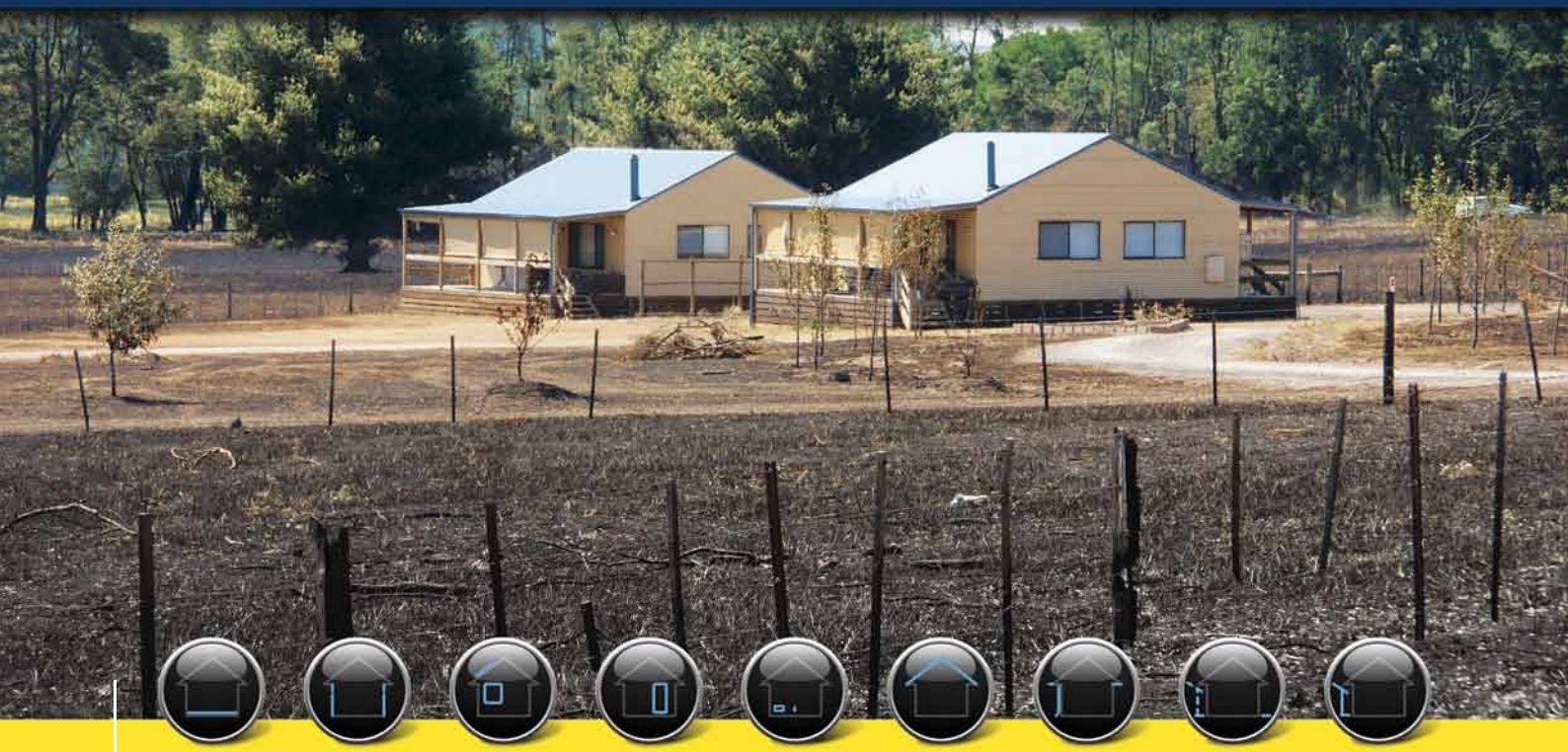
A guide to retrofit your home for better protection from a bushfire

Building and renovation ideas to better prepare your home in a bushfire situation.



Prepare. Act. Survive.

Use these building ideas as part of your overall bushfire survival plan.

CFA | PREPARE. ACT. SURVIVE. FireReady | State Government Victoria | Building Commission | Victoria We will rebuild

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- Walls and Fascias

- Windows (including skylights)

- External Doors

- Vents and Weepholes

- Roofs

- Eaves, Gutters and Downpipes

- Unenclosed external structures connected to the house (carports, decks, verandas, pergolas etc)

- Enclosed external structures within 6 metres of the house (garages, sheds etc).

A guide to retrofit your home for better protection from a bushfire

Introduction

FOLLOWING THE DEVASTATING BUSHFIRES OF FEBRUARY 2009, MANY PEOPLE WHO WERE NOT LIVING IN THE AFFECTED AREAS OR WHO SUFFERED MINOR PROPERTY DAMAGE ARE REASSESSING THEIR PREPAREDNESS.

The introduction of building regulations that require consideration of bushfire protection measures to Australian Standard 3959-2009 (AS 3959) mean that residents who are rebuilding or renovating now have a clear direction on how to increase protection to their homes. However, the majority of residences in bushfire prone areas pre-date those regulations, meaning existing houses are unlikely to achieve the increased levels of bushfire protection delivered by the new Standard.

The Building Commission and Country Fire Authority (CFA) have joined together to provide practical advice to those who wish to upgrade their existing homes to be better protected from bushfires. A range of options exist and this guide is divided into two parts; retrofit for generic ember protection and retrofit protection for various Bushfire Attack Levels (BAL), based upon the Standard.

Although this guide is designed to improve the performance of homes when subjected to bushfire attack there can be no guarantee that a building will survive a bushfire event. This is substantially due to the unpredictable nature and behaviour of fire and the difficulties associated with extreme weather conditions.

While this guide identifies available construction protection methods as per AS 3959, it should be clearly understood that such building enhancements are complementary to good site preparation and vegetation management in the context of your bushfire survival plan.

Reducing the risk from bushfire comprises a number of processes and tasks:

1. Assessing and managing site vegetation
2. Defendable space assessment and maintenance
3. Provision and maintenance of active protection equipment
4. Construction safety measures as outlined in this brochure

While your response to each of these elements will depend upon your circumstances, each should be considered in developing an appropriate bushfire strategy. This guide is provided to assist with retrofitting of existing homes only and is not intended to be a comprehensive bushfire assessment or compliance advice. More information relating to steps 1 to 3 can be found in the CFA's FireReady Kit.

This retrofit guide only applies for categories up to BAL 29. BAL 40 and BAL FZ are considered to be very high to extreme bushfire risk and therefore homes in these categories are not usually suitable for retrofit upgrades. See page 25 for more information if your home is in these categories.

The information contained within this guide and advice from Registered Building Practitioners will help you decide whether you retrofit your existing home and to what extent. You should consult with experts in this field, use Registered Building Practitioners (where required) and obtain three quotes.

For other relevant bushfire references and resources visit:

- **www.cfa.vic.gov.au**
- **www.buildingcommission.com.au**

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Is Retrofitting Mandatory?

RETROFITTING IS NOT MANDATORY. EACH FEATURE CAN BE APPLIED DEPENDING ON YOUR INDIVIDUAL NEEDS AND THE LEVEL OF FIRE PROTECTION DESIRED.

Each retrofitting measure is a step towards making your home safer against the impact of embers and radiant heat in the event of a bushfire. If you want your home to be comparable to the construction requirements under AS 3959, then ALL the works associated with a particular BAL category will need to be undertaken.

From 11 March 2009, the Victorian building regulations prescribed that all new homes must be designed, constructed and located with improved bushfire protection. The Victorian Government adopted these building regulations to expedite the rebuilding of bushfire affected homes without compromising safety.

The bushfire building regulations do not include mandatory retrofitting. This will be a decision that each home owner will need to make; taking into consideration recent events, your home's current level of protection, your location and home site.

Routine maintenance is an important part of bushfire protection for your home, out-buildings and garden. For example, if a window/door metal shutter is fitted, it needs to work at the time of a bushfire threat just like your fire equipment needs to be ready to go.

Retrofitting your home to reduce your bushfire risk can also result in improved noise and climate control.

Bushfire Risk

BUSHFIRES KILL. EVEN WELL-PREPARED HOMES CAN BE DESTROYED BY A BUSHFIRE.

Survival must be your main priority. The only sure way to survive a bushfire is to be well away from the threat.

Bushfire behaviour

Bushfire behaviour is influenced by several key environmental factors.

Victoria has adopted the new nationally agreed Fire Danger Ratings. These ratings recognise the significant increase in severe bushfire conditions over the past decade and the heightened level of danger to the community, as experienced on Saturday 7 February 2009.

Fire Danger Index

Every day during the fire season the Bureau of Meteorology (BoM) forecasts an outlook of the fire danger index (FDI) by considering elements of the predicted weather including temperature, relative humidity, wind speed, and dryness of vegetation. When determining the Fire Danger Rating, fire agencies, in consultation with the BoM, consider a range of other factors relating to that area and day.

These factors include:

- **The length of time the fire danger index has been elevated**
- **Extent of fire already in the landscape**
- **Fuel and dryness**
- **Likelihood of weather events such as lightning**
- **Grass fuel conditions.**

Fire Danger Rating (FDR)

A Fire Danger Rating is a prediction of fire behaviour, including how hard it would be to put out a fire once it starts. It provides information on:

- **The sort of bushfire behaviour that could be experienced on that day**
- **The type of threat bushfires may pose to life and property on any day given the forecast weather conditions.**

Vegetation and location

Vegetation and location significantly impacts on fire intensity. In addition to the FDI on the day of a fire, the type and arrangement of vegetation in proximity to your home will play a significant factor in determining the impact and effects of bushfire that you are likely to experience. The CFA FireReady Kit provides comprehensive advice in relation to these factors so that you can understand your individual bushfire risk environment.

Spread mechanisms

Bushfire spreads via three key mechanisms:

1. **Ember attack**
2. **Radiant heat**
3. **Direct flame contact**

The FDI and proximity of your home to vegetation and the firefront will determine whether or not you experience all three of these mechanisms, a limited combination or ember attack alone during a bushfire event.

Understanding the type of bushfire behaviour that you might experience at your site will provide you with an appreciation of the extent of site preparation and construction features that you may wish to employ for your home. The Building Commission and CFA recommend that you take particular interest in identifying your bushfire risk prior to considering the application of protection methods in this guide.

BUSHFIRE ATTACK LEVEL (BAL)

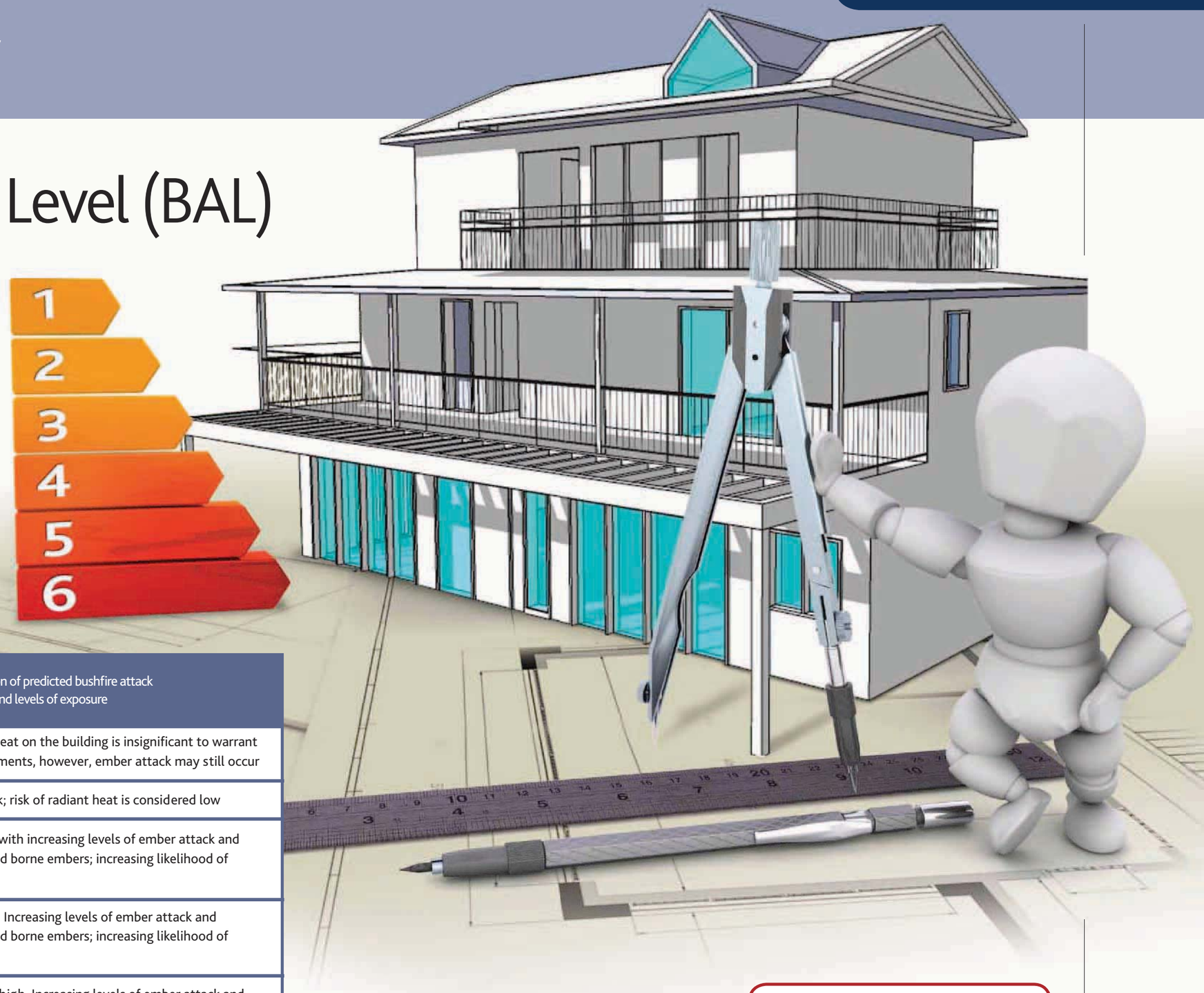
A guide to retrofit your home for better protection from a bushfire

Bushfire Attack Level (BAL)

THE NEW STANDARD CONTAINS SIX BUSHFIRE RISK CATEGORIES.

The categories are based on sophisticated scientific modelling that includes assessing the homes' construction type, radiant heat performance, proximity to outbuildings, slope of the land, vegetation type and fire shielding. This provides a more detailed risk assessment for each individual building site.

AS 3959 prescribes minimum construction requirements based on the determination of a Bushfire Attack Level (BAL). In addition to ember attack, each BAL is based on heat flux exposure thresholds. BAL-LOW is the lowest risk category and there are no additional construction requirements for this category; and BAL-FZ (Flame Zone) is the highest risk category. Refer to the table below for descriptions.



Bushfire Attack level (BAL)	Radiant Heat Exposure (AS 3959)	Description of predicted bushfire attack and levels of exposure
BAL – LOW	Insignificant	The risk is very low, radiant heat on the building is insignificant to warrant specific construction requirements, however, ember attack may still occur
BAL – 12.5	0 to 12.5 kW/m2	Primarily risk of ember attack; risk of radiant heat is considered low
BAL – 19	12.5 to 19 kW/m2	Risk is considered moderate with increasing levels of ember attack and burning debris ignited by wind borne embers; increasing likelihood of exposure to radiant heat
BAL – 29	19 to 29 kW/m2	Risk is considered to be high. Increasing levels of ember attack and burning debris ignited by wind borne embers; increasing likelihood of exposure to radiant heat
BAL – 40	29 to 40 kW/m2	Risk is considered to be very high. Increasing levels of ember attack and burning debris ignited by wind borne embers; increasing likelihood of exposure to radiant heat and some direct exposure to flames possible
BAL – FZ	40 kW/m2plus (Flame Contact)	Risk is considered to be extreme. Direct exposure to flames from fire front is likely in addition to high levels of radiant heat exposure and ember attack

To put these exposure levels into perspective, a radiant heat flux exposure of 6.4 kW/m2 will result in pain after approximately eight seconds skin exposure. So even at lower BAL categories, significant danger to people will still exist and external conditions may be too extreme for human survival in the short term.

To undertake a BAL assessment of your site, refer to the methodology in AS 3959. It is encouraged that you engage a Registered Building Practitioner or other suitably trained professional to assist in determining the BAL for your site.

Cost & Implementation Guide

The cost and implementation of retrofitting existing homes for bushfire protection measures will vary significantly depending on factors, such as:

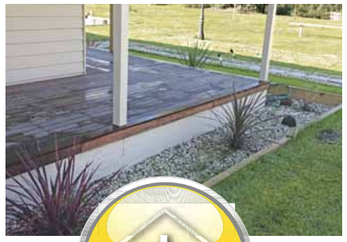
- **The existing construction methods and materials used in the building**
- **The age of the building**
- **Access around the building and the height of the building above surrounding ground**
- **Location and access to suitable tradespersons and material suppliers so that competitive pricing can be obtained**
- **Whether any heritage or other controls apply to the building.**

Owners are also cautioned that existing buildings may contain materials made from asbestos or have painted surfaces that contain lead. These materials should be handled in accordance with appropriate guidelines. Depending on the construction of your home, some retrofitting measures will be more or less expensive than others.

COST & IMPLEMENTATION GUIDE

A guide to retrofit your home for better protection from a bushfire

Examples of improvements that can be retrofitted to existing homes:



Low Cost	Moderate Cost	High Cost
Sealing all small gaps around the house with appropriate joining strips or a flexible silicon based sealant	Installing shutters or metal flyscreens to doors and windows to BAL 29	Replacing wall, fascia, roof or floor materials with non-combustible or bushfire resistant materials
Installing sarking behind weatherboards or other external cladding when they are being replaced for maintenance or other reasons	Application of product to timber to increase its resistance to fire	Installing sarking behind weatherboards or other external cladding when they otherwise would not have been replaced
Installing sarking beneath existing roofing when it is being replaced for maintenance or other reasons	Installing a sprinkler system	Installing sarking beneath existing roofing when it otherwise would not have been replaced
Replacing or overcladding parts of door frames less than 400mm above the ground, decks and similar elements or fittings with bushfire resisting timber or metal etc.	Separate external structures within six metres of the house with a 60/60/60 fire resistant wall	Replacing glass with toughened or laminated safety glass
Installing weather strips, draught excluders or draught seals at the base of side-hung doors	Replace decking with non-combustible material	Installing a private bushfire shelter
Sealing vents and weepholes in external walls with mesh of corrosion-resistant steel, bronze or aluminium	Replace external doors with non-combustible or solid timber doors with minimum thickness of 35mm	Installing tested shutters or metal flyscreens to doors and windows for BAL 40 and FZ
Sealing around roofing and roof penetrations	Enclose subfloor with non-combustible material	Replace overhead glazing with 'Grade A' safety glass

A guide to retrofit your home for better protection from a bushfire

Retrofit provisions relating to ember attack

EMBER ATTACK CAN OCCUR OVER DISTANCES GREATER THAN 100 METRES FROM THE FIRE FRONT. ANY GAPS, CRACKS OR AREAS WHERE EMBERS AND FUEL CAN LODGE SIGNIFICANTLY REDUCES THE HOME'S RESISTANCE TO BUSHFIRE.

The Victorian Bushfires Royal Commission 2009 recorded that: 'Post bushfire surveys in Australia have consistently found that most houses ignite and burn due to wind borne embers. Unlike direct flame exposure and radiant heat flux…ember attack is a threat at all BALs…hence, measures designed to prevent ignition by embers are key measures across the board.' Research consistently identifies that over 85 per cent of houses destroyed by bushfire was due to ember attack.

Retrofit construction requirements have been considered in this section where they specifically relate to ember attack. This is considered to represent a minimum level of bushfire resistance for homes.

BAL-40 and direct flame BAL-FZ are not referenced here, see page 25 for more information.

Flooring Systems
– Up to and including BAL 29

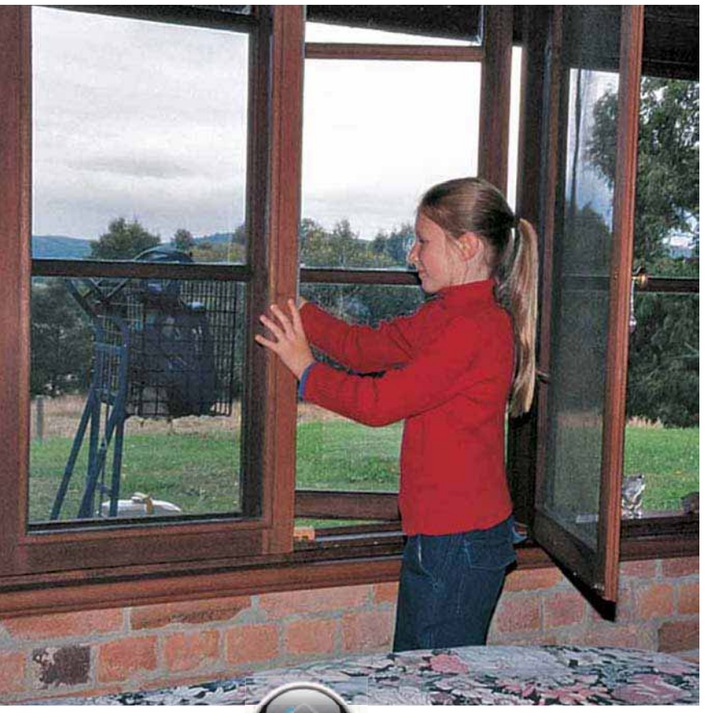
- **Enclose existing sub floors with suitable materials or construct the floor and structure with non-combustible materials to provide resistance to bushfire where the flooring is less than 400mm above the ground. Refer to page 20 - Flooring systems.**
- **While this is not required for lower BAL categories, implementation may be beneficial.**

Walls and Fascias
– Up to and including BAL 19

- **Replace or cover external surfaces of walls that are less than 400mm above the ground, decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending greater than 110mm in width with:**
  - Non-combustible materials; or
  - Fibre cement external cladding with a 6mm minimum thickness; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F; or
  - A timber species as specified in AS 3959 Appendix E; or
  - A combination of the above.
- **Cover, seal, overlap, back or butt-joint all joints in the external surface material of walls to prevent gaps greater than 3mm.**
- **Apply sarking-type material over the outer face of the building frame prior to re-fixing of any external cladding. Note: sarking should not be considered a replacement for sealing gaps but is useful as a backup if gaps occur.**

BAL 29

- **Replace or cover external walls at all heights with:**
  - Non-combustible materials (such as masonry, brick veneer, mud brick, concrete, aerated concrete, etc); or
  - Timber or steel-framed walls that are sarked on the outside of the frame and clad with:
    - > Fibre cement external cladding with a 6mm minimum thickness; or
    - > Steel sheet; or
    - > Bushfire resisting timber as specified in AS 3959 Appendix F.



Windows (Including skylights)

– Up to and including BAL 29

- **Protect window assemblies with:**
  - External screens [1] ; or
  - Bushfire shutters.
- **If located less than 400mm above the ground: decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending greater than 110mm in width should be made from:**
  - Bushfire resisting timber as specified in AS 3959 Appendix F; or
  - A timber species as specified in AS 3959 Appendix E; or
  - Metal; or
  - Metal-reinforced PVC-U; or
  - A combination of the above.
- **External hardware to windows required for opening should be metal.**
- **Where windows are not protected with external screens or bushfire shutters:**
  - Glazing less than 400mm above the ground, decks, carport roofs, awnings and similar elements should be 4mm (or thicker) 'Grade A' safety glass[2] ; and
  - Glazing above 400mm may be annealed glass; and
  - External screens should be provided to openable portions of the window; or
  - Glass blocks may be used for glazing of any height, without screens.
- **Where fitted, check that your bushfire shutters comply with AS 3959 and are made from:**
  - Non-combustible materials; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F; or
  - A timber species as specified in AS 3959 Appendix E; or
  - A combination of the above.
- **Where fitted, screens for windows and doors should comply with AS 3959 and have a mesh or perforated sheet with a maximum aperture of 2mm and made of corrosion-resistant steel, bronze or aluminium. Gaps around the perimeter of the screen to the building should not exceed 3mm. The frame supporting the mesh or perforated sheet should be:**
  - Metal; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F; or
  - A timber species as specified in AS 3959 Appendix E; or
  - A combination of the above.

External Doors

– Up to and including BAL 29

- **Protect side hung external doors with one of the following:**
  - External screens (see Windows); or
  - Bushfire shutters (see Windows); or
  - Neither of the above if the door is:
    - > Non-combustible; or
    - > A solid timber door with a minimum thickness of 35mm for the first 400mm above the threshold; or
    - > A hollow core door with a non-combustible kickplate for the first 400mm above the threshold; or
    - > A fully-framed glazed door with the frame constructed of a bushfire resisting timber as specified in AS 3959 Appendix F; or a timber species specified in AS 3959 Appendix E[2].
  - External hardware to doors required for opening should be metal.
  - Glazing in doors should comply with the glazing requirements for windows. (see page 12 of this brochure)
  - Parts of door frames less than 400mm above the ground, decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending greater than 110mm in width should be made of the following:
    - > Bushfire resisting timber as specified in AS 3959 Appendix F; or
    - > A timber species as specified in AS 3959 Appendix E; or
    - > Metal; or
    - > Metal-reinforced PVC-U; or
    - > A combination of the above.
  - Weather strips, draught excluders or draught seals could be installed at the base of side hung doors (gaps to the perimeter should generally be less than 3mm).
- **Protect external sliding doors with one of the following:**
  - External screens (see windows); or
  - Bushfire shutters (see windows); or
  - Neither of the above, if:
    - > Any glazing within the door is 'Grade A' safety glass; and
    - > The frame of the door and any glazing within the door is made of the following:
      - » Bushfire resisting timber as specified in AS 3959 Appendix F; or
      - » A timber species as specified in AS 3959 Appendix E; or
      - » Metal; or
      - » Metal-reinforced PVC-U.
- **Alter vehicle access (garage) doors with the following:**
  - All parts of doors less than 400mm above the ground level should be made from:
    - > Non-combustible materials; or
    - > Fibre cement external cladding with a 6mm minimum thickness; or
    - > Bushfire resisting timber as specified in AS 3959 Appendix F; or
    - > A timber species as specified in AS 3959 Appendix E2; or
    - > A combination of the above.
  - Panel lift, tilt and side-hung doors should be fitted with suitable weather-strips, draught excluders, draught seals or guide tracks (as appropriate), with a maximum gap size of 3mm.
  - Roller doors could have guide tracks with a maximum gap area of 3mm and be fitted with a nylon brush in contact with the door.
  - Doors should not include ventilation slots.

[1] *External screens are required in addition to other measures for BAL 29 and above.*

[2] *Glazing thickness increases progressively for BAL 19 and above.*

A guide to retrofit your home for better protection from a bushfire

Vents and Weepholes
– Up to and including BAL 29

- **Seal vents, weepholes and other openings greater than 3 mm in external walls with a mesh having a maximum aperture of 2mm and made of corrosion-resistant steel, bronze or aluminium.**

Roofs – Up to and including BAL 29

- **Check roof tiles, sheets and covering accessories are non-combustible.**
- **Seal the roof and wall junction to fill gaps greater than 3mm, either by the use of fascia and eaves linings or by sealing the top of the wall to the rafters at the line of the wall.**

- **Fit ember guards over roof ventilations points (such as gable and roof vents) with non-combustible material, mesh or perforated sheet with a maximum aperture of 2mm and made of corrosion-resistant steel, bronze or aluminium.**
- **Fully sark sheet and tiled roofs by the following:**
  - The sarking material should have a flammability index of not more than 5; and
  - Be located directly below the roof battens; and
  - Cover the entire area of the roof (including the ridge); and
  - Be installed to eliminate gaps where the sarking meets fascias, gutters, valleys etc; and
  - Sheet roofs may use foil backed insulation blankets over the battens.
- **Alternatively for sheet roofs: protection may be provided by sealing any gaps greater than 3mm at the fascia, wall line, valleys, hips and ridges – under corrugations or ribs of roof sheeting, or between roof components with:**
  - A mesh or perforated sheet with a maximum aperture of 2mm and made of corrosion-resistant steel, bronze, or aluminium; or
  - Mineral wool; or
  - Other non-combustible material; or
  - A combination of the above.
- **The recommendations for veranda, carport and awning roofs should be as the main roof (described above).** Roof penetrations:
  - Penetrations (including roof lights, roof ventilators, roof-mounted evaporative cooling units, aerials, vent pipes and supports for solar connectors) should be sealed with a non-combustible material at the roof to prevent gaps greater than 3mm.
  - Openings in vented roof lights, roof ventilators, or vent pipes should be fitted with ember guards made from perforated sheet with a maximum aperture of 2mm and made of corrosion-resistant steel, bronze or aluminium.
  - All overhead glazing should be 'Grade A' safety glass.
  - Glazed elements in roof lights and sky lights may be constructed of polymer provided that:
    - > A 'Grade A' safety glass diffuser is installed below the glazing; or
    - > A 4mm minimum thickness pane of 'Grade A' glass is installed in the outer pane of an Insulated Glazing Unit (IGU).
  - Flashing elements of tubular skylights [3] may be of fire-retardant material (in lieu of non-combustible) provided the roof integrity is maintained by an under-flashing material having a flammability index no greater than 5.
  - Evaporative cooling units should be fitted with butterfly closers at or near the ceiling level; or the unit should be fitted with non-combustible covers with a mesh or perforated sheet, having a maximum aperture of 2mm and made of corrosion resistant steel, bronze or aluminium.

[3] Tubular skylights are not permitted for BAL 29 and above unless it is a tested system to AS 1530.8.1.

Eaves, Gutters & Downpipes
– Up to and including BAL 29

- **Protect eaves penetrations as per roof penetrations.**
- **For eaves penetrations with openings greater than 3mm fit ember guards made of a non-combustible material, or with a mesh or perforated sheet, having a maximum aperture of 2mm and made of corrosion resistant steel, bronze or aluminium.**
- **Ensure box gutters are non-combustible and flashed at the junction with the roof with non-combustible material.**
- **Where installed, check gutters and valley leaf guards are non-combustible.**
- **Gables should be protected as per the requirements for walls.**
- **Above-ground, exposed water and gas supply pipes should be metal.**

Unenclosed external structures connected to the house
– Up to and including BAL 29

- **Check the space(s) between decking and the house is less than 3mm.**
- **Materials used to enclose sub-floor spaces less than 400mm from the ground should be provided in accordance with the recommendations for external walls.**
- **Decking, stair treads and trafficable surfaces of ramps and landings that are less than 300mm (measured horizontally at deck level) or 400mm (measured vertically) from the surface of the deck should be made from:**
  - Non-combustible materials; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F; or
  - A timber species as specified in AS 3959 Appendix E; or
  - PVC-U; or
  - A combination of the above.
- **Where glazed elements (windows, doors etc) are located less than 400mm vertically (above) and 300mm horizontally (across) from decking, stair treads or trafficable surfaces of ramps and landings, the surface of the deck should be made from:**
  - Non-combustible materials; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F; or
  - A timber species as specified in AS 3959 Appendix E; or
  - A combination of the above.

Enclosed external structures within six metres of the house
– Up to and including BAL 29

- **External structures should be constructed in accordance with the general building provisions for ember attack listed above.**

Retrofit provisions for radiant heat exposure corresponding to BAL-LOW

The risk of bushfire attack in BAL- LOW categories is minimal, as prescribed in AS 3959, based on low threat vegetation and non-vegetated areas within 100 metres of the house. For this reason, there are no specific bushfire construction requirements recommended for this category.

However, retrofit upgrades may be considered for existing homes using the ember attack section of this guide.

Retrofit provisions for radiant heat exposure corresponding to BAL-12.5

Flooring systems

- Construction recommendation as per ember attack could be considered.

Walls and Fascias

- Construction recommendation as per ember attack could be considered.

Windows (including skylights)

- Construction recommendation as per ember attack could be considered.

External doors

- Construction recommendation as per ember attack could be considered.

Vents and Weepholes

- Construction recommendation as per ember attack could be considered.

Roofs

- Construction recommendation as per ember attack could be considered.

A guide to retrofit your home for better protection from a bushfire

Eaves, Gutters and Downpipes

- Construction recommendation as per ember attack could be considered.

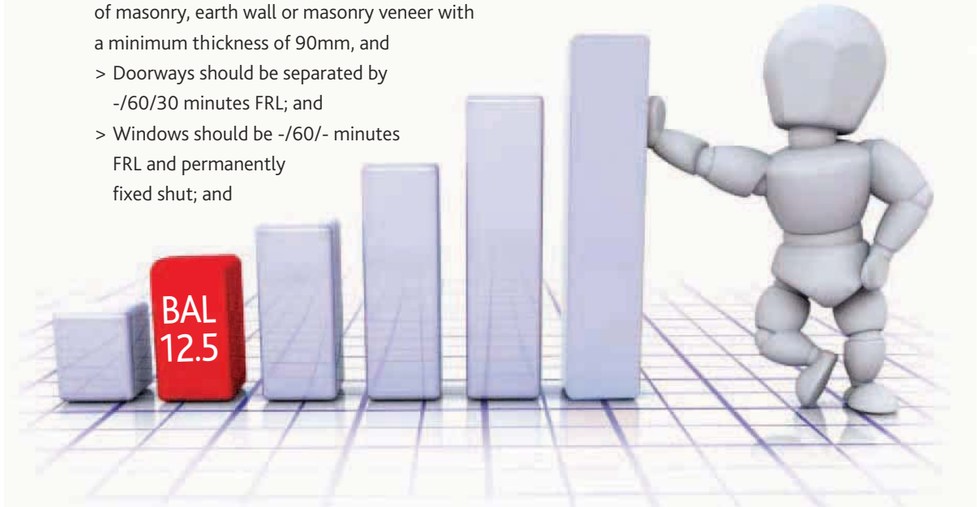
Unenclosed external structures connected to the house

- Enclosed structures attached to, or below a house (such as carports or verandas) should be constructed in accordance with the provisions for the rest of the house, or alternatively:

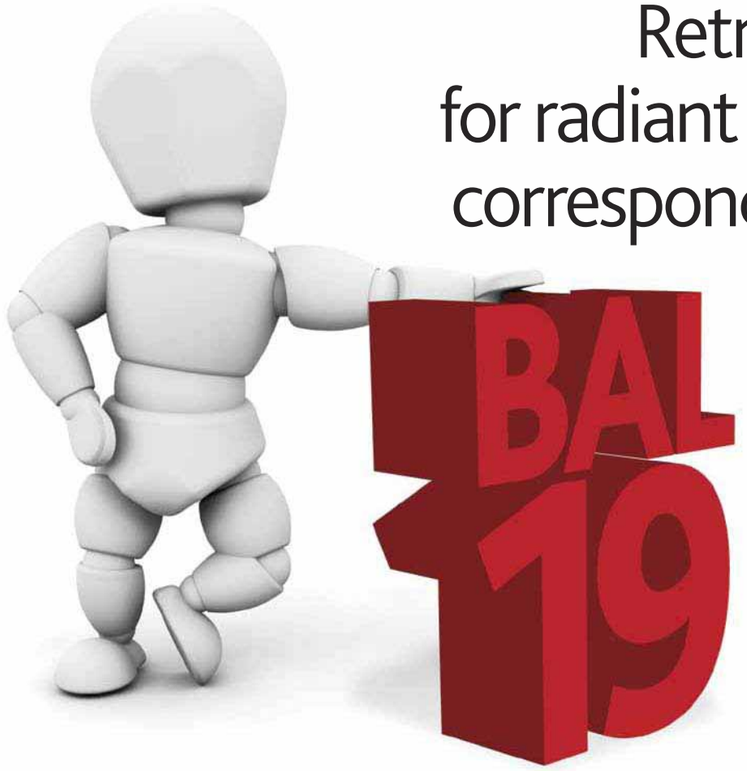
  - The wall to the house should be separated by 60/60/60 or -/60/60 minutes fire resistance level (FRL) construction (see definitions for FRL); or
  - The walls to the house should be constructed of masonry, earth wall or masonry veneer with a minimum thickness of 90mm, and
    - > Doorways should be separated by -/60/30 minutes FRL; and
    - > Windows should be -/60/- minutes FRL and permanently fixed shut; and
    - > Other openings should be -/60/- minutes FRL
    - > The above provisions exclude control joints, subfloor vents; and penetrations for pipes and conduits.

Enclosed external structures within six metres of the house

- Enclosed structures adjacent to a house such as garages, sheds etc. should be constructed in accordance with the provisions for the rest of the house; or alternatively:
  - The walls to the house should be separated from the adjoining structure by 60/60/60 or -/60/60 minutes FRL construction (See definitions for FRL); or
  - The walls to the house should be constructed of masonry, earth wall or masonry veneer with a minimum thickness of 90mm, and
    - > The doorways should be -/60/30 minutes FRL self closing fire doors; and
    - > Windows should be -/60/- minutes FRL and permanently fixed shut; and
    - > Other openings should be -/60/- minutes FRL
    - > The above provisions exclude control joints, subfloor vents; and penetrations for pipes and conduits.



Retrofit provisions for radiant heat exposure corresponding to BAL-19



Flooring systems

- **Construction recommendation as per ember attack could be considered.**

Walls and Fascias

- **Construction recommendation as per ember attack could be considered.**

Windows (including skylights)

- **Construction requirements as per ember attack with additional requirements of:**
- **For window assemblies not protected with bushfire shutters:**
  - Glazing less than 400mm above the ground, decks, carport roofs, awnings and similar elements should be of 5mm or thicker toughened glass; and
  - Glazing above 400mm may be annealed, if screened externally, for both fixed and openable panes; or
  - Glass blocks may be used for glazing of any height (without screens).
- **Where used, toughened glass must be screened, either internally or externally.**

External doors

- **Construction requirements as per ember attack with additional requirements of:**
- **Protect side hung and sliding external doors with one of the following:**
  - Glazing in doors should be toughened glass with a minimum thickness of 5mm.

Vents and Weepholes

- **Construction recommendation as per ember attack could be considered.**

Roofs

- **Construction recommendation as per ember attack could be considered.**

Eaves, Gutters and Downpipes

- **Construction recommendation as per ember attack could be considered.**

Unenclosed external structures connected to the house

- **Enclosed structures attached to, or below a house (such as carports or verandas) should be constructed in accordance with the provisions for rest of the house, or alternatively:**
  - The wall to the house should be separated by 60/60/60 or -/60/60 minutes FRL construction (see definitions for FRL); or
  - The walls to the house should be constructed of masonry, earth wall or masonry veneer with a minimum thickness of 90mm, and
    - > Doorways should be separated by -/60/30 minutes FRL; and
    - > Windows should be -/60/- minutes FRL and permanently fixed shut; and
    - > Other openings should be -/60/- minutes FRL
    - > The above provisions exclude control joints, subfloor vents; and penetrations for pipes and conduits.

Enclosed external structures within six metres of the house

- **Enclosed structures adjacent to a house should be constructed in accordance with the provisions for the rest of the house; or alternatively:**
  - The walls to the house should be separated by 60/60/60 or -/60/60 minutes FRL construction (See definitions for FRL); or
  - The walls to the house should be constructed of masonry, earth wall or masonry veneer with a minimum thickness of 90mm, and
    - > The doorways should be -/60/30 minutes FRL self closing fire doors; and
    - > Windows should be -/60/- minutes FRL and permanently fixed shut; and
    - > Other openings should be -/60/- minutes FRL
    - > The above provisions exclude control joints, subfloor vents; and penetrations for pipes and conduits.

Retrofit provisions for radiant heat exposure corresponding to BAL-29

Flooring systems

- **Enclosed subfloor areas should be constructed with:**
  - Non-combustible materials (such as masonry, brick veneer, mud brick, concrete, aerated concrete etc); or
  - Timber or steel-framed walls that are sarked on the outside of the frame and clad with:
    - > Fibre cement external cladding, with a 6mm minimum thickness; or
    - > Steel sheet; or
    - > Bushfire resisting timber as specified in AS 3959 Appendix F; or
    - > Mesh or perforated sheet with a maximum aperture of 2mm and made of corrosion resistant bronze or steel.
- **Unenclosed subfloor areas should have support posts, columns, stumps, piers and poles constructed of:**
  - Non-combustible material, or
  - Bushfire resisting timber as specified in AS 3959 Appendix F.
- **Where less than 400mm above the ground, unenclosed subfloor areas should have bearers and joists that are:**
  - Non-combustible; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F.
- **Where less than 400mm above the ground, the flooring of unenclosed subfloor areas should be:**
  - Non-combustible; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F; or
  - Any other type of timber, particle board or plywood; provided the underside of the flooring is lined with sarking type material or mineral wool insulation.
- **Alternatively, for unenclosed subfloors less than 400mm above the ground, a tested flooring system to Australian Standard 1530.8.1 (AS 1530.8.1) could be used.**

Walls and Fascias

Construction requirements as per ember attack with the additional requirements of:

- **Replace or cover external walls with:**
  - Non-combustible materials (such as masonry, brick veneer, mud brick, concrete, aerated concrete etc); or
  - Timber or steel-framed walls that are sarked on the outside of the frame and clad with:
    - > Fibre cement external cladding, with a 6mm minimum thickness; or
    - > Steel sheet; or
    - > Bushfire resisting timber as specified in AS 3959 Appendix F; or

BAL-29

A guide to retrofit your home for better protection from a bushfire

Windows (including skylights)

Construction requirements as per ember attack with the additional requirements of:

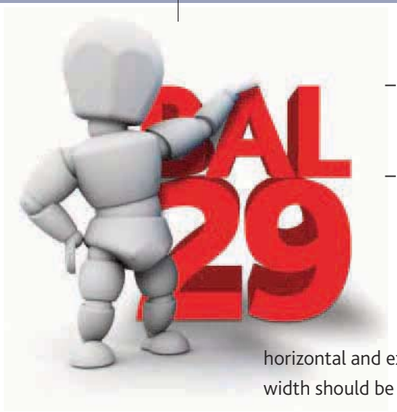
- **Window assemblies should be protected:**
  - With bushfire shutters; or
  - Could be constructed of:
    - > Window frames and joinery made from:
    - > Bushfire resisting timber as specified in AS 3959 Appendix F; or
    - > Metal; or
    - > Metal-reinforced PVC-U; and with
    - > Metal external hardware; and
  - Windows could be toughened glazing with a minimum thickness of 5mm; and
    - > If located less than 400mm above the ground, decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending greater than 110mm in width could be screened externally; and
    - > Openable portions of the window above 400mm may be either screened internally or externally.

- **Where fitted, bushfire shutters should comply with AS 3959 and be made from:**
  - Non-combustible materials; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F.
- **Where fitted, screens for windows should have a mesh or perforated sheet with a maximum aperture of 2mm and made of corrosion-resistant steel, bronze or aluminium. Gaps around the perimeter of the screen and the building should not exceed 3mm. The frame supporting the mesh or perforated sheet should be:**
  - Metal; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F.

External doors

Construction requirements as per ember attack with the exception of:

- **Where fitted, screens for doors should have a mesh or perforated sheet with a maximum aperture of 2mm, made of corrosion-resistant steel, bronze or aluminium. Gaps around the perimeter of the screen and the building should not exceed 3mm. The frame supporting the mesh or perforated sheet should be:**
  - Metal; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F.
- **Protect side hung external doors with one of the following:**
  - External screens; or
  - Bushfire shutters; or
  - Neither of the above if the door is:
    - > Non-combustible; or
    - > A solid timber door, with a minimum thickness of 35mm for the first 400mm above the threshold; or
    - > A door, including hollow core doors, protected externally by a screen; or
    - > A fully framed glazed door with the frame constructed of non-combustible materials, or bushfire resisting timber as specified in AS 3959 Appendix F.
  - External hardware to doors should be metal.



– Glazing in doors should be toughened glass with a minimum thickness of 6mm.
– Parts of door frames less than 400mm above the ground, decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending greater than 110mm in width should be screened externally.

- **Construct door frames with:**
  – Bushfire resisting timber as specified in AS 3959 Appendix F; or
  – Metal; or
  – Metal-reinforced PVC-U.
  – Install weather strips, draught excluders or draught seals at the base of side hung doors.
- **Protect external sliding doors with one of the following:**
  – External screens; or
  – Bushfire shutters; or
  – Neither of the above, if:
    > Any glazing within the door is 6mm toughened glass;
    and
    > The external hardware should be metal; and
    > The frame of the door and any supporting glazing within the door is made of the following:
      » Bushfire resisting timber as specified in AS 3959 Appendix F; or
      » Metal; or
      » Metal-reinforced PVC-U.

- **Vehicle access (garage) doors should comply with the following:**
  – All parts of doors should be made from:
    > Non-combustible materials; or
    > Fibre cement external cladding with a 6mm minimum thickness; or
    > Bushfire resisting timber as specified in AS 3959 Appendix F.
  – Panel lift, tilt and side-hung doors should be fitted with suitable weather-strips, draught excluders, draught seals or guide tracks (as appropriate) with a maximum gap size of 3mm.
  – Roller doors should have guide tracks with a maximum gap area of 3mm and be fitted with a nylon brush in contact with the door.
  – Doors should not include ventilation slots.

Vents and Weepholes

- **Cover vents and weepholes in external walls with a mesh having a maximum aperture of 2mm and made of corrosion-resistant steel, bronze or aluminium (except where the vents or weepholes are less than 3mm.)**

Roofs

Construction requirements as per ember attack with the additional requirements of:

- **A pipe or conduit that penetrates the roof should be non-combustible.**
- **A veranda, carport or awning roof separated from the main roof space by an external wall should have a support structure of:**
  – Non-combustible material, or
  – Bushfire resisting timber as specified in AS 3959 Appendix F; or
  – Timber rafters lined on the underside with 6mm (minimum) thickness fibre-cement sheeting (or material complying with AS 1530.8.1).
- **Roof penetrations:**
  – Seal penetrations (including roof lights, roof ventilators, roof-mounted evaporative cooling units; aerials, vent pipes and supports for solar connectors) with a non-combustible material at the roof to prevent gaps greater than 3mm.

– Fit ember guards over openings in vented roof lights, roof ventilators or vent pipes that are made from perforated sheet with a maximum aperture of 2mm and made of corrosion-resistant steel, bronze or aluminium.
– Ensure all overhead glazing is 'Grade A' safety glass.
– Construct glazed elements in roof lights and sky lights of polymer provided that:
  > A 'Grade A' safety glass diffuser is installed below the glazing; or
  > A 4mm minimum thickness pane of 'Grade A' glass is installed in the outer pane of an Insulated Glazing Unit (IGU).
– Where roof lights are installed in roofs having a pitch of less than 18 degrees to the horizontal, the glazing should be protected with ember guards made from mesh or perforated sheet, with a maximum aperture of 2mm and made from corrosion resistant steel, bronze or aluminium.
– Evaporative cooling units should be fitted with butterfly closers at or near the ceiling level; or the unit should be fitted with non-combustible covers with a mesh or perforated sheet, having a maximum aperture of 2mm and made of corrosion resistant steel, bronze or aluminium.
– External single pane glazed elements of roof lights and skylights, where the pitch of the glazed element is 18 degrees or less to the horizontal, should be protected with ember guards made from mesh or perforated sheet with a maximum aperture of 2mm and made from corrosion resistant steel, bronze or aluminium.
– Tubular skylights should not be used for BAL 29 and above unless it is a tested system to AS 1530.8.1.

Eaves, Gutters and Downpipes

- **Eaves linings should be:**
  – Fibre-cement sheet with a minimum thickness of 4.5mm; or
  – Bushfire resisting timber as specified in AS 3959 Appendix F.
- **Gutters other than box gutters should be metal or PVC-U.**
- **Fascias and bargeboards should be constructed of:**
  – Bushfire resisting timber as specified in AS 3959 Appendix F; or
  – Metal, fixed at 450mm centres.

Unenclosed external structures connected to the house

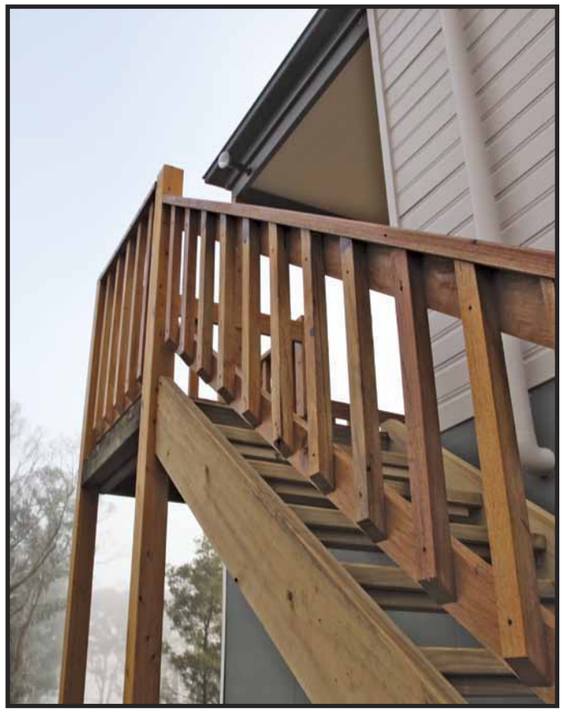
Construction requirements as per ember attack with the exception of:

- **Subfloor spaces are considered to be enclosed if the sides are in accordance with the requirements for external walls; including protection of openings with mesh or perforated sheet, in accordance with external walls.**
- **Decking, stair treads and trafficable surfaces of ramps and landings should be made from:**

  - Non-combustible materials; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F.
- **For the unenclosed subfloor spaces of verandas, decks, steps, ramps and landings use the following construction elements:**
  - Support posts, columns, stumps, stringers, piers and poles; and
  - Framing of the verandas, decks, ramps, and landings should be constructed of:
    - > Non-combustible materials; or
    - > Bushfire resisting timber as specified in AS 3959 Appendix F.
- **Balustrades, handrails and other barriers less than 125mm from any glazing or any combustible wall should be constructed of:**
  - Non-combustible materials; or
  - Bushfire resisting timber as specified in AS 3959 Appendix F.
- **Enclosed structures attached to, or below a house (such as carports or verandas) should be constructed in accordance with the provisions for rest of the house, or alternatively:**
  - The wall to the house should be separated by 60/60/60 or -/60/60 minutes FRL construction (see definitions for FRL); or
  - The walls to the house should be constructed of masonry, earth wall or masonry veneer with a minimum thickness of 90mm, and
    - > Doorways should be separated by -/60/30 minutes FRL; and
    - > Windows should be -/60/- minutes FRL and permanently fixed shut; and
    - > Other openings should be -/60/- minutes FRL
    - > The above provisions exclude control joints, subfloor vents; and penetrations for pipes and conduits.

Enclosed external structures within six metres of the house

- **Enclosed structures adjacent to a house should be constructed in accordance with the provisions for the rest of the house; or alternatively:**
  - The walls to the house should be separated by 60/60/60 or -/60/60 minutes FRL construction (See definitions for FRL); or
  - The walls to the house should be constructed of masonry, earth wall or masonry veneer with a minimum thickness of 90mm, and
    - > The doorways should be -/60/30 minutes FRL self closing fire doors; and
    - > Windows should be -/60/- minutes FRL and permanently fixed shut; and
    - > Other openings should be -/60/- minutes FRL
    - > The above provisions exclude control joints, subfloor vents; and penetrations for pipes and conduits.



Retrofit provisions for radiant heat exposure corresponding to BAL-40 & direct flame BAL-FZ

BAL-40 and direct flame BAL-FZ are considered to be very high to extreme bushfire risk. Homes in these categories may not be suitable for retrofit upgrades for direct radiant heat or flame attack. The measures for ember attack are still worthwhile as this may assist, for example, in situations where a fire front passes nearby providing ember showers.

For direct radiant heat or flame attack, homes located on these sites should be specifically designed, and constructed or upgraded for bushfire risk by appropriately trained and experienced professionals.

Buildings in these areas are considered to be at very high to extreme bushfire risk from ember attack, burning debris ignited by windborne embers, exposure to high level and extreme radiant heat and likelihood of direct exposure to flames from the fire front.

A simple retrofitting of building elements is not considered to be a satisfactory approach to mitigating the bushfire risk for such sites, nor are they likely to satisfy the relevant requirements of AS 3959.

Home owners are recommended to seek professional advice with regards to recommended upgrades or reconstruction to improve their houses' resistance to bushfire attack.

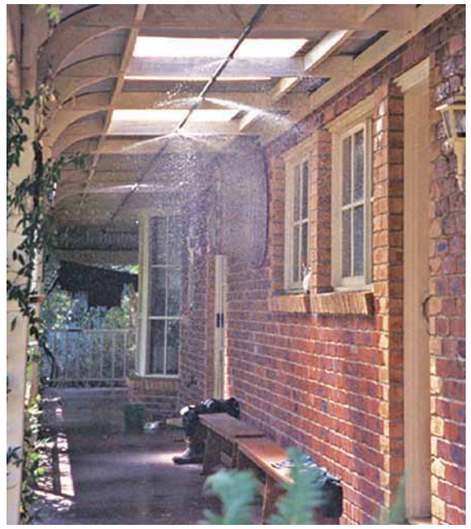
Non-AS 3959 applicable sites

RESIDENTIAL BUILDINGS THAT FALL OUTSIDE THE SCOPE OF AS 3959 (I.E. CANNOT NOMINATE A BAL DUE TO EXTREME SLOPES ON THE SITE OR ITS SURROUNDING VEGETATION) ARE AT GREATER RISK FROM BUSHFIRE ATTACK.

Extreme slopes not covered in AS 3959 are vegetated slopes greater than 30 degrees to the horizontal, situated within 100m of the house. This is because fire behaviour on steep slopes is much more severe and unpredictable and therefore the simplified approach in AS 3959 may not be sufficient without further professional advice and review.

The prescribed building elements recommended in this guide may be unsuitable for such sites and retrofitting homes is unlikely to achieve a comparable level of safety to that provided in AS 3959. Home owners are recommended to seek professional advice with regards to recommended upgrades or reconstruction to improve their resistance to bushfire attack.

Sprinkler systems can help fight embers



THE OBJECTIVE OF A BUSHFIRE SPRINKLER SYSTEM IS TO HELP EXTINGUISH EMBERS THAT LAND ON THE ROOF OR OTHER PARTS OF THE BUILDING.

To operate effectively, a sprinkler system needs to have an appropriate, adequate water supply, an activation mechanism and a delivery system including pipes and heads that will discharge water at appropriate densities.

The delivery system includes the pump, pipework and spray heads. You must ensure that the pump is the correct size and duty to deliver water to the spray heads at a suitable pressure. The pump must be protected from radiant heat. The correct size pipework can only be determined after the completion of a full hydraulic design.

Pipes must be made of non-combustible materials such as copper. The spray heads need to be carefully chosen so that they provide an appropriate spray pattern and discharge density that can operate effectively during a bushfire.

Other considerations:

- **Will your sprinkler system be able to run even if mains power fails?**
- **Do you have an adequate water supply? A sprinkler system should be able to run for several hours.**
- **What effect will wind have on the delivery of water to critical areas of your home?**

Bushfire sprinkler systems are only one treatment to improve the protection of your house from embers. On their own they are not a reliable solution to treat bushfire risk.

These systems should be regularly maintained and tested to ensure that they perform when required.

For more information about designing an appropriate bushfire sprinkler system, consult a licensed plumbing practitioner (or expert in this field).

Please note there is currently no Australian Standard for the design and installation of bushfire sprinkler systems; this section is intended as a guide only.

Private Bushfire Shelters (Bushfire bunkers)

ON 28 MAY 2010 THE VICTORIAN GOVERNMENT AMENDED THE BUILDING REGULATIONS 2006 TO REFERENCE THE NATIONAL PERFORMANCE STANDARD FOR PRIVATE BUSHFIRE SHELTERS.

These regulations mean that a building permit must be obtained for private bushfire shelters prior to construction. Bushfire shelters have to comply with the performance requirements set out in the National Performance Standard.

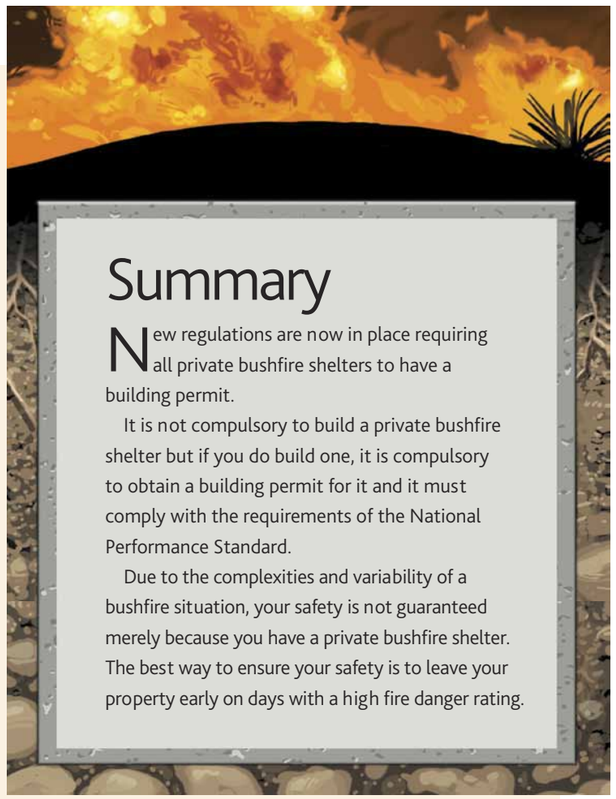
A private bushfire shelter is an option of last resort where individuals can take refuge during a bushfire while the fire front passes. Private bushfire shelters may not be a safe option in all cases and are a last resort as part of a bushfire survival plan.

Bushfire shelters have to comply with performance requirements set out in the National Performance Standard including maintaining tenable conditions within the shelter for the period of occupancy.

To obtain a building permit under the new system you either need to:

- **Purchase a shelter that has been accredited as meeting the performance requirements of the National Performance Standard by the Building Regulation Advisory Committee; or**
- **Apply to the Building Appeals Board for a determination that your non-accredited bushfire shelter complies with the regulations; or**
- **Obtain certification from a fire safety engineer who did not design the shelter to satisfy a building surveyor that your non-accredited bushfire shelter meets the requirements of the regulations.**

Note: Contact your local council as you may also need a planning permit to install a private bushfire shelter.



Summary

New regulations are now in place requiring all private bushfire shelters to have a building permit.

It is not compulsory to build a private bushfire shelter but if you do build one, it is compulsory to obtain a building permit for it and it must comply with the requirements of the National Performance Standard.

Due to the complexities and variability of a bushfire situation, your safety is not guaranteed merely because you have a private bushfire shelter. The best way to ensure your safety is to leave your property early on days with a high fire danger rating.

Definitions

Aperture	Openings in screens or mesh that are used to provide protection to windows, doors and other openings against ember attack.
AS 3959	Australian Standard 3959-2009 – Construction of buildings in bushfire prone areas published by Standards Australia and as amended from time to time.
Bushfire attack	Burning embers, radiant heat or flame generated by a bushfire, which might result in ignition and subsequent damage or destruction of a building.
Bushfire Attack Level (BAL)	The bushfire attack level for the site as determined by using either Method 1 (simplified procedure) or Method 2 (detailed procedure) under Australian Standard 3959-2009. These are stated as BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 or BAL-FZ.
Bushfire prone area	An area that is subject to, or likely to be subject to, bushfire attack.
Bushfire resisting timber	Timber that is deemed to be acceptable to withstand exposure up to a BAL-29 condition by means of one or more of: (a) The inherent properties of the material itself; (b) Being impregnated with fire-retardant chemicals; or (c) The application of fire-retardant coatings or substances. A list of approved timber species can be found in Australian Standard 3959 Appendix F
Bushfire shutter	A screen or barrier fixed to the building for the protection of window or door openings against bushfire attack.
Combustible	The classification of a material that is capable of igniting as determined by Australian Standard 1530.1.
Ember attack	Smouldering or flaming windborne debris that is capable of entering or accumulating around a building and may ignite the building or other combustible materials and debris.
Ember guard	A cover inserted in or over an opening or cavity to prevent the entry of burning embers.
Fire resistance level (FRL) **(XX/XX/XX minutes FRL)**	The nominal grading period, in minutes, that is determined by subjecting a specimen material or system to a fire test as set out in Australian Standard 1530.4 to specify structural adequacy, integrity and insulation. e.g an FRL of 120/60/30 minutes means 120 minutes structural fire adequacy / 60 minutes fire integrity / 30 minutes fire insulation. 0 minutes FRL is indicated by a dash, e.g. -/60/30.

Definitions

Flame zone (FZ)	The highest level of bushfire attack as a consequence of direct exposure to flames from the fire front in addition to heat flux and ember attack.
Flammability index	The index number for a material as determined by a test as set out in Australian Standard 1530.2.
Glazed assembly	Any combination of glass and any other material that fills a window or door opening; also known as a glazing system.
Grade A safety glass	A type of safety glazing that complies with Australian Standard 1288.
Heat flux exposure level	The quantity of heat energy per unit area that is measured on an exposed surface and it includes heat transferred by convection and radiation.
Insulated glazing unit (IGU)	Two or more panels of glass spaced apart and factory sealed with dry air or special gases in the units cavity.
Non-combustible	The classification of a material that is deemed not to be combustible when subjected to testing under Australian Standard 1530.1.
Sarking-type material	A material, such as a reflective foil or other flexible membrane, normally used for a purpose such as water proofing, vapour proofing or thermal reflectance.
Sub-floor	The part of the construction that is below the floor, whether enclosed or unenclosed, and includes floor joists, bearers, stumps, piers and the like.

NOTES

A guide to retrofit your home for better protection from a bushfire

Notes

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Bendigo office
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Wangaratta office
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1 White Street Wangaratta VIC 3677
T. +61 3 5721 4865
F. +61 3 5722 9074

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Headquarters
8 Lakeside Drive Burwood East VIC 3151
T. (03) 9262 8444 **F.** (03) 9264 6200

Bushfire Building Advice Line
1300 815 127

August 2010

www.buildingcommission.com.au **www.cfa.vic.gov.au**