Wolf Systems, Engineering Ease.

easi-joist®

Engineered Metal Web System

Technical Guide

Can you afford not to choose easi-joist®?

easi-joist® Metal Web System – Good for Business

easi-joists® are parallel chord trusses using stress-graded timber chords, plated together with Wolf Systems' patented, precision engineered metal webs, EP 1 985 774 A1 – the strongest available on the market.

Using fewer metal webs and up to 20% less timber than competitive products, easi-joist® offers unrivalled lightness, clear span ability and load bearing capacity. Less material usage reduces costs and maximises your competitive advantage.

Introduced by Wolf Systems over a decade ago as a total floor solution, the easi-joist® system has been developed apace with customer requirements. Today you can expect optimal versatility when designing floors, roofs or walls for domestic, commercial or industrial buildings.

The guaranteed route to lower costs.

Outperforms Standard Carcassing Joists and I-Beams

- easi-joist® may be positioned at any angle between 0 and 90 degrees in a variety of situations, whilst open web construction allows for easier, more practical installation of services – including pipework, cabling and ductwork – and reduced labour costs.
- Joist timbers may be preservative treated with waterborne solutions, or with non-corrosive spirit-based organic solvents. Copper chrome arsenate and similar treatments are not recommended.
- High acoustic and fire performance standards benefit party floor construction within multi occupancy buildings.
- Beams may be assembled into panel or cassette modules assisting you in attaining a sustainable and defect-free approach to construction.
- Factory manufactured and made-to-measure, easi-joists® are available to match the depths of solid joists and range from 195 to 417 mm. Trimmable ends facilitate installation where bearing support is inconsistent.

easi-joist® Software – the Complete Package

- easi-joist® specialist design and layout software, developed in the UK for the UK and Irish markets, ensures design accuracy whilst being intuitive and easy to use.
- Utilising Wolf Systems' patented, stronger metal webs, EP 1 985 774 A1, easi-joist® software means you can design for larger clear spans and heavier load requirements.

BIM Ready

- Seamless integration with Wolf Systems' pioneering Revit®- based Horizon software brings BIM (Building Information Modelling) capabilities to timber engineering designers.

Contents

Wolf Systems, Engineering Ease

Wolf Systems has developed its products and services to make complex or difficult timber engineering more straightforward - from the manufacture and supply of nailplates, metal webs and software for the design of roof trusses, metal web joists and timber frame wall panels, right through to our bespoke design services, training, machinery sales and outstanding customer support.

Our software is intuitive to use and our products engineered for outstanding performance and flexibility, making it easier to solve those difficult design problems and lower costs.

You'll also find Wolf a very easy and straightforward company to do business with: one that's driven by your needs, receptive to your ideas; proactive about support and entirely fair when it comes to both project timescales and pricing.

"reliable, helpful, there when you need them, products that are easy to use – these are just some of the reasons I chose to put Wolf Systems at the heart of our business"

Putting you at ease

Customer care is central to the Wolf Systems ethos and we strive to make it easy for you to access the help you need, when you need it. Our friendly and approchable team of specialists is always at hand to offer pragmatic advice and assistance, whether it's design, technical, training or service-related.

Choose to work with Wolf Systems and you can be sure your business is well supported, with the resources only a large and customer-led company can supply.

Part of the Wolf Group

Wolf Systems UK is an integral part of the Wolf Group – a family run business with over 45 years' experience in timber engineering, employing some 3000 staff across 21 European countries.

From our beginning in 1966 we have always been an unashamedly engineering centric business – but one that puts its customers first.

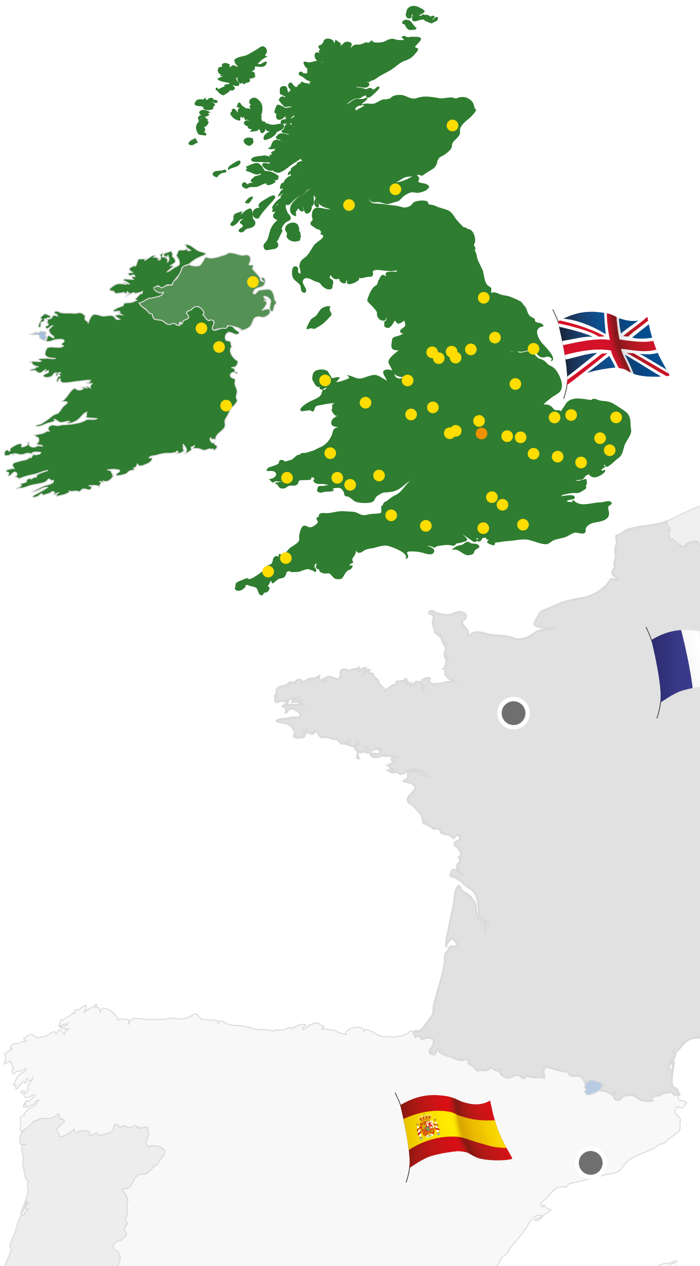
Our UK operation, established in 1988, serves the UK market and is head of software and product development for the company's timber engineering business.

Today we have a UK-wide network of licensed manufacturers and are justifiably proud of our reputation for making timber engineering as easy as possible for them.

The international size and scale of our business enables us to invest substantially in on going product and software development, resulting in technically advanced software, innovative products and a level of customer service recognised for excellence.

On top of world-class products, our customer services and design teams provide expert technical support and backup for software implementation, training and design.

We can also assist with manufacturing setup and provide a comprehensive range of machinery for the manufacture of components.



Easy on the Environment

Wolf Systems promotes timber engineering using sustainable resources. Recognising that our operations will have an impact on the local, regional and global environment, we continually seek to improve environmental performance by increasing energy efficiency, minimising waste and preventing pollution.

We strive to:

- Undertake all activities with the intention of reducing the company's environmental impact as far as possible.
- Conserve energy in our offices and manufacturing units.
- Save water in all our operations, through installation of water-saving devices and other measures, where applicable.
- Minimise waste in all our operations, by prevention of unnecessary packaging, reuse of materials and recycling.

In 2011 we installed 135kW of solar panels which produce ***40% of our electricity requirement*** *and save* ***50 tonnes of CO_2*** *each year.*

Industry Associations

Wolf Systems is an active member of the Trussed Rafter Association (TRA), the Structural Timber Association (STA), BM TRADA and the Engineered Wood Products Committee. Our association with the leading bodies within our industry is your assurance of the quality of our products and best practice across our services.

The Trussed Rafter Association (TRA) is the respected voice of the trussed rafter industry in the UK.

The Association is committed to stringent standards of quality and service and sets a professional benchmark for the industry.

Members include the principal manufacturers of trussed rafters, industry suppliers and professionals involved in roof design and construction.

TRA requires all its manufacturing members to have third party supervised Quality Assurance and Professional Indemnity insurance so helping to ensure quality and peace of mind for the customer.

The Timber Research and Development Association (TRADA) is an internationally recognised centre of excellence on the specification and use of timber and wood products.

TRADA is a company limited by guarantee and a not-for-profit membership-based organisation. TRADA's origins go back over 70 years and its name is synonymous with independence and authority. Its position in the industry is unique with a diverse membership encompassing companies and individuals from around the world and across the entire wood supply chain, from producers, merchants and manufacturers, to architects, engineers and end users.

The Structural Timber Association (STA) is currently the country's leading timber organisation, which represents a wide membership of businesses and people involved in construction using engineered timber, from across the UK.

The STA leads the industry on quality, health & safety, education, technical knowledge and customer service. The STA's activities include seminars, factory tours, research, provision of information, networking, advocacy and discussion.

The Irish Timber Frame Manufacturers' Association (ITFMA) is the trade association for the timber frame manufacturing industry in Ireland. It is an independently constituted company limited by guarantee with no share capital. All full members are represented on the Board of Directors. Voting on issues is not based on turnover. The Association is the recognised representative body for Timber Frame Manufacturers on the Island of Ireland and membership is synonymous with professionalism and quality. In addition, the ITFMA provides marketing, training and education of the timber frame concept.

Standards and Compliance

European Technical Approval is basically an assessment of a product to make sure it is fit for its intended use within each European Member State; in our case, the assessment of easi-joist® for use within domestic, industrial or commercial buildings.

This assessment is based on fulfilling the six essential requirements set out in the Construction Products Directive (CPD). There is no suitable design method for metal web joists in Eurocode 5 unlike trusses, hence the need for ETA to provide a harmonised design standard.

Wolf ETA Certificate No. ETA-07/0032

easi-joist® has been officially approved by Robust Details Ltd. under detail E-FT-3. This means that easi-joist® used in timber frame flats, constructed as per E-FT-3 will not require pre-completion sound testing to prove compliance with Part E of the Building Regulations in England & Wales; saving time, money and the uncertainty of pre-completion testing.

The Irish Agrément Board is designated by Government to issue European Technical Approvals.

Irish Agrément Board Certificates establish proof that the certified products are 'proper materials' suitable for their intended use under Irish site conditions, and in accordance with the Building Regulations.

The Irish Agrément Board operates in association with the National Standards Authority of Ireland (NSAI) as the National Member of UEAtc.

Wolf IAB Certificate No. 07/0280

ISO 9000 is the internationally recognised standard for an organisation's internal Quality Management. The term 'quality' refers to all those features of a product or service which are required by the customer.

An organisation's 'Quality Management' refers to its actions to ensure that its products or services satisfy its customers' quality requirements and comply with any regulations applicable to those products or services.

Wolf Systems supplies all its products and services to ISO 9001 ensuring the highest standards are provided by our company.

easi-joist® is recognised for use in floor construction by the NHBC in the United Kingdom and Homebond in the Republic of Ireland.

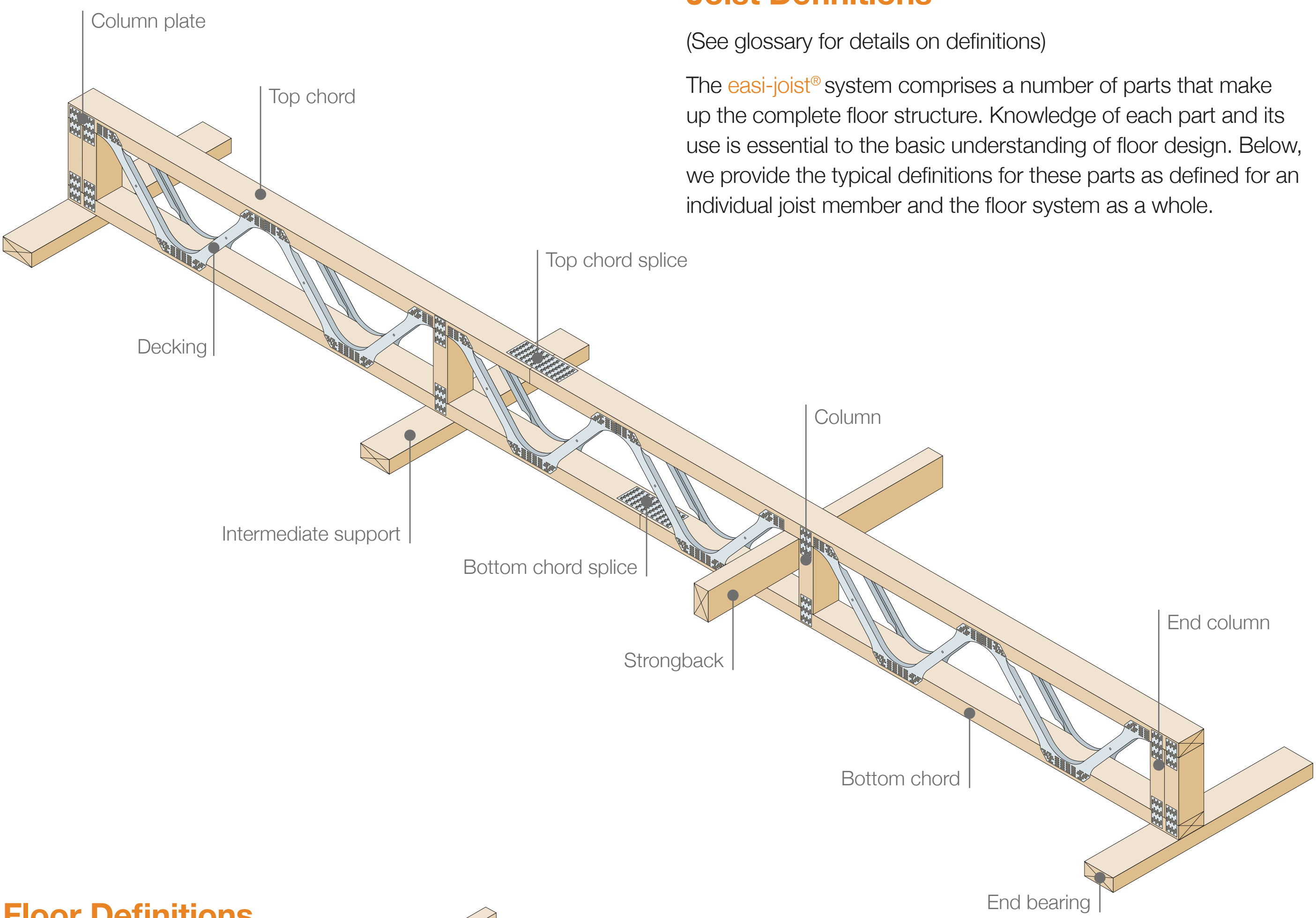
NHBC is the standard setting body and leading warranty and insurance provider for new and newly converted homes in the UK.

HomeBond is the national organisation which since 1978 has enabled home builders to provide their customers with new home warranties and deposit and stage payments cover in Ireland.

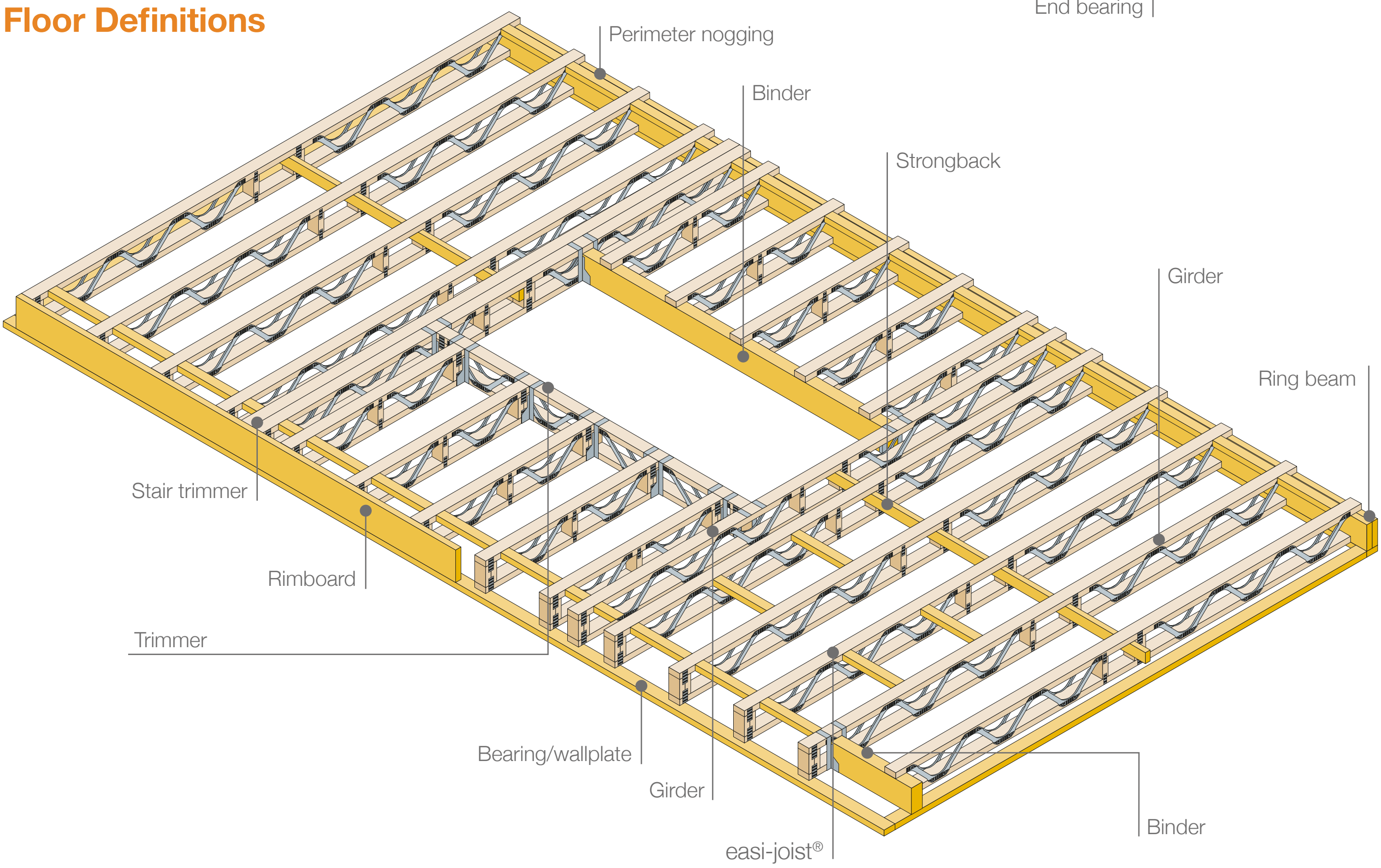
Joist Definitions

(See glossary for details on definitions)

The easi-joist® system comprises a number of parts that make up the complete floor structure. Knowledge of each part and its use is essential to the basic understanding of floor design. Below, we provide the typical definitions for these parts as defined for an individual joist member and the floor system as a whole.

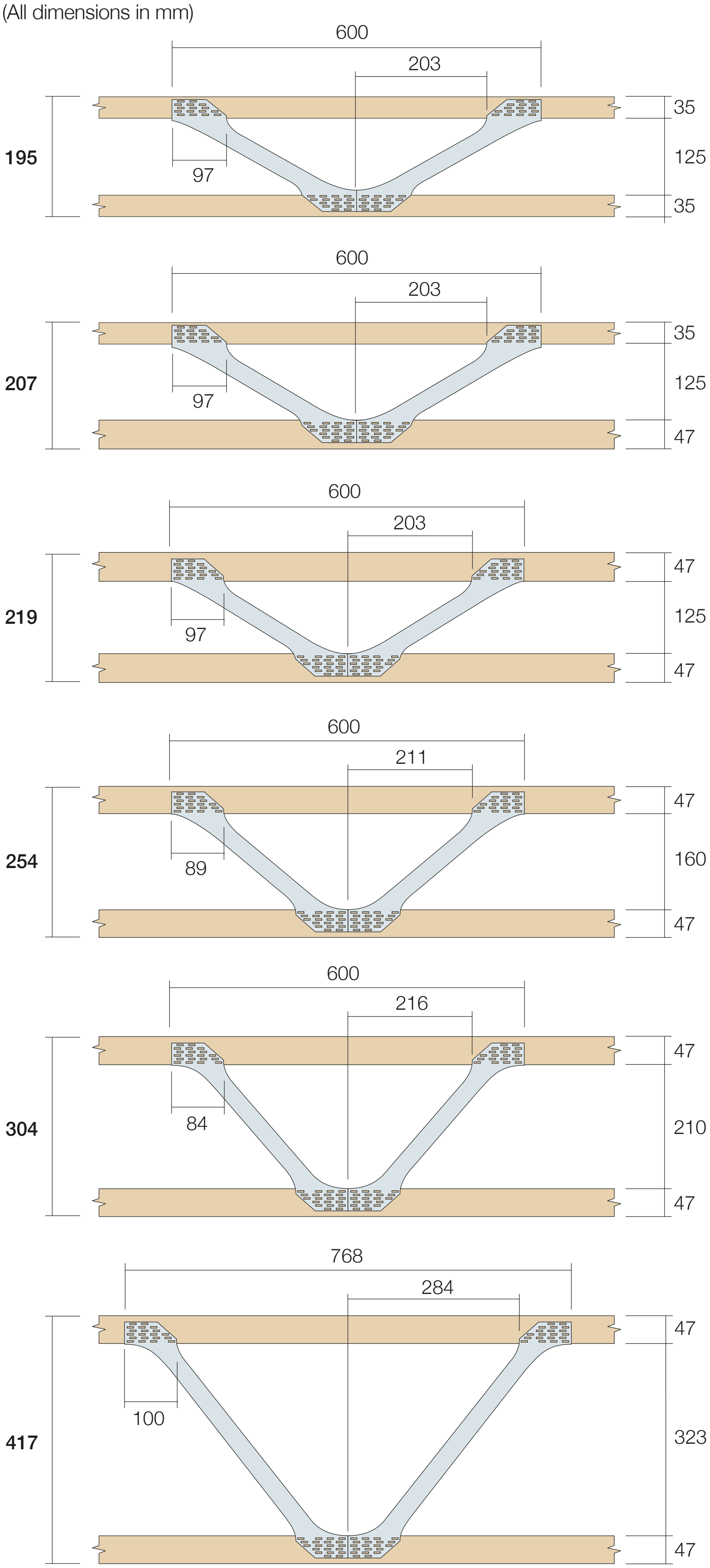


Floor Definitions



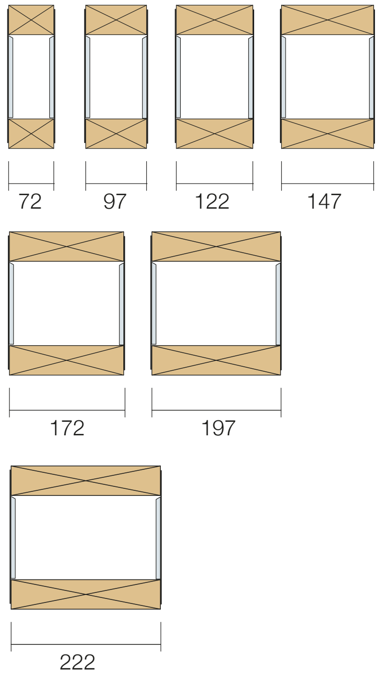
Joist Specification

(All dimensions in mm)

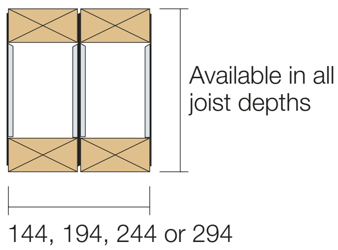


Joist Widths

Single joist widths



Multi-ply joist widths



easi-joist® metal web joists are available in 6 different depths utilising 35mm and 47mm top and bottom timber chords.

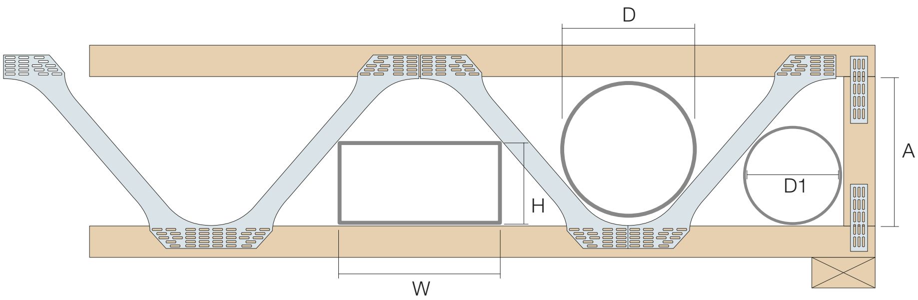
Web code	Joist depth	Chord depth
WS200	195	35
WS200	207	35/47
WS200	219	47
WS250	254	47
WS300	304	47
WS400	417	47

Fixing

Fixing of multi-ply joists is to be carried out to metalwork suppliers instructions using propriety fastening screws.

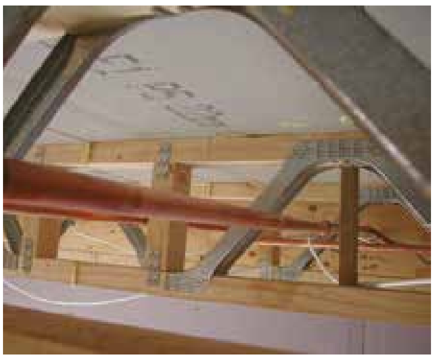
Type and spacing as specified by easi-joist® software.

easi-joist® is designed to allow for easy accommodation of electrical, plumbing, waste water and other services required within the floor joist area with no cutting or notching required.



Clearance for circular services

	WS200	WS250	WS300	WS400
A (mm)	125	160	210	323
D (mm)	100	150	200	280
D1(mm)	100	100	130	190



Clearance for rectangular services

	WS200	WS250	WS300	WS400
H mm	W mm	W mm	W mm	W mm
50	300	300	330	500
100	100	200	250	410
150	50	70	170	330
200	N/A	N/A	70	250
250	N/A	N/A	N/A	170
300	N/A	N/A	N/A	70

A significant advantage of the easi-joist® floor system is the open web design. The space provided by the metal web allows for the easy installation of services within the void.

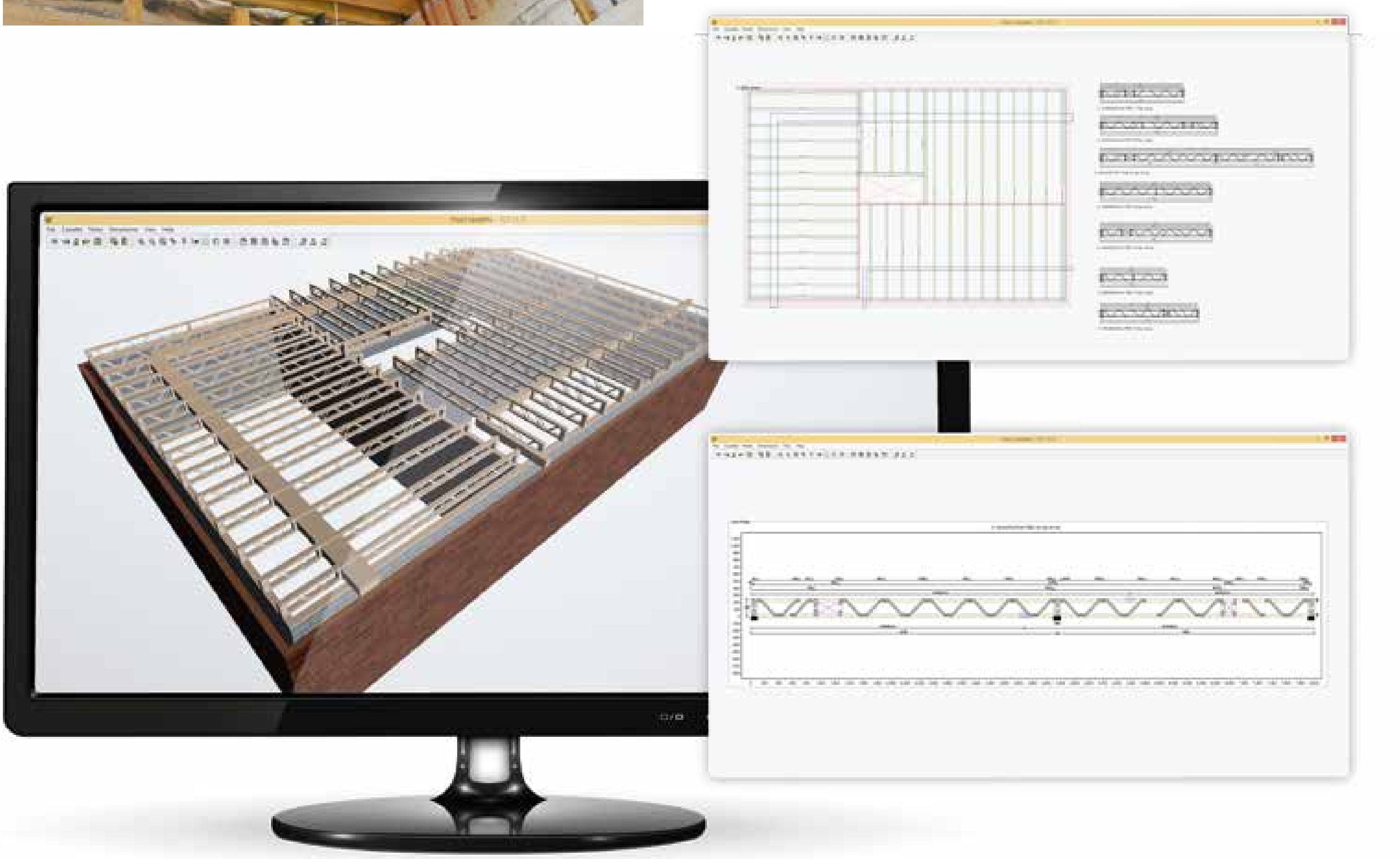
Pipework, electrical cables and ducting can be easily routed through the joist space providing real time savings. By removing the laborious work needed for notching, drilling or cutting holes when using other joist systems the installation cost of services can be greatly reduced.

Furthermore, the curved edges of the webs and the absence of protruding plate edges removes any potential for damage when feeding through pipes and cables.

In addition to the need to install traditional ventilation services in bathrooms and kitchens, Government initiatives for air tightness may require the installation of mechanical systems for heat recovery and air exchange. The open web design provides an ideal zone for the passage of ducting for these devices.

Designing Voids in Joists

Although the use of metal webs allows the passage of typical service runs (see page 10), the provision for larger services can be accommodated in joist designs using the easi-joist® software. Adding service runs at plan level automatically links to joist design for accurate placement of columns and webs to allow the easy passage of large or location specific service runs.



The benefits of off-site construction are widely recognised and the manufacture of floor cassettes is becoming increasingly more popular.

Floor cassettes offer numerous advantages over construction of the floor on-site, such as:

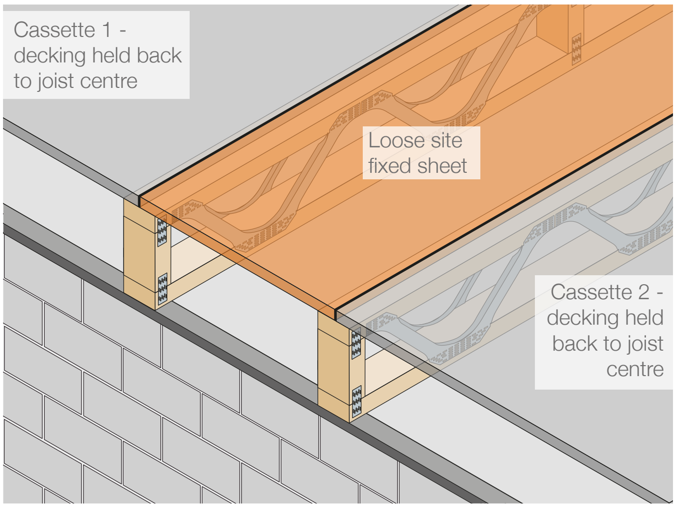
- Quality
- Control
- Speed of construction
- Space on site
- Site wastage

easi-joist® is ideally suited for the manufacture of floor cassettes. Along with the advantages on-site for the accommodation of services and long-term stability, the wide bearing surface makes it easier to lay out the joists in preparation for adding rimboard, blocking and decking during assembly of the floor cassette.

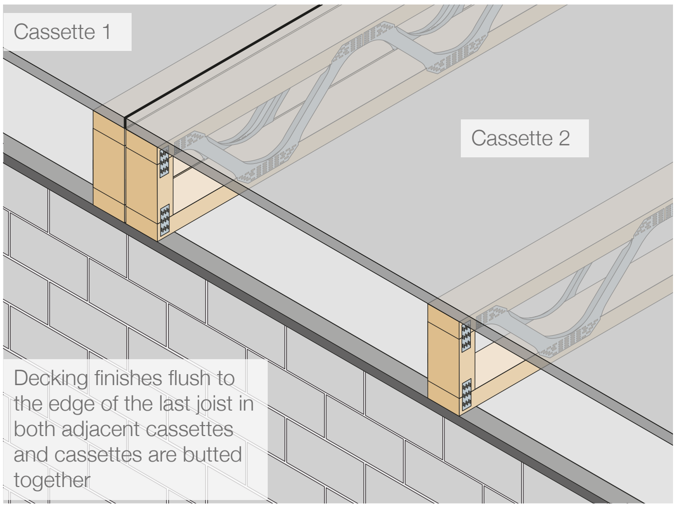
Adjoining Cassette Edge Types

There are a varied number of edge types adopted for the installation of floor cassettes. Below are a selection of suitable edge types which can be used when installing adjoining floor cassettes.

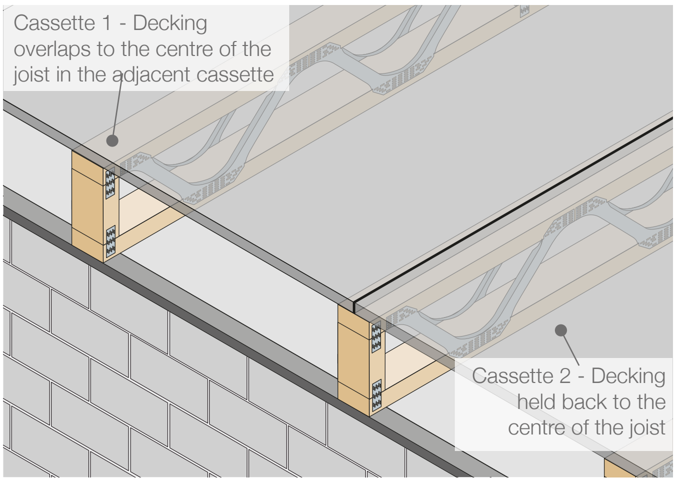
Cassette Edge Style - Holdback Both Edges

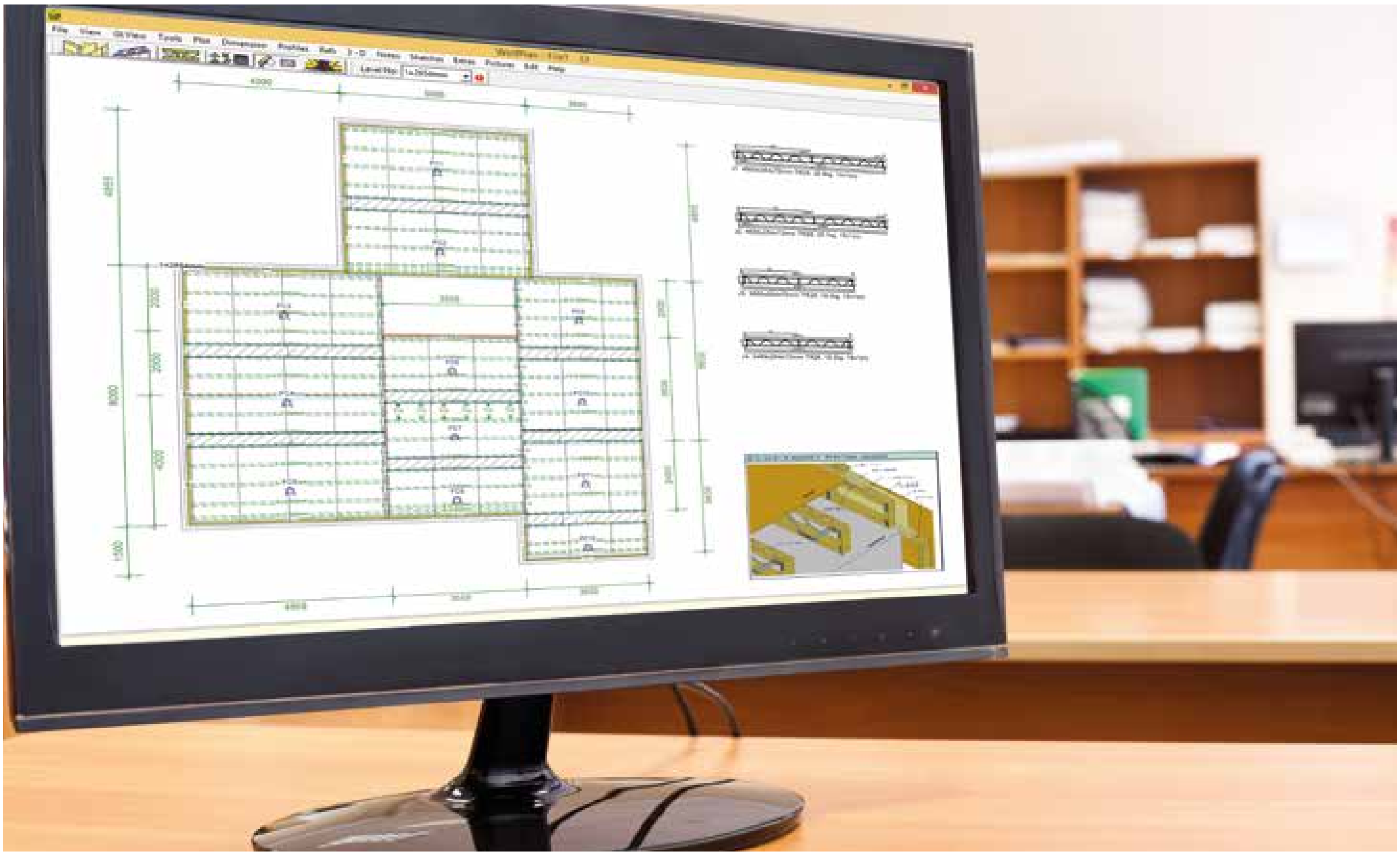


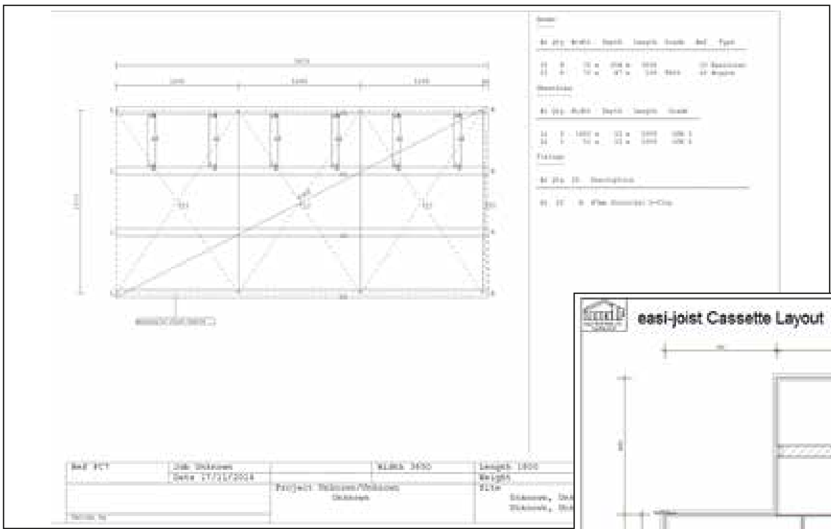
Cassette Edge Style - No Overlap or Holdback



Cassette Edge Style - Alternative Overlap and Holdback

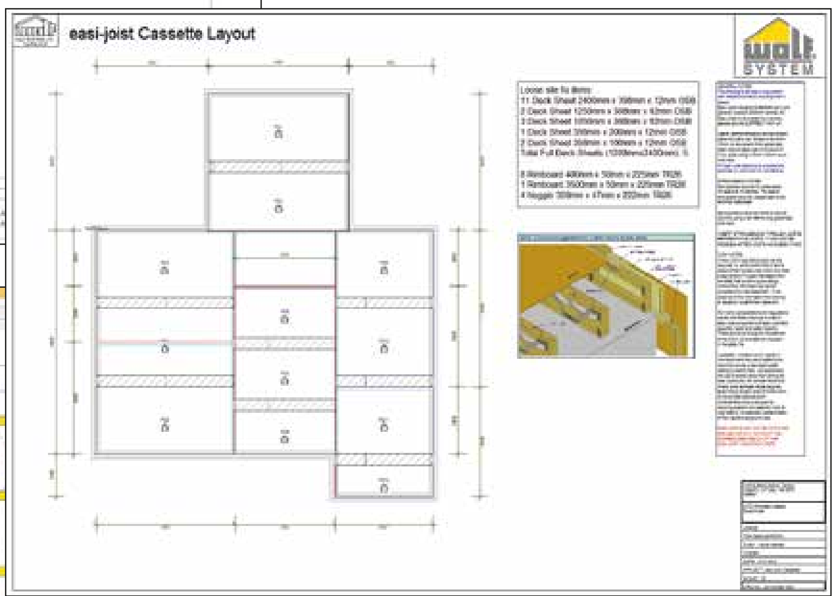


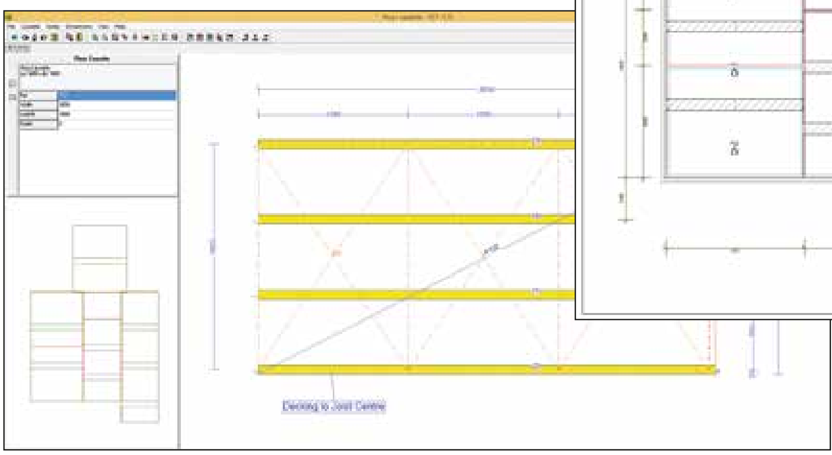




easi-joist® Cassette Software

The easi-joist® design software allows easy automation of floor cassette detailing. In addition to splitting floor plans into individual cassettes, the software can produce output to facilitate factory manufacture and site installation.





To supply easi-joist® in the UK and Ireland it has been necessary to ensure the floor system meets the requirements of The Building Regulations.

European Technical Approval (ETA)

After exhaustive tests carried out by BM TRADA, easi-joist® was the first metal web floor system to attain ETA approval.

Irish Agrément Board (IAB)

After satisfying the requirements of the IAB, easi-joist® has been approved for supply in the Republic of Ireland.

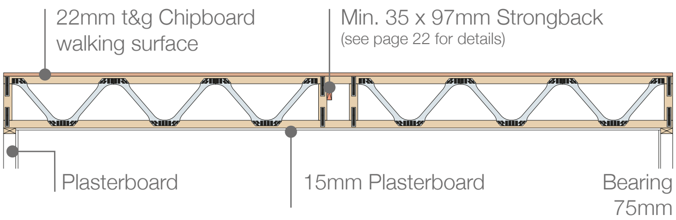
United Kingdom

Intermediate Floors

Typical detailing for intermediate floor construction using easi-joist®. See specification and detail below.

Intermediate Floor Construction Specification

- Joists: Minimum 219mm easi-joist® at 600mm centres.
- Ceiling: 15mm plasterboard fixed at 230mm centres as per manufacturer's specification with 38mm Gyproc drywall timber screws.
- Decking: 22mm tongued and grooved moisture resistant chipboard fixed with 51mm Gyproc drywall timber screws and appropriate adhesive. Screws to be spaced at 200mm at the perimeter and 300mm on intermediate support. Adhesive bead to be placed along joist top chord prior to decking placement. See pages 28 - 34.



Fire Resistance (30 minutes)

The easi-joist® floor system has been tested in accordance with BS 476: Part 21: 1987 and achieved a fire resistance exceeding Requirement B3 of The Building Regulations.

Acoustic Performance

The easi-joist® floor system has been tested in accordance with BS EN ISO 140 – 3: 1995 and achieved a weighted airborne sound reduction index which exceeds Requirement E2 of The Building Regulations.

NOTE

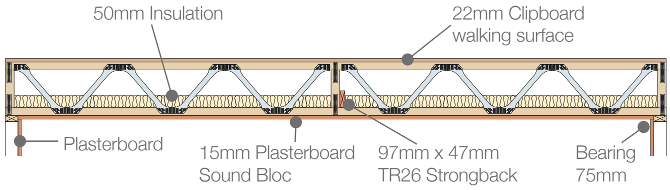
insulation is not required to meet sections B3 or E2 of The Building Regulations.

Scottish Details for Sound Reduction

Intermediate Floor Construction Specification for Scottish Building Regulations differs from the rest of the UK. Acoustic performance requires a weighted airborne sound reduction index of 43db.

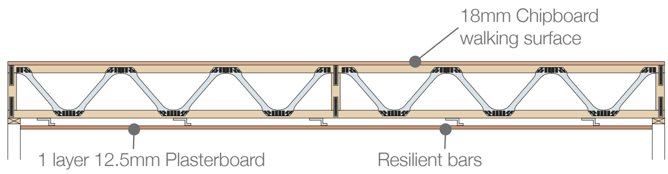
There are two types of detail provided.

Floor Specification Including 50mm Insulation



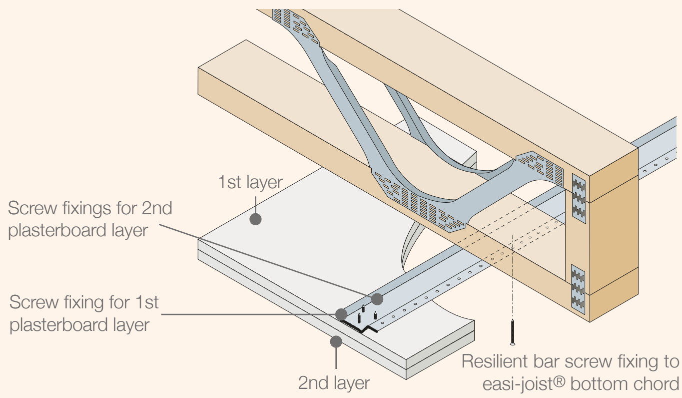
- Joist: 254mm easi-joist® at 600mm centres
- Ceiling: 15mm Soundbloc plasterboard fixed at 300mm centres using 41mm Gyproc drywall screws
- Decking: 22mm Chipboard P5 tongue and groove screwed at 300mm centres using 51mm Gyproc drywall timber screws.

Floor Specification Including Resilient Bars



- Joist: 219mm easi-joist® at 400mm centres
- Ceiling: Resilient Bars at a maximum 450mm centres fixed with 36mm Gyproc drywall screws. 1 layer of 12.5mm plasterboard fixed to the resilient bars at 300mm centres with 25mm Gyrpoc drywall screws. No insulation is required for this detail.
- Decking:18mm Chipboard P5 tongue and groove screwed at 200mm centres using 51mm drywall timber screws. This should be at 200mm centres on the perimeter and 300mm centres on intermediate supports.

Resilient Bar and Plasterboard



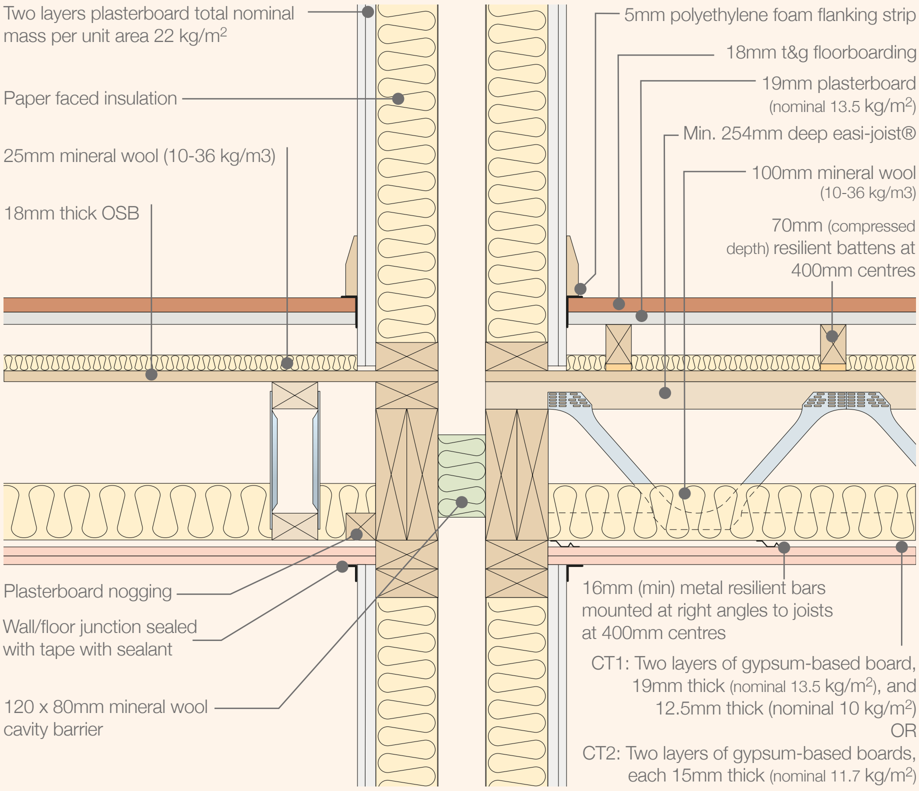
Plasterboard Fixings Must Not Touch Joist

United Kingdom

Separating Floors

easi-joist® has been officially approved by Robust Details Ltd under detail E-FT-3. This means that easi-joist® used in timber frame flats, constructed as per E-FT-3, will not require pre-completion sound testing to prove compliance with Part E of the Building Regulations in England and Wales.

To ensure compliance, it is essential the floor is carefully constructed with specific floor and ceiling materials. See below for details.



Separating Floor Construction (Robust Detail E-FT-3): 60 minutes Fire Resistance

Robust Detail Loads

Top chord

a. 1500 N/m² (Live load)

b. 220 N/m² (Partitions)

c. 475 N/m² (Robust makeup dead load)

- 5mm polyethylene foam strip
- 18mm t & g floor boarding
- 19mm plasterboard
- 70mm resilient battens
- 25mm insulation (10-36 kg/m³)
- 18mm OSB

Bottom chord

a. 366 N/m² (Robust makeup dead load)

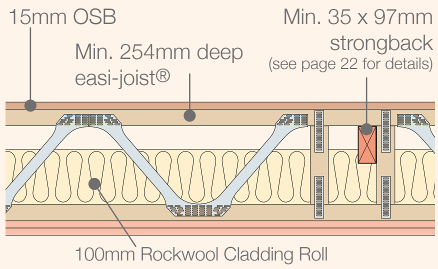
- 100mm mineral wool (10-36 kg/m3)
- Resilient bars at 400mm centres
- 2 layers plasterboard
- Self weight

Fire Resistance (60 minutes)

Typical detail of separating floor with 60 minute fire resistance.

60 minutes fire resistance can be achieved using either of the following ceiling treatments:

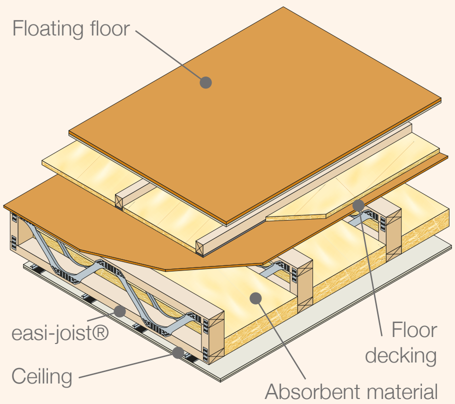
- Two layers of gypsum-based board, 19mm thick (nominal13.5 kg/m²), and 12.5mm thick (nominal 10 kg/m²).
- Two layers of gypsum-based boards, each 15mm thick (nominal 11.7 kg/m²).



Separating Floor Construction: Fire Resistance (60 minutes)

Acoustic Performance

Using Robust Details-approved easi-joist® avoids the need to carry out pre-completion sound testing, eliminating the risk and uncertainty of remedial action being required on completed floor constructions. A typical detail of separating floor, as approved by Robust Details, is shown below.



Separating Floor Construction (Robust Detail E-FT-3)

Note: This floor construction is for timber frame buildings only built in accordance with Robust Details and has not been approved for masonry construction. For further information on the easi-joist® robust detail, please contact Wolf Systems' Design Office.

Republic of Ireland

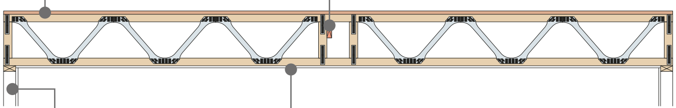
Intermediate Floors

Typical detailing for intermediate floor construction using easi-joist® in the Republic of Ireland.

Intermediate Floor Construction Specification

- Joists: Minimum 219mm easi-joist® at 400mm centres.
- Ceiling: 12.5mm plasterboard fixed at 230mm centres as per manufacturer's specification with 38mm Gyproc drywall timber screws. Ceiling finished with nominal 5mm (minimum of 3mm) plaster skim coat.
- Decking: 18mm tongued and grooved moisture-resistant chipboard fixed to manufacturer's recommendations.

Intermediate Floor Construction Detail



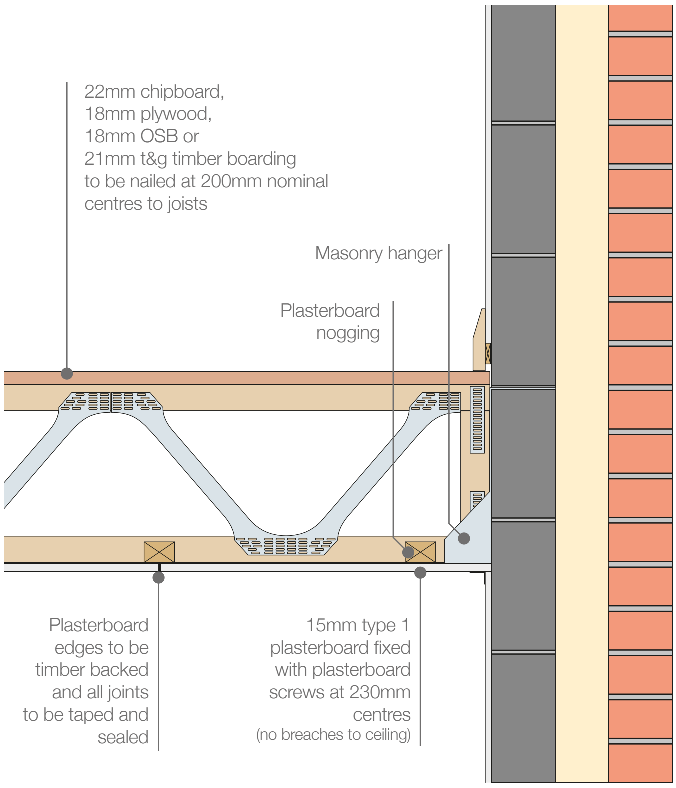
Fire Resistance (30 minutes)

The easi-joist® floor system has been successfully tested in accordance with BS 476: Part 21: 1987.

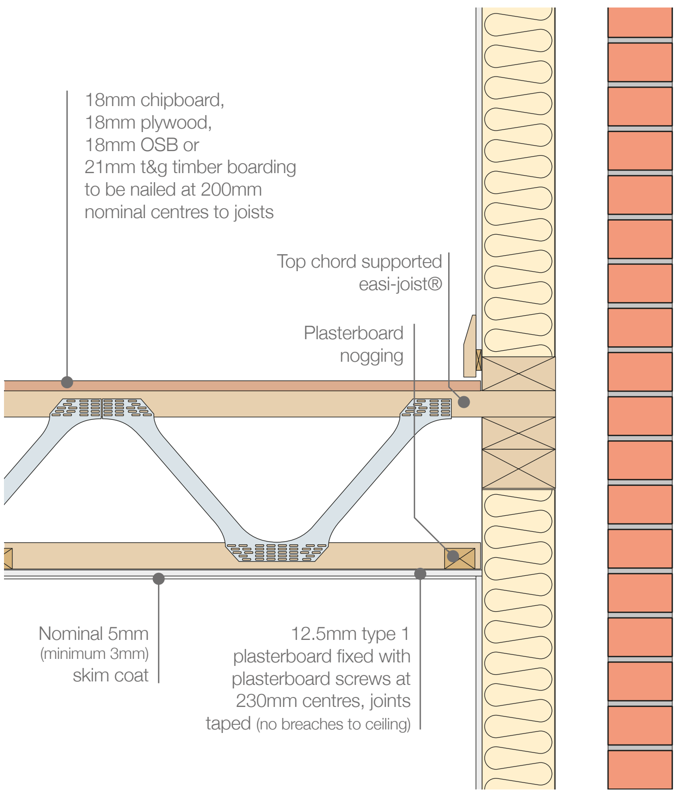
The fire resistance of floors incorporating easi-joist® varies according to the type of floor construction.

Acoustic Performance

The easi-joist® floor system has been tested in accordance with BS EN ISO 140 - 3: 1995 and achieved a weighted airborne sound reduction index which exceeds Requirement E2 of The Building Regulations.



Intermediate Floor Construction: 30 minutes Fire Resistance with easi-joists® at more than 400mm Centres



Intermediate Floor Construction: 30 minutes Fire Resistance with easi-joists® at 400mm Centres

Republic of Ireland

Separating Floors

Acoustic Performance

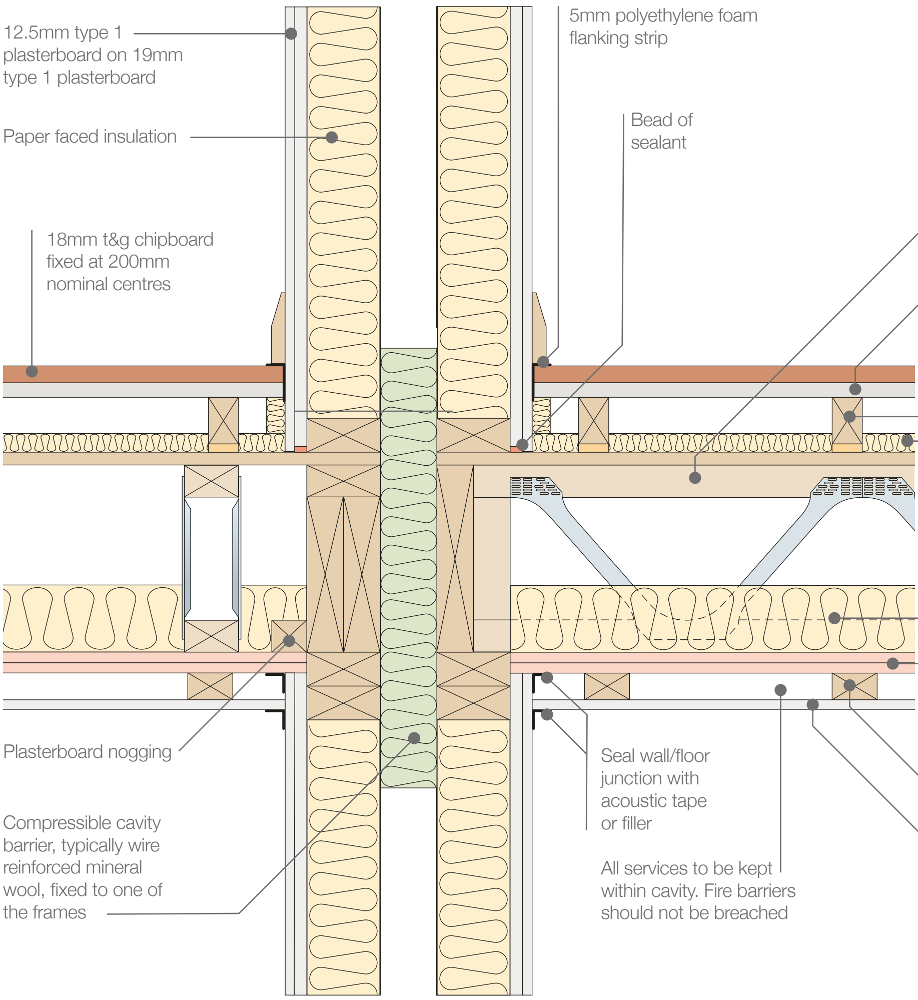
The type of floor construction used will determine the resistance to impact and airborne sound. Test data has been reviewed which indicates that the sound insulation properties of compartment floors, incorporating easi-joist®, are at least as good as those of similar construction incorporating traditional joists.

The sound resisting properties depend on the sealing and integrity of the construction being maintained intact. Services and openings shall not be located within or through the voids unless specified in and installed strictly in accordance with the design drawings. Where openings are permitted, appropriate steps shall be taken to seal them, to achieve the required performance levels.

Fire Resistance (60 minutes)

The easi-joist® floor system has been successfully tested in accordance with BS 476: Part 21: 1987.

See illustration below for typical detailing of separating floor with 60 minute fire resistance.



Separating Floor Construction: 60 minutes Fire Resistance

Span Tables

The following span tables are to be used as a basic guide to achievable joist span for given depth and spacing, and should be used for estimating or feasibility only.

Due to variations in timber grades, load sets, support conditions and bearing widths, the tables are not suitable as a design tool. Please consult an easi-joist® manufacturer for more information and design assistance.

United Kingdom and Ireland Span Table

Joist depth	Joist centres	Chord dimensions	Maximum achievable span - BS	Maximum achievable span - EC5 UK	Maximum achievable span - EC5 Ireland
WS200 easi-joist®					
195	400	72 x 35	4,675	4,300	4,275
		97 x 35	5,025	4,625	4,625
		122 x 35	5,275	4,900	4,900
		147 x 35	5,500	5,100	5,100
	600	72 x 35	4,025	3,775	3,700
		97 x 35	4,425	4,125	4,025
		122 x 35	4,725	4,400	4,300
		147 x 35	4,925	4,675	4,550
WS200 easi-joist®					
219	400	72 x 47	5,175	4,800	4,800
		97 x 47	5,550	5,150	5,150
		122 x 47	5,850	5,450	5,450
		147 x 47	6,075	5,700	5,700
	600	72 x 47	4,675	4,350	4,250
		97 x 47	4,975	4,775	4,675
		122 x 47	5,225	5,125	5,025
		147 x 47	5,450	5,375	5,300
WS250 easi-joist®					
254	400	72 x 47	5,650	5,225	5,225
		97 x 47	6,025	5,625	5,625
		122 x 47	6,350	5,950	5,950
		147 x 47	6,625	6,200	6,200
	600	72 x 47	5,075	4,900	4,800
		97 x 47	5,425	5,300	5,250
		122 x 47	5,675	5,600	5,575
		147 x 47	5,925	5,825	5,825
WS300 easi-joist®					
304	400	72 x 47	6,275	5,800	5,800
		97 x 47	6,700	6,225	6,225
		122 x 47	7,075	6,575	6,575
		147 x 47	7,375	6,875	6,875
	600	72 x 47	5,625	5,600	5,550
		97 x 47	6,025	6,000	5,975
		122 x 47	6,325	6,325	6,300
		147 x 47	6,600	6,600	6,575
WS400 easi-joist®					
417	400	72 x 47	7,200	6,900	6,900
		97 x 47	7,650	7,400	7,400
		122 x 47	8,000	7,825	7,825
		147 x 47	8,275	8,200	8,200
	600	72 x 47	6,400	6,600	6,450
		97 x 47	6,775	7,175	7,000
		122 x 47	7,075	7,525	7,300
		147 x 47	7,325	7,900	7,625

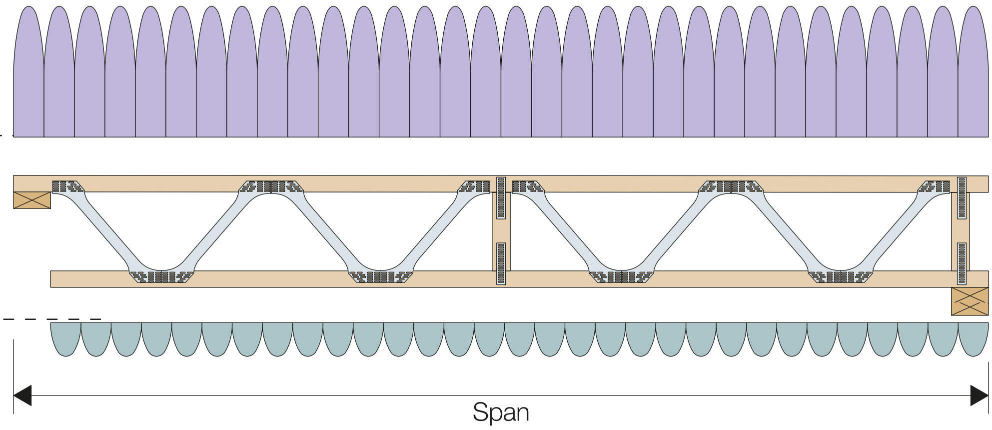
Load and Span Description

Top Chord UDL

(Floor: LL + DL + Partition)

Bottom Chord UDL

(Ceiling: DL)

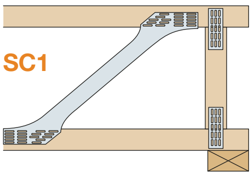


Support Conditions (SC)

There are four typical support conditions used in the design of easi-joist® which provide an important benefit in flexibility for connecting to different bearing members such as timber frame, masonry or steel. For more information on support conditions, see pages 28 - 34 of this manual.

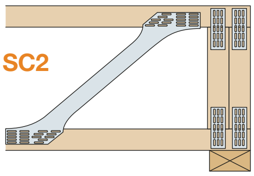
The support conditions below are possible for varying methods of connection to timber frame or masonry walls, or connection to steel or timber beams.

SC1



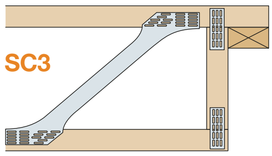
Bottom Chord Trimmable

SC2



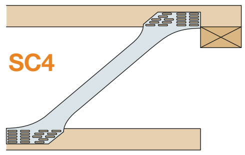
Bottom Chord Full

SC3



Top Chord Closed

SC4



Top Chord Open

Floor Load Criteria

Spans are calculated based on the following applied loads

	BS	EC5 UK	EC5 Ireland
Top chord (Imposed)	1500 N/m^2	1500 N/m^2	1500 N/m^2
Top chord (Dead)	210 N/m^2	210 N/m^2	210 N/m^2
Top Chord (Partitions)	220 N/m^2	350 N/m^2	500 N/m^2
Bottom chord (Dead)	200 N/m^2	200 N/m^2	200 N/m^2

General Notes:-

1. Maximum span assumes 100mm wide bearing with the support condition SC2, maximum span of the joist taken over the bearing.
2. Lateral restraint is provided by a suitably fixed floor deck, which will prevent buckling of the compression flange.
3. Support conditions and web direction/orientation can affect the spanning capacity of a joist.
4. Strongbacks to be used for spans over 4m.

BS applicable notes:-

5. Spans are based on deflections being limited to 0.003 x span up to a maximum of 14mm.
6. The joists are assumed to be part of a load-sharing system as defined in BS 5268 2, Clause 2.9.

EC5 applicable notes:-

5. UK -Spans are based on vibrations checks of fundamental frequency being not less than 8 Hz, Unit point load deflection and Unit impulse velocity response as per limits in table NA.6, NA to BS EN 1995-1-1:2004.
6. Ireland - Spans are based on vibrations checks of fundamental frequency being not less than 8 Hz, Unit point load deflection and Unit impulse velocity response as per limits in NA.2.7, NA:2010+A1:2003 to I.S. EN 1995-1-1:2005.
7. UK - Net final deflection, $w_{net,fin}$, limited to l/250, for floor member with plasterboard, Table NA.5, NA to BE EN 1995-1-1:2004.
8. Ireland - Net final deflection, $w_{net,fin}$, limited to l/250, for floor member with plasterboard, Table NA.3, NA:2010+A1:2003 to I.S. EN 1995-1-1:2005.
9. UK - The joists are part of a load distribution system, with a k_{sys} factor of 1.1, BS EN 1995-1-1:2004, clause 6.6 (2).
10. Ireland - The joists are part of a load distribution system, with a k_{sys} factor of 1.1, IS EN 1995-1-1:2005, clause 6.6 (2).

Design for Serviceability Limit State (SLS)

Serviceability limit states are defined to enable designers to avoid unduly high deflections or vibrations, which would compromise the usability of the building, its appearance and the comfort of its inhabitants. easi-joist® is designed in accordance with BS EN 1995-1-1:2004 (EC5) and UK National Annex (UKNA).

Deflection

EC5 requires that the deformation of an easi-joist® must be such that the floor make up it supports will be able to function as designed, that there will be no adverse visual effects, no structural implications and services must be able to function satisfactorily.

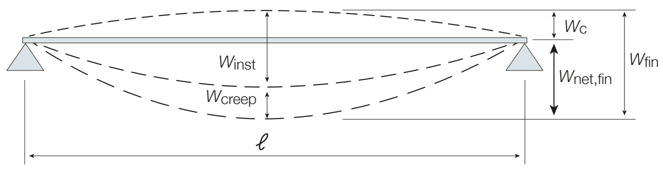
To prevent the occurrence of unacceptable damage arising due to excessive deflections as well as to meet functional and visual requirements, serviceability criteria should be specified for each project and agreed with the client. The UKNA table NA.5 gives guidance for limiting values for deflections of individual beams, which take into account creep deformations, UKNA table NA.5.

Components of Deflection

w_c	is the precamber (if applied);
w_{inst}	is the instantaneous deflection;
w_{creep}	is the creep deflection;
w_{fin}	is the final deflection;
$w_{net,fin}$	is the net final deflection.

The net deflection below a straight line between the supports, $w_{net,fin}$ should be taken as:

$w_{net,fin} = w_{inst} + w_{creep} - w_c = w_{fin} - w_c$



Limiting Values for Deflection of Beams

Limiting Value for Deflections of Individual Beams

Type of member	Limiting value for net final deflections of individual beams, $w_{net,fin}$	
	A member of span, between two supports	A member with a cantilever ℓ
Roof or floor members with a plastered or plasterboard ceiling	ℓ /250	ℓ /250
Roof or floor members without a plastered or plasterboard ceiling	ℓ /150	ℓ /75
NOTE *When, calculating $w_{net\ fin}$, w_{fin} should be calculated as u_{fin} in accordance with BSEN 1995-1-1:2004+A1:2008,2.2.3(5)*		

UKNA Table NA.5

Vibration

The qualitative and quantitative assessment of human perception of, susceptibility to and acceptance of structural vibration is very complex. These characteristics are dependent on many factors, and EC5 and UKNA defines the human sensitivity to the acceptance of vibration is influenced by a residential floor having a fundamental frequency, $f1$, not less than 8 Hz. In calculating $f1$ the mass of the floor should be the permanent actions only without including partition loads or any variable actions.

For residential floors having a fundamental frequency greater than 8 Hz, human sensitivity relates to the effects of vibration amplitude and velocity caused by dynamic footfall. EC5 satisfies vibration amplitude requirement by checking a 1kN static load simulating the foot force effect at the centre of the span and limiting the deflection ‘a’. The vibration velocity is checked with a unit impulse force of 1N.s at the centre of the floor simulating heel contact and limited in relation to the deflection ‘a’. The limits are given in UKNA table NA.6. The modal damping ratio ζ for typical UK floors is 0.02 as stated in the UKNA NA.2.7

Limits for a and b in BS EN 1995-1-1:2004+A1:2008 Expressions (7.3) and (7.4)

Parameter	Limit	
a, deflection of floor under 1kN point load	1,8mm 16 500/$\ell^{1,1}$mm where = joist span inmm	for $\ell \leqslant$ 4 000mm for ℓ > 4 000mm
b, constant for the control of unit impulse velocity response	for a $\leqslant$ 1mm for a > 1mm	b = 180 - 60a b = 180 - 40a
NOTE *The formulae for b correspond to BS EN 1995-1:2004+A1:2008, Figure 7.2. With a value of 0,02 for the modal damping ratio,ζ, the unit impulse velocity response will not normally govern the size of the floor joists in residential timber floors.*		

UKNA Table NA.6

Thermal Performance

The Thermal performance of easi-joist® compared to solid timber has been independently analysed by C4Ci using Physibel's 3D numerical thermal modelling program called TRISCO.

The Test

Solid timber and easi-joist® profiles were modelled over a 600mm length with an air cavity to each side with decking/ceiling directly attached.

The Results

Expressed as an equivalent thermal transmittance (U-Value), the results for both profiles were;

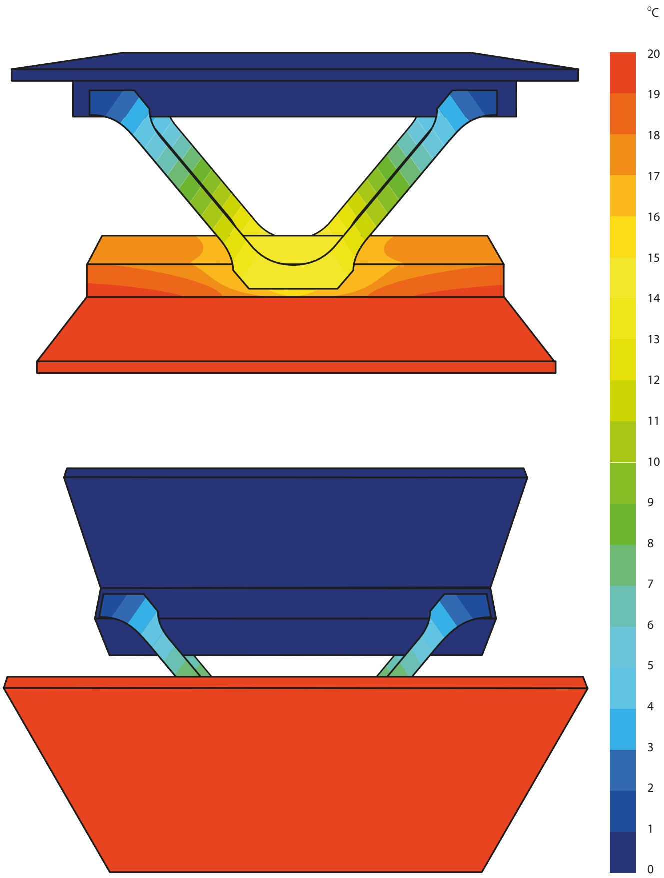
easi-joist® = 3.570 W/(m2.K)

Solid Timber = 3.426 W/(m2.K)

Conclusion

The small (4%) difference in effective thermal transmittance between the two profiles is negligible when one bears in mind that the end condition (either built-in or in metal joist hangers) will dominate heat transfer between rooms in practice, and will be identical for both easi-joist® and solid timber.

C4Ci are happy to confirm that in respect of thermal transmittance between rooms, easi-joist® floors can be regarded as equivalent to conventional timber joisted floors.



Trisco - Calculation Results

Trisco data files: Wolf joist inputted 0.25 Y context steel.tre

Equivalent thermal transmittance

Ueq = Q/((ti-te) * (A1+A2+A3)) = 3.570 W/(m^2.K)

Q = 17.137 W

ti = 20.000000°C

te = 0.000000°C

A1 = 0.24m^2

Xmin = 0 Xmax = 128 Ymin = 1 Ymax = 1
Zmin = 0 Zmax = 17

A2 = 0 m^2

A3 = 0 m^2

Ly = (Q/(ti-te) - U2 x A2 - U3 x A3)/A1 = 3.570 W/(m^2 .k)

Trisco data files: Wolf joist inputted 0.25 Y context timber.tre

Equivalent thermal transmittance

Ueq = Q/((ti-te) x (A1+A2+A3)) = 3.426 W/(m^2.K)

Q = 16.445 W

ti = 20.000000°C

te = 0.000000°C

A1 = 0.24m^2

Xmin = 0 Xmax = 30 Ymin = 1 Ymax = 1
Zmin = 0 Zmax = 34

A2 = 0 m^2

A3 = 0 m^2

Ly = (Q/(ti-te) - U2 x A2 - U3 x A3)/A1 = 3.426 W/(m^2 .k)

Extra heat flow due of steel over timber $\frac{3.570}{3.426} = 1.042$

Extra heat flow approximatly 4%

Strongback Sizes and Installation

Strongbacks are an essential part of the floor construction as a whole. They provide essential damping qualities to the floor by connecting joists together to form a load sharing system that limits deflection and stiffens the floor. In addition they provide a useful form of lateral bracing within the floor during its construction (see pages 24, 29 and 51 for further strongback bracing details).

Fixing & Splicing

Correct installation of the Strongback and flooring material will ultimately determine how well the easi-joist® floor system will perform. It is recommended that the Strongback be installed tight to the top chord of the easi-joist® beam and should be twice nailed to the columns provided with 3.35 x 65mm wire nails. Strongbacks may be spliced where required by fixing a 600mm timber splice equally over the joint, and nailed using 6 no 3.35 x 65mm nails on either side of the joint.

IMPORTANT

The correct fixing of the strongback is essential to overall floor performance and must be carried out as instructed above. Fixing the strongback by screwing is also satisfactory.

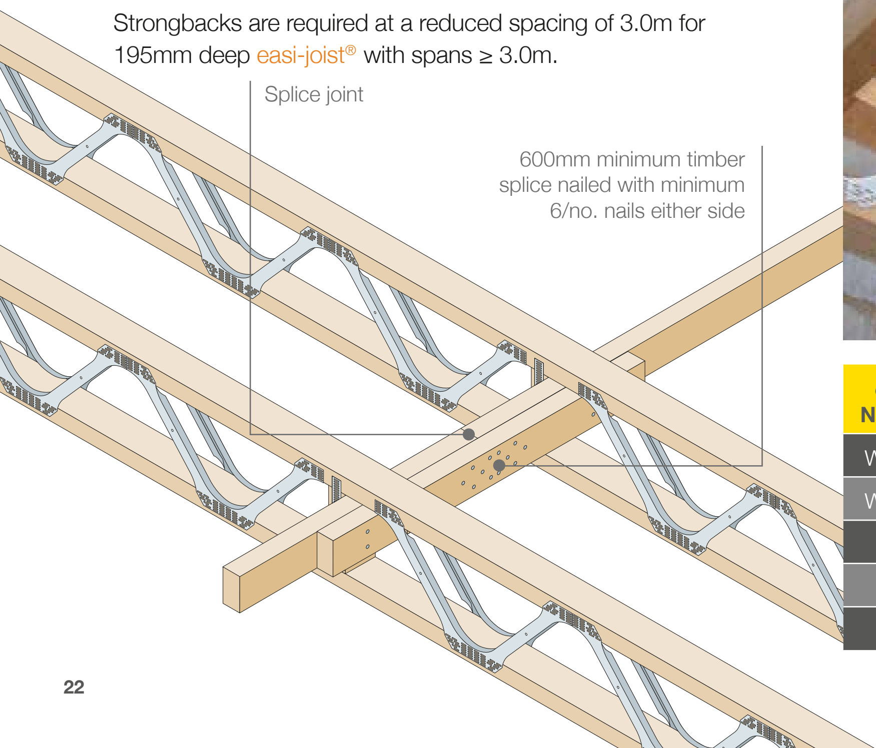
Deflection Limits

When strongbacks are used, easi-joist® beams have a maximum deflection limit of 14mm or span x 0.003, whichever is least. If strongbacks are not provided NHBC Standards 6.4-D4 (a) stipulates a maximum 12mm deflection limit. NHBC requires that strongbacks are to be used and located according to the following rules:

- Spans less than 4.0m = strongback not required
- Spans between 4.0m and 8.0m = 1 strongback at centre of span
- Spans greater than 8.0m = 2 strongbacks at equal spacing

NOTE

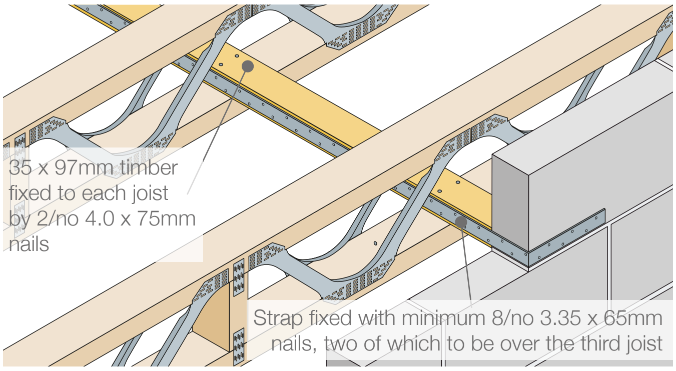
Strongbacks are required at a reduced spacing of 3.0m for 195mm deep easi-joist® with spans ≥ 3.0m.



Horizontal Restraint Strap

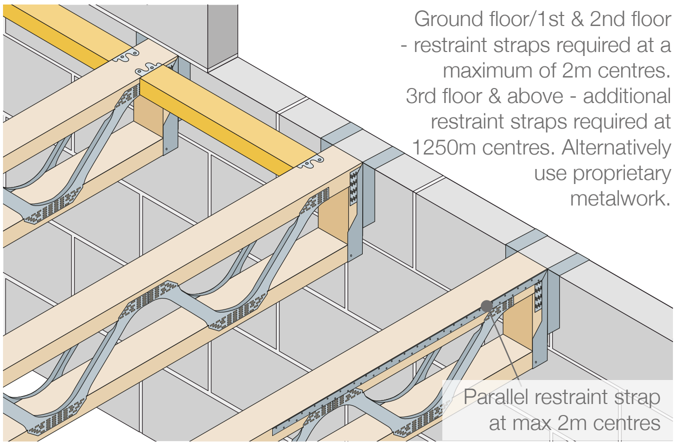
Horizontal bracing straps are required to be fixed to loadbearing walls perpendicular to easi-joist®. This member must be continuous over a minimum of 3 easi-joist®.

Straps to be fixed in strict accordance with manufacturer's instructions.



Parallel Restraint Bracing

Joists Perpendicular to Masonry Wall



easi-joist® Nominal Size	Strongback Max Spacing	Strongback Size and Grade	Alternative Strongback
WS200 - 195	3.0m	35 x 97 TR26	35 x 97 C16
WS200 - 219	4.0m	35 x 97 TR26	35 x 97 C16
WS250	4.0m	35 x 97 TR26	35 x 122 C16
WS300	4.0m	35 x 122 TR26	35 x 147 C16
WS400	4.0m	35 x 147 TR26	35 x 172 C16

Suspended Ground Floors

When designing and installing easi-joist® at ground floor level, the following points should be considered.

Ground floor suspended floors are classified as Service Class 2 and therefore will have an increased moisture content.

Adequate provision should be made for ventilation of the void below the joists which must be maintained at a minimum of 150mm depth and comply to with Building Regulations.

The absence of a ceiling covering results in the bottom chord of the easi-joist® having no lateral restraint. Therefore noggins must be installed along each side of the intermediate supports to prevent buckling where the bottom chord will be in compression. Noggins should be secured with z clips.

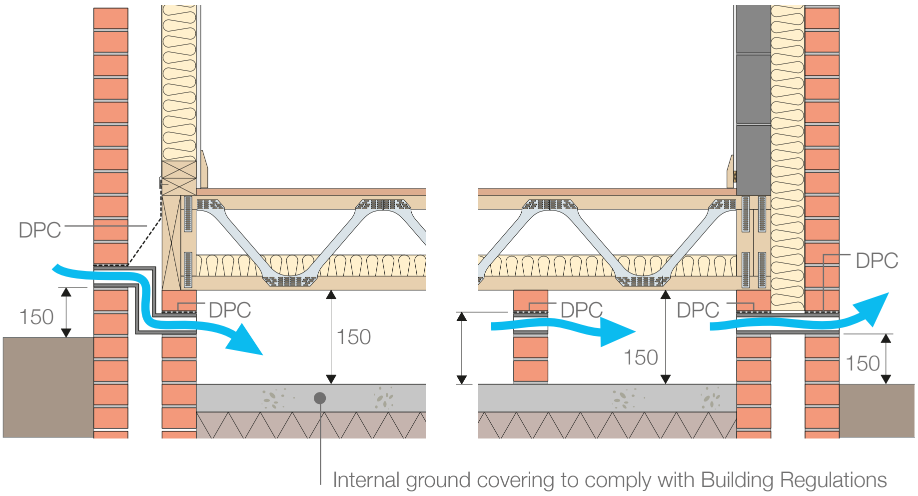
Deflection limits may be reduced to account for the reduced stiffness of the floor compared to floors fitted with a ceiling diaphragm.

Large appliances such as washing machines or spin dryers may produce dynamic movement requiring more stringent deflection limits.

Induced dynamic movement will be reduced by using a discontinuous joist layout between separate ground floor rooms.

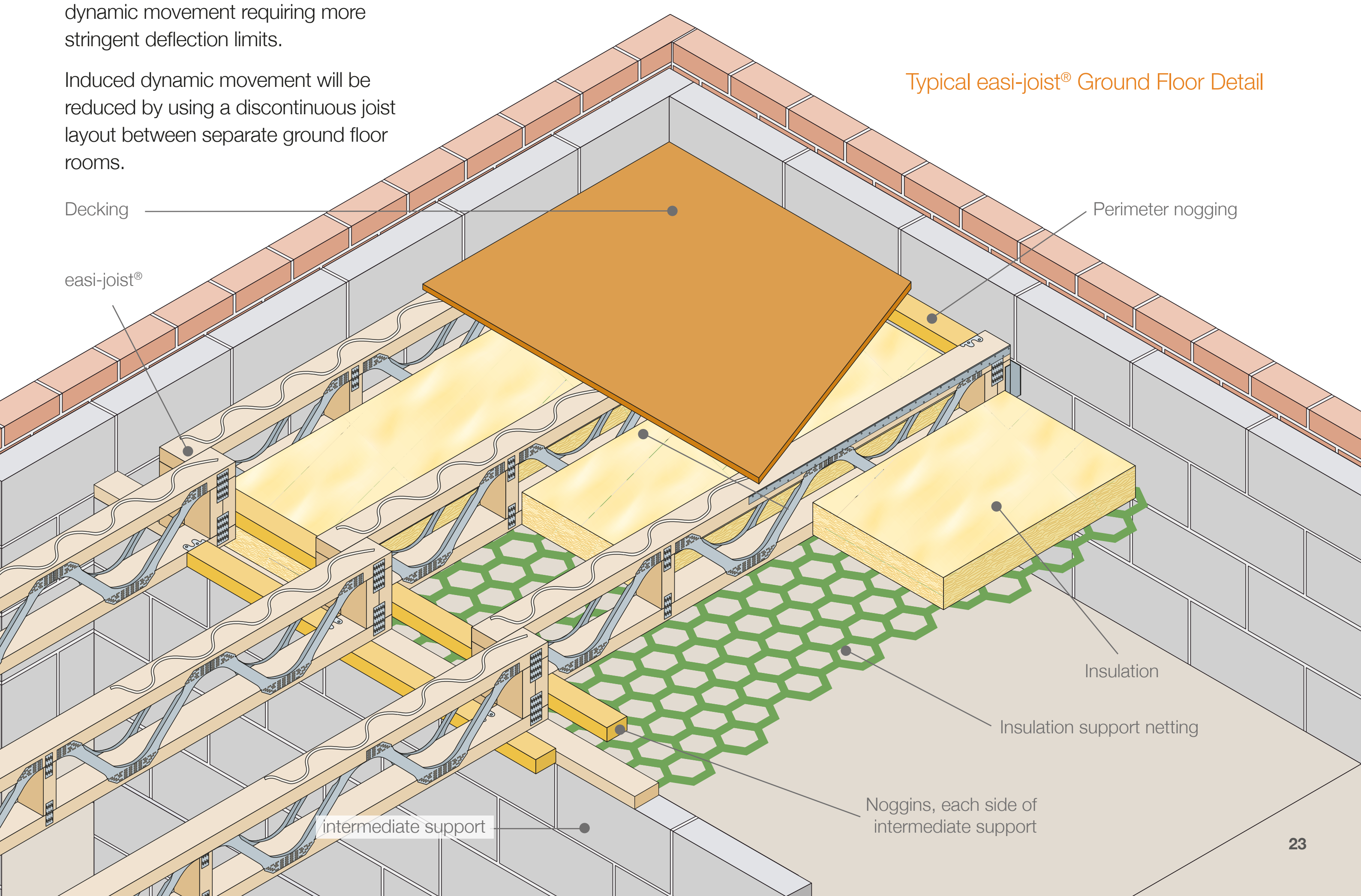
British Standard Service Classes

- Service Class 1
  Internal use in continuously heated building, 12% moisture content
- Service Class 2
  Covered and generally heated, 15% moisture content
- Service Class 2
  Covered and generally unheated, 18% moisture content
- Service Class 3
  External use, fully exposed, more than 20% moisture content



Note: Dimensions (mm) are minimum requirements

Typical easi-joist® Ground Floor Detail



Loading

Dead Loads

Dead load should account for all building materials in the floor structure including ceiling linings and insulation. This should also include non-load bearing partition walls which have not been accounted for with line loads.

The minimum dead load for single occupancy domestic floors including the floor deck, self-weight of joists and plasterboard, but excluding any allowance for non-load bearing partitions should be a minimum of 0.41 kN/m^2.

Imposed Loads

Imposed or "live" loads are generated by the intended use and occupancy of the floor generated by moveable partitions and domestic storage, concentrated, impact and inertia loads.

Imposed loads are the loads produced by the occupancy of a building including storage and inhabitants. The imposed floor load compatible with the building usage should be obtained from BS 6399-1 and BS EN 1991-1-1. Typical imposed uniformly distributed floor loads are shown on page 19.

Additional Loads

Care should be taken to ensure additional loads are considered within the design of easi-joist®. Examples of additional loads are snooker tables, load bearing walls, access hoists, home multi-gyms, spa baths, water storage cylinders and chandeliers.

Each of these examples will require region, line or points loads to be additionally applied to the floor design. The list is not exhaustive and advice should be sought if in doubt regarding additional loads.

Partition Loads

It is the guidance of the EWP code of practice that loading which allows for the self-weight of non-load bearing partitions shall always be applied to the design of domestic floors using easi-joist®, irrespective of whether non-load bearing partitions are present on the floor.

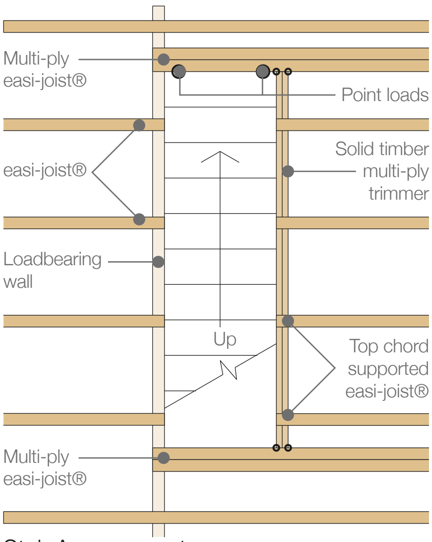
The self-weight of partitions should be accounted for by applying loads in accordance with the following:

1. Where the location of partitions are known, joists should be designed for the most onerous of the following:
   - a minimum line load at partition locations of 0.64 kN/m.
   - a minimum uniform load of 0.22 kN/m^2 for BS design, or 0.35kN/m^2 for EC5 design.
2. Where the location of partitionsis not known, joists should be designed for a minimum load of 0.22kN/m^2 for BS design, or 0.35kN/m^2 for EC5 design.

The minimum partition load of 0.64 kN/m is applicable for partitions weighing up to 27 kg/m^2 and 2.4m high.

Stair Loads

Wherever stairs are fixed to easi-joists® the dead and imposed load from the stairs should always be applied to the floor.



Stair Arrangement

Weights of Building Materials

Asphalt roofing	per layer	206 N/m^2
Chipboard	18mm	140 N/m^2
Chipboard	22mm	175 N/m^2
Plasterboard	9.5mm	81 N/m^2
Plasterboard	12.5mm	110 N/m^2
Plasterboard	15mm	131 N/m^2
Plasterboard	19.1mm	187 N/m^2
Plywood	12mm	82 N/m^2
Plywood	15mm	103 N/m^2
Plywood	18mm	124 N/m^2
Fibreglass insul	100mm	40 N/m^2
Joist self-weight	600mm c/c	90 N/m^2

Stiffness

The dynamic action of any floor system is dependent on the floor geometry, the applied loads and the level of expectation of the occupants.

Damping

Components can be added to the building structure which act to reduce vibration and deflection of the floor. This is known as damping.

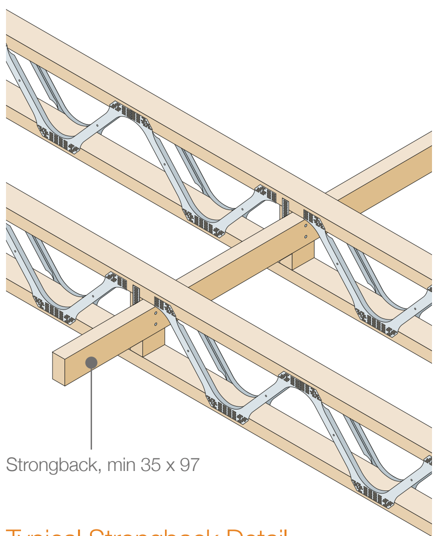
An important contributor to the damping effect is the strongback, a solid timber member running perpendicular to the joists. By providing a solid connection between adjacent joists, the movement of any individual joist is reduced.

The improvements to the floor gained by the installation of a strongback are dependent on its correct size, position and fixture to the easi-joist®.

Strongbacks are generally provided at the centre of any span greater than 4m.

Other floor damping components include internal walls, resilient battens and floor or ceiling coverings screwed directly to the joists. Damping is achieved by reducing the effective area or by restraining the dynamic action of the floor.

See page 22 for more details on strongbacks.



Typical Strongback Detail

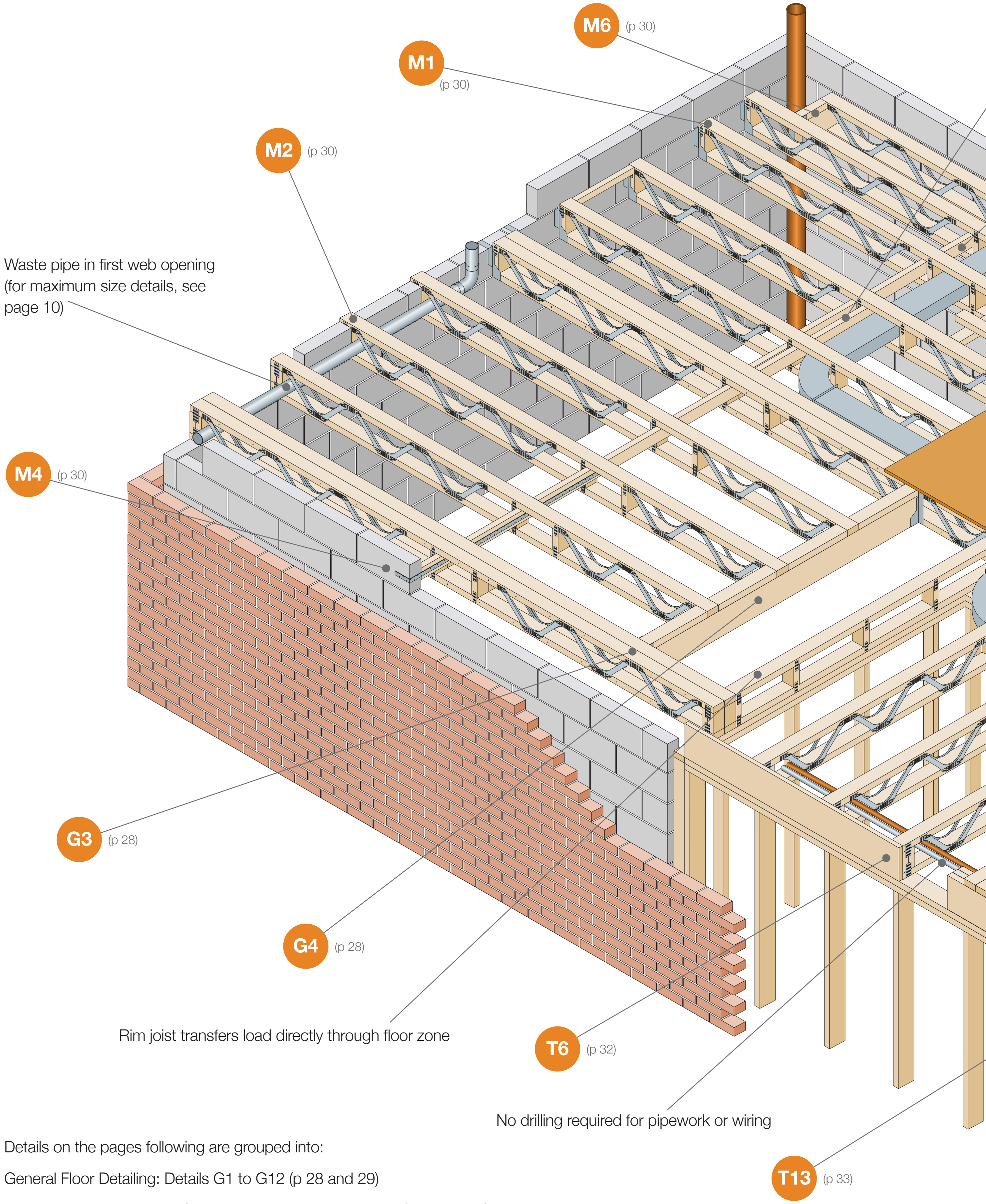
Typical Minimum Imposed Uniformly Distributed Floor Loads

This table presents a summary of the most common imposed loads taken from the full list given in the codes of practice BS 6399-1 and BS EN 1991-1-1.

Type of occupancy	Examples of specific use	Uniformly distributed load (kN/m^2)	
		BS 6399-1	BS EN 1991-1-1
A: Domestic and residential	1. All usages within self-contained dwelling units and communal areas (including kitchens) in blocks of flats with limited use (1, 2)	1.5	1.5
	2. Bedrooms and dormitories except those in hotels and motels	1.5	1.5
	3. Bedrooms in hotels and motels hospital wards, toilet areas	2.0	2.0
	4. Billiard rooms	2.0	2.0
	5. Communal kitchens except in flats covered by 1 above	3.0	3.0
B: Offices and work areas (4)	6. Operating theatres, x-ray rooms, utility rooms	2.0	2.0
	7. Work rooms (light industrial) without storage	2.5	2.5
	8. Offices for general use	2.5	2.5
	9. Banking halls	3.0	3.0
	10. Kitchens, laundries, laboratories	3.0	3.0
	11. Rooms with mainframe computers or similar equipment	3.5	3.5
	12. Machinery halls	4.0	4.0
	13. Projection rooms	5.0	5.0
	14. Factories, workshops (general industrial)	5.0	5.0
C: Areas where people may congregate	15. Public, institutional and communal dining rooms (3), lounges, cafes and restaurants	2.0	2.0
C1: Areas with tables	16. Reading rooms with no book storages	2.5	2.5
	17. Classrooms	3.0	3.0
Areas without obstacles for moving people	18. Corridors, hallways, aisles, stairs, landings, etc. in institutional type buildings (not subject to crowds or wheeled vehicles), hostels, guest houses, residential clubs, and communal areas in blocks of flats not covered by 1 above	3.0	3.0
	19. Corridors, hallways, aisles, stairs, landings, etc. in all other buildings including hotels, motels and institutional	Foot traffic 4.0	Foot traffic 4.0
		Wheeled trolleys	Wheeled trolleys
		5.0	5.0

Notes

1. Communal areas in blocks of flats with limited use refers to blocks of flats of not more than three storeys and with not more than four self-contained dwelling units per storey accessible from one staircase.
2. For communal areas in other blocks of flats see C3 (refers to the continued section of Table 1 in BS 6399-1: 1996).
3. Where a dining room may also serve as an area for dancing refer to BS 6399-1 and BS EN 1991-1-1.
4. Imposed loads for storage areas within buildings of this occupancy type should be obtained from BS 6399-1 or BS EN 1991-1-1.

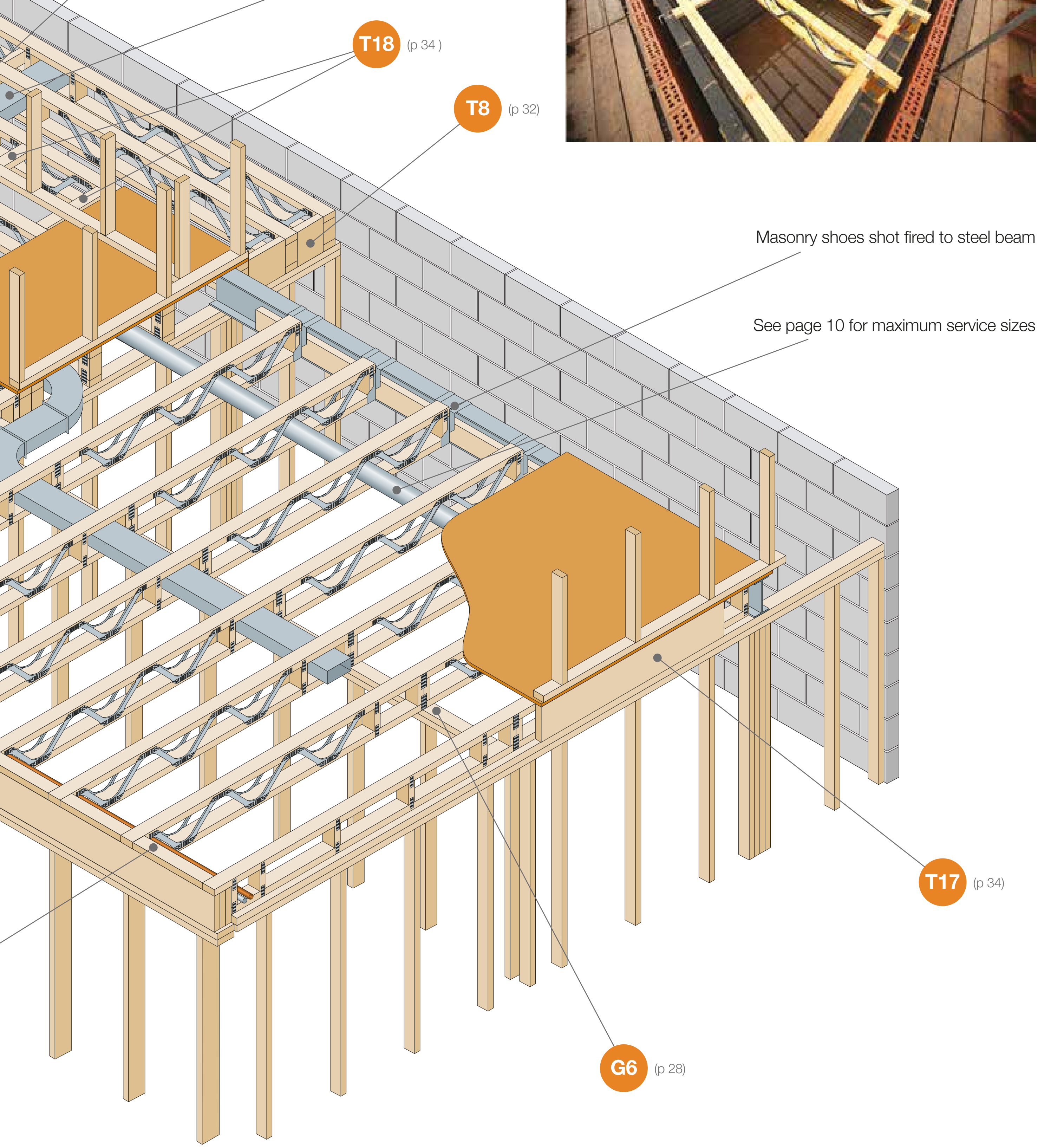


Details on the pages following are grouped into:

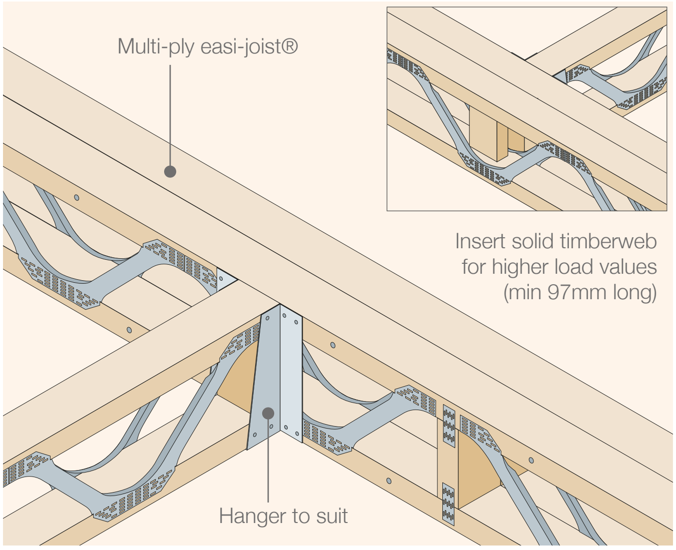
General Floor Detailing: Details G1 to G12 (p 28 and 29)

Floor Detailing in Masonry Construction: Details M1 to M10 (p30 and 31)

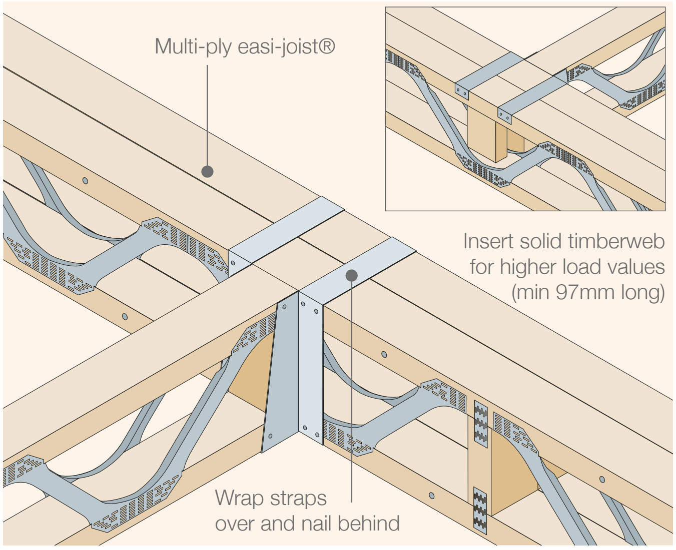
Floor Detailing in Timber Frame Construction: Details T1 to T20 (p31 - 34)


G7 (p 29)
G8 (p 29)
Ducting routed through floor (for maximum size details, see page 10)
T18 (p 34)
T8 (p 32)
Masonry shoes shot fired to steel beam
See page 10 for maximum service sizes
T17 (p 34)
G6 (p 28)

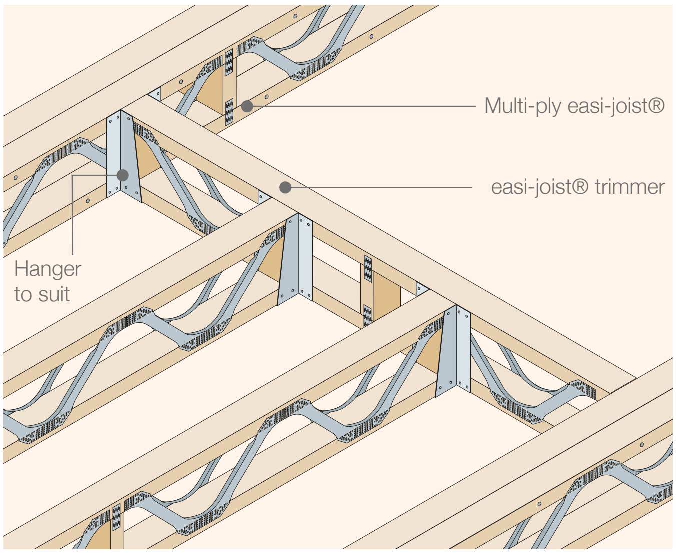
G1 • Face Fix Hanger



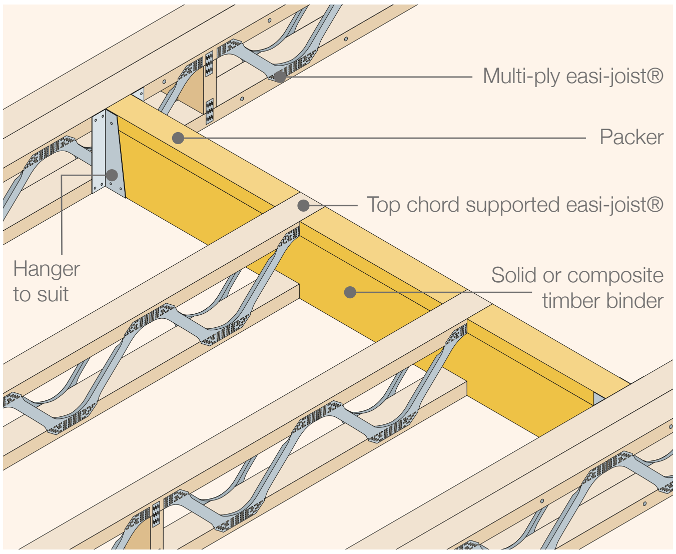
G2 • Strap Hanger



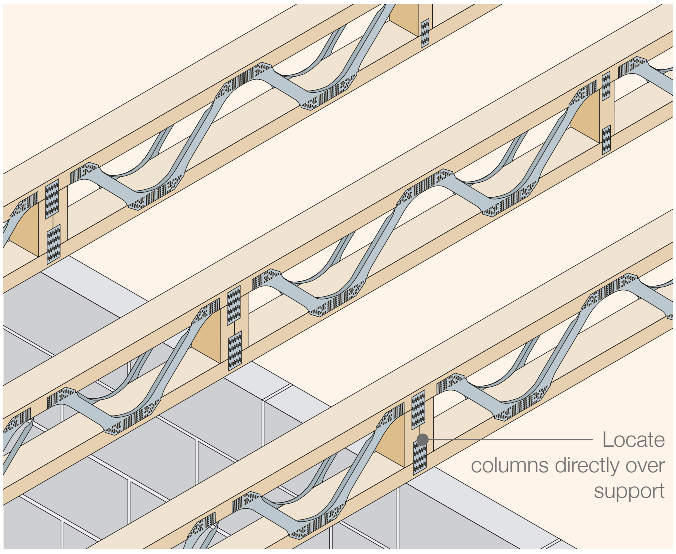
G3 • Stair Opening with easi-joist®



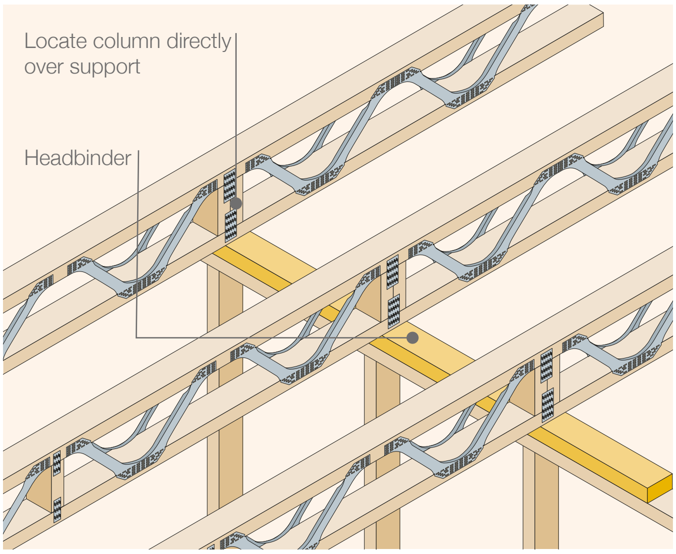
G4 • Stair Opening with Binder



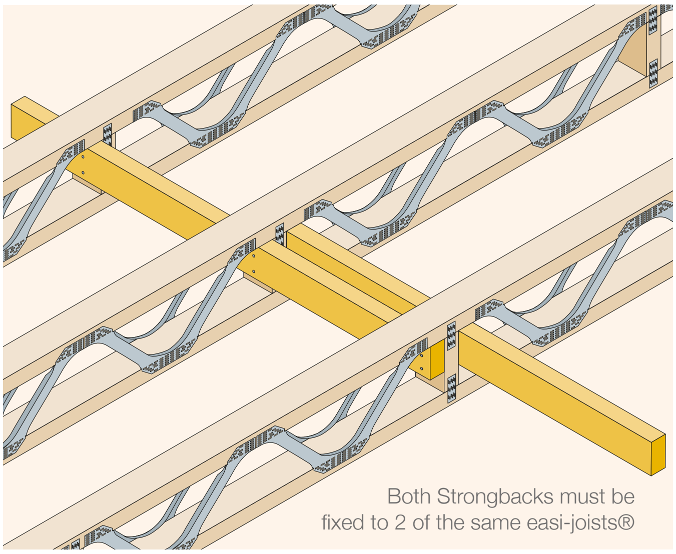
G5 • Intermediate Support (on to block wall)



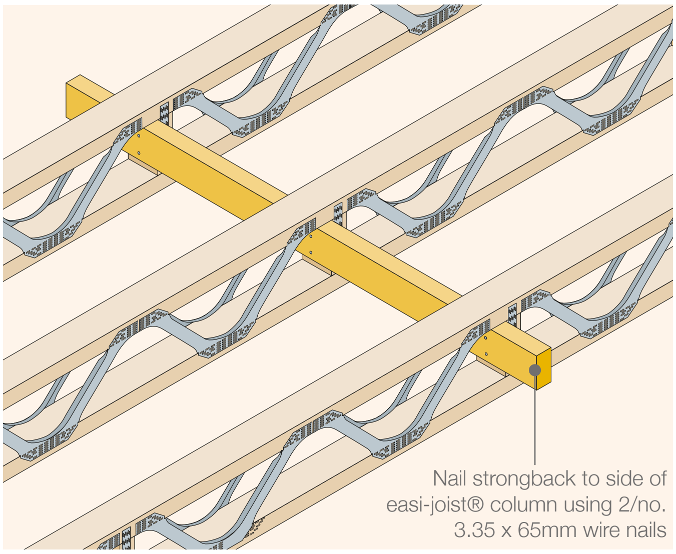
G6 • Intermediate Support (on to stud wall)



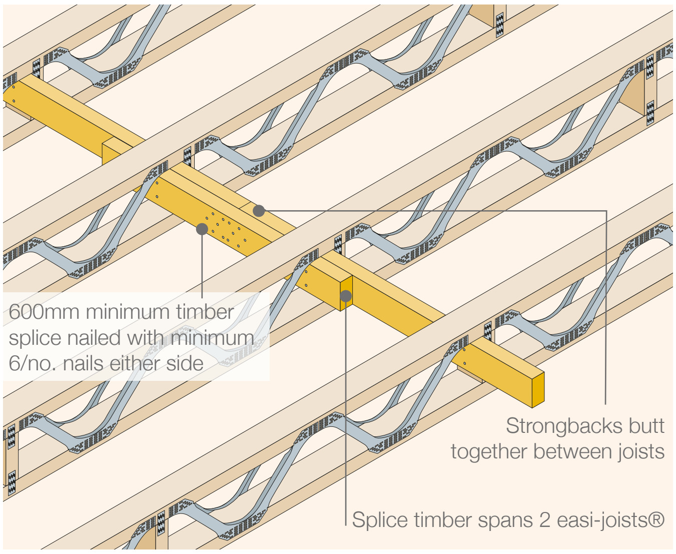
G7 • Strongback Lapping



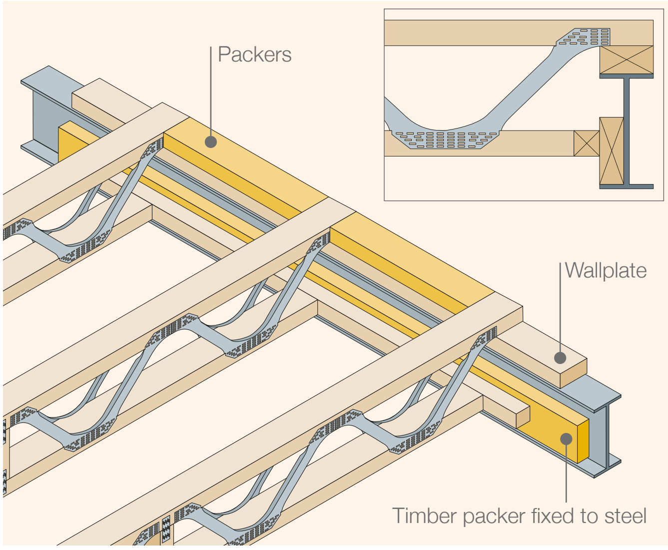
G8 • Strongback



G9 • Strongback Splice



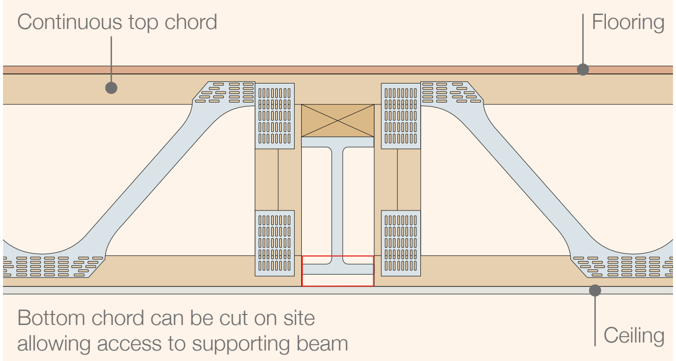
G10 • Top Chord Support on to Steel



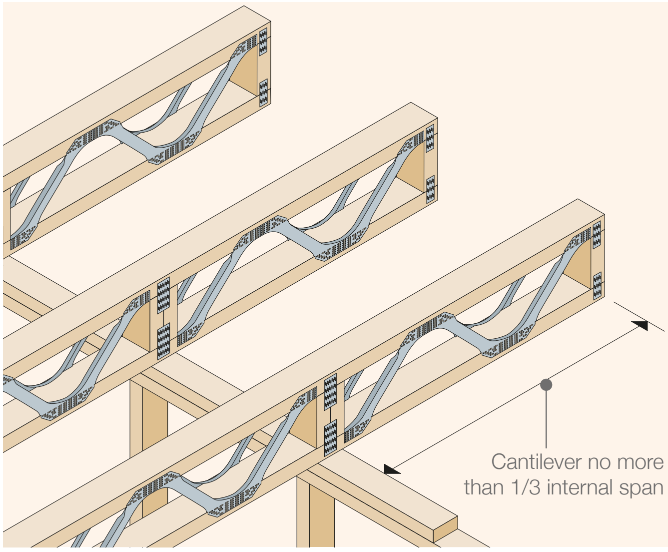
G11 • Joist on I-Beam with Hidden Support

Hidden top chord support allows for continuous ceiling material

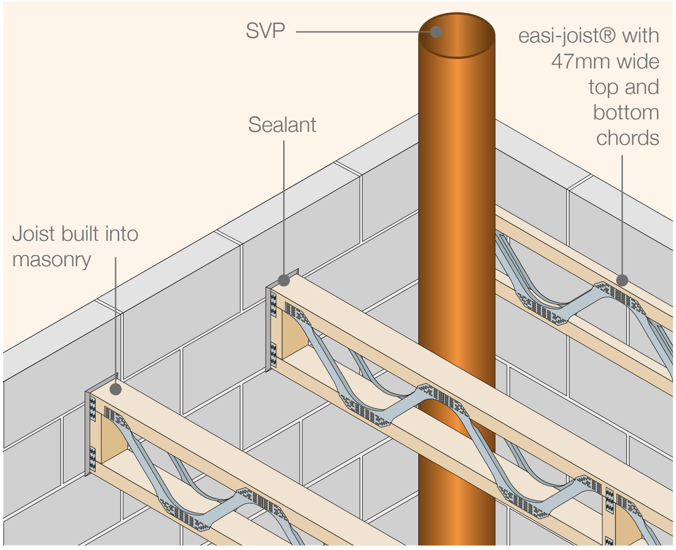
It is the responsibility of the designer to check the design of the joist to ensure the bottom chord can be cut to allow access to the beam



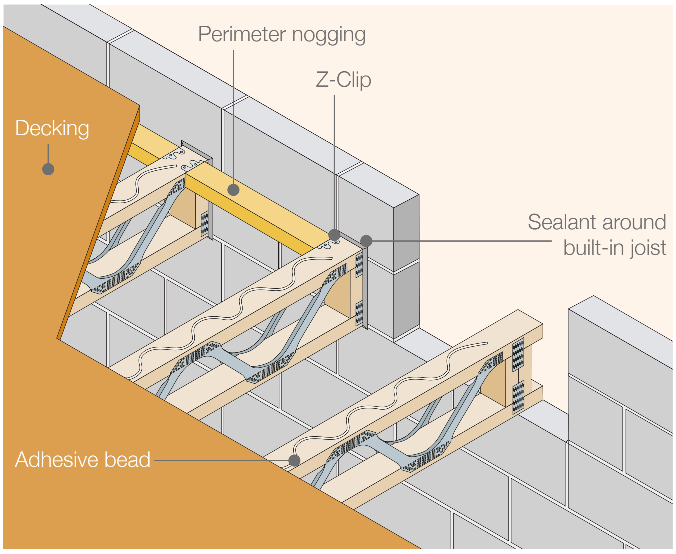
G12 • Cantilevered Joists



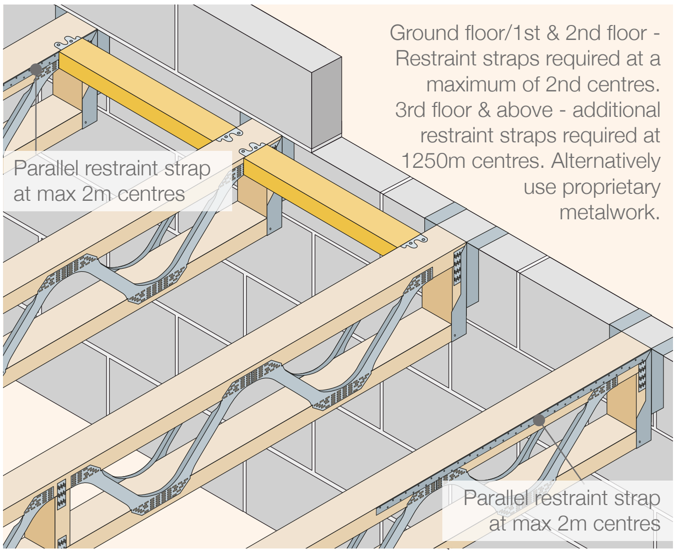
M1 • SVP with Narrow Chord End Joist



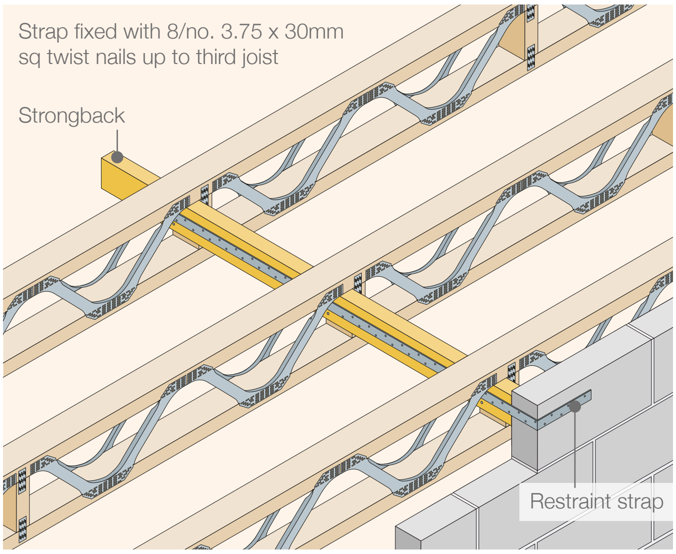
M2 • Bottom Chord Support Built In



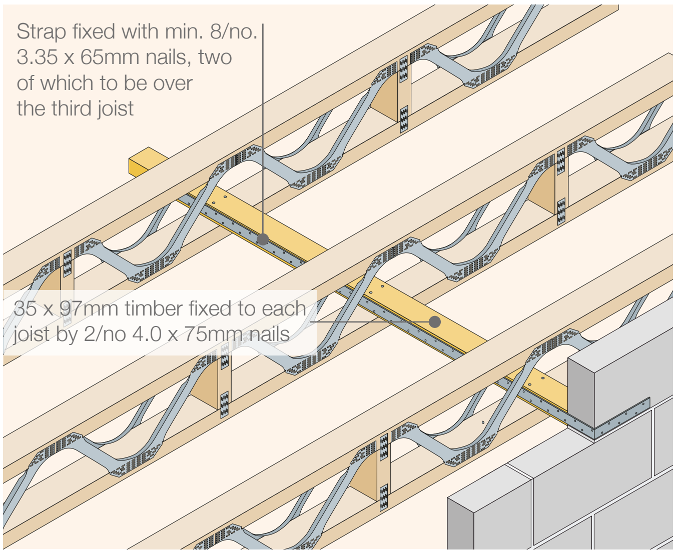
M3 • Parallel Restraint Bracing - Joists Perpendicular to Masonry Wall



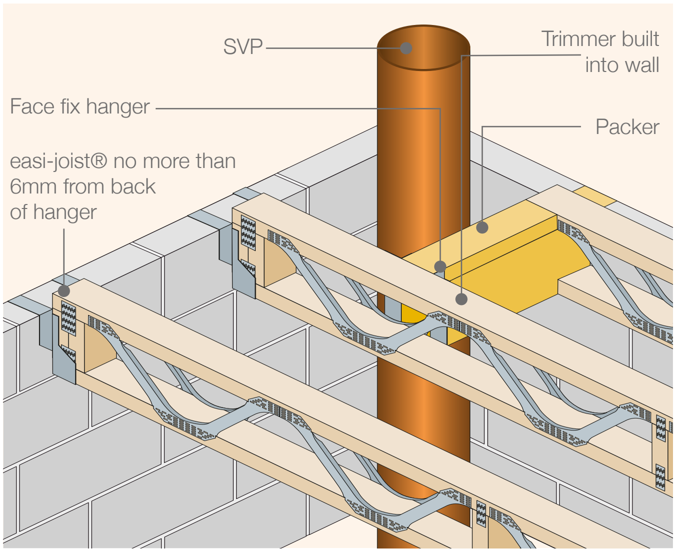
M4 • Lateral Restraint of Strongback



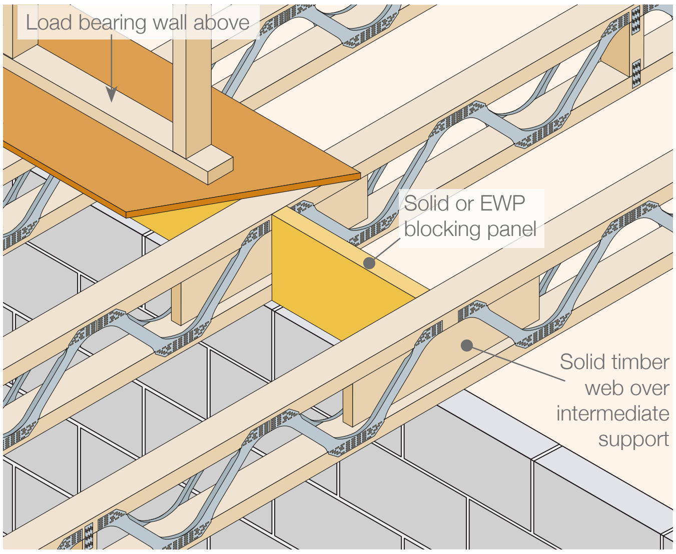
M5 • Lateral Restraint Bracing



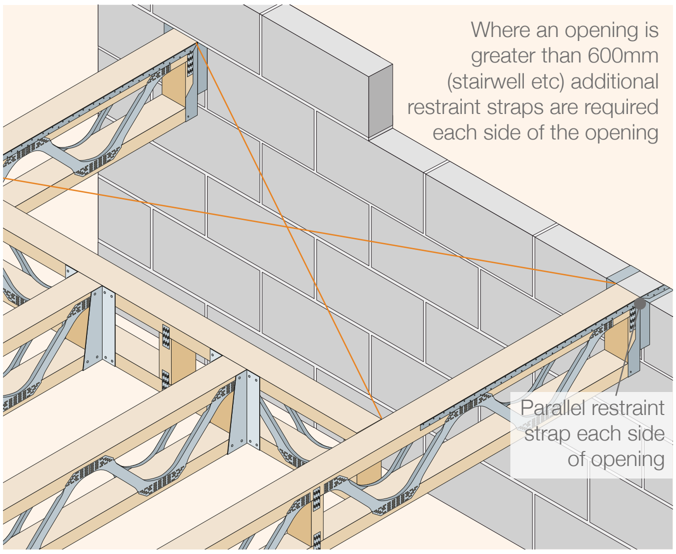
M6 • SVP with Trimmer



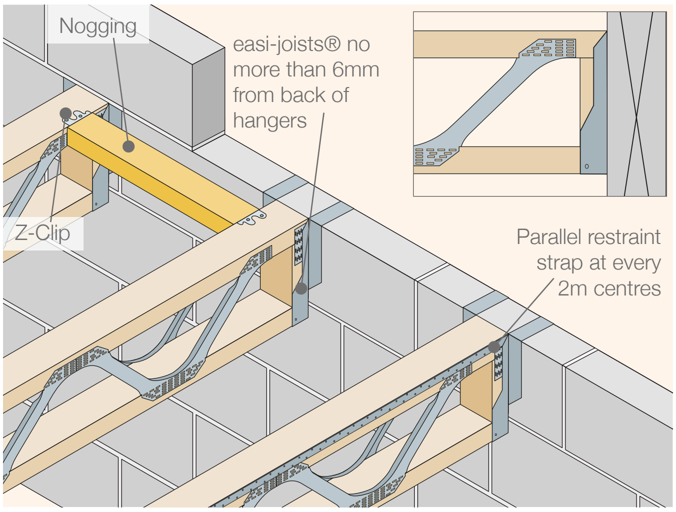
M7 • Solid Timber Web over Intermediate Support



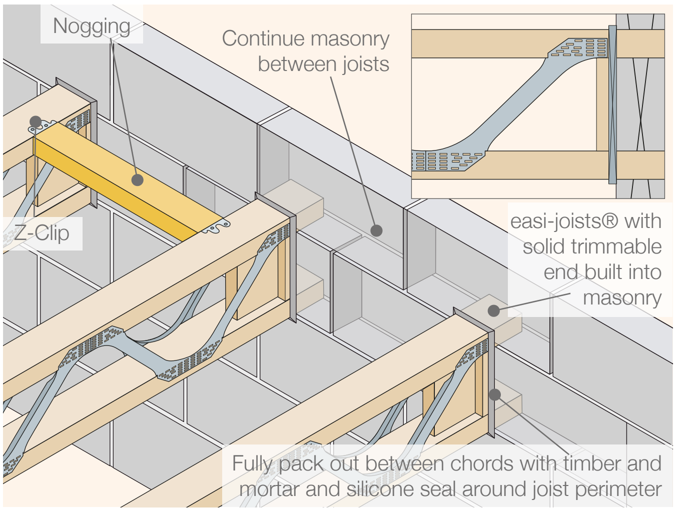
M8 • Parallel Restraint Bracing - Opening greater than 600m



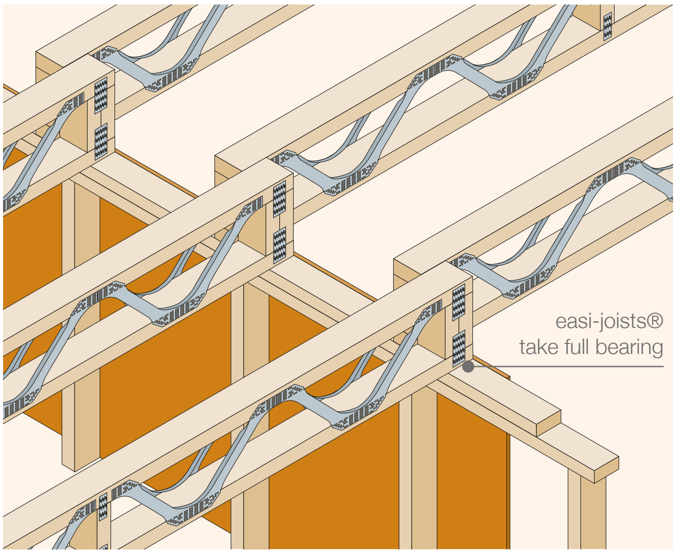
M9 • Hangers with Noggings and Parallel Restraint Straps



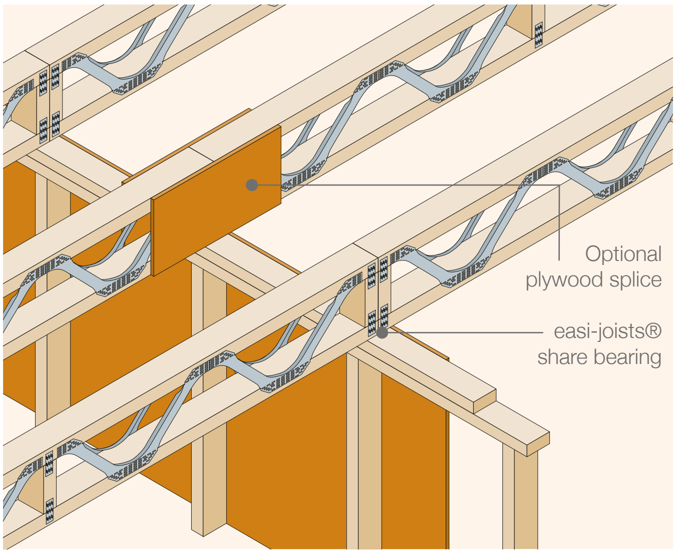
M10 • Bottom Chord Support Built in with Solid Timber Web Trimmable End



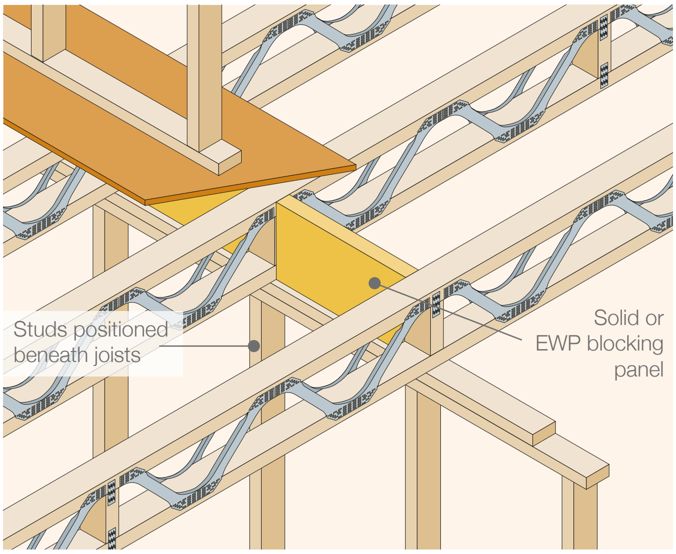
T1 • Internal Wall Lapped Joists



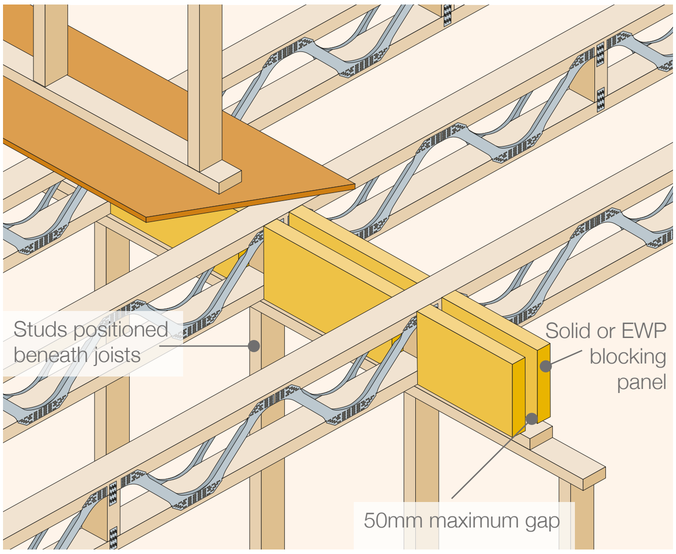
T2 • Internal Wall Butted Joists



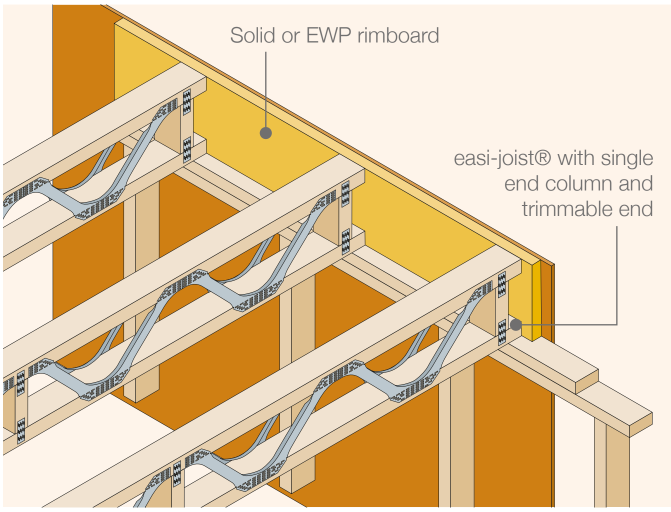
T3 • Intermediate Support Bearing Over Stud Wall



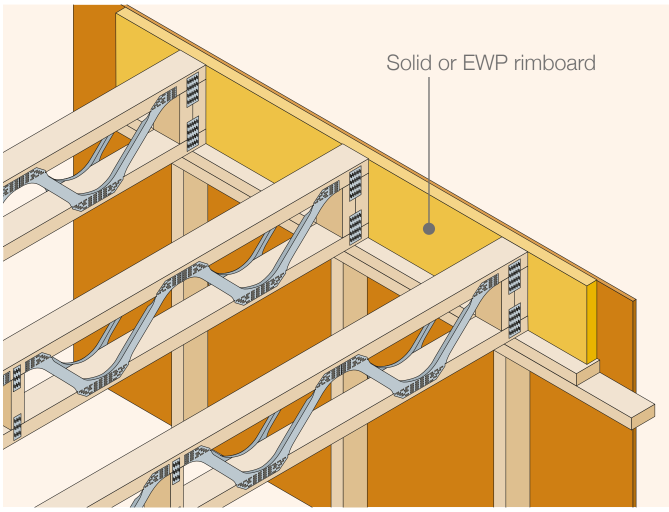
T4 • Intermediate Support (on to stud wall)



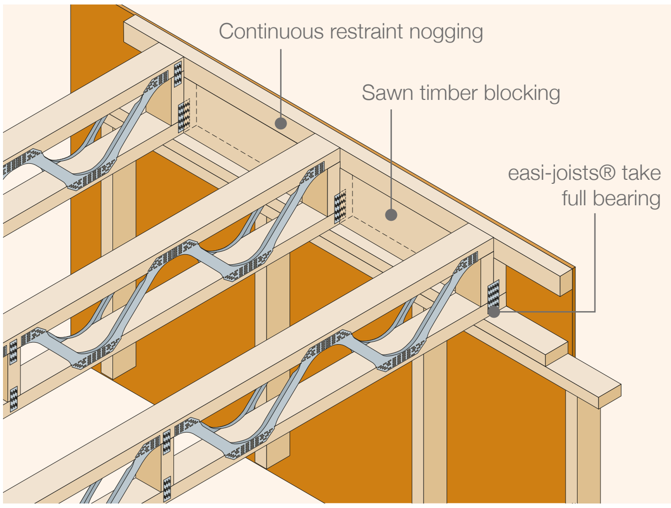
T5 • Bottom Chord Support with Trimmable End and Rimboard



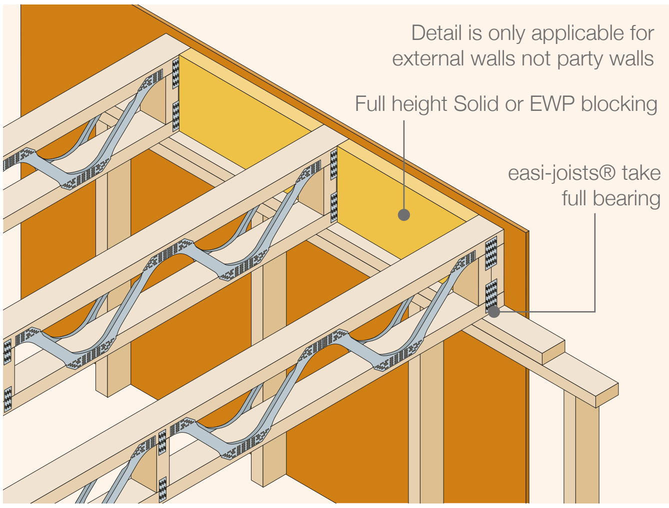
T6 • Bottom Chord Support with Rimboard Closure



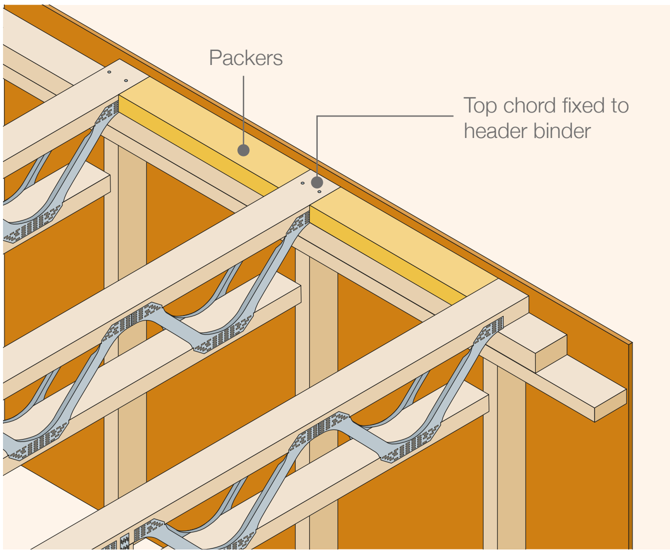
T7 • Bottom Chord Support with Restraint Noggings



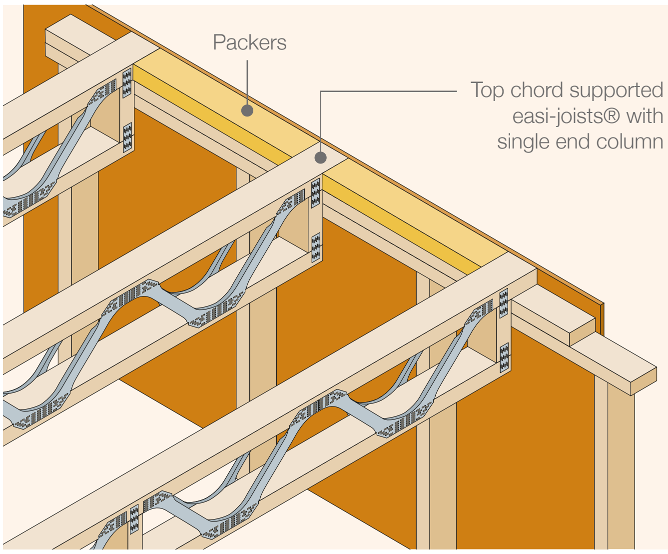
T8 • Bottom Chord Support with Full Height Blocking



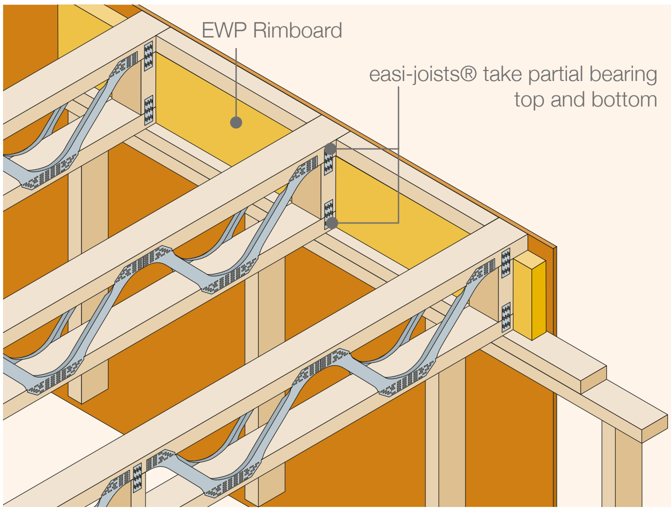
T9 • Top Chord Support



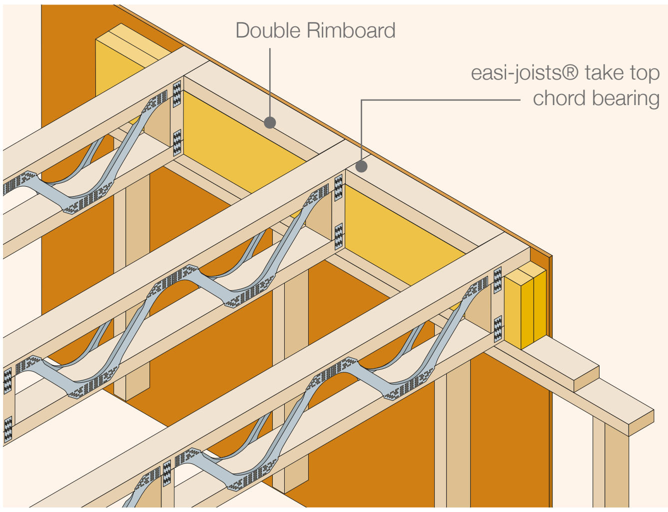
T10 • Top Chord Support with End Column



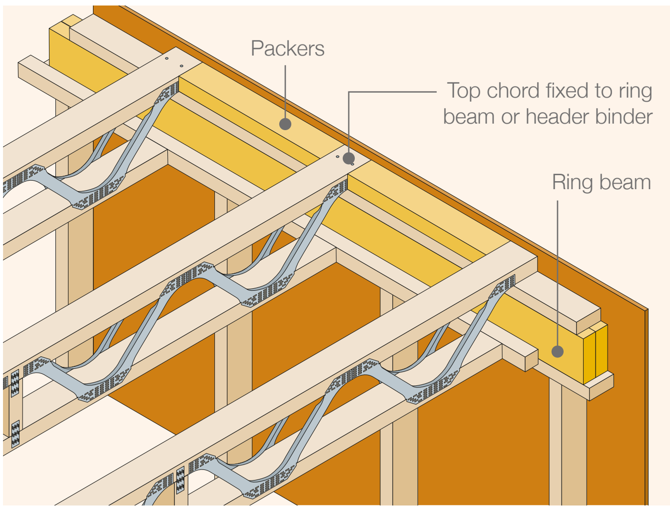
T11 • Bottom and Top Chord Support with EWP Rimboard



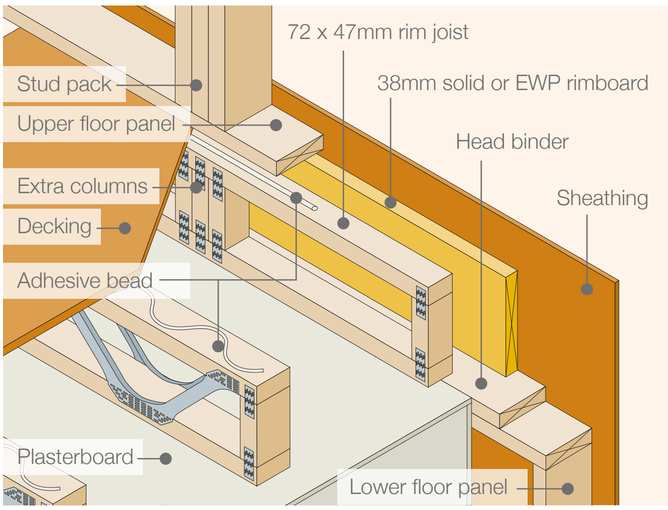
T12 • Top Chord Support with Double Rimboard



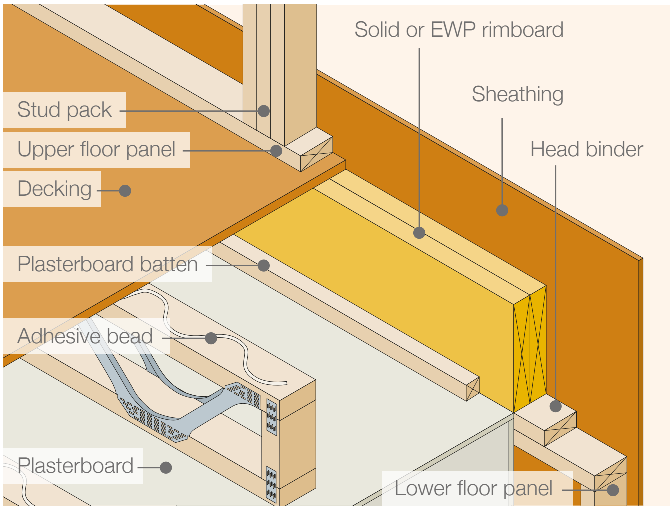
T13 • Top Chord Support on Ring Beam



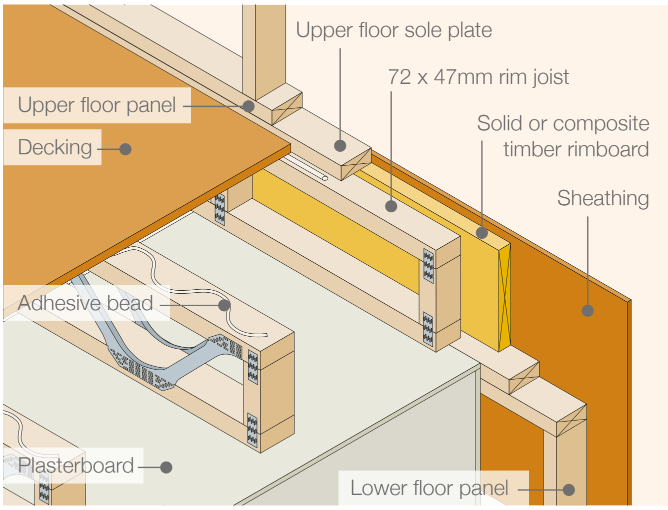
T14 • Proposed Arrangement for Timber Frame Construction



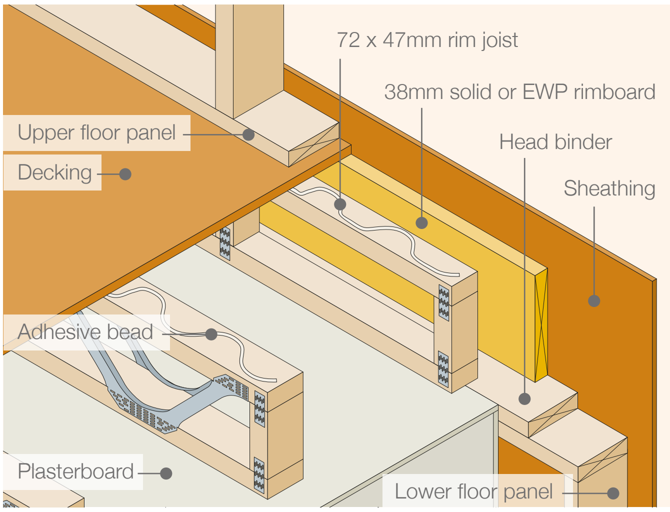
T15 • Proposed Arrangement for Timber Frame Construction



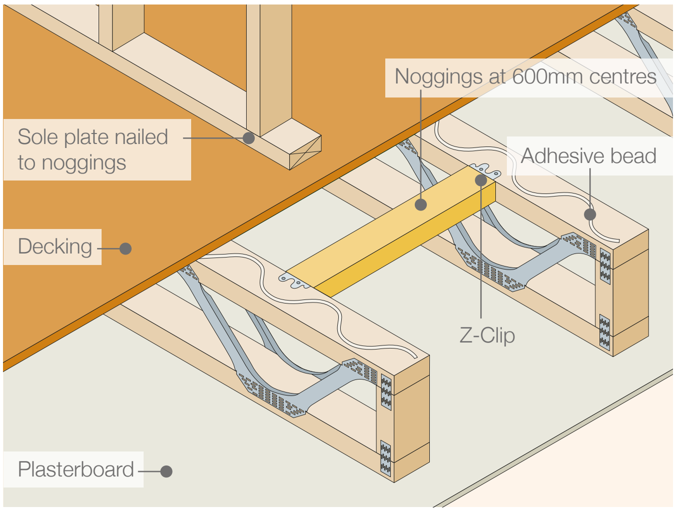
T16 • General Arrangement for Timber Frame Construction



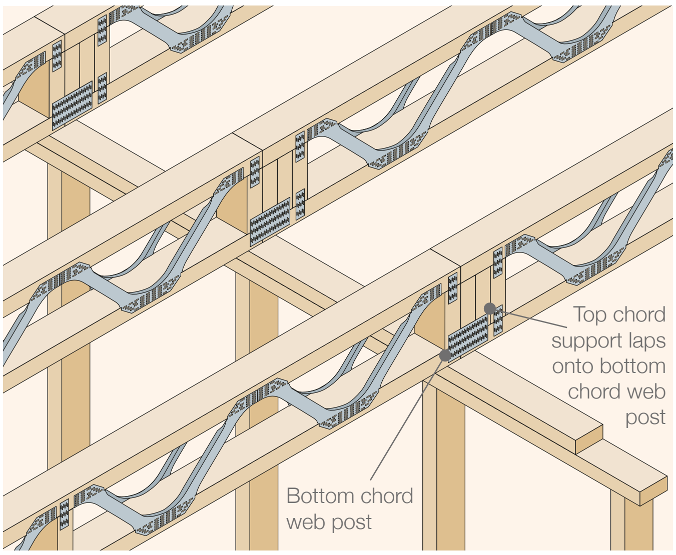
T17 • Proposed Arrangement for Timber Frame Construction



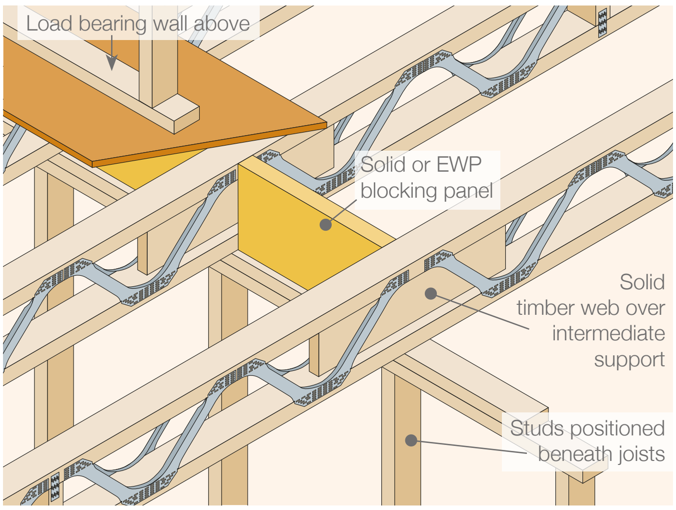
T18 • Non-Load Bearing Wall Support Parallel with Joists



T19 • Internal Wall Lap Support



T20 • Solid Timber Web over Intermediate Support Stud positioned beneath Joists

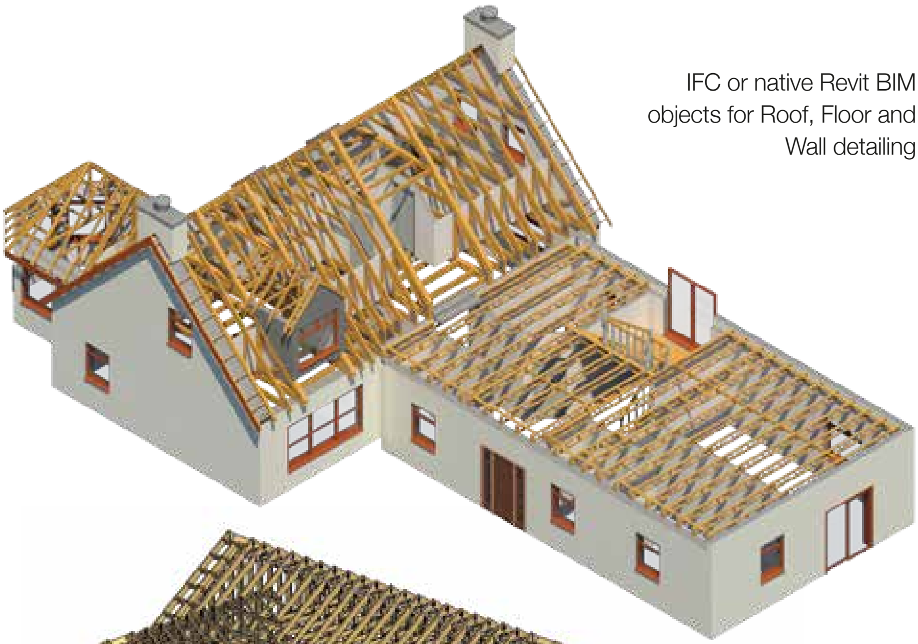


easi-joist® BIM enabled

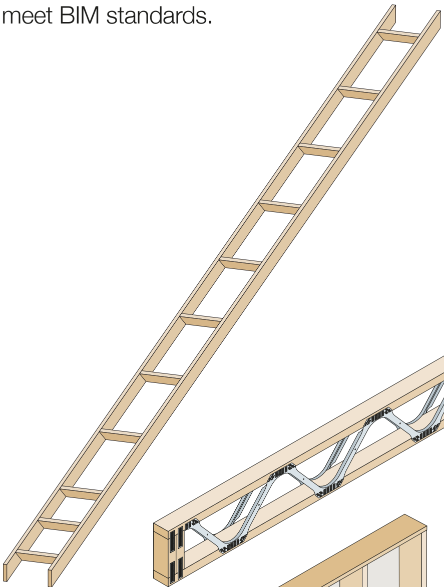
BIM (Building Information Modelling) is an innovative approach to the design construction and management of buildings; wherein high quality and accurate project design scope, schedule and cost information is continuously and immediately available.

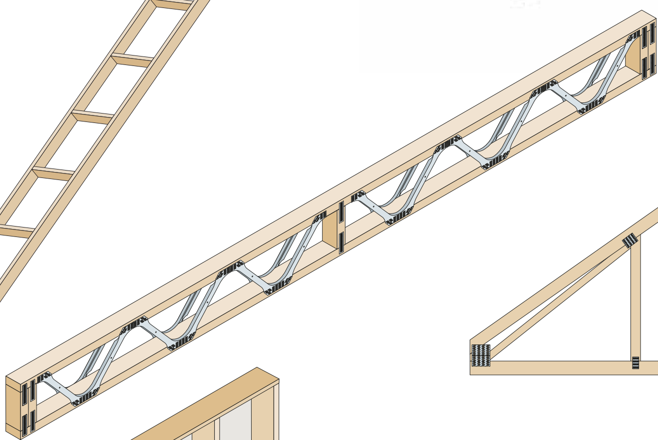
In the most simplistic terms, it's a collaborative way of working – a process, supported by technology that is fast gaining traction in the UK construction industry, whereby the smart use of information during a project ensures a successful outcome.

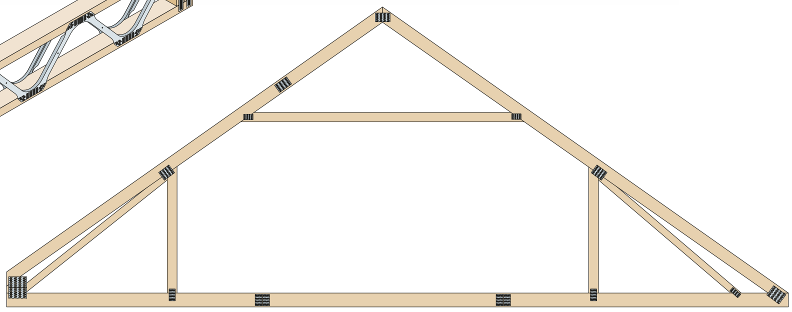
Central to the BIM process is a 3D building information model, with information that is shared in an exploitable data format between different systems. Wolf Systems and their customers can engage in the BIM process by providing Floor, Roof and Wall Panel designs to meet BIM standards.

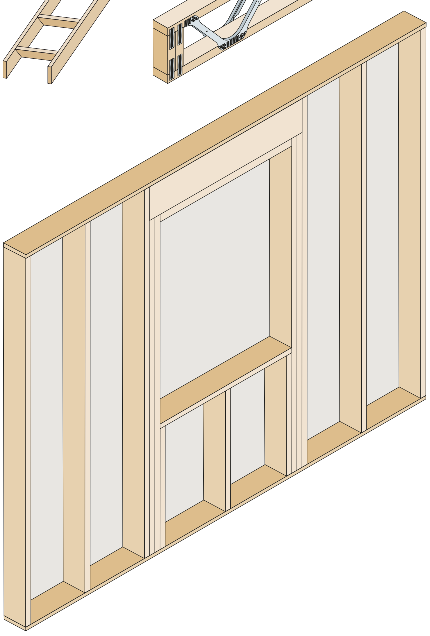


IFC or native Revit BIM objects for Roof, Floor and Wall detailing



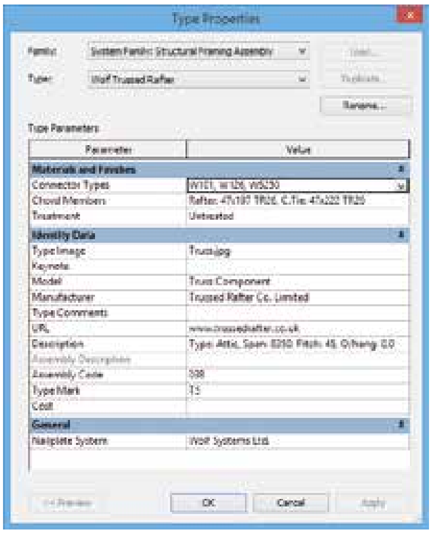






easi-joist® BIM objects can be produced through our Horizon software built on Autodesk's Revit® platform. Objects for trussed rafters and timber frame wall panels can be produced also. These objects can be provided as native Revit families or exported to the IFC file format to meet Open BIM standards.

Truss, easi-joist® and wall panel BIM objects are digital representations of the real world component and can be provided with all project and product data embedded to enable the exchange of valuable information to other participants involved in the BIM process.



Introduction

Metalwork items required for easi-joist® floor systems can be obtained from either Cullen Building Products or Simpson Strong-Tie and are available in a variety of sizes to suit the entire easi-joist® range.

Timber Hangers

There are two main types of timber to timber connection associated with easi-joist® floors – trimmers supporting onto easi-joist® and trimmers supporting onto solid timbers. In both cases a trimmer itself could be either solid timber or easi-joist®.

Cullen UW / HW or Simpson IUB / HIUB:

Both ranges are designed specifically for easi-joist® to easi-joist® connections but can also accommodate solid or composite timber as supported items. Hangers are designed to suit the specific depth of the supporting easi-joist® and have nail or screw holes aligned with both top and bottom timber flanges.

Cullen KH / MHE range or Simpson JHA / SAE range:

Joist hangers designed for solid timber to timber connections which can also accommodate easi-joist® as supported items. KH and JHA strap hangers are versatile but have limited flange depth making them unsuitable for deeper joists. MHE and SAE face fix hangers offer higher safe working loads.

Restraint Strap

Provides lateral restraint to the floor system by creating a positive connection between joists and parallel end walls. The strap is made from 1.5mm galvanised steel 1.5m long and is fixed in place with 3.75 dia. x 30mm square twist nails. Straps should be fitted at a maximum of 2m spacing between joist support positions.

Additional parallel restraint straps (as shown in photograph) are also required every 2m unless the masonry shoes provide restraint.

Masonry Hangers (Cullen JHIR range or Simpson JHM range

Hangers are required to bear directly onto masonry with a minimum crush strength of 3.5N/mm2 which should be extended to a minimum of 675mm (3 block courses) above the hanger and allowed to cure before loads are applied.

The supported joist should finish no greater than 6mm away from the face of the hanger. Masonry hangers may also be shot fired onto steel beams.

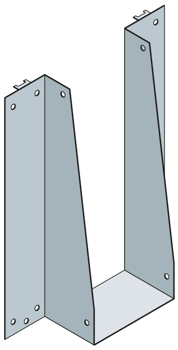
Z-Clips

Double angled brackets which quickly and securely locate and fix noggins to top or bottom flanges without need to stagger the noggins. Primarily used for perimeter noggins or for noggins supporting walls running parallel to joists.

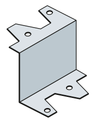
Joist Girder Screws (Cullen Timberlok or Simpson SDS)

These are self-tapping coach screws with a hexagonal head available in a variety of lengths.

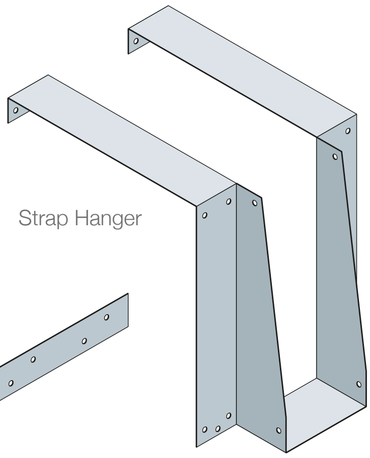
Drive into top and bottom chords at maximum 600mm centres to fix joists into a multi-ply girder.



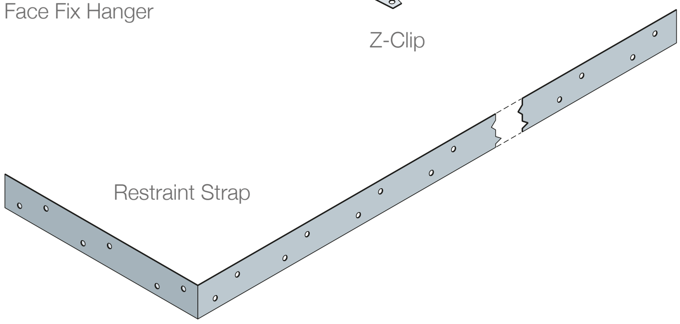
Face Fix Hanger



Z-Clip



Strap Hanger



Restraint Strap

Specifying Metalwork in BS Design

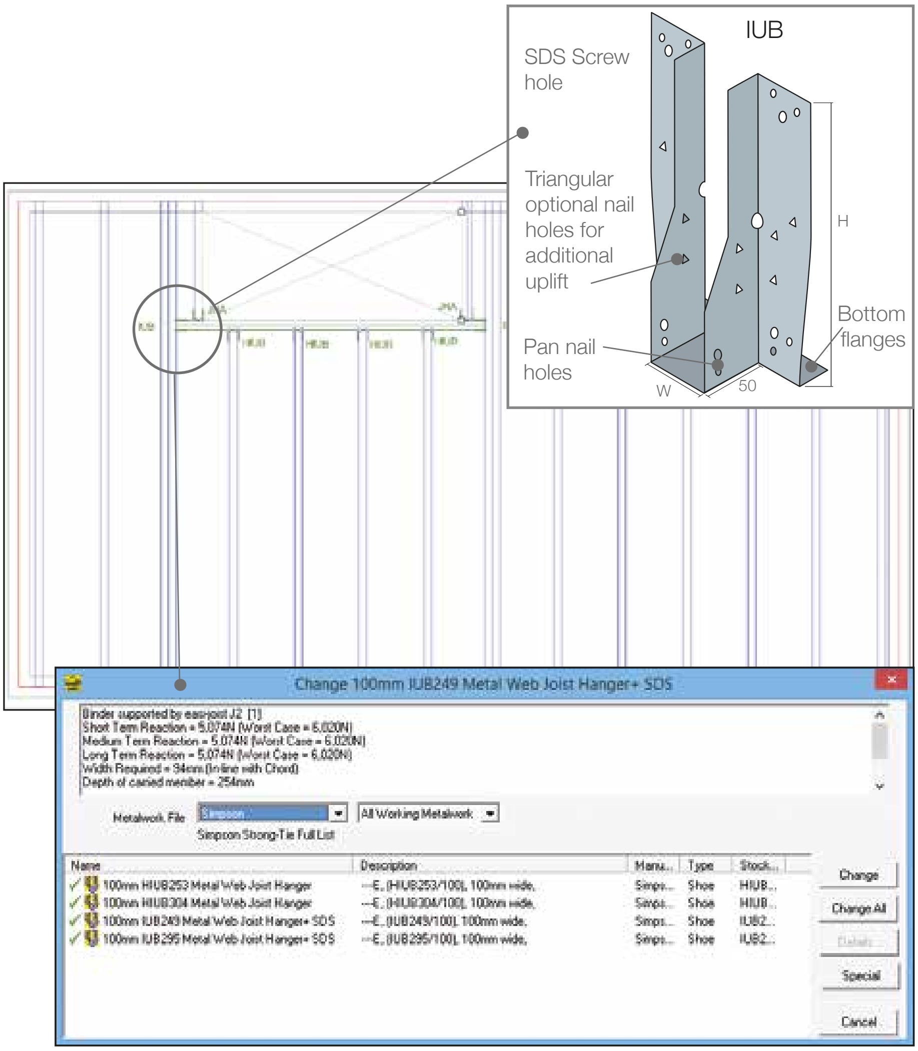
Wolf design software contains metalwork supplied by the major manufacturers in the UK and Ireland.

The Wolf software will automatically specify the correct metalwork for a connection, by comparing the easi-joist® reaction with the Safe Working Load value of the hanger.

Occasionally it may be necessary for the designer to manually select metalwork where non-standard connections occur.

First the designer will need to obtain the Medium Term reaction for the supported easi-joist® or binder. This value can either be found in the engineering software or from a joist calculation sheet.

Next, the user should cross check the reaction with the Safe Working Load (kN) of the hanger, found in the metalwork catalogues. If the reaction is less than the SWL, then the hanger can be used.



Specifying Metalwork in Eurocode 5

As structural timber design in Eurocode 5 is based on limit state analysis, the designer is required to compare the characteristic value of the required load carrying capacity from the easi-joist® software, with characteristic metalwork capacities published by metalwork suppliers.

Material Safety "γ_m" for Connections & Strength Modification factor "k_{mod}"

The characteristic value of required load carrying capacity are factored by γ_m and k_{mod}.

For timber to timber connections γ_m = 1.3 and timber to masonry connections γ_m = 1.5.

The k_{mod} is a modification factor taking into account the effect of the duration of load and moisture content.

Values of k_{mod} for Solid Timber
Extract from Table 3.1 in BS EN1995-1-1:2004

Material	Standard	Service Class	Load-duration Class				
			Permanent Action	Long Term Action	Medium Term Action	Short Term Action	Instantaneous Action
Solid Timber	EN 14081-1	1	0.60	0.70	0.80	0.90	1.10
		2	0.60	0.70	0.80	0.90	1.10
		3	0.50	0.55	0.65	0.70	0.90

Reaction Design Value "R_d" & Characteristic Value of Required Load Carrying Capacity "R_k".

The worst case combinations of actions are calculated giving the reaction design value R_d and the corresponding duration of load.

$$R_d = \Sigma\xi.\gamma G.G_k\ldots + \Sigma\gamma Q.Q_k\ldots$$

The characteristic value of required load carrying capacity R_k, is given by, Timber to Timber Connections,

$$R_k = \frac{R_d.\gamma_m}{k_{mod}}$$

Timber to Masonry Connections,

$$R_k = R_d.\gamma_m$$

Introduction

easi-joists® can easily be adapted to create pitched roof structures as a lighter, more thermally efficient alternative to solid sawn timber. By redesigning the end column configuration, the easi-joist® system can be installed onto a wallplate or ridge beam without the need for a bevelled wallplate or special metalwork items. This versatile connection detail enables top and bottom supports to accommodate a range of bearing widths and can also incorporate intermediate supports.

Using joists for roof structures requires consideration of external load factors and more complex geometry at eaves and ridge locations.

Loading

Dead load should account for all building materials in the roof structure including ceiling linings and insulation.

Deflection is limited by BS 5268 to 0.003 times the span.

For roofs with pitch less than 30°, a man point load check (900 N) should be applied to the centre of any span as a short term load assuming no imposed loading. For steeper pitches, the load is assumed to be spread by a roof ladder.

Snow

Flat roof

Imposed (snow) load should be a minimum of 750 N/m^2 depending on geographical location.

Pitched roof

Imposed (snow) load should be minimum of 750 N/m^2 until 30° pitch whereupon it drops linearly to zero at 60° pitch.

In order to calculate dead load, refer to BS 648 Weights of Building Materials or the roof covering manufacturer's literature.

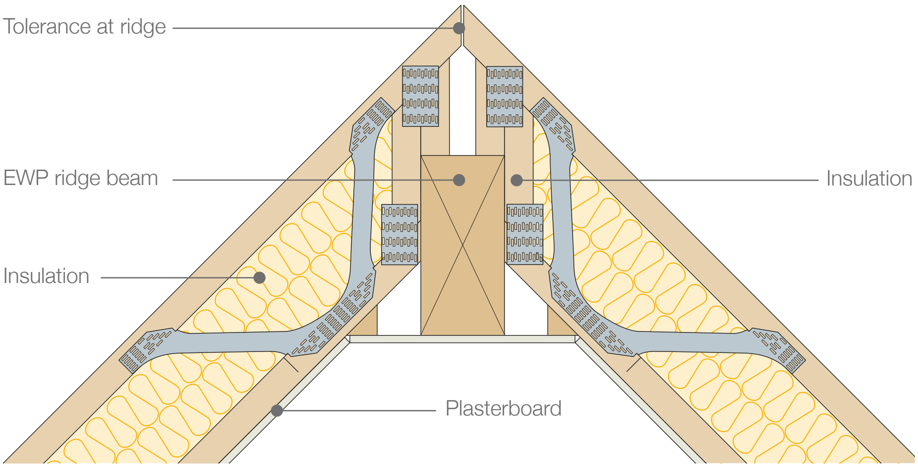
Wind

If a structural engineer identifies that the roof covering is not sufficient to resist wind uplift (usually in the case of light roof coverings at high elevations with low pitches) then further measures must be taken to vertically restrain the joists to the wallplate. For example, restraint straps may be used to anchor the roof structure to the masonry.

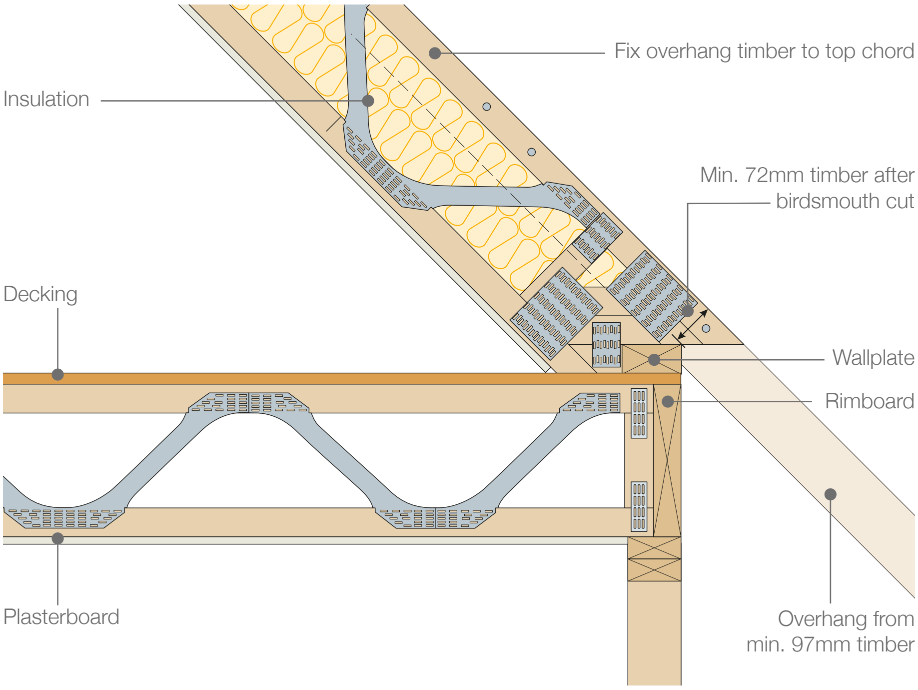
Bracing

easi-joist® roofs should be temporarily braced longitudinally and diagonally during erection.

Structural sarking is the preferred method of providing racking resistance for the roof structure, however longitudinal and diagonal bracing can also be used.



Ridge Detail



Eaves Detail

easi-joist® Roof U-Value for Flat and Pitched Roofs

The table below was comprised in association with the National Standards Authority of Ireland. The U values below are a result of assessing the thermal performance of easi-joist®, using a 3D numerical thermal modelling program.

This table provides values for flat and pitched roofs (maximum pitch 70°), with easi-joist® at 400mm centres. The U-values have been calculated for roof spans of 5m. Results are for both an unventilated roof and a roof incorporating a 50mm well ventilated air gap.

There are two sets of results, using a combination of different insulation within the roof makeup. Both have mineral wool (λ = 0.04 W/mk) between the flanges/steel webs of the easi-joist® rafters and a range of insulations were used between the easi-joist® rafters (for more information please contact Wolf Systems).

In all cases outlined in the below table, the internal temperature factor frsi was above the 0.75 value set out in Appendix D of Part L of the Building Regulations 1997 to 2009. For U-values outside the scope of this table, designers should contact Wolf Systems Ltd.

Roof U-Value Table (W/m^2.K)

Tables cover both flat and pitched roofs (up to 70° pitch insulation on slope) - W/m^2.K

Joist Designation	Joist Depth mm	Insulation Depth mm	Insulation between joists (W/mK), Insulation between the steel webs 0.040 W/mK.					Insulation between joists and steel webs (W/mK).				
			0.020	0.025	0.030	0.035	0.040	0.020	0.025	0.030	0.035	0.040
Minimum 50mm Well Ventilated Gap Above												
WS 200/72	219	150	-	-	-	-	-	0.239	0.271	-	-	-
		219	-	-	-	-	-	0.172	0.194	0.196	0.217	0.237
WS 250/72	254	200	0.218	0.238	0.258	0.278	0.297	0.181	0.202	-	-	-
		254	0.184	0.238	0.217	0.233	0.249	0.170	0.191	-	-	-
WS 300/72	304	200	0.230	0.251	0.271	0.291	0.310	0.215	-	-	-	-
		250	0.195	0.212	0.228	0.244	0.260	0.182	0.202	-	-	-
		304	0.166	0.180	0.194	0.208	0.221	0.155	0.172	-	-	-
WS 400/72	417	250	0.209	0.226	0.243	0.259	0.275	0.197	0.217	-	-	-
		300	0.185	0.199	0.213	0.227	0.240	0.174	0.191	-	-	-
		350	0.165	0.178	0.190	0.201	0.213	0.156	0.171	-	-	-
		417	0.133	0.144	0.154	0.164	0.174	0.126	0.138	-	-	-
Unventilated Air Layer												
WS 200/72	219	150	-	-	-	-	-	0.229	0.258	-	-	-
WS 250/72	254	150	-	-	-	-	-	0.225	-	-	-	-
		200	0.194	0.211	0.240	0.257	0.274	0.181	0.202	-	-	-
WS 300/72	304	200	0.207	0.223	0.256	0.273	0.290	0.195	0.215	-	-	-
		250	0.175	0.189	0.203	0.216	0.229	0.165	0.182	-	-	-
WS 400/72	417	250	0.192	0.206	0.233	0.247	0.261	0.182	0.198	-	-	-
		300	0.170	0.182	0.204	0.217	0.229	0.161	0.176	-	-	-
		350	0.151	0.162	0.180	0.191	0.202	0.143	0.156	-	-	-

Note:-

- Source: NSAI Agrement Certificate - Table 13
- For U-values outside the scope of this table, designers should contact Wolf Systems Ltd.
- The U-values above have been calculated for roof spans of 5m.
- Allowances have been made for one double web at each support.
- An additional correction factor for air gaps has been applied (dU = 0.01W/m^{2}K).

These values are based on the following construction (external to internal):

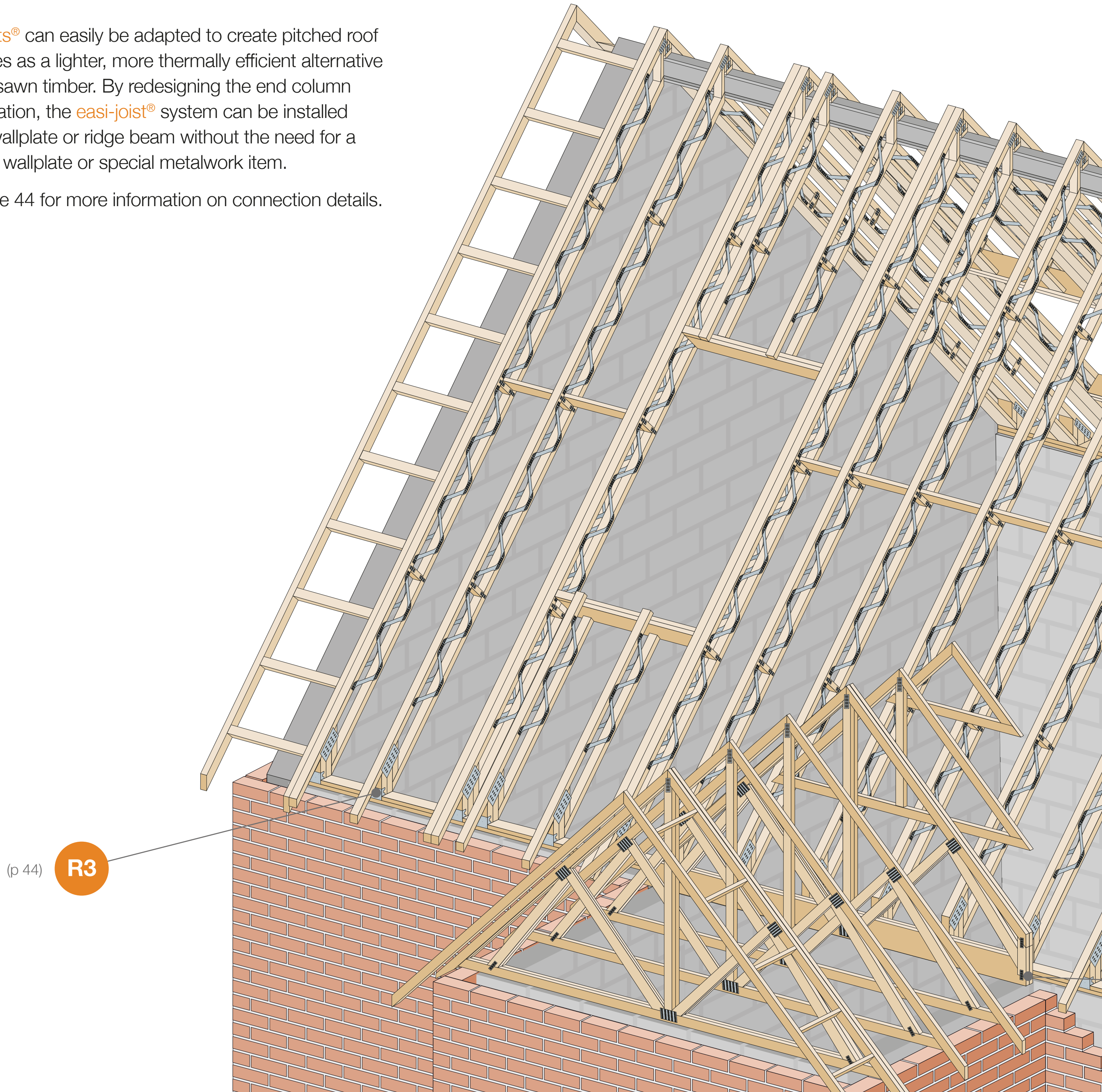
- Conventional tiled or slated pitched roof
- Well ventilated or unventilated air gap as outlined above
- 9mm OSB/plywood/softwood board λ = 0.13 W/mK
- easi-joist® rafters @ 400mm centres, all joist flanges 72mm x 47mm
- 12.5mm plasterboard λ = 0.21 W/mK

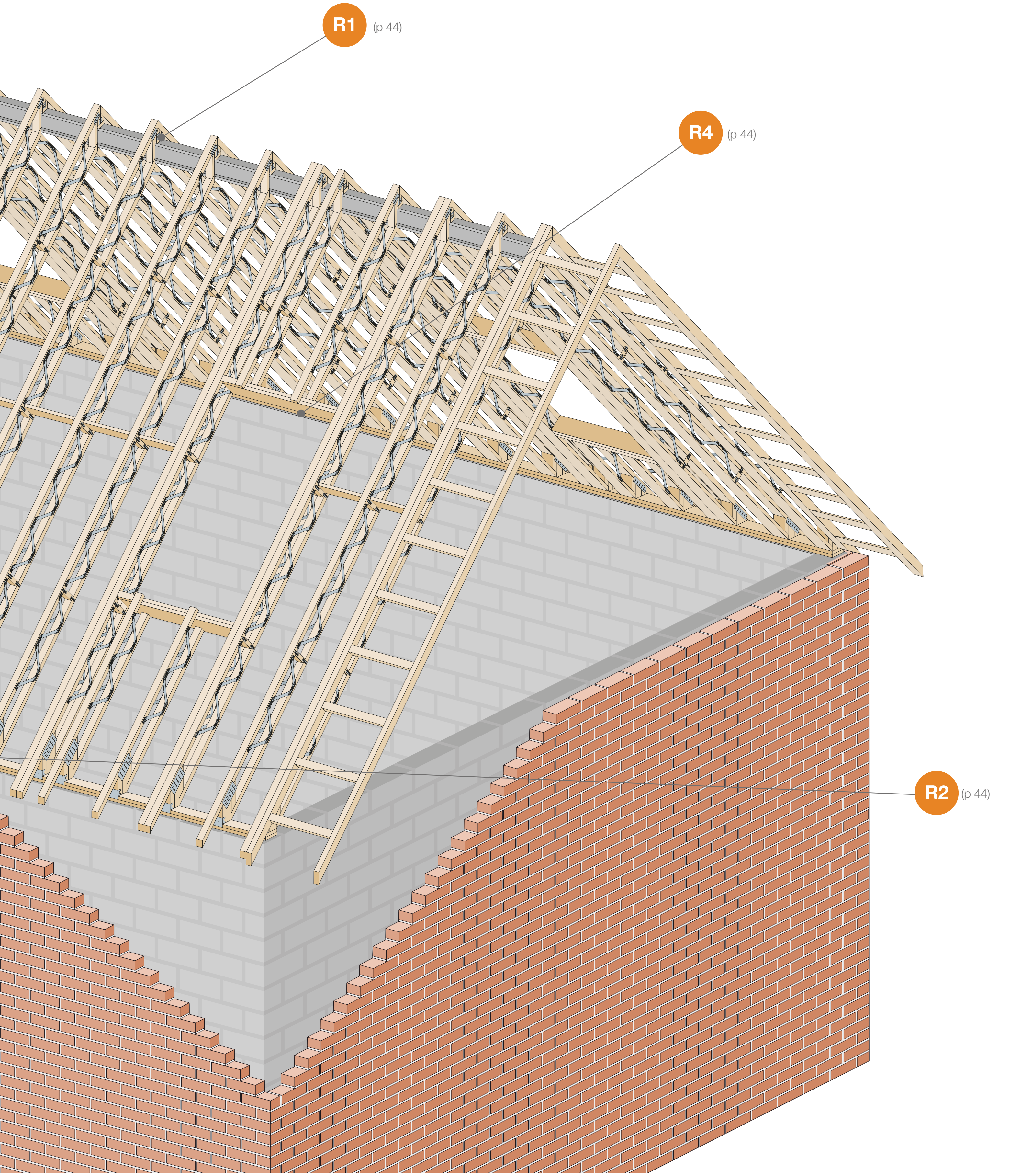
The U-values assume no insulation above or below the rafters. Rough values for insulation above or below could be arrived at by the formula,

$$\mathbf{U}\,(\text{with extra insulation above/below}) = \left(\left(\mathbf{U}\,(\text{table value})\right)^{-1} + \mathbf{R}(\text{extra insulation})\right)^{-1}$$

easi-joists® can easily be adapted to create pitched roof structures as a lighter, more thermally efficient alternative to solid sawn timber. By redesigning the end column configuration, the easi-joist® system can be installed onto a wallplate or ridge beam without the need for a bevelled wallplate or special metalwork item.

See page 44 for more information on connection details.




R1 (p 44)
R4 (p 44)
R2 (p 44)

Roof Span Tables

The following span tables are to be a basic guide to achievable joist span for given depth and spacing, and should be used for estimating or feasibility only.

Due to variations in timber grades, load sets, support conditions and bearing widths, the tables are not suitable as a design tool. Please consult an easi-joist® manufacturer for more information and design assistance.

United Kingdom and Ireland Roof Span Table

Joist depth	Joist centres	Chord dimensions	Maximum achievable roof span - BS	Maximum achievable roof span - EC5 UK & Ireland
WS200 easi-joist®				
195	400	72 x 35	5,625	5,375
		97 x 35	6,175	6,050
		122 x 35	6,625	6,575
		147 x 35	7,025	7,050
	600	72 x 35	4,900	4,875
		97 x 35	5,375	5,350
		122 x 35	5,750	5,750
		147 x 35	6,100	6,100
WS200 easi-joist®				
219	400	72 x 47	6,450	6,425
		97 x 47	7,075	7,175
		122 x 47	7,600	7,725
		147 x 47	8,075	8,200
	600	72 x 47	5,625	5,625
		97 x 47	6,150	6,200
		122 x 47	6,600	6,650
		147 x 47	7,000	7,075
WS250 easi-joist®				
254	400	72 x 47	7,250	7,275
		97 x 47	7,950	8,050
		122 x 47	8,550	8,675
		147 x 47	9,050	9,200
	600	72 x 47	6,300	6,325
		97 x 47	6,900	6,950
		122 x 47	7,425	7,475
		147 x 47	7,850	7,950
WS300 easi-joist®				
304	400	72 x 47	8,350	7,650
		97 x 47	9,175	9,325
		122 x 47	9,850	10,025
		147 x 47	10,450	10,650
	600	72 x 47	7,250	6,900
		97 x 47	7,975	8,075
		122 x 47	8,550	8,675
		147 x 47	9,050	9,200
WS400 easi-joist®				
417	400	72 x 47	10,300	8,375
		97 x 47	11,275	10,475
		122 x 47	12,125	12,325
		147 x 47	12,825	13,025
	600	72 x 47	8,875	7,550
		97 x 47	9,700	9,450
		122 x 47	10,375	10,550
		147 x 47	10,975	11,150

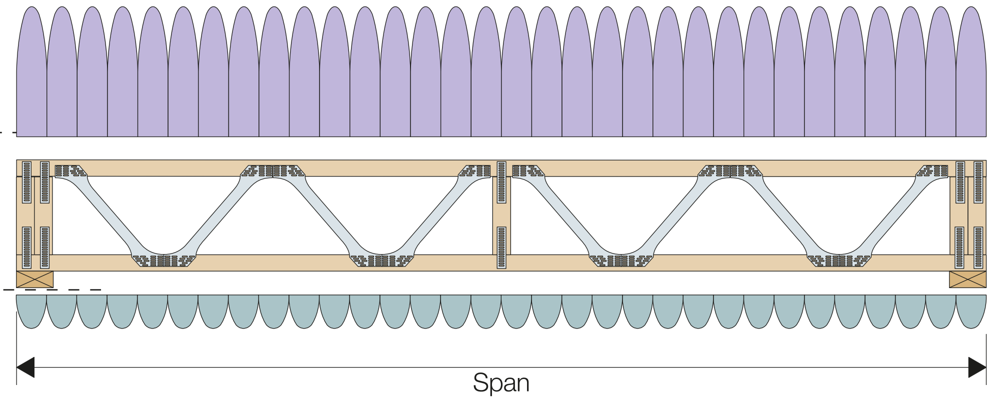
Load and Span Description

Top Chord UDL

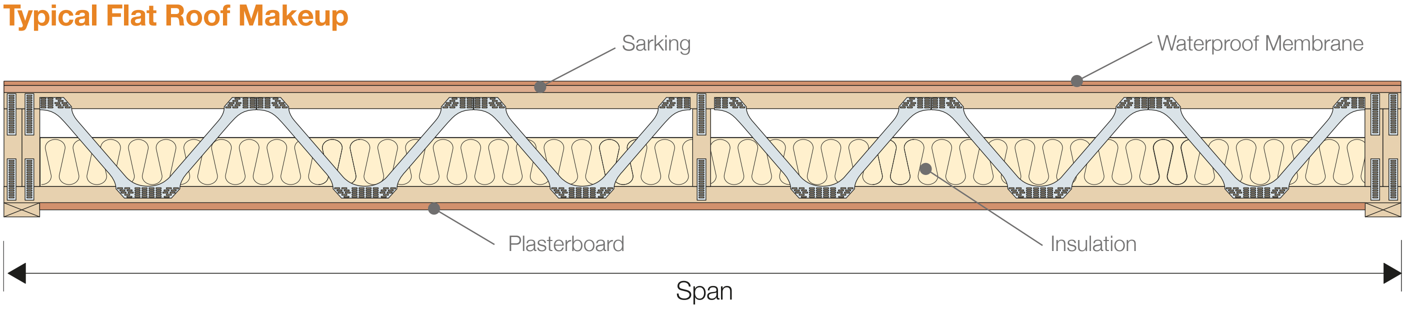
(Floor: LL + DL + Partition)

Bottom Chord UDL

(Ceiling: DL)



Typical Flat Roof Makeup



Roof Load Criteria

Spans are calculated based on the following applied loads

	BS	EC5
Top chord (Dead)	300 N/m²	300 N/m²
Top chord (Imposed)	750 N/m²	600 N/m²
Bottom chord (Dead)	200 N/m²	200 N/m²

General Notes:-

1. Maximum span assumes 100mm wide bearing with the support condition SC2, maximum span of the joist taken over the bearing.
2. The roof joists are designed for Service Class 2.
3. Top Chord laterally restrained by suitably fixed sarking.
4. Strongbacks to be positioned mid-span and fixed to the bottom chord of joist to act as a restraint to the bottom chord, 9mm plywood to run parallel to strongback, nailed to opposite side of column. Plywood to match full depth of column, to be located at each end of strongback and to cover at least 3 joists at 6 metre intervals.
5. Support conditions and web direction/orientation can affect the spanning capacity of a joist.

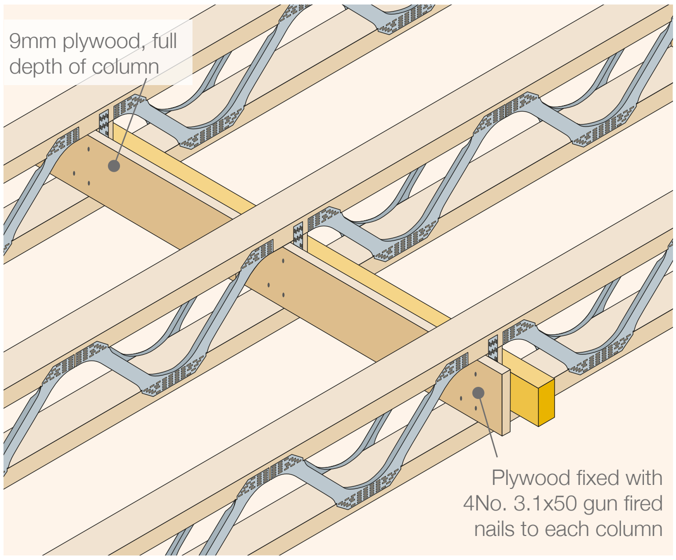
BS applicable notes:-

6. Imposed snow load in accordance with BS 6399-3.
7. Man point load for access limited to roofs for normal maintenance and repair only in accordance with BS 5268-3.
8. Deflection limited to span x 0.003, for roof member with plasterboard in accordance with BS 5268-2.
9. The joists are part of a load distribution system, with a load sharing factor of 1.1, in accordance with BS 5268-2.
10. Flat roof pressure coefficients in accordance with BS 6399-2.

EC5 applicable notes:-

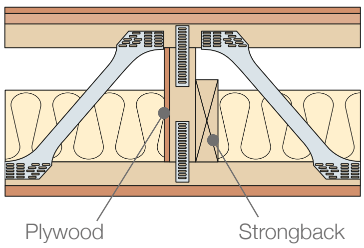
6. UK - Characteristic snow load sk for Zone 4 at an altitude of 100m, NA to BS EN 1991-1-3:2003, NA.2.8.
7. Ireland - Characteristic snow load sk for Zone 4 at an altitude of 100m, NA+A1 to I.S. EN 1991-1-3:2003, NA.1.
8. UK - Access limited to roofs for normal maintenance and repair only, imposed loads qk = 0.6kN/m² and Qk = 0.9kN, Table NA.7, NA to BS EN 1991-1-1:2002.
9. Ireland - Access limited to roofs for normal maintenance and repair only, imposed loads qk = 0.6kN/m² and Qk = 1.0kN, Table NA.4, NA:2013 to I.S EN 1991-1-1:2002.
10. UK - Net final deflection, ωnet,fin, limited to l/250, for roof member with plasterboard, NA.2.6 Table NA.5,NA to BS EN 1995-1-1:2004.
11. Ireland - Net final deflection, ωnet,fin, limited to l/250, for roof member with plasterboard, Table NA.3, NA:2010+A1:2003 to I.S. EN 1995-1-1:2005.
12. UK - The joists are part of a load distribution system, with a ksys factor of 1.1, BS EN 1995-1-1:2004, clause 6.6 (2).
13. Ireland - The joists are part of a load distribution system, with a ksys factor of 1.1, I.S. EN 1995-1-1:2005, clause 6.6 (2).
14. UK - Flat roof pressure coefficients from Table NA.5, NA to BS EN 1991-1- 4:2005, NA.2.28.
15. Ireland - Flat roof pressure coefficients to NA to I.S. EN 1991-1-4:2005.

Roof Bottom Chord Restraint Detail



Strongback located on the bottom chord of easi-joist®

Note: Plywood to be placed at 6m intervals, fixed to a minimun of 3 easi-joists® and located at each end of the strongback.

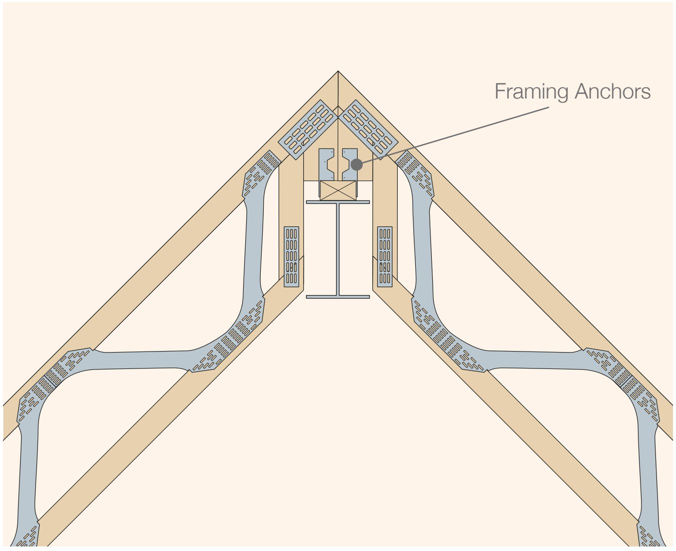


Roof Loading

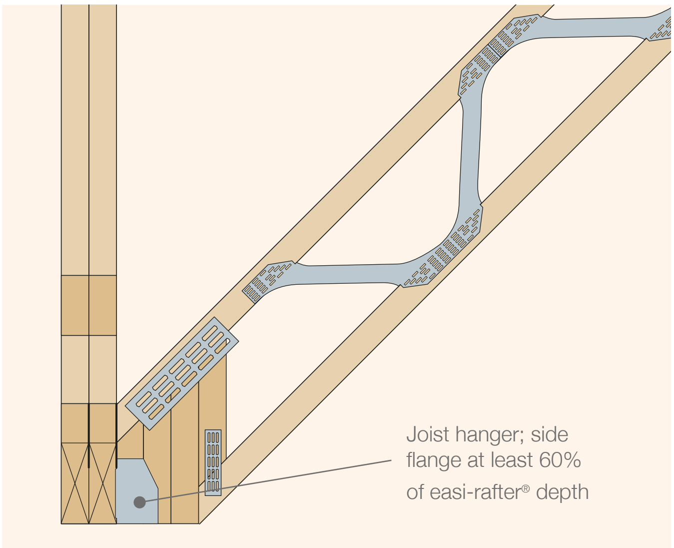
Spans are calculated based on the following applied load:-

	BS	EC5
Top Chord il:	0.75 kN/m²	0.60 kN/m²
Top Chord dl:	0.30 kN/m²	0.30 kN/m²
Bottom Chord dl:	0.20 kN/m²	0.20 kN/m²
Total Load	**1.25 kN/m²**	**1.10 kN/m²**

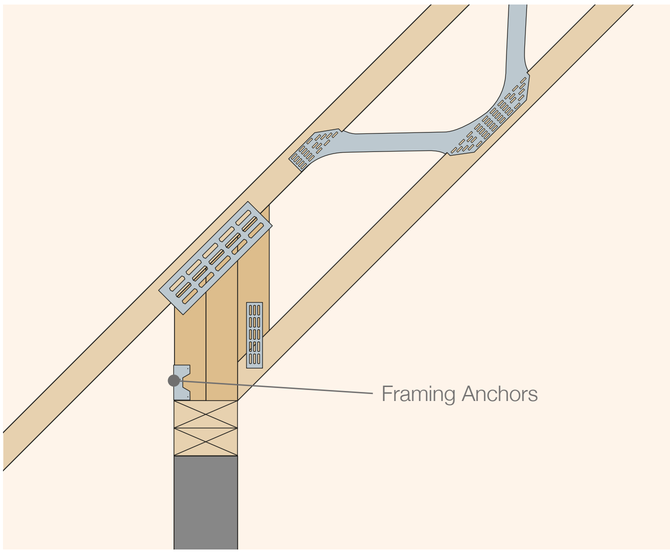
R1 • easi-rafter® Ridge Detail



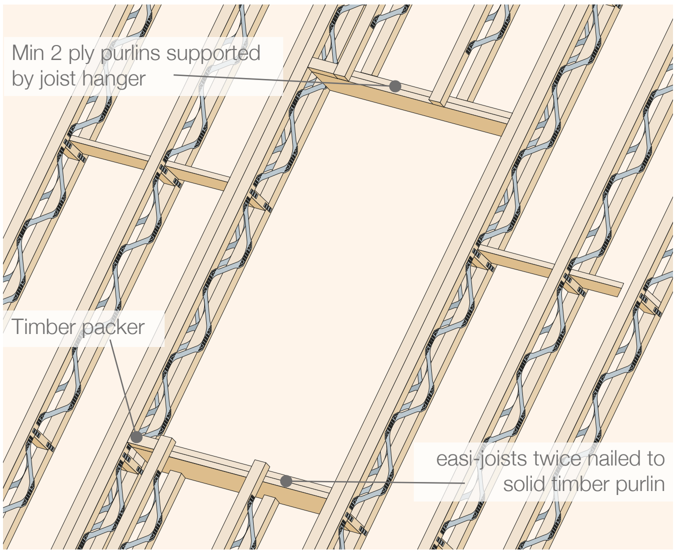
R2 • easi-rafter® Hanger Detail



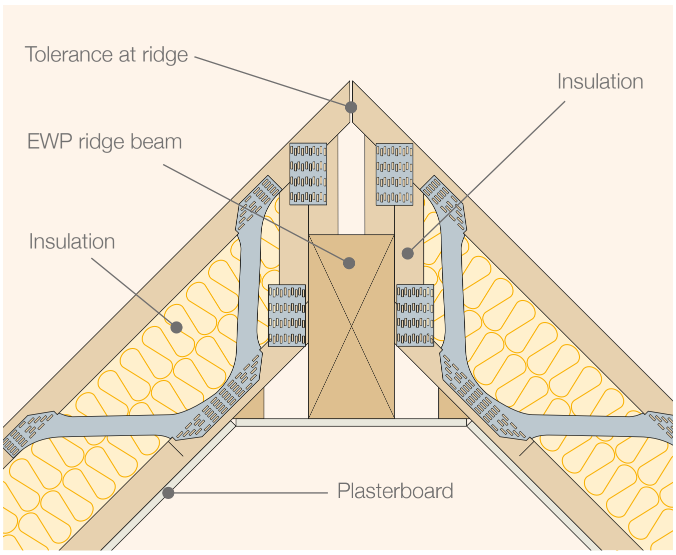
R3 • Typical easi-rafter® Heel



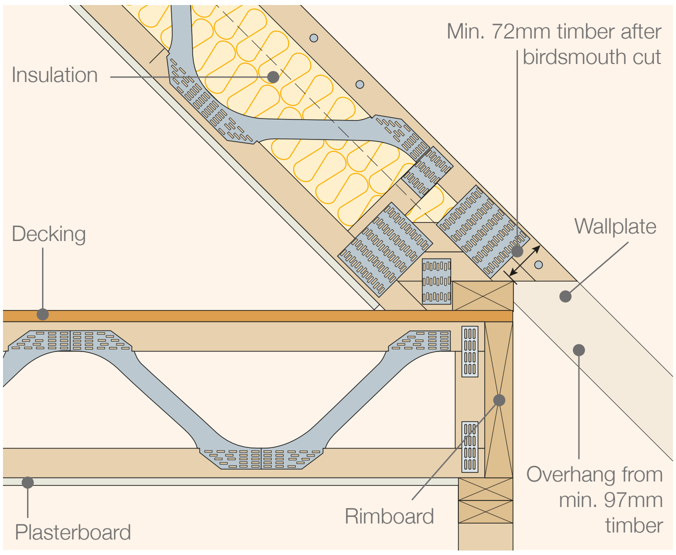
R4 • easi-rafter® Opening



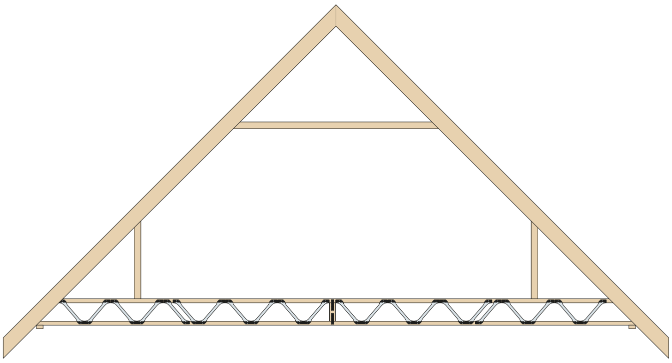
R5 • Typical Rafter Detail



R6 • Typical Eaves Detail

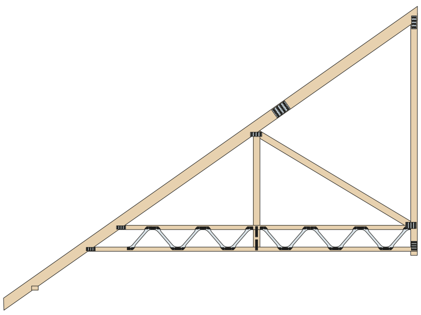


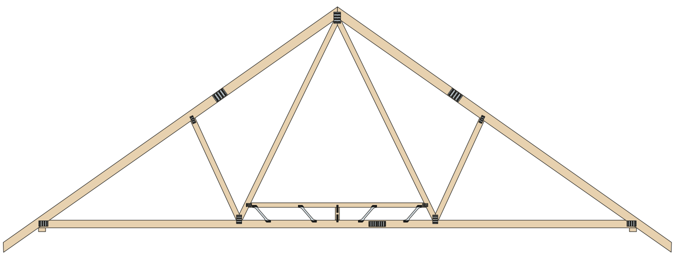
The flexibility of putting easi-joist® in a truss goes beyond adding to its strength properties. Insulation thickness has grown and is a potential problem for home owners wishing to use the attic space for storage. Adding easi-joist® into the truss overcomes this issue by raising the attic floor level and providing adequate space for the insulation.

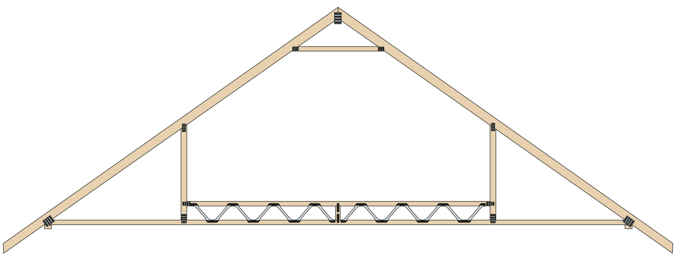


easi-joist® can be designed in a truss in a variety of ways. The most common use is within an attic truss forming the bottom chord section. It can also be designed only within the floor zone depending on the requirements.

The truss shapes illustrated below demonstrate how easi-truss can be used to overcome the problem of using the attic space for storage when over deep insulation is present.





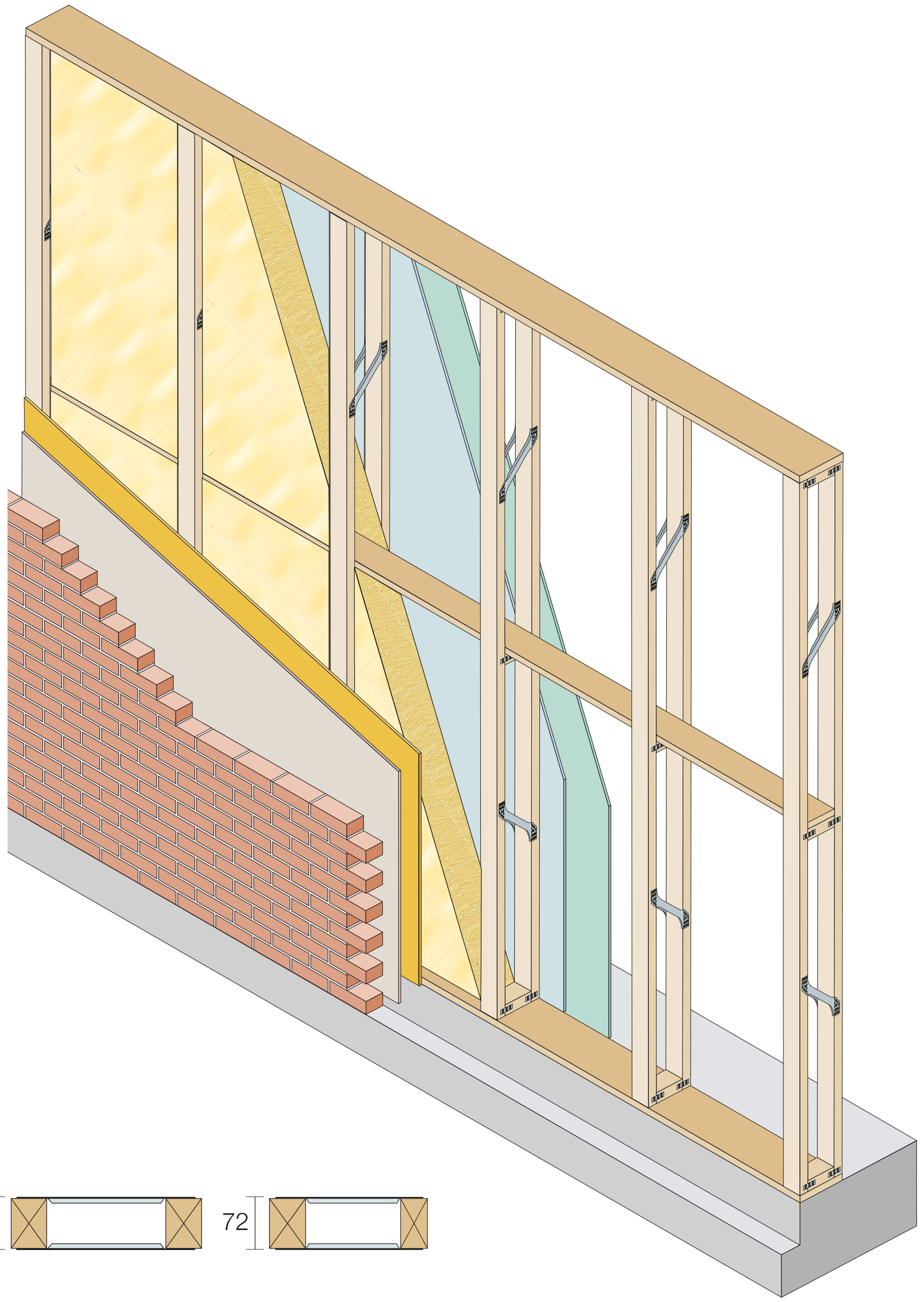


Introduction

The easi-wall® system comprises open web studs assembled from strength graded timber flanges plated together with precision engineered metal webs.

The easi-wall® stud combines the lightness of timber with the structural qualities of metal. The resulting component is a structurally efficient wall stud system that is also capable of including thicker layers of insulation than conventional timber wall systems.

easi-wall® is a precision designed and manufactured wall system, created to make wall manufacture faster, more cost effective and easier to install.



Timber

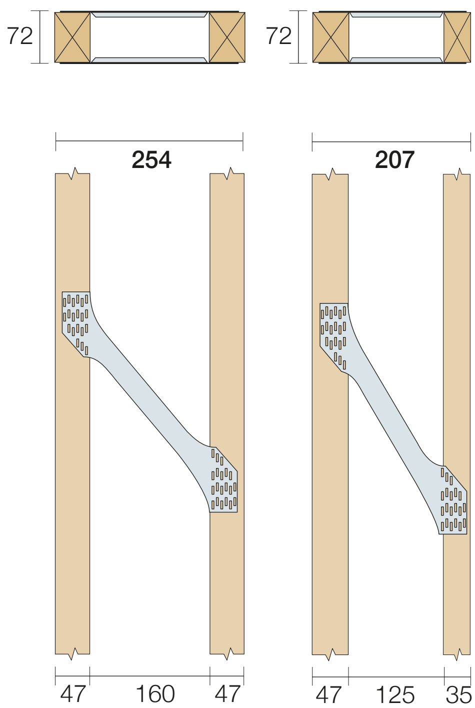
Timber used in the design of easi-wall® studs is kiln dried and strength graded, and complies with current European and British Standards.

Preservative

Stud timbers may be treated with waterborne solutions, or with noncorrosive spirit based organic solvents. Copper chrome arsenate and similar treatments are not recommended.

Features and Advantages

- The open web design accommodates thick layers of virtually uninterrupted insulation achieving U-Values as low as 0.11W/m²K.
- Minimal thermal bridging when compared to other systems.
- Provides enhanced racking resistance
- Light and easy to handle
- Factory manufactured, made to measure.
- Dimensional stability
- Reduced site wastage



easi-wall® Stud Specification

There are two stud wall options:

- EW207
- EW254

Timber Specification

Timber for flanges, end and centre blocks are strength grade TR26 (C27 equivalent).

Centre and end blocking pieces:
35x72x125/160

Centre and end blocking nail plates:
Wolf 101:0207

A party wall is a description given to a wall which separates two dwellings. A common example is a wall between semi-detached houses or a wall separating two apartments.

The main function of a party wall is to provide fire, acoustic and thermal separation between dwellings, as per Building Regulations Part B – Fire, Part E - Resistance to the passage of sound and Part L – Conservation of fuel and power.

Depending on the type of building, the typical make up is either 2 masonry block walls with a cavity in between or in a timber frame building; 2 panels with a cavity.

Masonry Party Wall

In a masonry party wall situation, easi-joists® should be supported by hangers, this prevents any chance of air leakage from the cavity or the neighbouring property into the dwelling.

Both the floor decking and plasterboard to the underside of the easi-joist® are required to extend to the masonry block.

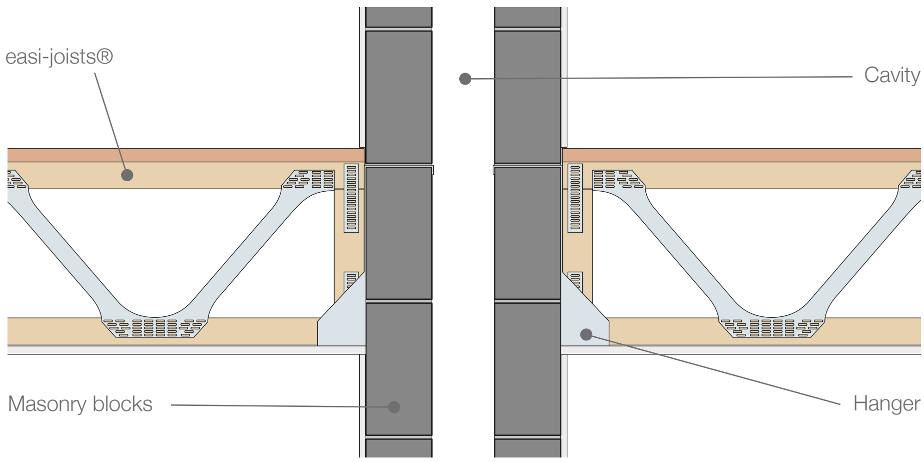
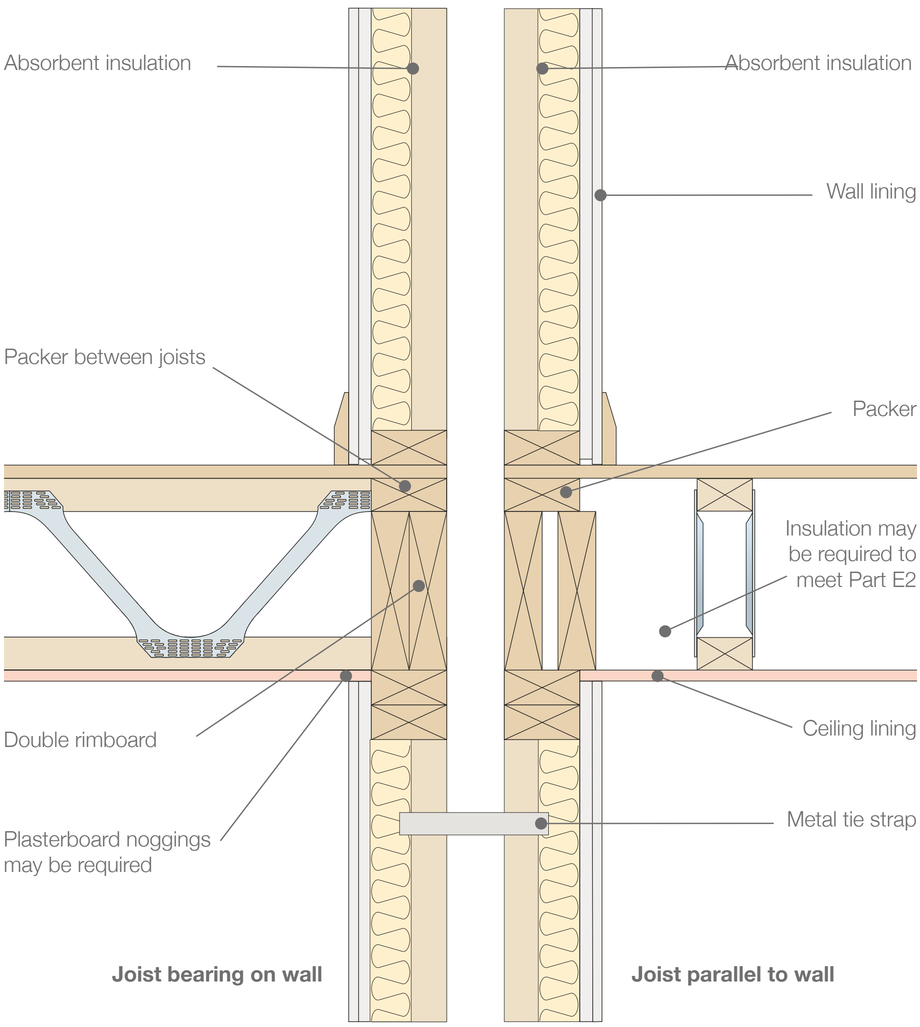


Figure 4-7 Party Wall to Intermediate Floor Junction - Metal Web Joists



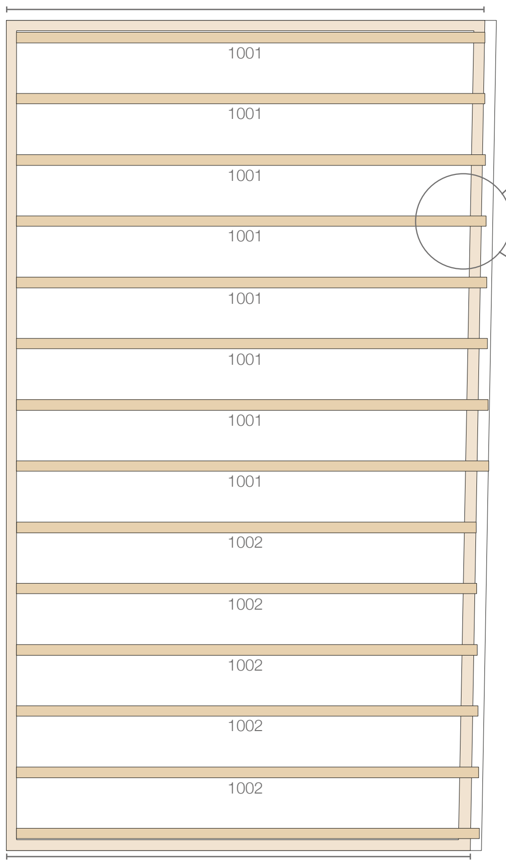
Timber Frame Party Wall

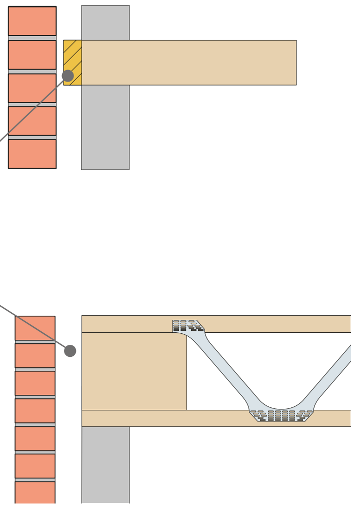
In a timber frame situation, a common alternative to hangers, is to support the easi-joist® top chord on to a double rimboard.

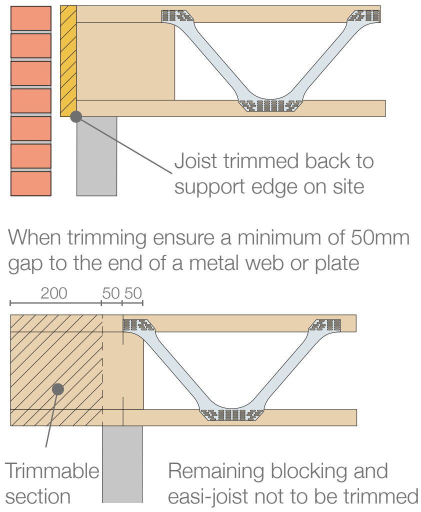
To provide a continuous solid barrier within the floor zone, the double rimboard should sit directly over the easi-joist®. A packer should sit tightly in between the top chords of the easi-joist® and the structural decking extended to the cavity edge of the rim. Any gaps should be fire-stopped.

Where easi-joists® run parallel to a party wall, a continuous packer is to be used

Solid Trimmable End Support





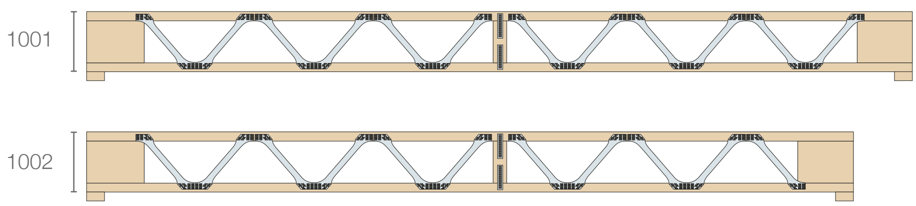


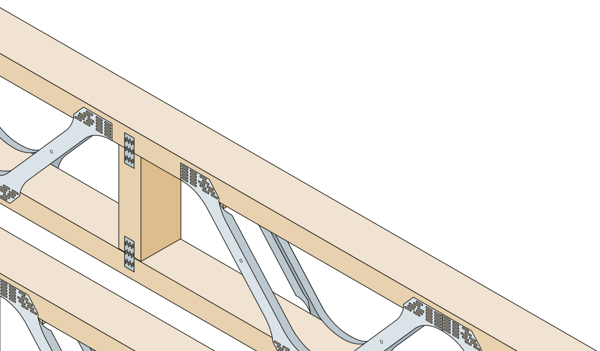
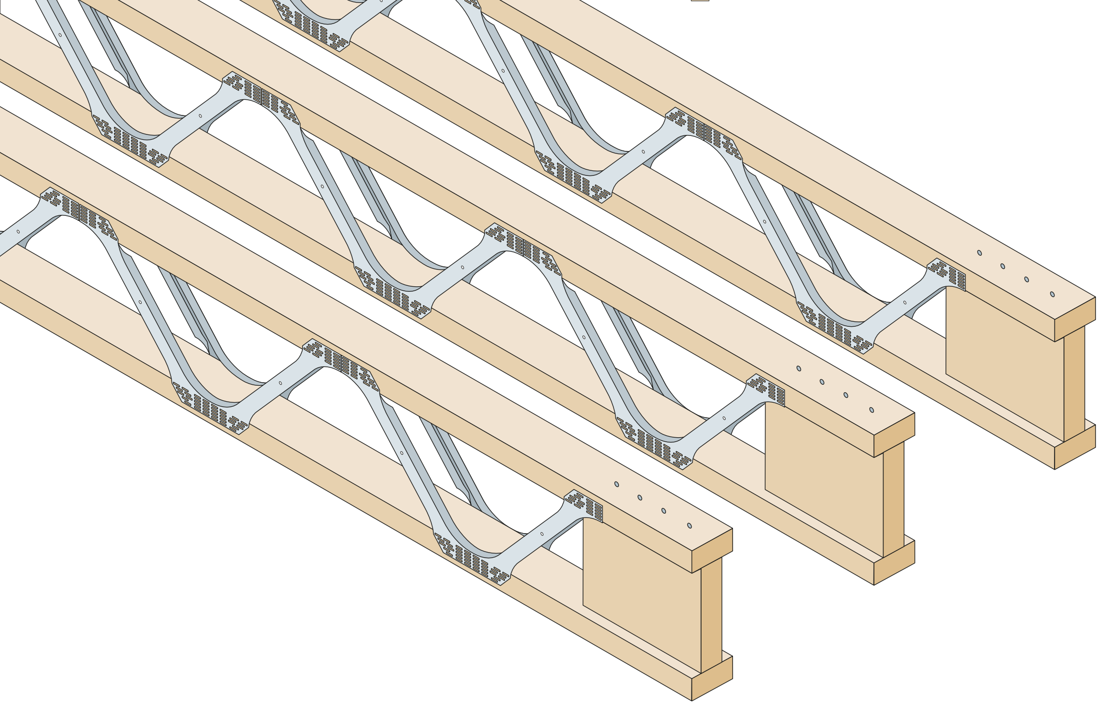
The solid trimmable end is a design solution to a problem presented by some construction projects where parallel walls are uneven. A 47mm web is fixed between the chords using 3.35mm x 65mm nails. The positioning of the nails is determined by the software and will be fixed in the factory.

Trimmable end detail has been tested to allow up to 400mm solid timber webs at each end of the joist which provides huge flexibility should a project require it.

Each trimmable end joist is designed so that it can be supported along the length of the solid web section, adding to the variety of situations and effectiveness of the joists used on site.

Care should be taken on site to ensure that when cutting the solid section, there is at least 50mm of timber remaining to the web to allow for the edge distance of the nails in the nailplate zone of the metalweb.

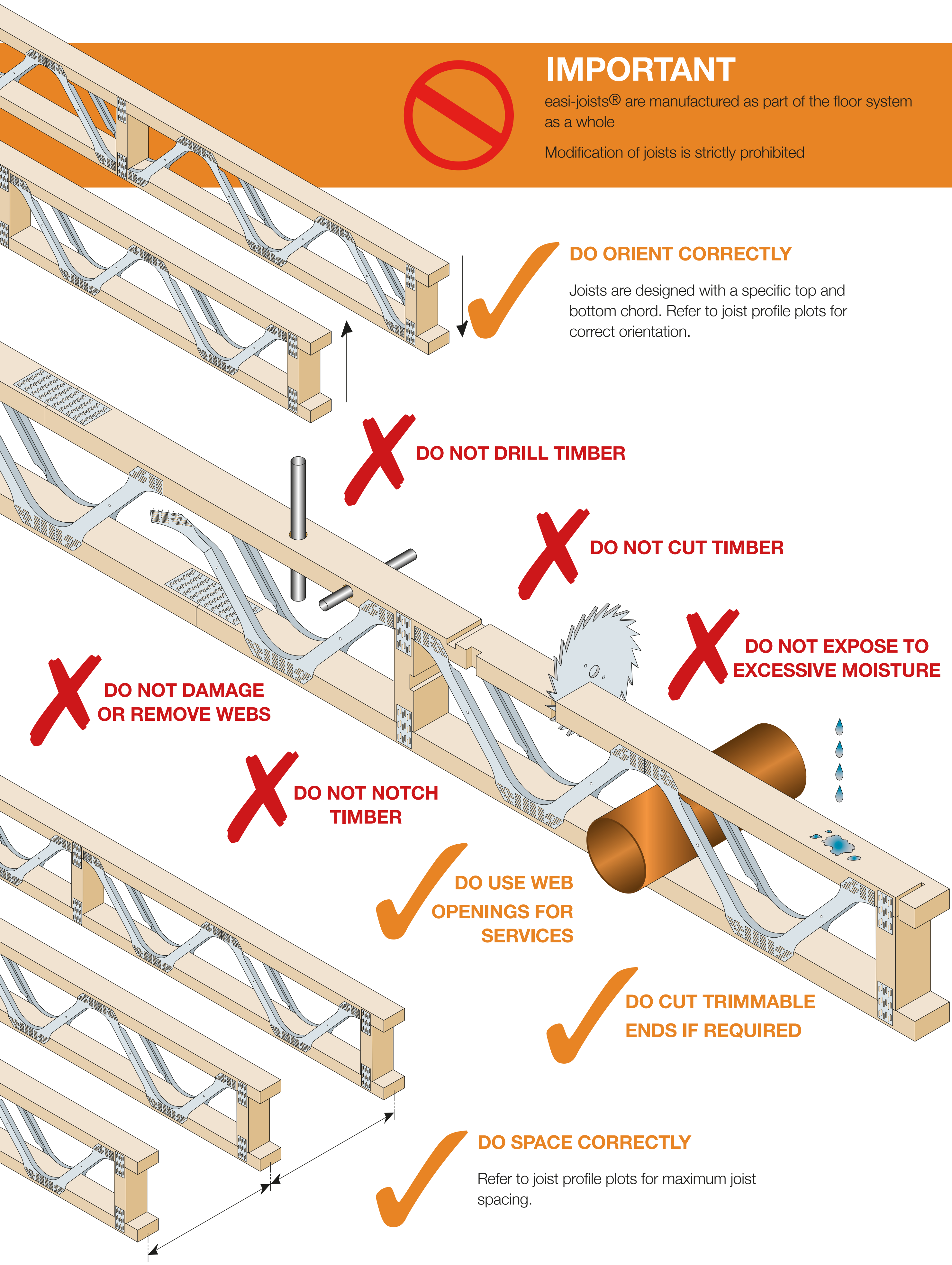


IMPORTANT

easi-joists® are manufactured as part of the floor system as a whole

Modification of joists is strictly prohibited



Handling

- The site manager or contractor will be responsible for the handling of easi-joist® from the time of unloading the delivery.
- Avoid dropping, twisting or subjecting easi-joist® to heavy impact.
- Always lift easi-joist® in the upright position to prevent lateral distortion.
- Use a fabric sling for lifting joists and ensure even weight distribution.

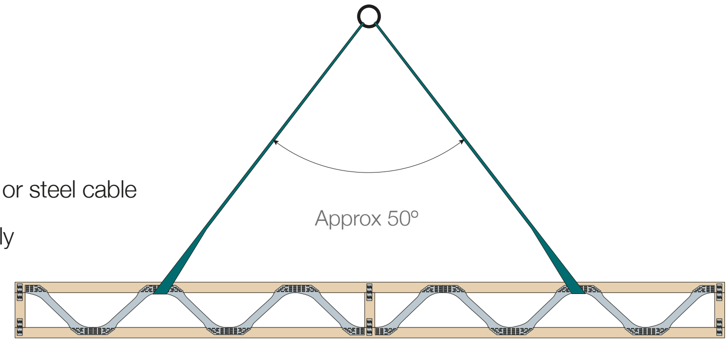
Storage

- Storage time of easi-joist® prior to installation should be kept to a minimum.
- easi-joist® should be left in bundles and remain in packaging until used.
- During such time, joists should be kept as dry as possible, and laid horizontally in an upright position, clear from the ground. Bearers should be used underneath web or column joints to prevent distortion.
- Joists are unstable until fully braced or boarded. Do not walk or store materials on an unrestrained floor area.
- Sheet materials stacked on the easi-joist® floor should not exceed 250mm in height and 150 kg per joist. The stack must not extend more than 1500mm from the edge of the floor with its longest span perpendicular to the joists.

Lifting Joists

Do not use chains or steel cable

Use fabric sling only



Safety

- Use protective gloves when manually handling easi-joist®.
- Refer to plans for joist weights, remembering to account for multi-ply girders.
- Observe health and safety regulations as set out by the current standards and regulations.

Planning

- Study layout drawings and plan which section will be erected first, starting from which end. Identify girder joists and stair trimmer which will need to be installed first to provide support for others.
- Check support conditions for all joists ensuring all internal supporting walls are present and that all supporting masonry is cured.
- Identify joists by reference number and place them next to required areas. (Joists should not be moved from dry storage until immediately before erection.)

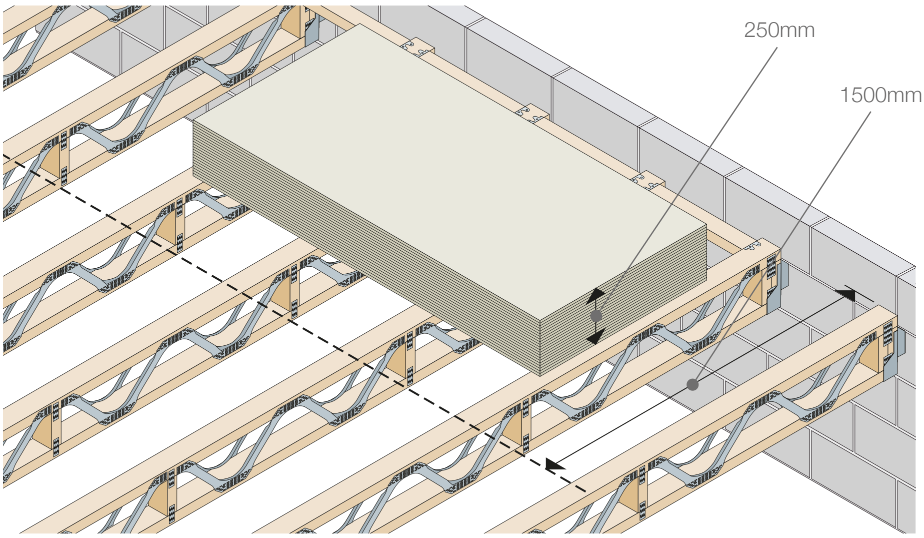
Installation

- All joists are to be installed truly vertical, parallel and top side up.
- Refer to layout plans or profiles for the correct orientation of the joist.
- Noggings, restraint straps, decking and strongbacks should be properly installed to the specification of the manufacturer or designer.
- Where masonry hangers are used, ensure at least three courses of blockwork or equivalent have been laid and the mortar cured before the floor is used.
- Spacing and loading of easi-joist® must not exceed that stated in the design.

Checking

- Ensure all joists are fully bearing on their supports, packing gaps if necessary.
- Check adjacent joists are level with each other and the ends of the joists form a straight line.

Stacking Materials



IMPORTANT: It is inadvisable to stack building materials on floor joists other than floor decking as described above.

Temporary Erection Bracing

The builder is responsible for identifying and minimising the risks involved in erecting open-web joists to ensure that the health and safety of workers is maintained. Builders should be aware of the health and safety responsibilities imposed on them by the Construction (Design and Management) Regulations 2007.

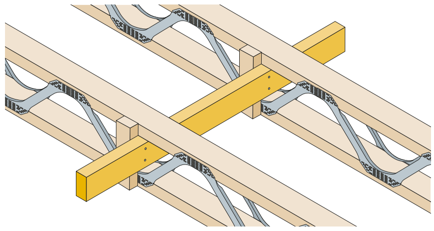
Proper erection procedures and bracing are vital to the safe construction of open web joist floors.

The following notes may assist builders in preparing a safety assessment.

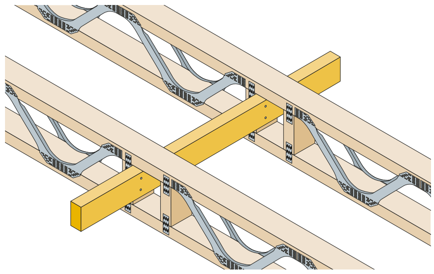
- Un-braced joists may be unstable.
- Do not allow anyone to walk on unbraced joists.
- Do not store building materials on unbraced joists.
- Open-web joists should be erected straight and vertical. Horizontal deviation : 10mm max. Vertical deviation: 2mm max.
- Temporary bracing comprises diagonal brace, longitudinal brace and permanent strongbacks.
- All longitudinal braces, diagonal braces, strongbacks and hangers should be completely installed and fully nailed as detailed.
- Lateral strength should be provided by a diagonally braced system across at least 3 joists as shown in the temporary bracing diagram. Additional braced and blocked systems should be provided at 12m spacing in long joist runs.
- Construction materials may only be stored on joists when all bracing is in place. The material should be spread over at least 4 joists and not more than 1500mm from a support. Floor/ceiling boards may be stacked up to 250mm high (150 kg per joist at 600mm centres, 100 kg per joist at 400mm centres) on braced floors.
- Flooring should be fully fixed to the joists before additional loads are placed on the floor.
- Temporary bracing may be progressively removed as decking is fixed.

Strongback Details

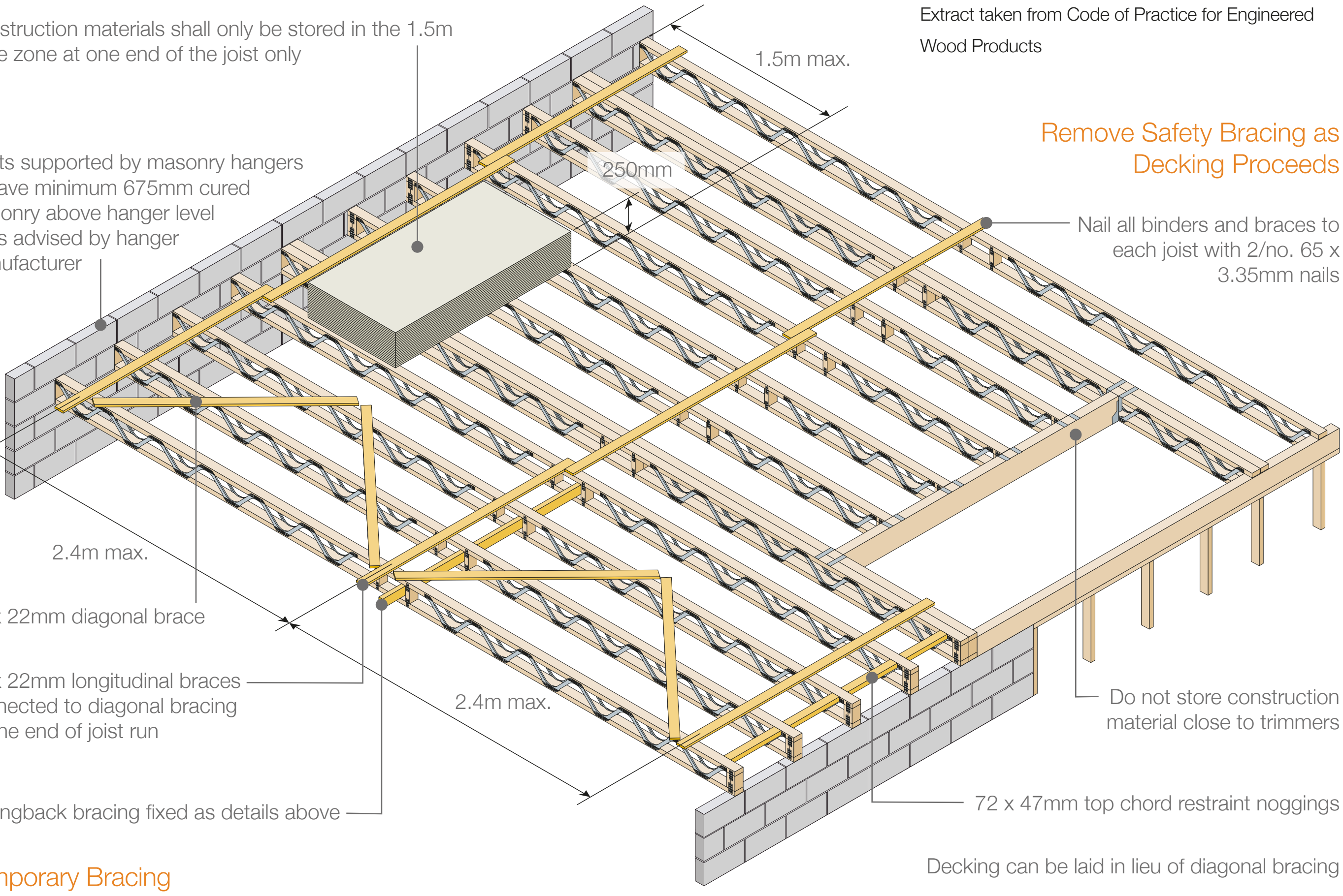
Fix 75 x 38mm (min) blocks to top and bottom chords with 2.no. 65 x 3.35mm wire nails. Insert strongback through joists before fixing joists in position, as it may not be possible to do this at a later stage. Position strongback tight to underside of top flange. Fix 97 x 35mm (min) strongback to blocks with 2/no. 65 x 3.35mm wire nails.



Fix 97 x 35mm (min) strongbacks to joists with 2/no. 65 x 3.35mm wire nails.



Extract taken from Code of Practice for Engineered Wood Products



Temporary Bracing

This diagram indicates temporary erection bracing only. It is applicable to both masonry and timber frame construction.

Bearing	The area of a member receiving structural support.
BIM	Building Information Modelling
Building Designer	The person responsible for the structural stability and integrity of the building as a whole.
Cantilever	The part of a structural member extending beyond the end support.
Chord	The horizontal timber members at the top and bottom of an easi-joist®.
Column	A vertical timber block fixed between the chords of an easi-joist®.
Compartment Floor	Separating two dwellings and required to provide sound resistance and 1 hour fire resistance.
Compression Block	A vertical timber block fixed to the side of joists where substantial vertical loads are applied.
Dead Load	The load produced by the fabric of the floor structure.
Decking	Timber boarding providing the floor or roof surface.
Deflection	Vertical deformation due to loading.
Dwarf Wall	A load bearing timber frame wall of similar depth to the floor joists.
easi-joist®	An engineered joist made from stress graded timber chords fixed with galvanised steel webs.
easi-rafter®	An engineered rafter made from stress graded timber chords fixed with galvanised steel webs.
easi-truss®	A roof truss using easi-joist® as a rafter or ceiling-tie, as opposed to solid sawn timber.
easi-wall®	An engineered wall panel assembled using a derivative of easi-joist® as studs.
EWP	Engineered Wood Product - a man-made composite timber product.
Header Binder	Horizontal length of timber fixed onto the top rail of a timber frame panel.
Imposed Load	The load produced by the occupancy of a building including storage and inhabitants.
Intermediate Support	Structural support within the span of a joist.
Line Load	A UDL applied along a single line.
Live Load	Also known as IMPOSED LOAD.
Nogging	A horizontal timber block fixed between the chords of adjacent joists.
OSB	Oriented Strand Board - a composite product made from strands of wood and glue.
Partition Wall	Timber framed non-load bearing wall applying a load to the floor below.
Point Load	A force applied at a single position.
Rimboard	A product used on the perimeter of a building to enclose the floor structure.
Rim Joist	A structural member comprising of two chords with columns at set spacing.
Ring Beam	A structural beam used to distribute floor loads evenly to the walls below.
Services	Pipe work, ducting and cables laid within the floor zone.
Sheathing	OSB or plywood sheets nailed to timber frame panels to provide racking resistance.
Span	The overall length of a joist.
Strongback	A structural timber fixed perpendicular to a run of easi-joist® to reduce deflection.
SVP	Soil Vent Pipe.
Trimmable End	Timber allowed for tolerance which can be removed without compromising the joist.
Trimmer	A structural member framing a floor opening.
UDL	Uniformly Distributed Load - either an area load (N/sq.m) or a line load (N/m).
Web	A diagonal galvanised steel strut fixed into the chords of an easi-joist® with pressed nails.

Version: 6th Edition, July 2015.

Support

From our UK headquarters in Coventry, Wolf Systems supports a network of easi-joist® manufacturers across the UK and Ireland.

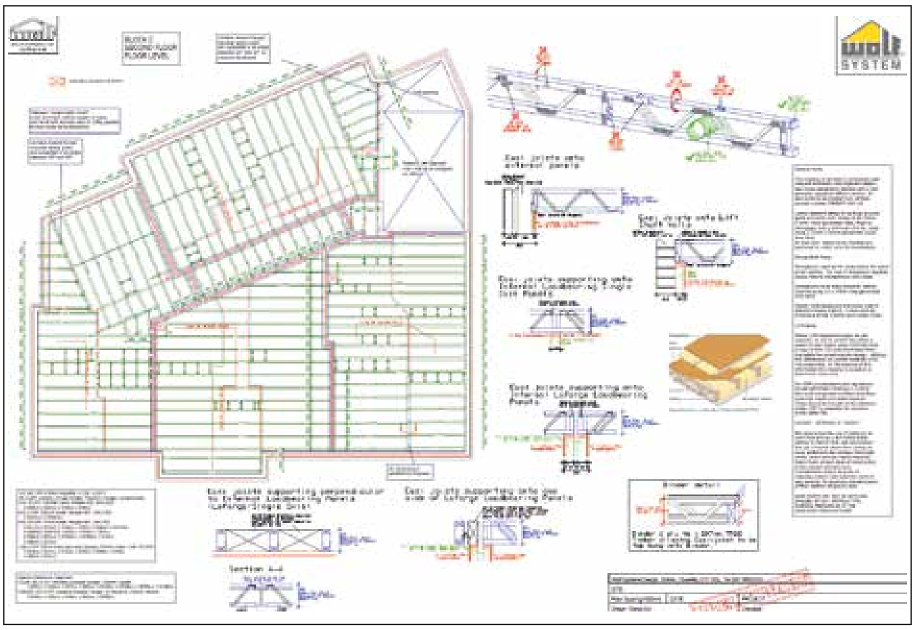
A team of highly trained and experienced personnel provide technical, practical and commercial solutions for our manufacturers and their customers.

We use the latest internet-based support packages together with on-site support services to ensure easi-joist® manufacturers receive comprehensive and relevant support and assistance.

Software

easi-joist® metalweb floor joists are designed and detailed using computer design software which is written by Wolf Systems. We have extensive knowledge of producing technically expert, user-friendly design software for timber engineering applications and our experience in this area is of proven benefit to our customers and manufacturers.

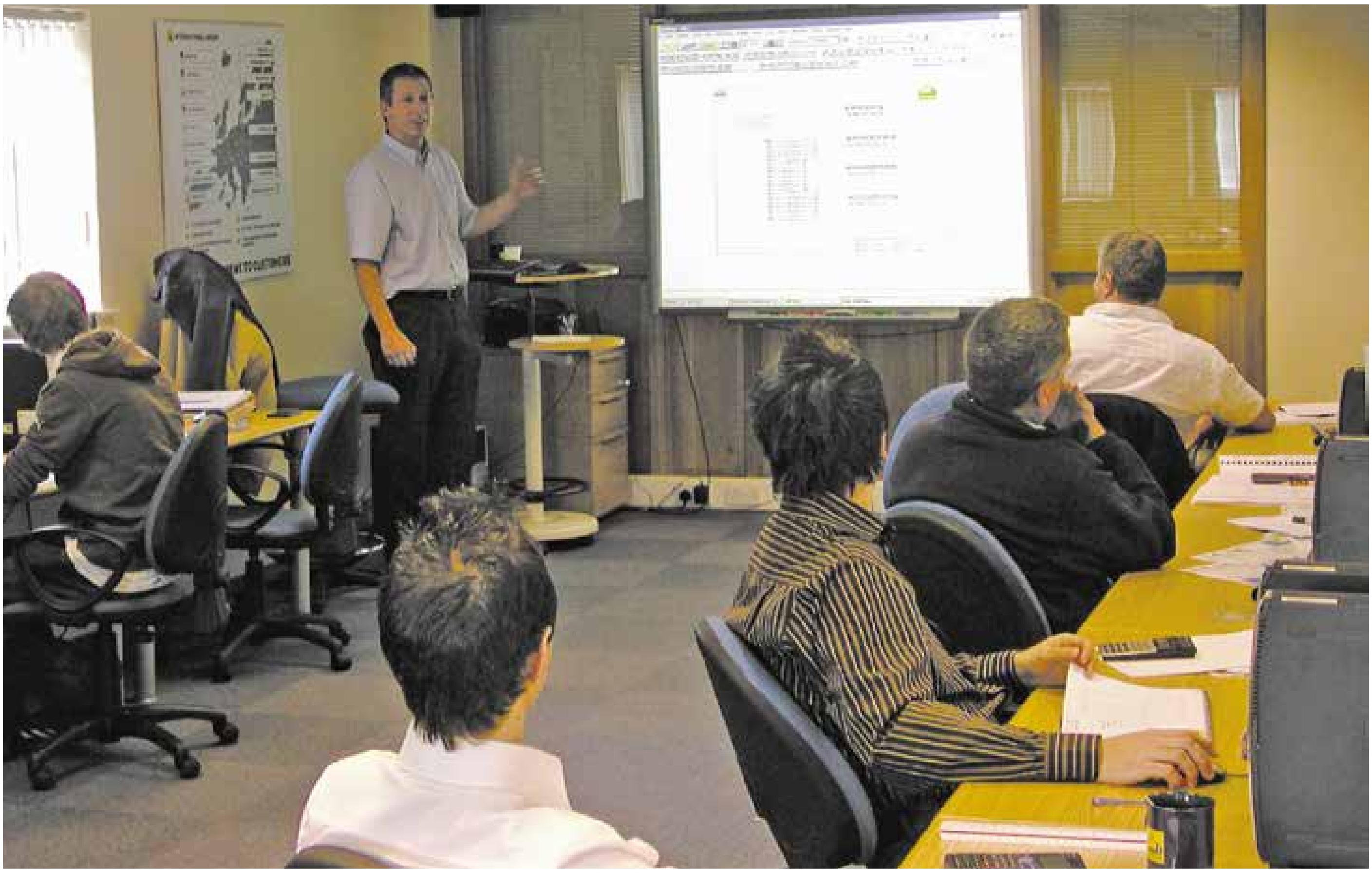
All of our software is written in the UK for the UK and Irish markets, allowing us to tailor our applications to meet the demands of the local environment and ensure easi-joist® manufacturers have the tools they need to quickly and easily design and manufacture their products.



Training

All licensed easi-joist® manufacturers receive training in the use of our design software and good floor design practice. This training takes place in a dedicated training suite at Wolf Systems' offices. Manufacturers also receive ongoing training to keep them up-to-date with relevant building regulations and technical issues as well as with important advances in our design software.

Additional training is provided for manufacturer sales and service staff to ensure they are aware of the benefit easi-joist® has over more traditional flooring methods.

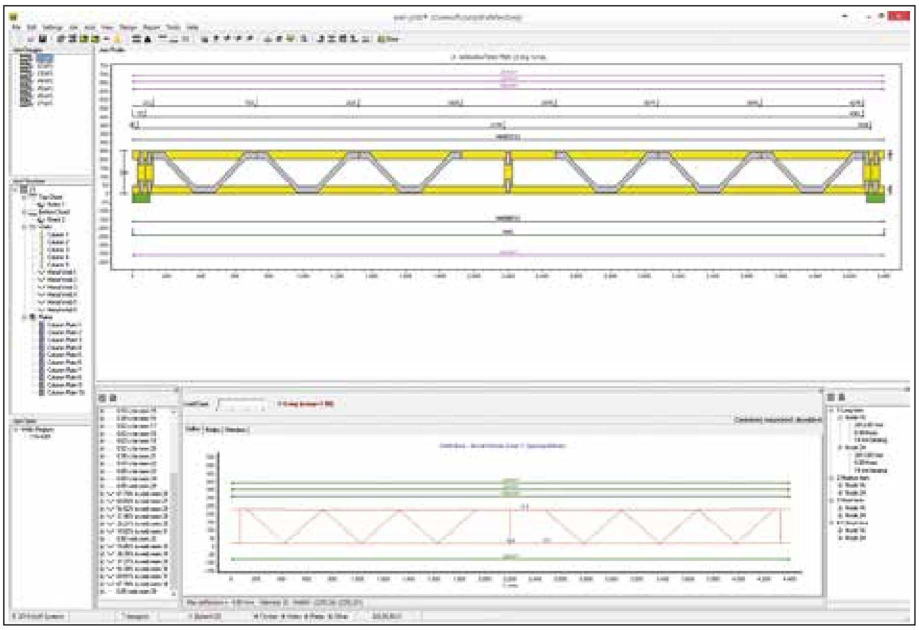


Design Service

Wolf Systems also provides manufacturers with a design service for projects using easi-joist® metal web joists.

Using the skills and experience of our own in-house design team, Wolf Systems offer a floor design service from initial feasibility study to final construction drawing and detailing.

This service assists the manufacturer, contractor and client by providing all the information necessary to achieve a quickly and easily installed easi-joist® floor.



Wolf Systems, Engineering Ease.

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