NS
	5500	390	390	890	1490	NS	NS	NS
ej24063 ej25563 ej26563	4000	390	390	390	750	NS	NS	NS
	5000	390	390	640	1250	NS	NS	NS
	6000	390	540	1140	1750	NS	NS	NS
ej24090 ej26590	4500	390	390	410	1010	NS	NS	NS
	5500	390	390	910	1510	NS	NS	NS
	6500	390	810	1410	2010	NS	NS	NS
ej30045	4500	390	390	390	390	390	750	NS
	5500	390	390	390	390	690	1250	NS
	6500	390	390	390	540	1150	1750	NS
ej30063	4500	390	390	390	390	390	760	NS
	5500	390	390	390	390	650	1260	NS
	6500	390	390	390	550	1150	1760	NS
	7000	390	390	390	800	1400	2010	NS
ej30090	5000	390	390	390	390	420	1020	NS
	6000	390	390	390	390	920	1570	NS
	7000	390	390	390	820	1420	2020	NS
	7500	390	390	460	1070	1670	2270	NS
ej36063 ej40063	5000	390	390	390	390	390	390	770
	6000	390	390	390	390	390	390	1270
	7000	390	390	390	390	390	570	1770
	7500	390	390	390	390	390	820	2020
ej36090 ej40090	5000	390	390	390	390	390	390	780
	6000	390	390	390	390	390	390	1280
	7000	390	390	390	390	390	580	1780
	8000	390	390	390	390	470	1080	2280

SERVICES HOLE GUIDE

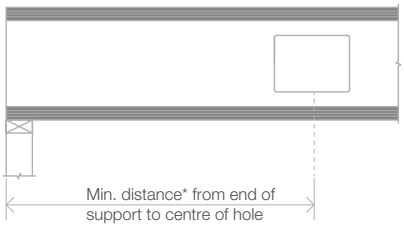
(SQUARE & RECTANGULAR HOLES)

Floor Joist Applications in Domestic Residences ONLY

Note:

1. Distance from support is measured from the end of the support to the centre of the hole.
2. Web hole locations can be interpolated for intermediate spans.
3. Web hole depth may be limited by depth of joist and 5mm clearance requirement to flange.
4. NS - Not Suitable.

Distance from end of support to centre of hole



*Refer to service hole guide for minimum distance from supports

e-joist Section Code	Installed Span (mm)	Square Holes						
		75x75	100x100	125x125	150x150	175x175	200x200	250x250
		Minimum distance from end of support to centre of hole (mm)						
ej20045	3000	430	440	670	NS	NS	NS	NS
	4000	430	550	1170	NS	NS	NS	NS
	5000	430	1050	1670	NS	NS	NS	NS
ej24045	3500	430	440	460	570	NS	NS	NS
	4500	430	440	460	1070	NS	NS	NS
	5500	430	440	960	1570	NS	NS	NS
ej24063 ej25563 ej26563	4000	430	440	460	830	NS	NS	NS
	5000	430	440	710	1330	NS	NS	NS
	6000	430	590	1210	1830	NS	NS	NS
ej24090 ej26590	4500	430	440	480	1090	NS	NS	NS
	5500	430	440	980	1590	NS	NS	NS
	6500	430	860	1480	2090	NS	NS	NS
ej30045	4500	430	440	460	470	480	850	NS
	5500	430	440	460	470	780	1350	NS
	6500	430	440	460	620	1240	1850	NS
ej30063	4500	430	440	460	470	480	860	NS
	5500	430	440	460	470	740	1360	NS
	6500	430	440	460	630	1240	1860	NS
	7000	430	440	460	880	1490	2110	NS
ej30090	5000	430	440	460	470	510	1120	NS
	6000	430	440	460	470	1010	1670	NS
	7000	430	440	460	900	1510	2120	NS
	7500	430	440	530	1150	1760	2370	NS
ej36063 ej40063	5000	430	440	460	470	480	490	900
	6000	430	440	460	470	480	490	1400
	7000	430	440	460	470	480	670	1900
	7500	430	440	460	470	480	920	2150
ej36090 ej40090	5000	430	440	460	470	480	490	910
	6000	430	440	460	470	480	490	1410
	7000	430	440	460	470	480	680	1910
	8000	430	440	460	470	560	1180	2410

e-joist Section Code	Installed Span (mm)	Rectangular Holes				
		125 x 250	150 x 300	175 x 350	200 x 400	250 x 500
		Minimum distance from end of support to centre of hole (mm)				
ej20045	3000	730	NS	NS	NS	NS
	4000	1230	NS	NS	NS	NS
	5000	1730	NS	NS	NS	NS
ej24045	3500	520	640	NS	NS	NS
	4500	520	1140	NS	NS	NS
	5500	2390	2480	NS	NS	NS
ej24063 ej25563 ej26563	4000	520	900	NS	NS	NS
	5000	770	1400	NS	NS	NS
	6000	2700	2770	NS	NS	NS
ej24090 ej26590	4500	540	1160	NS	NS	NS
	5500	1040	1660	NS	NS	NS
	6500	1540	2160	NS	NS	NS
ej30045	4500	520	540	920	1200	NS
	5500	1490	1900	2090	2200	NS
	6500	3120	3140	3190	3200	NS
ej30063	4500	520	540	570	960	NS
	5500	520	1200	1660	1870	NS
	6500	2610	2770	2870	2930	NS
	7000	3380	3410	3440	3460	NS
ej30090	5000	520	540	600	1220	NS
	6000	520	540	1100	1770	NS
	7000	520	970	1600	2220	NS
	7500	520	1220	1850	2470	NS
ej36063 ej40063	5000	520	540	570	590	1020
	6000	520	540	650	1290	1810
	7000	520	1640	2180	2440	2730
	7500	520	2550	2830	2990	3190
ej36090 ej40090	5000	520	540	570	590	1030
	6000	520	540	570	590	1530
	7000	520	540	570	780	2030
	8000	520	540	570	1620	2530

DESIGN AND SPAN OPTIMISATION

Continuous Span Optimisation

- Floor performance and economy can vary significantly depending on the position of internal load-bearing walls.
- Adjusting joist layouts to make efficient use of available supports, our team can often reduce and economise joist sizes while maintaining the required performance levels.
- This ensures Wesbeam's townhouse designs achieve the most cost-effective solution without compromising serviceability.

Single Span Solutions for Narrow Lots

- In narrow-lot townhouse designs, continuous spans are not always possible.
- Wesbeam can evaluate the use of different joist depths, widths, and spacings to achieve single span layouts that meet both performance and architectural requirements.
- Options range from economical solutions to stiffer high-performance floors with tighter deflection and vibration limits.

Tailored to Project Requirements

Wesbeam's Design Centre can engineer floors to suit:

- Higher performance requirements such as reduced bounce or increased stiffness.
- Specific load conditions where heavy items are concentrated, for example:
  - Waterfall kitchen benches
  - Stone baths
  - Large-format floor tiling
  - Feature staircases or void surrounds

By tailoring the floor system design to the exact requirements of each project, Wesbeam ensures an efficient solution that is structurally appropriate to the client's vision.

wesbeam
building better wood

ABN 89 004 268 017
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WESTERN AUSTRALIA
190 Pederick Road
Neerabup | WA | 6031
E sales@wesbeam.com

QUEENSLAND
3 Bult Drive
Brendale | QLD | 4500
E sales.qld@wesbeam.com

SOUTH AUSTRALIA
200 Cavan Road
Dry Creek | SA | 5094
E sales@wesbeam.com

VICTORIA
Rear | 35 Greens Road
Dandenong South | VIC | 3175
E sales.vic@wesbeam.com

NEW SOUTH WALES
8-24 Dunheved Circuit
St Marys | NSW | 2760
E sales.nsw@wesbeam.com

TECH HOTLINE
T 1300 356 460