

BUSHFIRE DESIGN & DETAILING

**Design principles, compliance pathways
and installation details for residential steel
roofing and walling**

BD&D V21 -INDUSTRY 23



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DOCUMENT PURPOSE

The purpose of this document is to demonstrate the principles of bushfire design and discuss the two independent pathways to achieve compliance for residential buildings.

Examples of detailing of steel roofing and walling under each pathway are provided to assist understanding of the different approaches. The details also provide guidance for installers.

This document addresses bushfire design principles and detailing for BAL-12.5 to BAL-40. BAL-FZ requires more complex construction requirements (both in selection of materials and installation system) as set out in the referenced Standards.

The benefits of using steel products in bushfire prone areas are also showcased through a number of case studies.



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DESIGNING FOR BUSHFIRES

Residential buildings and associated structures constructed in designated bushfire prone areas must provide resistance to bushfires in order to reduce the danger to life and reduce the risk of the loss of the building.

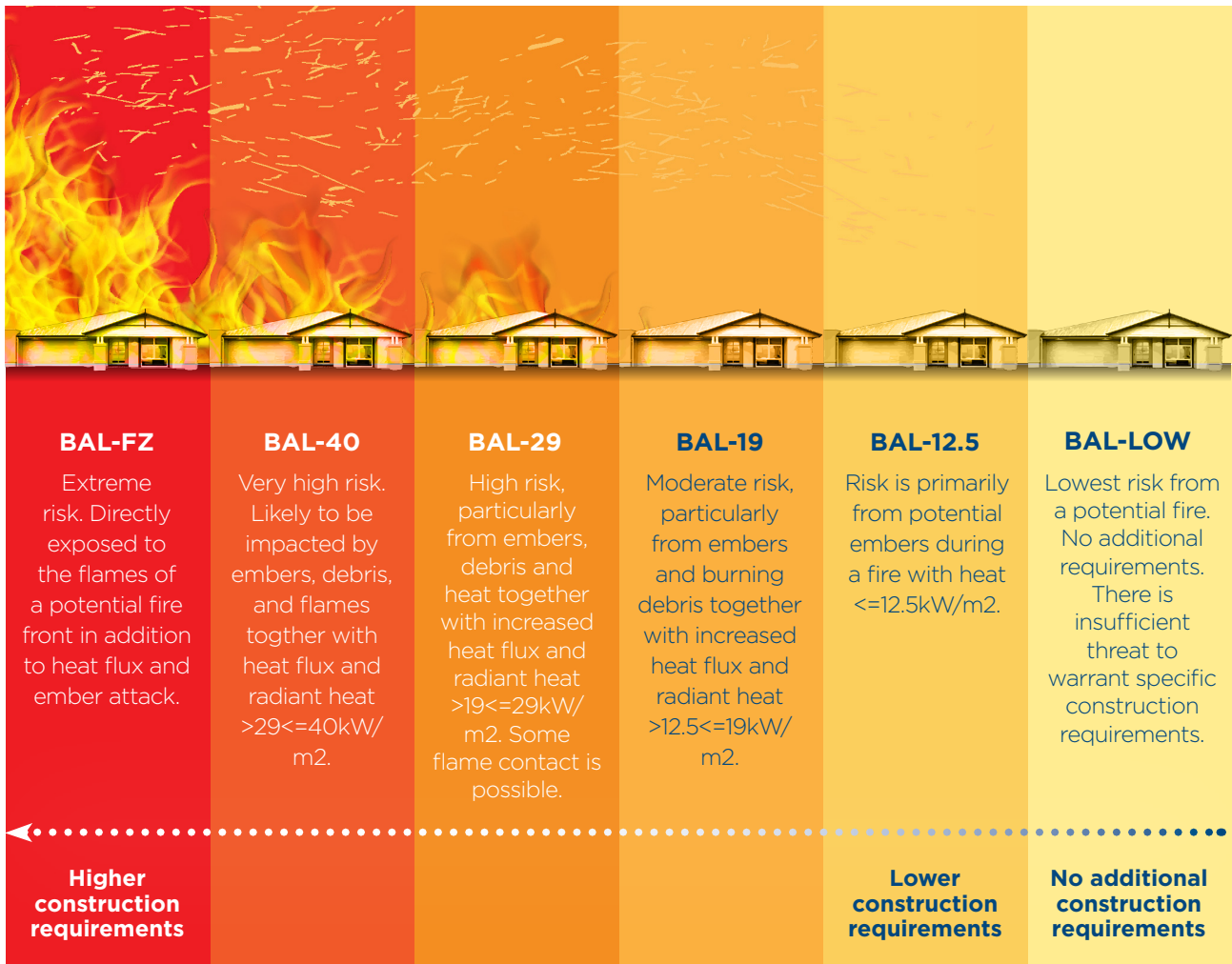
A Class 1 building or a Class 10a building that is constructed in a designated bushfire prone area must be designed and constructed to-

- Reduce the risk of ignition from a design bushfire with an annual exceedance probability not more than 1:50 years; and
- Take account of the assessed duration and intensity of the fire actions of the design bushfire; and
- Be designed to prevent internal ignition of the building and its contents; and
- Maintain the structural integrity of the building for the duration of the design bushfire.

The Bushfire Attack Level (BAL) assesses a building's potential vulnerability to ember attack, radiant heat, and direct flame contact during a bushfire event. It determines the required construction practice for bushfire protection and takes into consideration parameters such as the Fire Danger Index (FDI), land gradient and the proximity and type of vegetation surrounding the building.

There are six levels of bushfire attack defined in AS3959: 2018 Construction in Bushfire-prone Areas, ranging from low to flame zone (FZ). These six levels are described in general terms in the figure below.

The BAL rating is the responsibility of the building authority in the particular state/territory.

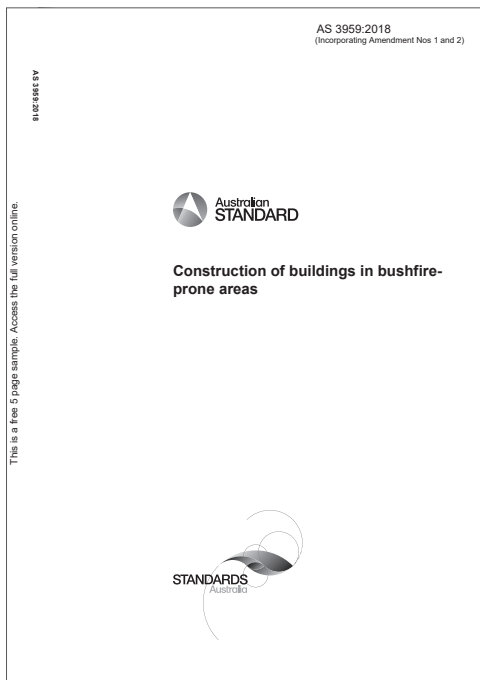


APPROACHES TO BUSHFIRE RESISTANT CONSTRUCTION

There are two independent Deemed-to-Satisfy (DtS) solutions for construction in designated bushfire prone areas, which take different approaches. These solutions are listed in NCC2022 Vol 2 H7D4 along with references to applicable State and Territory variations.

Note that example details are shown in this publication - please refer to the current published edition of each Standard for full details.

AS3959:2018 Construction of buildings in bushfire Prone Areas



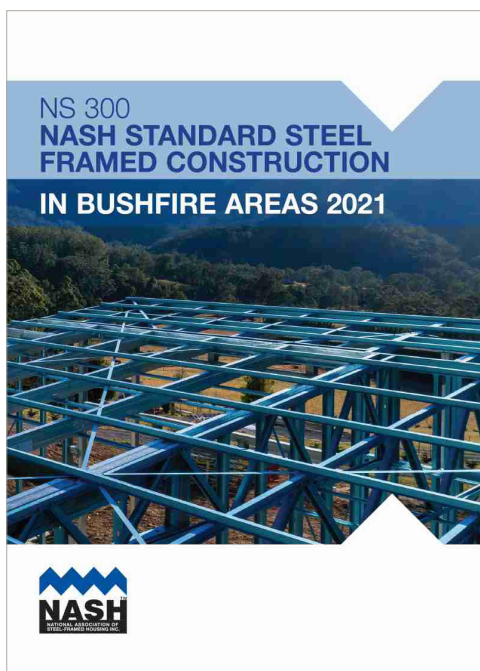
APPROACH

The standard specifies requirements for the construction of buildings in bushfire-prone areas **to improve their resistance to bushfire attack** from burning embers, radiant heat, flame contact and combinations of the three attack forms.

All gaps are to be sealed. Gaps 2mm or greater must be:

- Sealed by a non-combustible material (e.g. mineral wool or membrane); or
- Screened with a corrosion resistant ember guard with apertures less than 2mm.
- Roof and wall membranes must have a Flammability Index not greater than 5.
- Gaps backed by close-fitting, non-combustible insulation are considered sealed.

NASH NS300 - NASH Standard Steel Framed Construction in Bushfire Areas 2021



APPROACH

The standard sets out acceptable construction solutions for steel framed residential and low-rise buildings in bushfire prone areas **to reduce the risk of ignition from bushfire attack** involving embers, radiant heat and direct flame impingement **using non-combustible building materials** such as steel framing and cladding and/or other materials deemed by the NCC to be suitable where non-combustible materials are required.

The NASH bushfire standard provides two solutions: The first for BAL-12.5 to BAL-40 exposure (the focus of this document) and the second for BAL-FZ.

NASH bushfire standard can be purchased at: <https://nash.asn.au/product/nash-standard-for-steel-framed-construction-in-bushfire-areas-2021-ns300/>

Designers and building professionals should refer to the above standards for full details which include compliance and installation requirements for BAL-FZ.

Generally, the construction requirements specified for a particular BAL rating shall be acceptable for a lower BAL rating. Note that under both construction standards attached garages and sheds are to be included in the bushfire design if within 6m of the building. Note that construction

It is important to note that construction must follow either the NASH Standard pathway OR the AS3959 pathway. Pathway elements cannot be mixed, for example a wall constructed to AS3959 will not comply with a roof constructed to the NASH standard.

under the NASH Bushfire Standard pathway versus the AS 3959 pathway is more cost-effective for higher BAL zones, especially for steel roof construction in BAL-FZ

BlueScope Steel also has a guide which provides details for installers who are fixing COLORBOND® steel for roofing, walling, fascia and guttering together with TRUECORE® steel framing when buildings are designed using the NASH Bushfire Standard pathway in BAL-12.5 to BAL-FZ.



COMPLIANCE PATHWAYS - BAL-12.5 TO BAL-40

The pathway for compliance with either AS3959 or NASH should be detailed on the design plans together with the BAL rating. It is important that installers are aware of the compliance pathway being followed as this impacts the installation process and accessories required.

The choice of framing and cladding materials will have an impact on the construction approaches available.

FRAMING

As timber is deemed combustible, timber framed structures need to follow the AS3959 design standard and require additional measures to improve resistance to bushfire attack.

Steel framing is deemed non-combustible and hence construction of steel framed homes has the option of construction following the NASH Bushfire standard using non combustible building materials.

ROOF & WALL CLADDING MATERIALS

Steel cladding, being non-combustible, is an excellent choice for use in bushfire prone areas. No additional provisions are required when installing steel roofing and wall cladding under the NASH Bushfire pathway. However, given timber framed construction is deemed combustible,

additional accessory components are required when installing steel roof and wall claddings as set out in AS3959. Options are:

- Use sarking or blanket and foil (most common). Sarking materials should have a minimum flammability index of 5 as per AS1520.2. When used, these must be located over all framing and battens across the entire roof area and extend into gutters and valleys; or
- Any gaps must be sealed at the fascia or wall line, hips and ridges by suitable mesh, mineral wool and/or other non-combustible material or
- use systems tested to AS1530.8.1.

Insulated panels are considered combustible unless tested and certified to AS1530.8.1 (note that certified insulated panel systems are available and hence can be treated as “non-combustible” components).

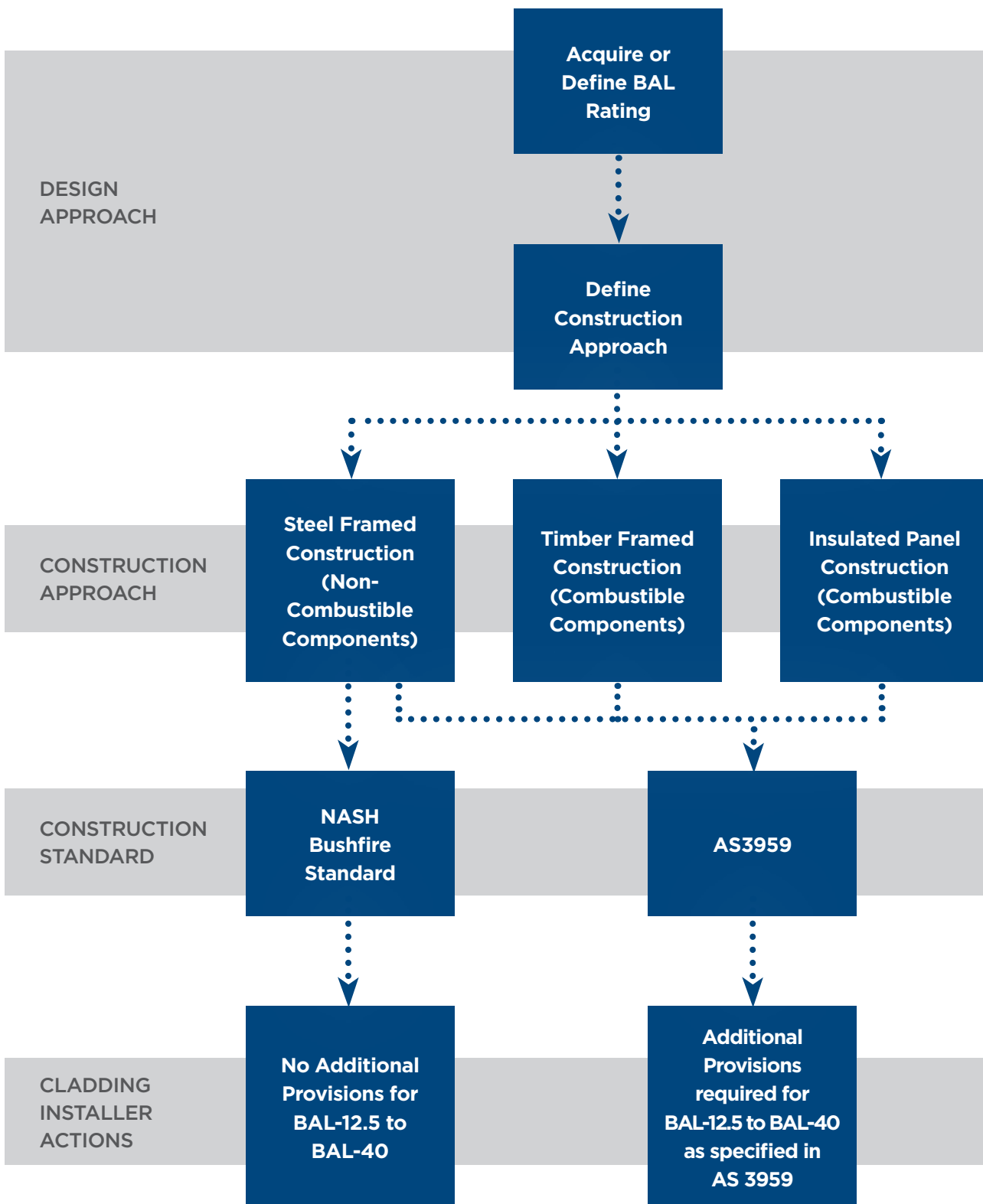
Note that bushfire design must incorporate condensation management provisions* BAL rated high-level and low-level vents are required in bushfire prone areas along with appropriate maintenance.

*As defined in NCC2022 Housing Provision Standards Clauses 10.8.2 & 10.8.3

COMPLIANCE PATHWAYS FLOWCHART BAL-12.5 TO BAL-40

The flowchart below outlines the process to determine the available compliance pathway from a construction approach i.e., combustible or non-combustible framing and roof and wall cladding components.

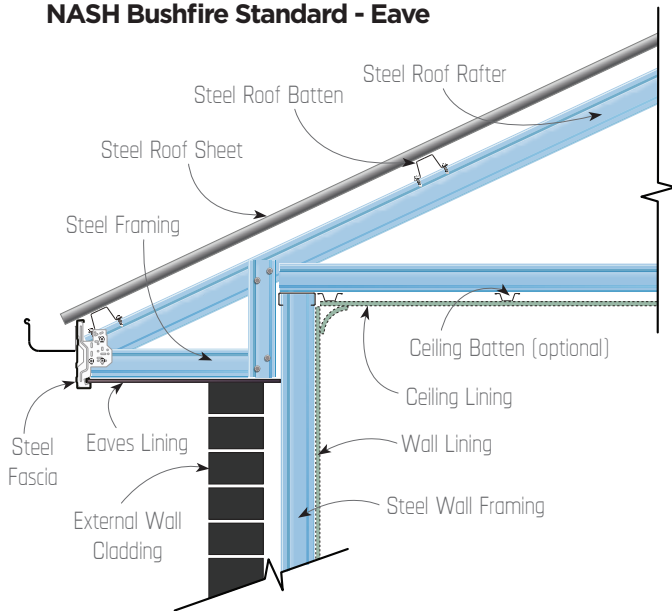
The top of the flowchart provides context for designers. The bottom of the flowchart identifies Construction Standards and provisions relevant for builders and installers.



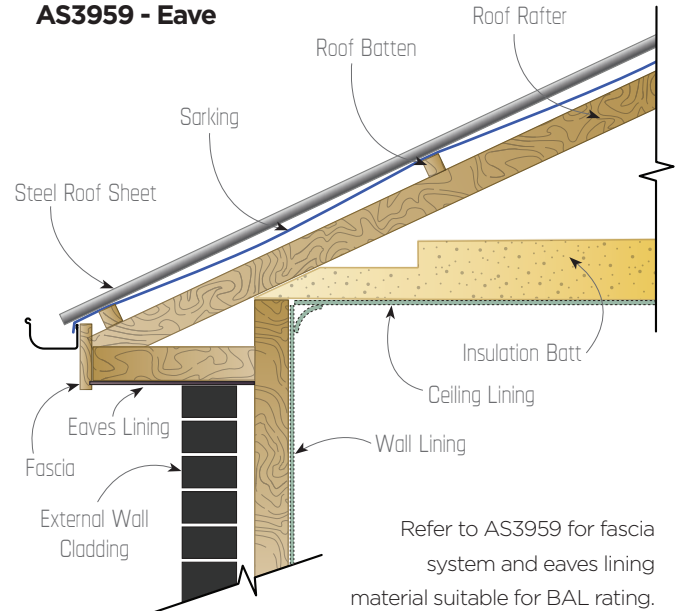
ROOF DETAILING FOR BAL-12.5 TO BAL-40

Examples of construction details for steel roofs under NASH Bushfire Standard and AS3959 pathways are provided below. Note that blanket and foil or membrane can be used under the NASH Bushfire Standard to increase thermal performance, but is not mandatory for bushfire control.

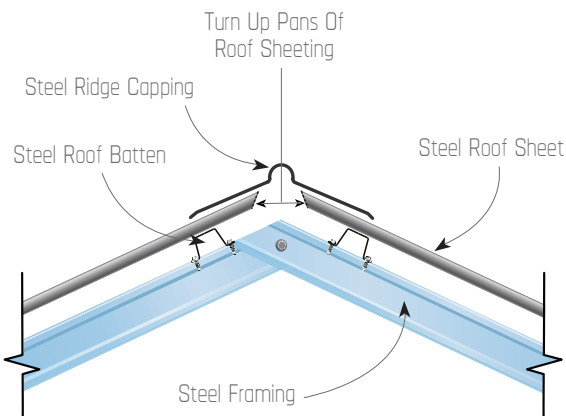
NASH Bushfire Standard - Eave



AS3959 - Eave

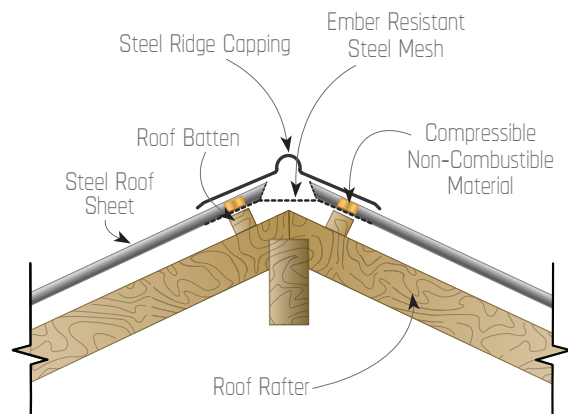


NASH Bushfire Standard - Ridge & Hip



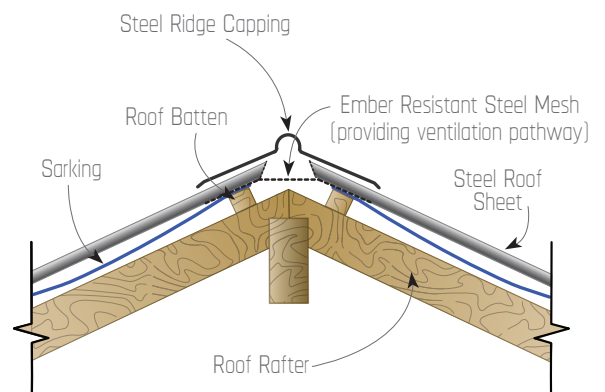
AS3959 - Ridge & Hip

OPTION 1 - Using Mesh



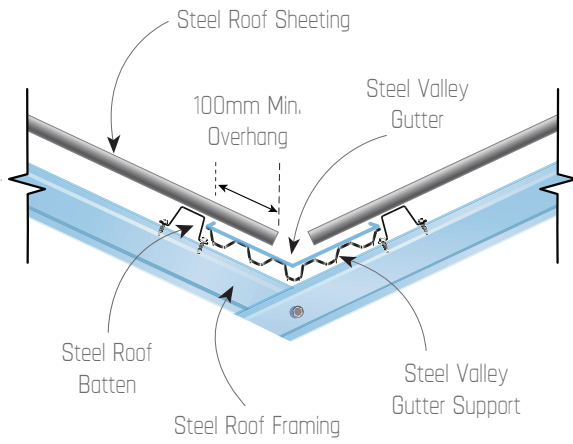
AS3959 - Ridge & Hip

OPTION 2 - Using Mesh and Sarking

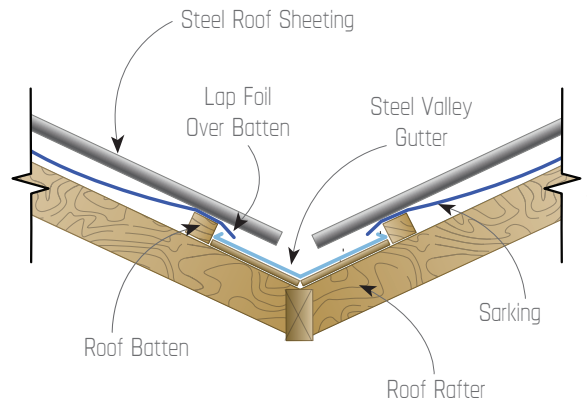


It is important to note that construction must follow either the NASH Standard pathway OR the AS3959 pathway as they are NOT INTERCHANGEABLE. Pathway elements cannot be mixed, for example a wall constructed to AS3959 will not comply with a roof constructed to the NASH standard.

NASH Bushfire Standard - Valley



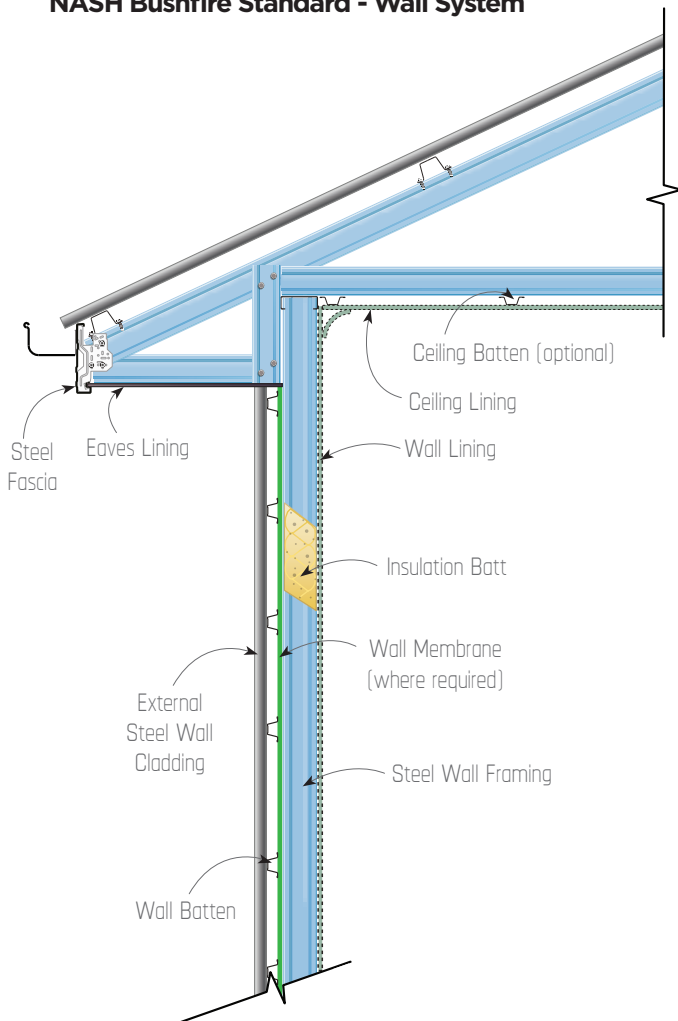
AS3959 - Valley



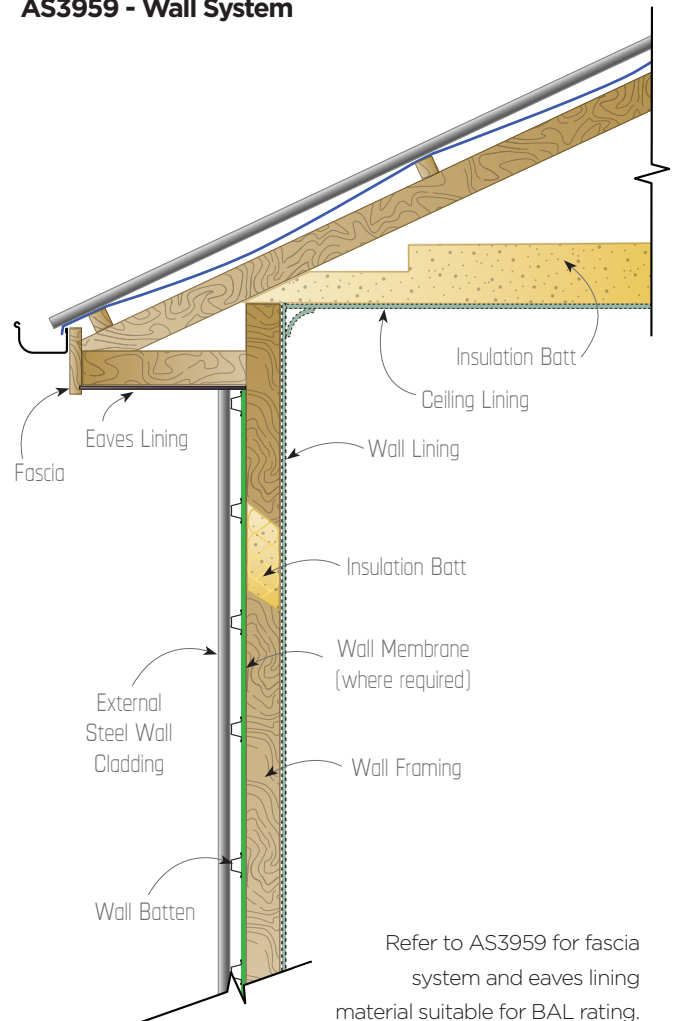
WALL DETAILING FOR BAL-12.5 TO BAL-40

Examples of construction details for steel clad walls under NASH Bushfire Standard and AS3959 pathways are provided below:

NASH Bushfire Standard - Wall System



AS3959 - Wall System



Refer to AS3959 for fascia system and eaves lining material suitable for BAL rating.

BENEFITS OF STEEL IN BUSHFIRE DESIGN - CASE STUDIES

FORTIS House

FORTIS House is an initiative headed by the Resilient Building Council (RBC) in response to the 2019-20 Black Summer bushfires. The project has delivered house designs and a set of building principles for extreme weather and disaster resilience, sustainability, self-sufficiency and quality.⁴

FORTIS House incorporates non-combustible construction approaches such as those defined in the NASH bushfire standard – often utilising steel components (e.g. light gauge steel framing, and steel roofing and wall cladding products). An example of this can be seen by the FORTIS house design⁵ – The Conjola



⁴ <https://fortishouse.org/about-fortis/>

⁵ <https://fortishouse.org/fortis-design/>

Steel Fencing

The CSIRO's research and investigation into the performance of residential boundary fencing in bushfires ⁶ found that "a steel fence offers greater protection to people's homes against bushfire than other alternative materials because of its non-combustibility"

Of the different materials tested, pre-painted and metallic coated sheet steel (in this case made from COLORBOND® steel) performed best under all exposure conditions and in particular when faced with a 30 minute flame immersion test used to stimulate potential effects of an adjacent house fire, which is common during bushfire events."

A review of the Shoalhaven NSW bushfires that occurred in 2019 further demonstrated the effectiveness of steel fencing as a radiant heat barrier for bushfire protection. ⁷

Steel fencing was proposed as a potential strategy to help mitigate building to building fires. "In Conjola Park it was estimated that 60% of all building losses occurred through building to building fires.



⁶ <https://cdn.dcs.bluescope.com.au/download/bushfire-crc-csiro-fencing-report>

⁷ Image & Reference: Colin Wood – Shoalhaven City Council Bushfire Study Review (NSW 2019)

DEFINITIONS

- Bushfire Attack Level (BAL) - a means of measuring a building's potential exposure to ember attack, radiant heat and direct flame contact, in a bushfire event.
- Combustible - combustible as determined by AS 1530.1
- Fire Danger Index (FDI) - the chance of a fire starting, its rate of spread, its intensity and the difficulty of its suppression according to prevailing conditions.
- National Construction Code (NCC), published by the Australian Building Codes Board - performance-based code, containing all performance requirements for the construction of buildings in Australia.
- Non-combustible - not deemed combustible as determined by AS 1530.1 or not deemed combustible in accordance with the NCC.
- Mineral wool - a fibrous bulk insulating material typically composed of rock or glass fibres bound with polymer resin used in walls and ceilings. Trade names include Rockwool® and Glasswool®.
- Heat Flux is the rate of heat energy transferred per surface unit area - kW/m².
- Radiant Heat is the heat that emanates from a fire. Radiant heat travels in a straight line and is invisible to the naked eye. Radiant heat can dry and ignite fuels, and can be fatal in a bushfire. Radiant heat can be felt up to 150m from the fire. (Source CSIRO)
- Design bushfire is referenced in the Verification Method used to develop Performance Solutions. It refers to the characteristics of a bushfire, its initiation, spread and development, which arises from weather conditions, topography and fuel (vegetation) in a given setting, used to determine fire actions.
(Source [NCC-2022-Bushfire-Verification-Methods-Handbook-FA.pdf](#))



NASH is an Australian industry association representing the interests of fabricators, material suppliers and customers of cold-formed steel structural framing systems for residential and similar construction. NASH develops Standards, Handbooks and Technical Notes for use by the industry and NASH Standards are referenced as Deemed-to-Satisfy solutions in the National Construction Code.

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The Voice of Australian Steel

The Australian Steel Institute (ASI) is the nation's peak body representing the entire Australian steel supply chain from the manufacturing mills right through to end users in building and construction, heavy engineering and manufacturing.

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