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Timber-framed Construction

Sacrificial Timber Construction Joint



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1 Introduction

In lightweight timber-framed buildings, fire protection is generally achieved by the use of fire-resistant linings. Due to the sequencing of trades in constructing fire and sound-rated timber-framed buildings, it is not always possible to provide complete coverage with fire-resistant linings, as framing elements often get in the way.

The National Construction Code – Building Code of Australia also has a requirement that a construction joint, which is what is being described here (Provision C3.16, Volume 1) is required to be fire-resisting with respect to integrity and insulation.

Solid timber has been researched and tested and has been shown in some cases to provide equivalent or better performance than fire-resistant linings. It is mainly used where linings stop at junctions between walls, roofs, ceilings and floor elements, or where walls abut other walls.

This Guide provides standard details for common locations where timber sacrificial blocks can be used to form these construction joints in walls and floors for Fire Resistance Levels of 60/60/60 and 90/90/90.

2 Scope

The Guide provides typical details where sacrificial-timber blocks are commonly used to maintain Fire Resistance Levels. This Guide provides typical thickness details and locations for sacrificial-timber blocks as well as any other associated construction needs to support nearby linings or to fill-related voids.

3 Assessment and Testing

Appendix A lists the assessments and tests that have been used to support the details in this Guide. The critical assessment that is used to draw together all the various research reports is Warringtonfire Aust report 22221A – Performance of various MRTFC roof, wall or floor junctions if tested in accordance with AS1530.4-2014.

4 How to Use This Guide

The Guide contains details that are illustrations only. Each illustration's detail has either been through a test or an assessment that supports its use has been made. Refer to Appendix A for reference to reports and assessments used to support these details.

The purpose of this Guide is to provide the foundation to the details used in WoodSolutions Technical Design Guide #1 – Timber-Framed Constructions for Townhouse Buildings Class 1a and #2 – Timber-Framed Constructions for Multi-Residential Buildings Class 2 and 3.

The details contained in each illustration have three essential elements:

- what it is protecting
- thickness and location of timber blocks required
- any associated construction such as metal angle or fire-grade mineral wool.

5 Junctions between Building Elements

Due to the number of building classifications and types of construction covered by this Guide, there is a variety of situations when the wall, ceiling, roof and floor elements may require the maintenance of the fire and sound rating.

In these cases, solid-timber blocking is used as an equivalent to fire-protective linings; the thicker the blocks, the greater the Fire Resistance Level achieved. In timber-framed construction, this is an important means of making fire-resisting joints between walls and roof, ceiling and floor elements as well as junctions of walls with walls. Refer to Figure 1 for general locations where timber blocks can be used.

Such joints are generally only required where there is a break in the fire-protective lining, and this generally excludes situations where two elements with the same Fire Resistance Level (FRL) intersect. Instead, the emphasis is on junctions between non-fire-rated elements and fire-rated elements, or elements of lower fire rating meeting elements with a higher fire rating.

The following details show typical construction practices that can be used to provide fire resistance continuity. The principles described in this Guide can be used for situations not covered by this Guide but which are consistent with the Guide's intent.

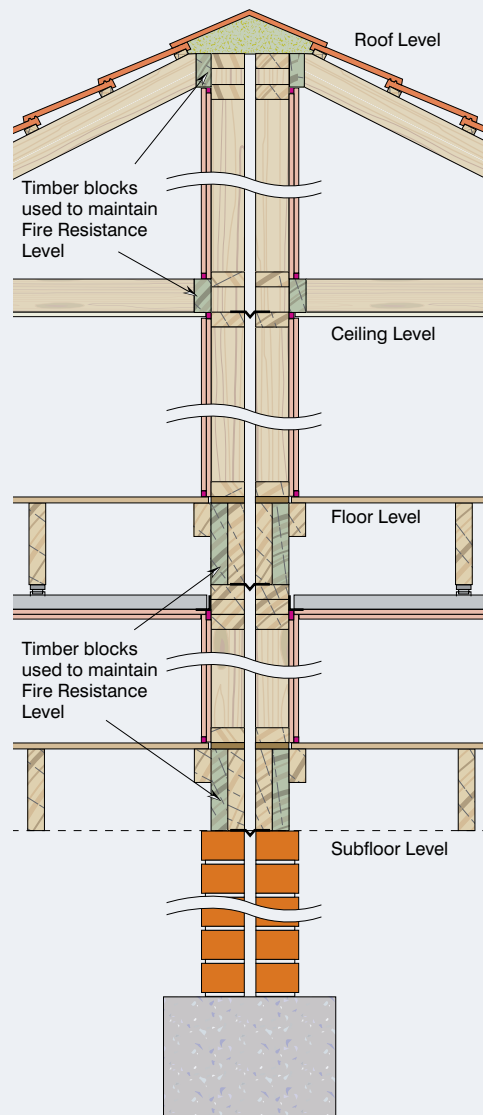


Figure 1: Common locations of sacrificial-timber blocking – elevation view.

The Intersection of Building Elements with Equivalent Fire Resistance Levels

Where building elements have equivalent Fire Resistance Levels, there is no requirement to continue the fire rating through the intersections. Often in these situations, a cavity barrier is required to limit the spread of fire, heat and smoke within a fire-rated cavity. The construction details on cavity barriers depend on the deemed-to-satisfy building regulation being followed. Refer to WoodSolutions Technical Design Guide #2 or #37 for details of cavity barriers that meet the deemed-to-satisfy building regulation being used.

6.1 Use of Sacrificial-Timber Blocking

The quantity and thickness of sacrificial-timber blocks depend on the difference in Fire Resistance Levels of the two elements that abut each other. The National Construction Code – Building Code of Australia requires different Fire Resistance Levels for various building elements, depending on their situation, such as:

- rise in storeys
- if sprinklers are included
- if contained within a specific area
- if the element is loadbearing or non-loadbearing
- location of the exterior wall from boundary or neighbouring building.

There may be places where non-fire-rated elements or lower-fire-rated elements will abut fire-rated elements.

This Guide details common locations where junctions are required to maintain a Fire Resistance Level of 60/60/60 and 90/90/90. Each detail will indicate the level of fire resistance it can achieve. In general terms only, a Fire Resistance Level of 60/60/60 requires the use of overlapping timber blocks having a minimum thickness of 45 mm. For a Fire Resistance Level of 90/90/90, the use of at least two overlapping timber blocks having a minimum thickness of 45 mm and the addition of metal angle of the minimum dimension of 35 x 35 x 0.75 mm is required. Each detail must be referred to for the specific requirements.

Timber blocks are to be arranged so that they are continuous. Where they are required to be joined, they must be arranged so that the joint is backed by a block of timber with similar thickness. Where two timber blocks are used for the 90 minutes Fire Resistant Level system, no joint is to occur within 100 mm.

Details presented in this Guide are applicable for double-stud as well as single stud construction, unless noted otherwise. For construction details of the fire-rated floor, wall and ceiling systems refer to appropriate lining manufacturers.

6.2 General Material Requirements

6.2.1 Timber Blocks

Wherever timber blocks are referred to within this Guide, they are to be a minimum size as nominated on the figure and have a density of no less than 470 kg/m³. Joints in blocking pieces must be backed by a similar thickness piece of timber with at least 100 mm projection beyond the joint.

6.2.2 Metal Angle

Wherever metal angles are referred to within this Guide, they are to be made from galvanised steel and be a minimum size 35 x 35 x 0.7 BMT.

6.2.3 Mineral Wool

Wherever mineral wool is referred to within this Guide, the mineral wool must have a fusion temperature in excess of 1,120°C.

6.3 Roofs

6.3.1 Timber Rafter Roof Rafter and Ceiling Joist Elements Supported off Timber Blocks – FRL 60 Minutes

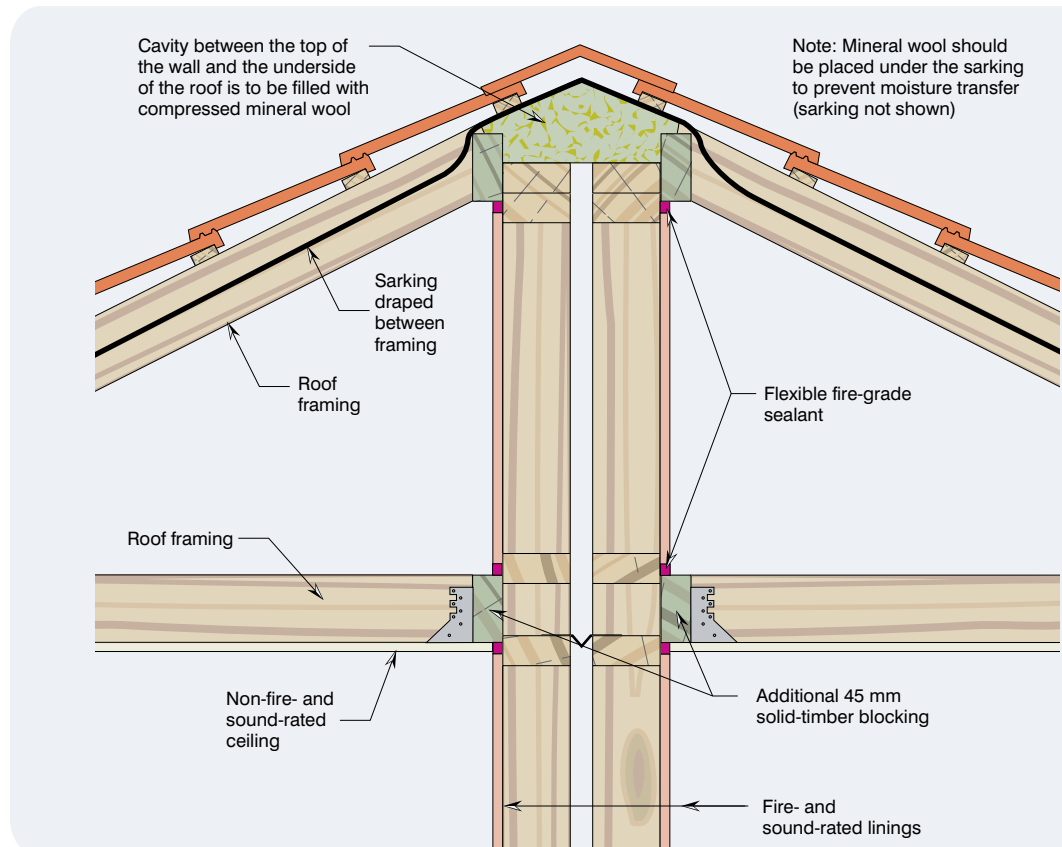


Figure 2: Timber roof rafter and ceiling joist supported off sacrificial-timber blocks – FRL 60 minutes – elevation view.

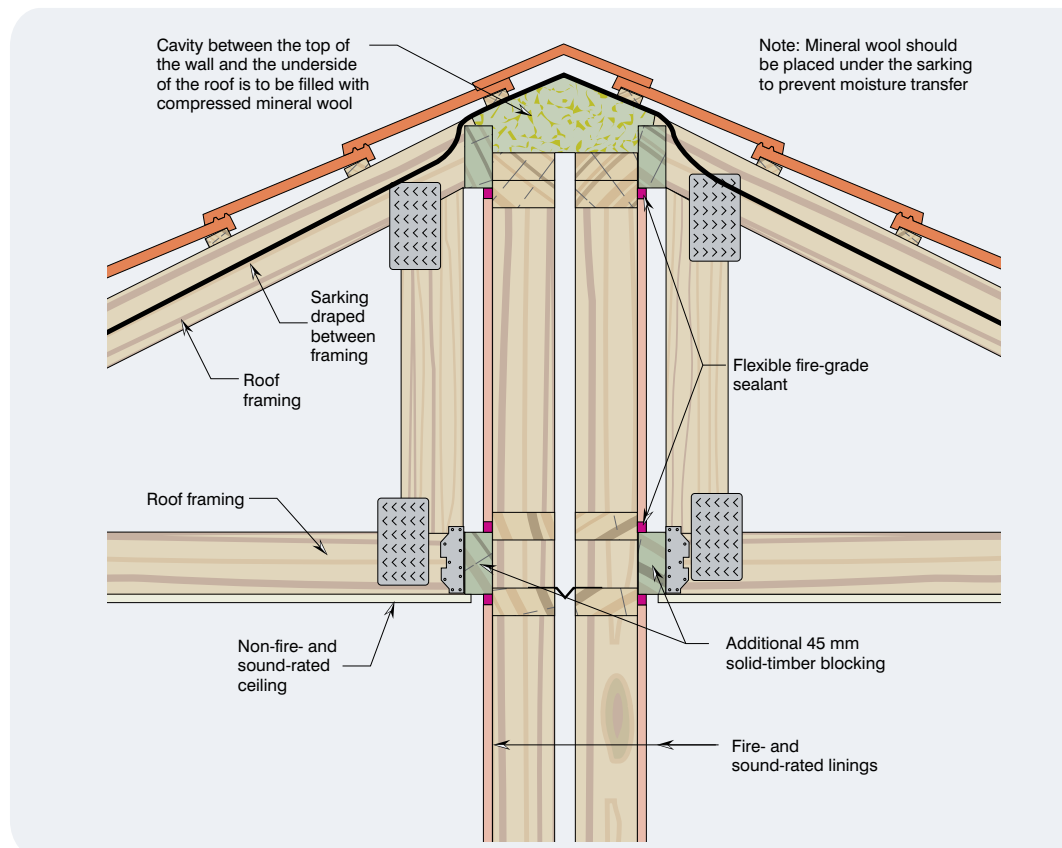


Figure 3: Timber trusses supported off sacrificial-timber blocks – FRL 60 minutes – elevation view.

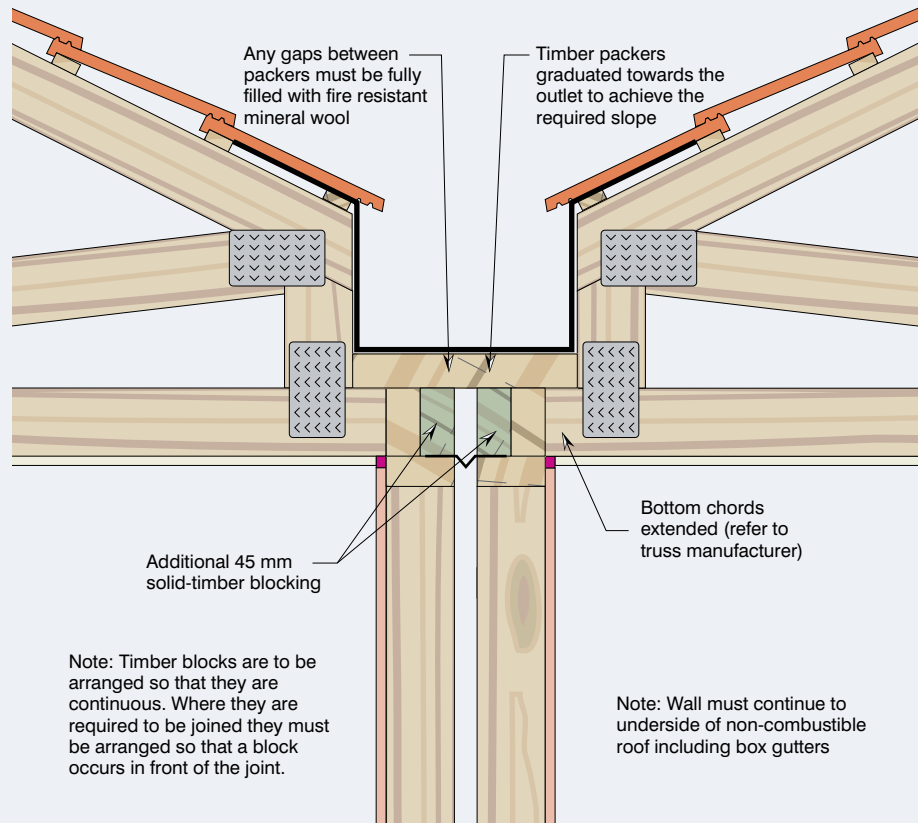


Figure 4: Timber trusses supported off sacrificial-timber blocks at box gutter – FRL 60 minutes – elevation view.

6.4 Interior Walls

6.4.1 Non-Fire-Rated Wall Abutting Fire- and Sound-Rated Wall – FRL 60 Minutes

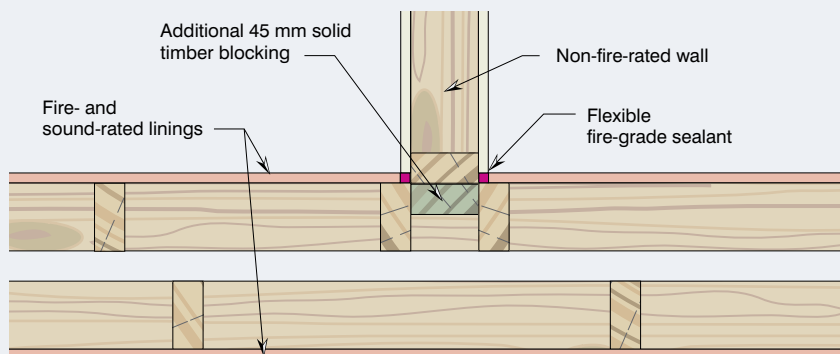


Figure 5: Non-fire-rated single stud wall abutting fire- and sound-rated double stud wall using timber blocks – FRL 60 minutes – plan view.

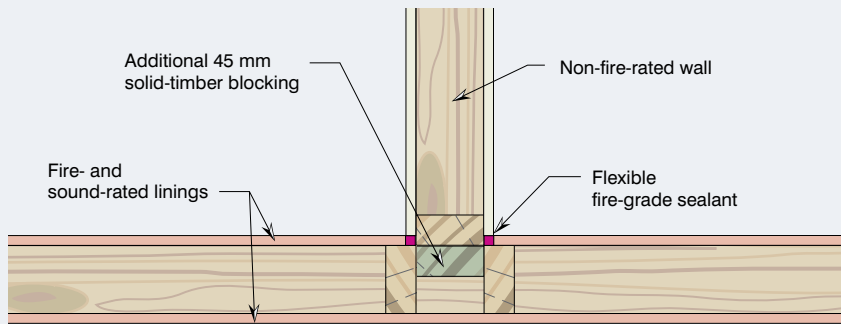


Figure 6: Non-fire-rated single stud wall abutting fire- and sound-rated single stud wall using timber blocks – FRL 60 minutes – plan view.

6.4.2 Non-Fire-Rated Wall Abutting Fire- and Sound-Rated Wall – FRL 90 Minutes

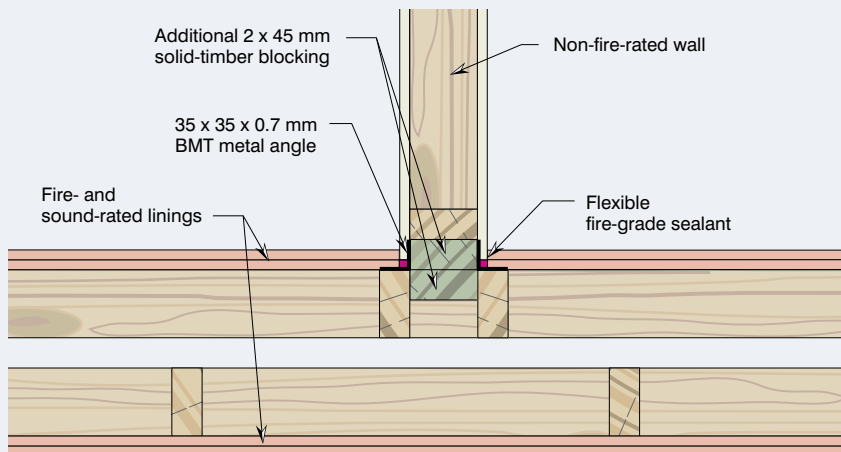


Figure 7: Non-fire-rated single stud wall abutting fire- and sound-rated double stud wall using timber blocks – FRL 90 minutes – plan view.

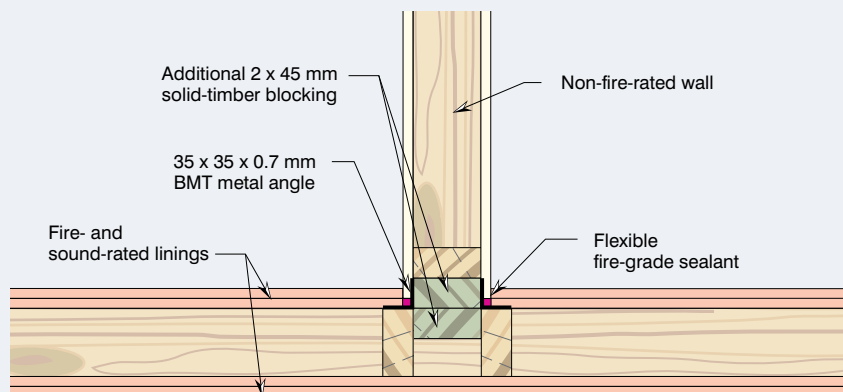


Figure 8: Non-fire-rated single stud wall abutting fire- and sound-rated single stud wall using timber blocks – FRL 90 minutes – plan view.

6.5 Exterior Walls

6.5.1 Sound- and Fire-Rated Wall Abutting Brick Veneer External Wall – FRL 60 Minutes

This detail is for the timber block element of this junction only. For detail on the fire-resistant mineral wool refer to manufacturers' requirements.

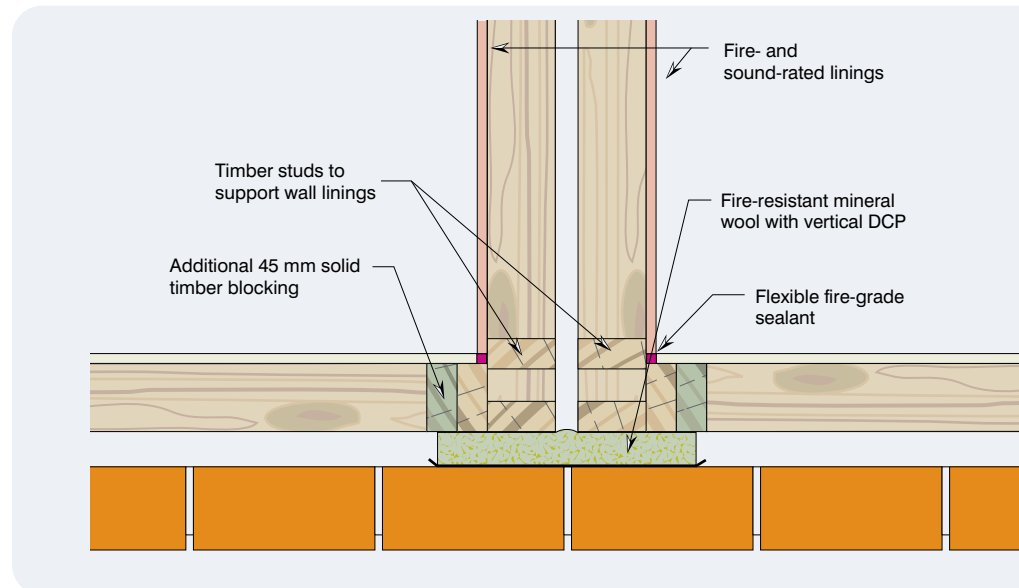


Figure 9: Fire- and sound- rated wall abutting a non-rated brick veneer cavity wall – FRL 60 minutes – plan view.

6.5.2 Sound- and Fire-Rated Wall Abutting Non-Fire-Rated Staggered Exterior Brick Veneer Wall – FRL 60 Minutes

This detail is for the timber block element of this junction only. For detail on the fire resistant mineral wool refer to manufacturers' requirements.

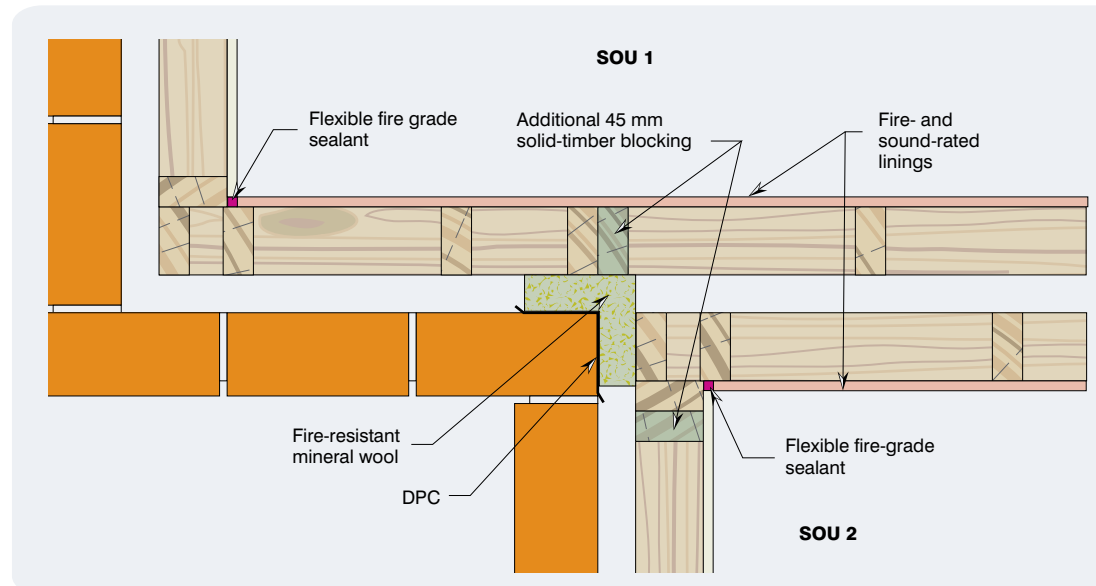


Figure 10: Fire- and sound-rated wall abutting a non-rated staggered brick veneer cavity wall – FRL 60 minutes – plan view.

6.5.3 Sound- and Fire-Rated Wall Abutting Non-Fire-Rated Exterior Lightweight Wall – FRL 60 Minutes

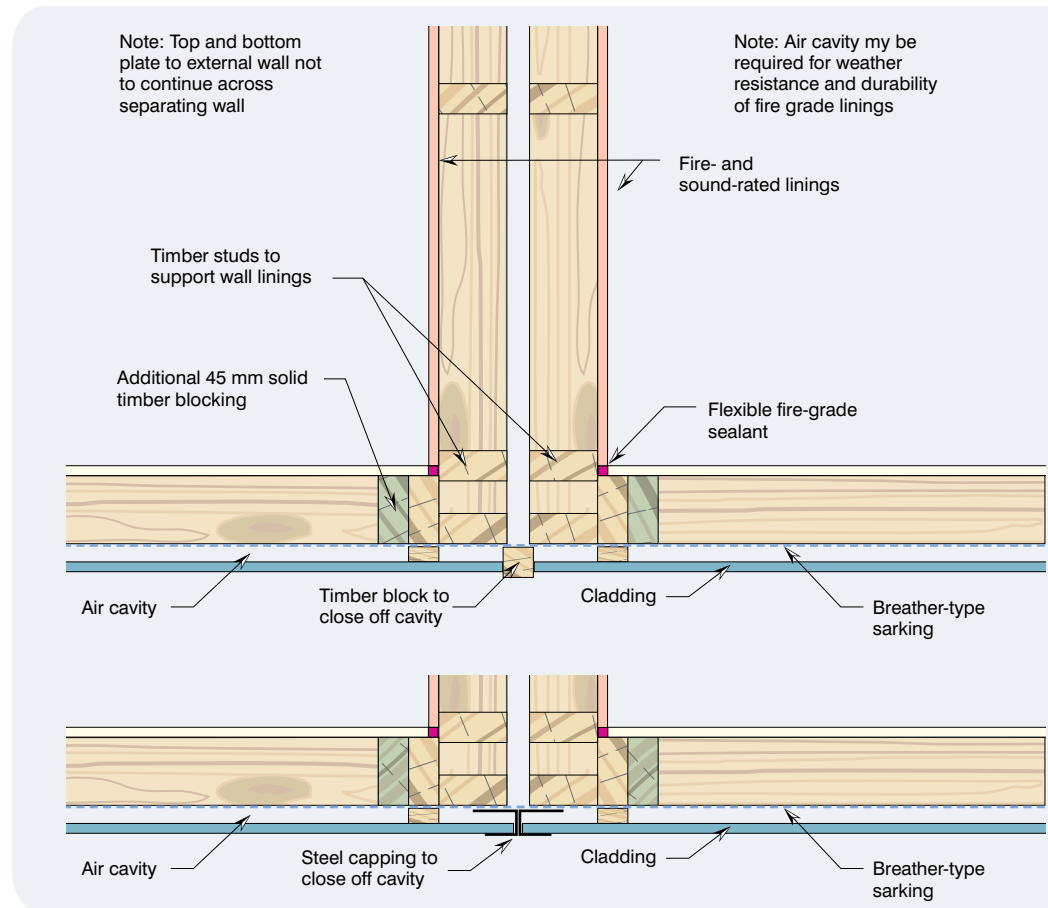


Figure 11: Fire- and sound-rated wall abutting a non-rated lightweight external wall – FRL 60 minutes – plan view.

6.6 Floors

6.6.1 Joist Parallel to Wall, Double Joist Detail – FRL 60 Minutes

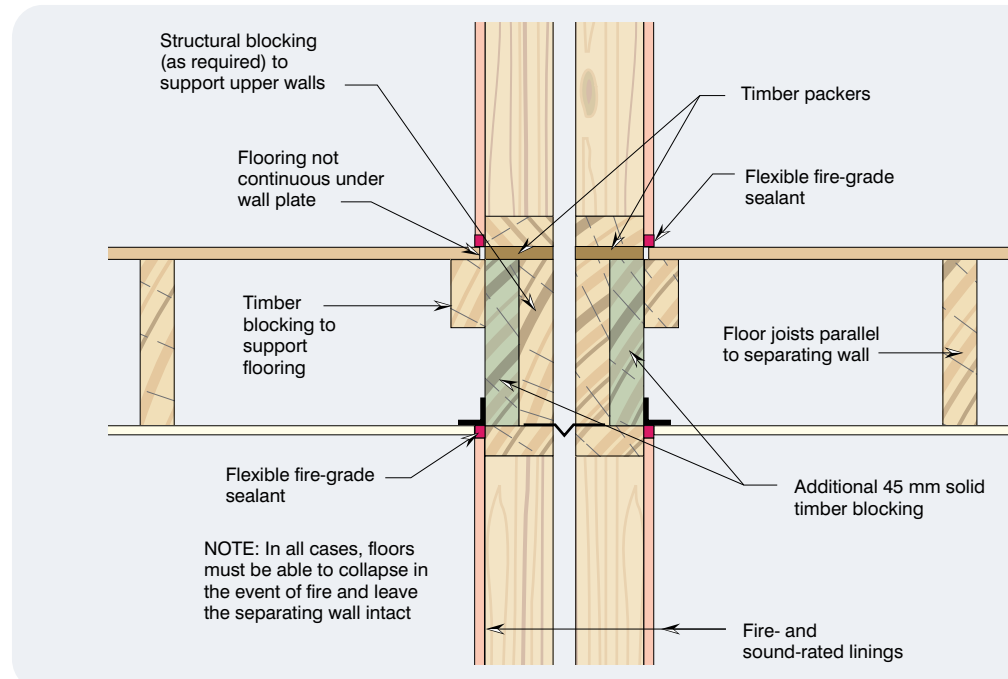


Figure 12: Joist parallel to wall – double joist detail – FRL 60 minutes – elevation view.

6.6.2 Joist Parallel to Wall, Double Joist Detail – FRL 90 Minutes

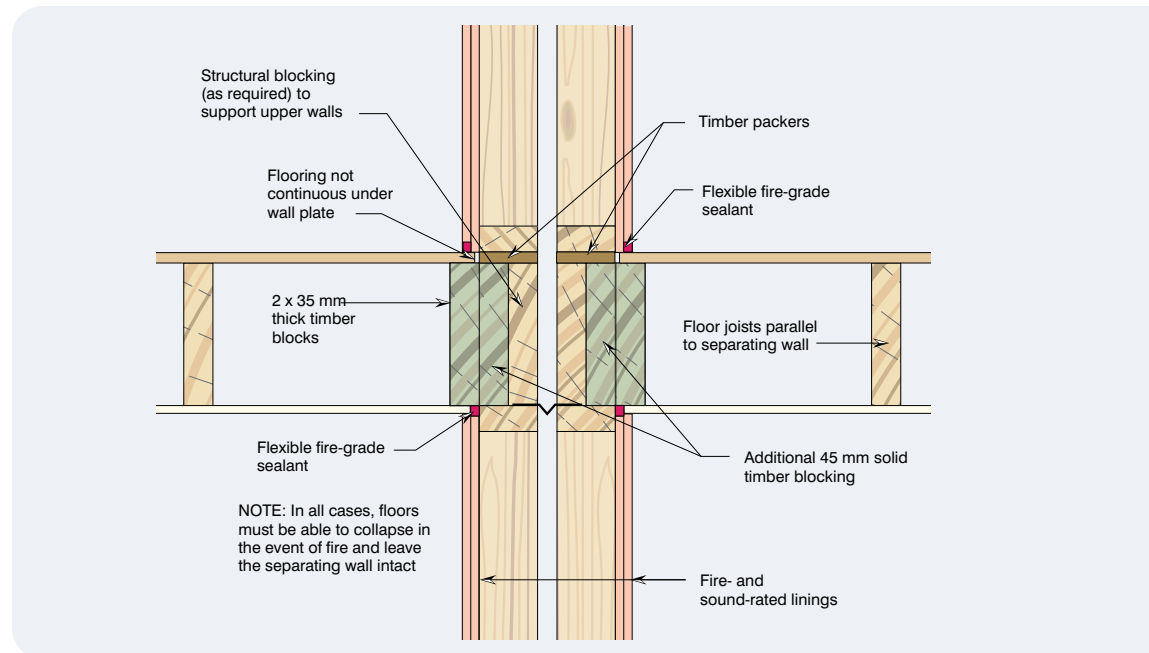


Figure 13: Joist parallel to wall, double joist detail – FRL 90 minutes – elevation view.

6.6.3 Joist Parallel to Wall, Wall Stud Through Junction – FRL 60 Minutes

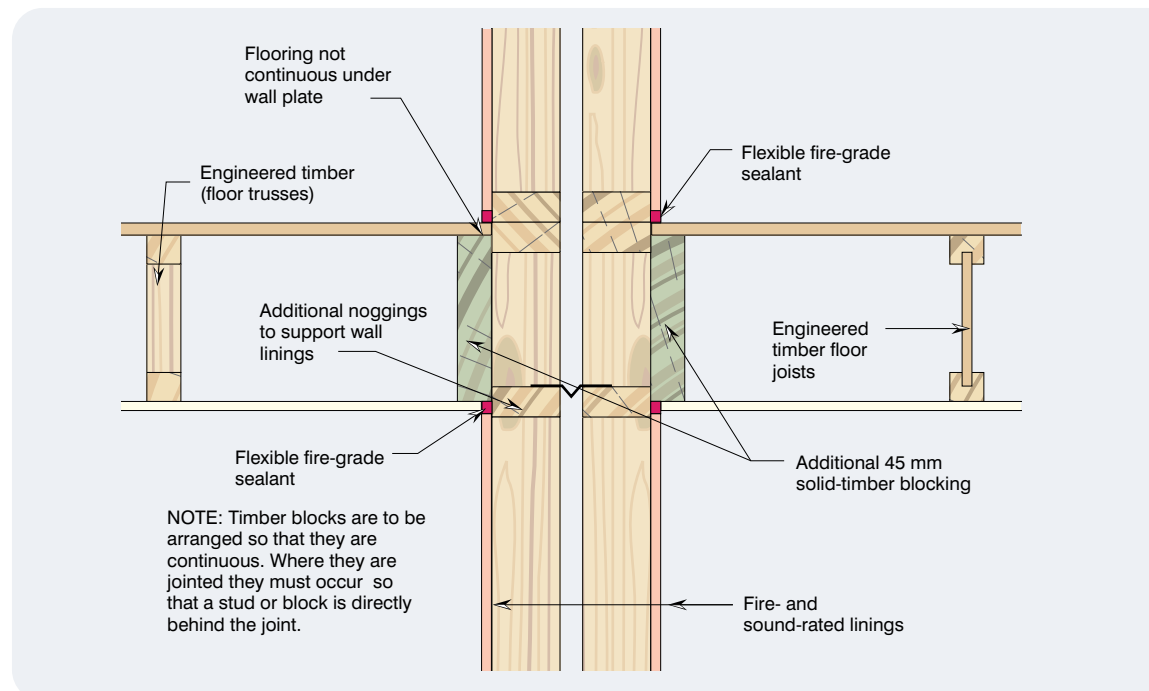


Figure 14: Joist parallel to wall, wall studs continuous through junction with timber blocks – FRL 60 minutes – elevation view.

6.6.4 Joist Parallel to Wall, Wall Stud Through Junction – FRL 90 Minutes

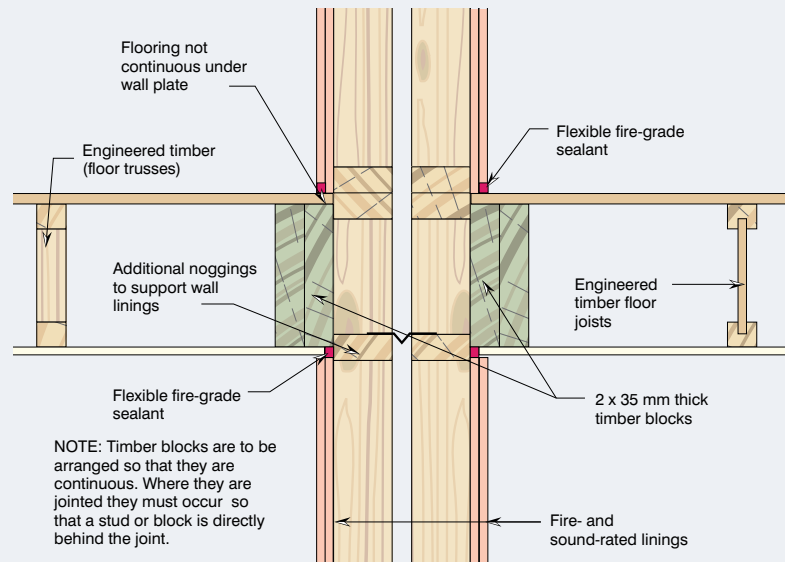


Figure 15: Joist parallel to the wall, wall studs continuous through the junction with timber blocks – FRL 90 minutes – elevation view.

6.6.5 Joist Perpendicular to Wall – FRL 60 Minutes

Detail for joist parallel to wall the same, except joists not supported off timber blocking.

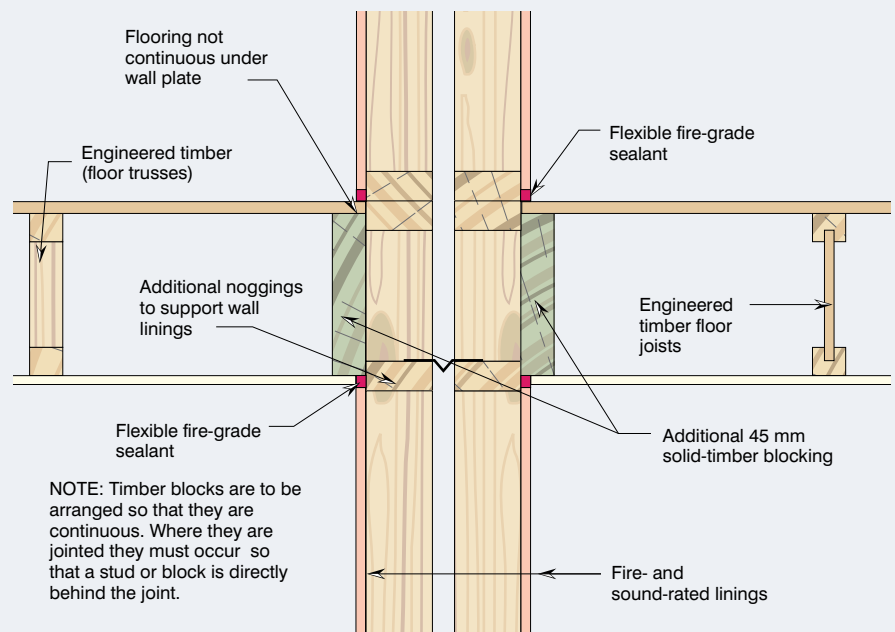


Figure 16: Joist perpendicular to the wall and supported off timber blocks – FRL 60 minutes – elevation view.

6.6.6 Joist Perpendicular to Wall – FRL 90 Minutes

Detail for joist parallel to wall the same, except joists not supported off timber blocking.

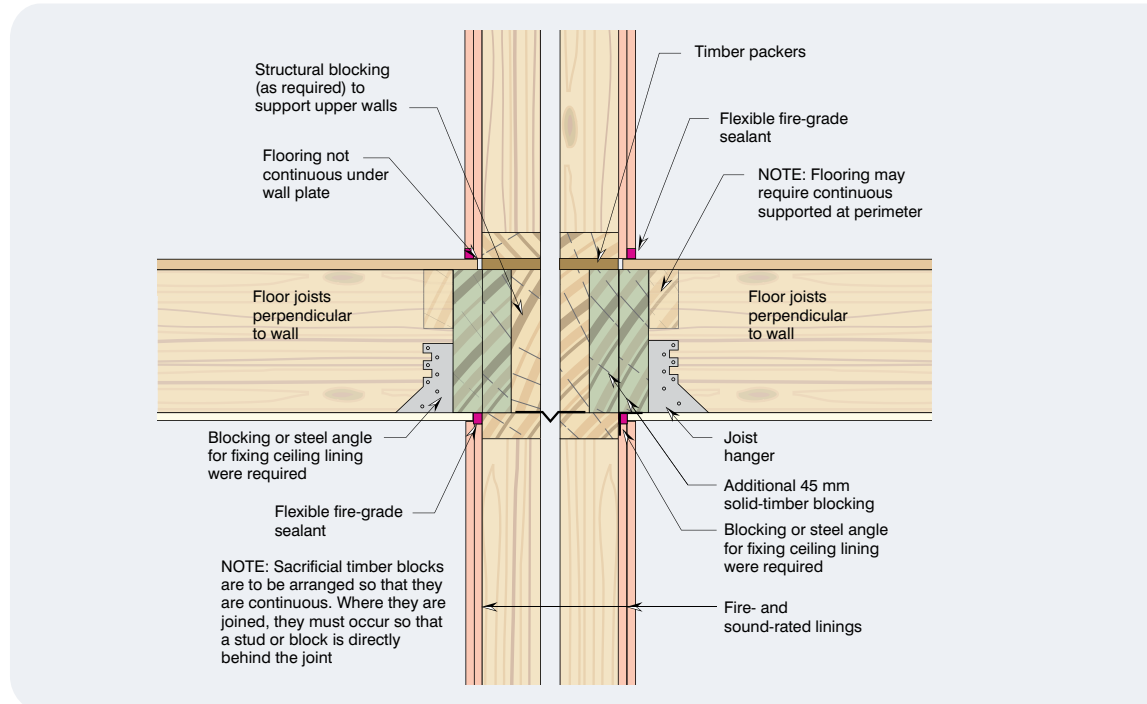


Figure 17: Joist perpendicular to wall and supported off timber blocks – FRL 90 minutes – elevation view.

6.6.7 Fire Pockets in Fire-Rated Walls – FRL 60 Minutes

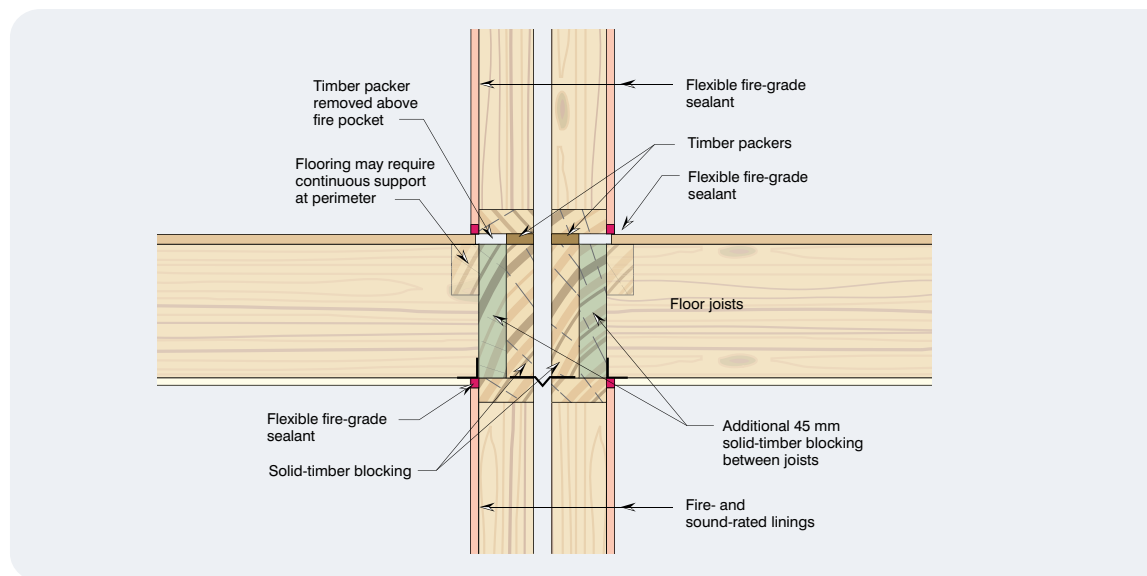


Figure 18: Joist supported by fire pockets in fire- and sound-rated wall – FRL 60 minutes – elevation view.

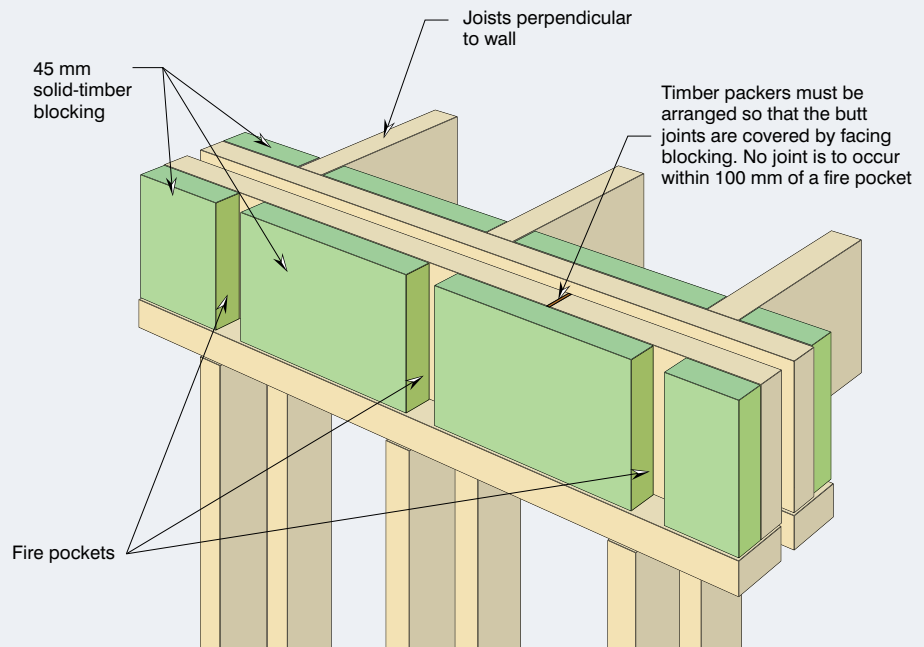


Figure 19: Fire pockets in fire- and sound-rated wall – FRL 60 minutes – elevation view.

6.6.8 Fire Pockets in Fire-Rated Walls – FRL 90 Minutes

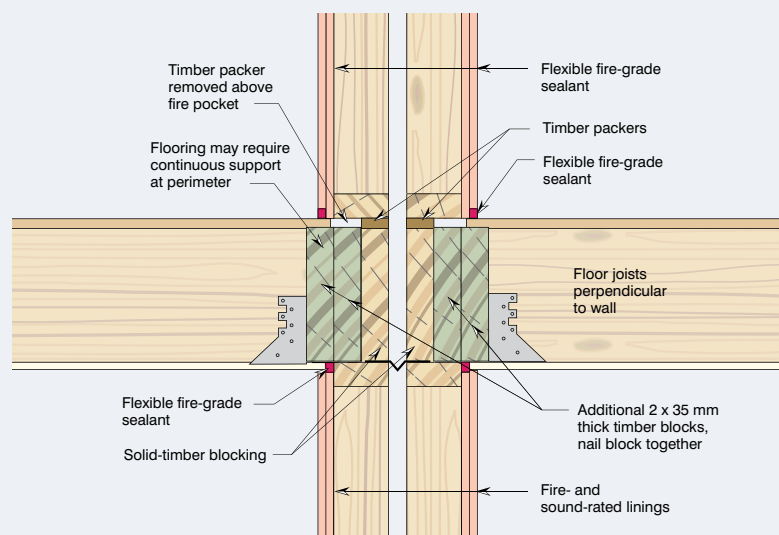


Figure 20: Joist supported by fire pockets in fire- and sound-rated wall – FRL 90 minutes – elevation view.

6.6.9 Fire Pocket Top Chord Support Detail for Floor Truss – FRL 60 Minutes

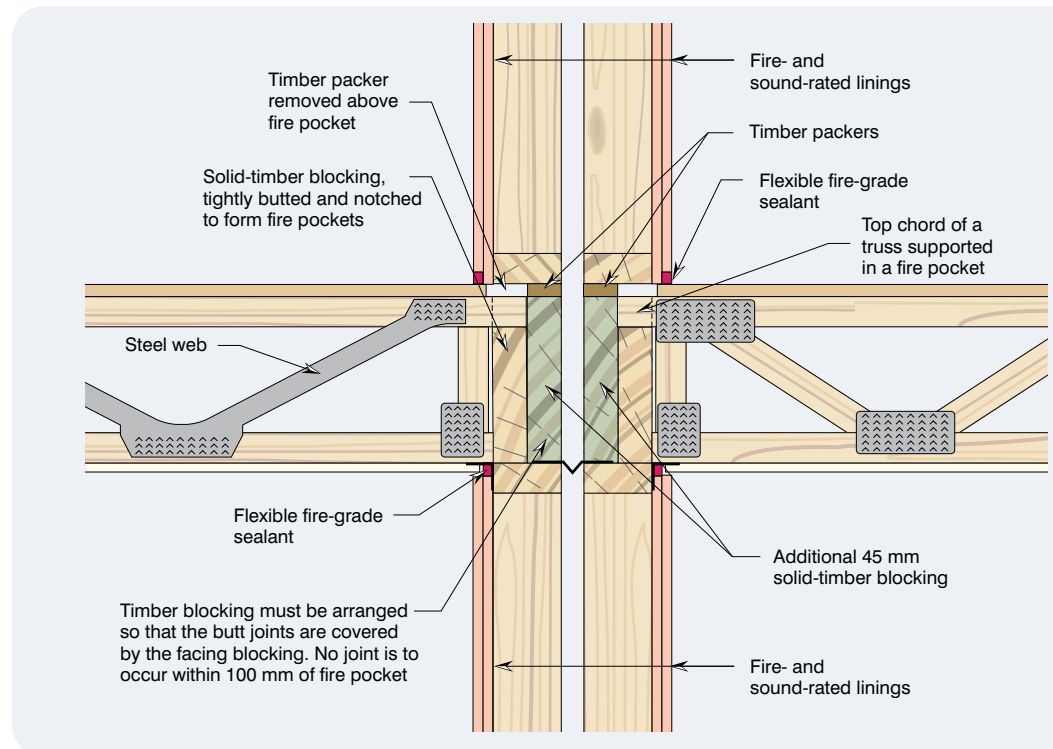


Figure 21: Floor truss supported by fire pockets in fire- and sound-rated wall – FRL 60 minutes – elevation view.

6.6.10 Fire Pocket Top Chord Support Detail for Floor Truss – FRL 90 Minutes

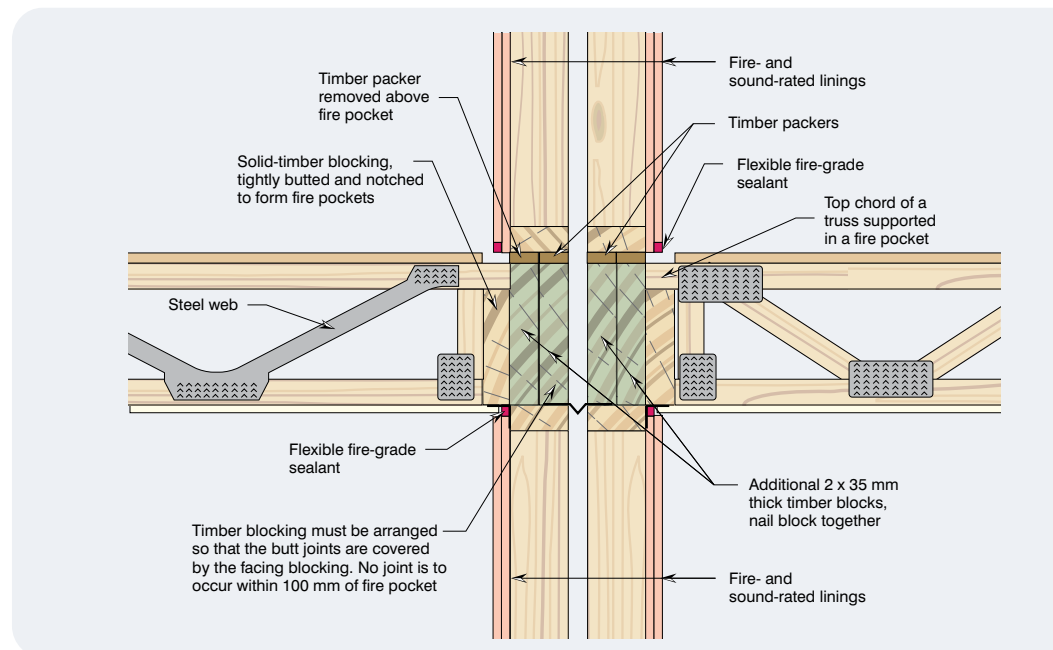


Figure 22: Floor truss supported by fire pockets in fire- and sound-rated wall – FRL 90 minutes – elevation view.

6.6.11 Floor Truss Top Chord Ledger Support Detail – FRL 60 Minutes

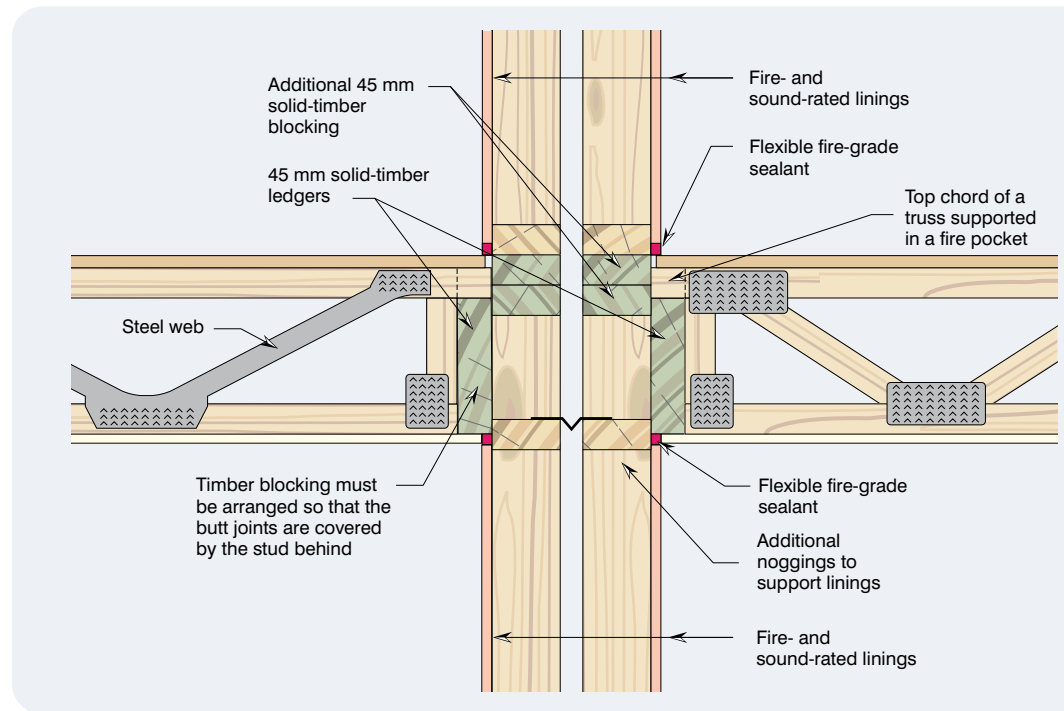


Figure 23: Floor truss supported on their top chords by ledger to the side of the fire- and sound-rated wall – FRL 60 minutes – elevation view.

6.6.12 Floor Truss Top Chord Ledger Support Detail – FRL 90 Minutes

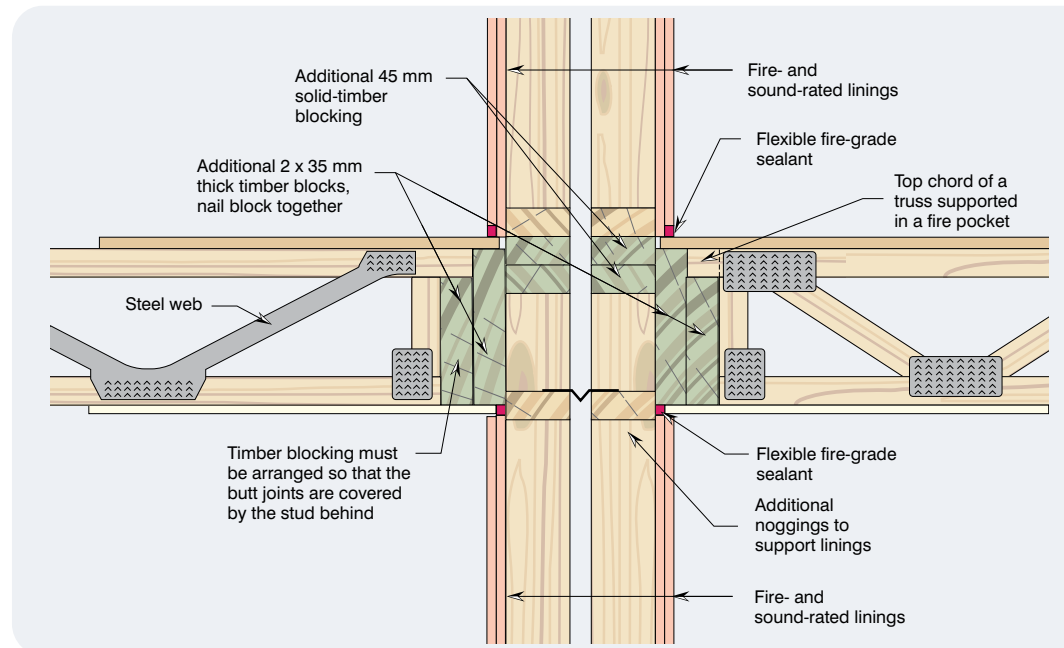


Figure 24: Floor truss supported on their top chords by ledger to the side of the fire- and sound-rated wall – FRL 90 minutes – elevation view.

6.7 Non-Fire-Rated Steel Beam Pocket Support

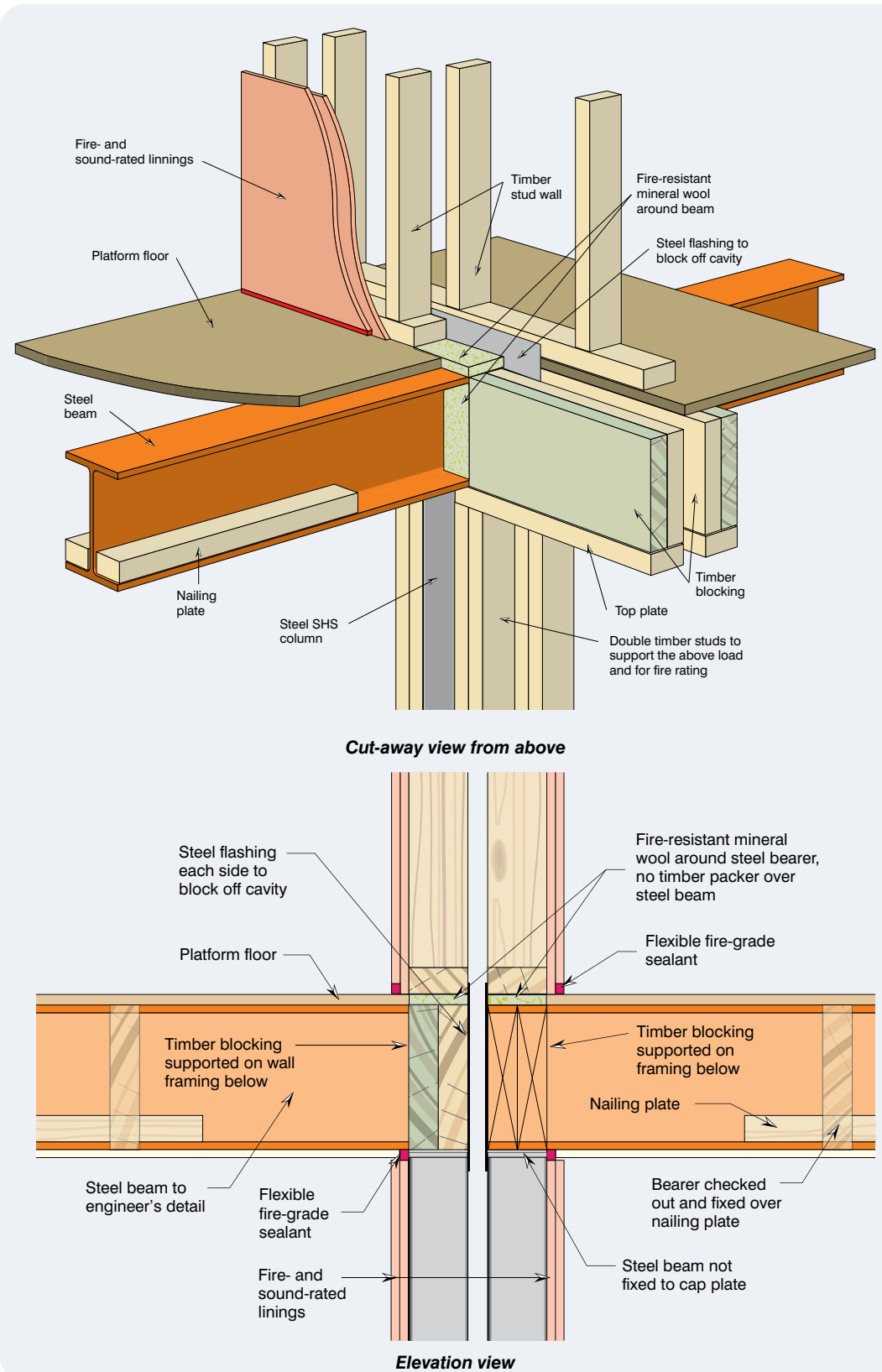


Figure 25: Steel beam and column housed in fire- and sound-rated wall – FRL 60 minutes.

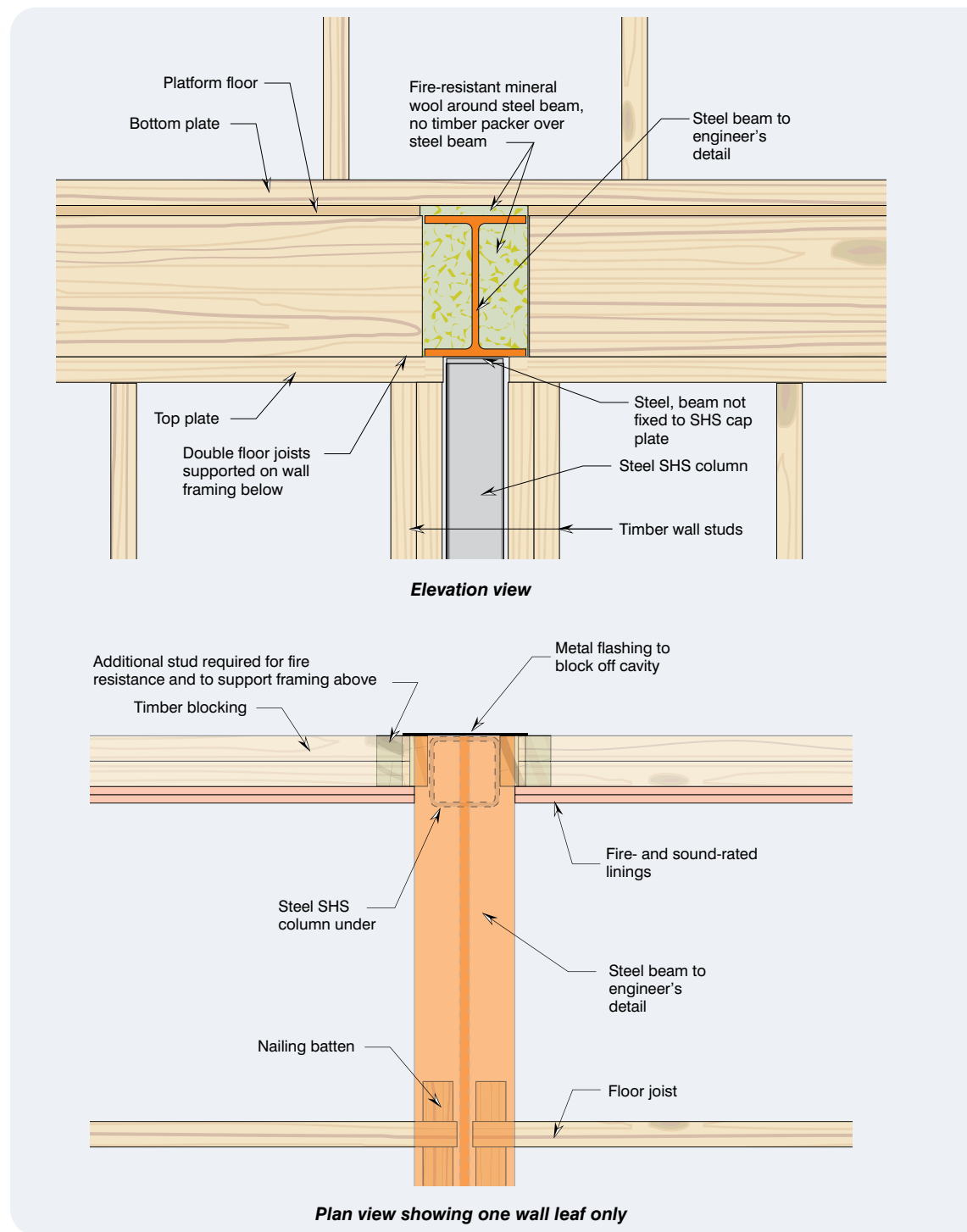


Figure 26: Detail of steel beam pocket in fire- and sound rated wall – FRL 60 minutes.

6.8 Timber Blocks Size of Alternative Thickness and/or Density

Generally, the Guide requires 1 x 45 mm thick timber blocks for Fire Resistance Level of 60 minutes and 2 x 35 mm thick timber blocks for Fire Resistance Level of 90 minutes, with the timber having a minimum density of 470 kg/m³.

Timber blocks of greater density can substitute the block for either Fire Resistance Level. For the 90 minutes Fire Resistance Level that requires 2 x 35 mm thick timber blocks can be substituted by another single piece of timber with a higher density. The thickness of timber required can be calculated from AS/NZS 1720.4 Timber Structures Part 4: Fire resistance of timber elements is the effective depth of char for a 75 minute period. The minimum thickness of timber allowed is 45 mm. Therefore, the effective depth of char is

$$d_c = c \cdot t + 7.0 \text{ mm} \quad (1.1)$$

Where

C = notional char rate, found from AS/NZS 1720.4 or common species are repeated in Table 1.

t = 75 minutes

Table 1 provides minimum timber block thickness for common timber used in construction. The timber block thicknesses are represented in minimum dimension, and may not be commercially available to this dimension. Where this is the case, the next timber size should be used. Where engineered timber is used, the base timber species' density should be used not the density of the engineered timber that includes the weight of the adhesive.

Table 1: Minimum Block Thickness for FRL 90 Minutes Based on AS/NZS 1720.4.

Timber Species ¹	Notional Charring Rate	Minimum Block Thickness based on Effective Depth of Char for 75 minutes exposure
Blackbutt	0.5	45
Cypress	0.56	49
Douglas fire	0.65	56
European Spruce	0.65	56
Gum, Spotted	0.46	45
Ironbark, grey	0.46	45
Ironbark, red	0.47	45
Jarra	0.52	46
Merbau (Kwila)	0.51	45
Radiata pine	0.65	56
Victorian Ash and Tasmanian Oak	0.59	51

Note:

1. The density of other timber species can be found from AS 1720.1 or AS 1720.2.
2. Where the effective depth of char is calculated to be less than 45 mm, the minimum block thickness of 45 is used.

A

Further Design Assistance Appendix A – Design References

Australian Building Codes Board

- Building Code of Australia – Volume 1 & 2.

Australian Standards

- AS/NZS 1720.4 - Timber Structures Part 4: Fire resistance of timber elements.
- ASAS 1530.4 – Methods for fire tests on building materials, components and structures – Fire-resistance tests on elements of construction.
- AS 1684 – Residential Timber Framed Construction Standard.
- AS/NZS 1267.1 Acoustics – Rating of sound insulation in buildings and building elements.
- AS/NZS 2908.2 – Cellulose cement products – Flat sheets.
- AS 4072.1 – Components for the protection of openings in fire-resistant separating elements – Service penetration and control joints.

WoodSolutions Technical Design Guides

- Guide #1: Timber-Framed Construction for Townhouse Buildings Class 1 – Design and construction guide for BCA compliant sound- and fire-rated construction
- Guide #2: Timber-Framed Construction for Multi-Residential Buildings Class 2, and 3 – Design and construction guide for BCA compliant sound- and fire-rated construction
- Guide #37R: Mid-Rise Timber Buildings – Multi-residential Class 2 and 3

Test and Assessment Reports

Bodycote Warringtonfire (Aus)

- 22567A Assessment Report: The likely fire-resistance performance of timber-framed walls lined with plasterboard if tested in accordance with AS 1530.4 2005, April 2009.
- 22567B Assessment Report: The likely fire-resistance performance of MRTFC wall floor junctions if tested in accordance with AS 1530.4 2005, September 2008.
- RIR 22567B Regulatory Information Report: The likely fire-resistance performance of MRTFC wall floor junctions if tested in accordance with AS 1530.4 2005, September 2008.
- 2256701 Test Report: Fire-resistance test of a timber wall floor junction in general accordance with AS 1530.4 2005, September 2008.
- 2256702 Test Report: Fire-resistance test of a wall beam junction when tested in general accordance with AS 1530.4 2005, September 2008.

Exova Warringtonfire Australia

- 2365300 Test Report: Fire-resistance test of floor junctions incorporating timber and plasterboard in general accordance with AS 1530.4 2005, May 2009.
- 2365400 Test Report: Fire-resistance test of floor junctions incorporating timber and plasterboard in general accordance with AS 1530.4 2005, May 2009.
- 2365500 Test Report: Fire-resistance test of floor junctions incorporating timber and plasterboard in general accordance with AS 1530.4 2005, May 2009.

B

Appendix B – Glossary of Terms

BCA

Building Code of Australia – Volume 1 – Class 2 to 9 Buildings and Volume 2 – Class 1 and Class 10 Buildings.

Cavity barrier

A non-mandatory obstruction installed in concealed cavities within fire-rated wall or floor/ceiling systems.

Construction joint

Discontinuities of building elements and gaps in fire-rated construction required by the BCA to maintain fire resistance. Refer to Deemed-to-Satisfy Provision C3.16, Volume 1, BCA.

Discontinuous construction

A wall system having a minimum of 20 mm cavity between two separate wall frames (leaves) with no mechanical linkage between the frames except at the periphery i.e. top and bottom plates.

Exit

Includes any of the following if they provide egress to a road or open space:

- an internal or external stairway
- a ramp complying with Section D of the BCA
- a doorway opening to a road or open space.

Fire-grade lining

Either fire-grade plasterboard, fibre-cement or a combination of both, used to provide the required Fire Resistance Level (FRL) for walls or floor/ceiling systems. Individual linings manufacturers should be contacted to determine the extent to which a given lining material provides fire-resisting properties.

Fire-isolated passageway

A corridor or hallway of fire-resisting construction which provides egress to a fire-isolated stairway or ramp.

Fire-isolated stair or ramp

A stair or ramp construction of non-combustible materials and within a fire-resisting shaft or enclosure.

Fire-protective covering

- 13 mm fire-grade plasterboard; or
- 12 mm cellulose fibre-reinforced cement sheeting complying with AS 2908.2; or
- 12 mm fibrous plaster reinforced with 13 mm x 13 mm x 0.7 mm galvanized steel wire mesh located not more than 6 mm from the exposed face; or
- other material not less fire-protective than 13 mm fire-grade plasterboard.

Note: Fire-protective covering must be fixed in accordance with normal trade practice (e.g. joints sealed).

Fire Resistance Level (FRL)

The period of time in minutes determined in accordance with Specification A2.3 (of the BCA) for the following:

- structural adequacy
- integrity
- insulation.

Fire-resisting construction

Construction that satisfies Volume 2 of the BCA.

Fire-resisting (fire-rated)

As applied to a building element, means having the FRL required by the BCA for that element.

Fire-resisting junction

The intersection between a fire-rated wall or floor/ceiling system and/or another rated or non-rated system, which maintain the fire resistance at the intersection.

Fire-resisting mineral wool

Compressible, non-combustible, fire-resisting material used to fill cavities and maintain fire resistance or restrict the passage of smoke and gases at gaps between other fire-resisting materials.

Note: The mineral wool to be used in all applications in this manual must be fire-resisting and therefore must have a fusion temperature in excess of 1,160°C.

Fire-resisting sealant

Fire-grade material used to fill gaps at joints and intersections in fire-grade linings to maintain Fire Resistance Levels.

Note: The material should also be flexible to allow for movement and where required waterproof as well.

Fire-source feature

Either:

- the far boundary of a road adjoining the allotment; or
- a side or rear boundary of the allotment; or
- an external wall or another building on the allotment which is not of Class 10.

Habitable room

A room for normal domestic activities and includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room and sunroom, but excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.

Internal walls

Walls within, between or bounding separating walls but excluding walls that make up the exterior fabric of the building.

Note: Fire walls or common walls between separate buildings or classifications are NOT internal walls.

Lightweight construction

Construction which incorporates or comprises sheet or board material, plaster, render, sprayed application, or other material similarly susceptible to damage by impact, pressure or abrasion.

Non-combustible

Applied to a material not deemed combustible under AS 1530.1 – Combustibility Tests for Materials; and applied to construction or part of a building – constructed wholly of materials that are not deemed combustible.

Performance requirements

The objectives, functional statements and requirements in the Building Code of Australia that describe the level of performance expected from the building, building element or material.

R_w

Refer to Weighted sound reduction index.

Unit

Sole-occupancy unit.

Weighted sound reduction index (R_w)

The rating of sound insulation in a building or building element as described in AS/NZS 1267.1:1999.

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