

The background of the slide is a close-up, slightly blurred image of a bushfire. The flames are a mix of bright yellow and orange, with darker red and black smoke rising from the bottom. On the right side of the image, there is a stylized, semi-transparent silhouette of a house with a chimney, partially obscured by the flames.

# CR Bushfire.

## When Fire Safety Meets Bushfire Safety

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# Different Disciplines.

- FPA brings both disciplines together under one accreditation banner.
- Fire Protection Accreditation Scheme (FPAS)
- Bushfire Planning and Design (BPAD)
- BPAD and FPAS working together?



# What is the difference?



**INTERNAL IGNITION**  
**Fire Systems Engineering protects the inside**



**EXTERNAL IGNITION**  
**Bushfire Engineering stops on the outside**



# Ignition Sources.

## Internal Fires.

- Power boards
- Electrical leads
- Appliances
- Cigarettes
- Candles
- Clothes dryers

*“Electrical appliances and faults cause almost 40% of home fires” (Fire & Rescue NSW)*

## External Fires.

- Arson
- Electrical power line sparks
- Lightning strikes
- Agricultural operations
- Hazard reduction

*“Lightning accounts for about half of [bushfire] ignitions in Australia” (Geoscience Australia)*





# Bushfire Behaviour.

- **Embers**
  - **Radiant Heat**
  - **Flame Contact**
  - Smoke
  - Wind
- 
- Embers lodge inside house = internal ignition
  - Radiant heat impacts building materials
  - Flame contact impacts building materials



# Fire Engineering.

***“The application of engineering principles, rules and expert judgement based on a scientific appreciation of the fire phenomena, of the effects of fire, and the reaction and behaviour of people, in order to:***

- save life, protect property and preserve the environment and heritage;***
- quantify the hazards and risk of fire and its effects;***
- evaluate analytically the optimum protective and preventative measures necessary to limit, within prescribed levels, the consequences of fire.”***

**(AFEG)**



# Predictability.

- Fire within a building is more predicatable.
- Timings are more predictable.
- Confined space.
- Building can be compartmentalized.
- Suppression.





# Bushfire Variables.

- Fuel availability.
- Fuel moisture.
- Vegetation structure.
- Slope/topography.
- Size of bushfire prone landscape.
- Weather – wind direction, wind speed, temperature, relative humidity.
- Distance of asset from vegetation.
- Suppression.





# Building v Planning.

- Structural fire is a building function
  - NCC Compliance
- Bushfire is a planning and building function
  - Environmental Planning and Assessment Act 1979
  - Rural Fires Act 1997
  - NCC Compliance through AS3959:2018 (or the NASH Standard)
  - Specification 43



# Environmental Planning and Assessment Act 1979.

## 4.14 Consultation and development consent—certain bush fire prone land(cf previous s 79BA)

(1) Development consent cannot be granted for the carrying out of development for any purpose (other than a subdivision of land that could lawfully be used for residential or rural residential purposes or development for a special fire protection purpose) on bush fire prone land (being land for the time being recorded as bush fire prone land on a relevant map certified under section 10.3(2)) unless the consent authority—

(a) is satisfied that the development conforms to the specifications and requirements of the version (as prescribed by the regulations) of the document entitled *Planning for Bush Fire Protection* prepared by the NSW Rural Fire Service in co-operation with the Department (or, if another document is prescribed by the regulations for the purposes of this paragraph, that document) that are relevant to the development (***the relevant specifications and requirements***), or

(b) has been provided with a certificate by a person who is recognised by the NSW Rural Fire Service as a qualified consultant in bush fire risk assessment stating that the development conforms to the relevant specifications and requirements.



# *Rural Fires Act 1997.*

## **100B Bush fire safety authorities**

(1) The Commissioner may issue a bush fire safety authority for—

(a) a subdivision of bush fire prone land that could lawfully be used for residential or rural residential purposes, or

(b) development of bush fire prone land for a special fire protection purpose.

(2) A bush fire safety authority authorises development for a purpose referred to in subsection (1) to the extent that it complies with standards regarding setbacks, provision of water supply and other matters considered by the Commissioner to be necessary to protect persons, property or the environment from danger that may arise from a bush fire.



# National Construction Code.

The general objectives of the NCC are to:

- to protect building occupants (including attending emergency services personnel)
- to facilitate the activities of emergency services personnel
- to protect other buildings from being affected by a fire in the building in question.

Construction measures for bushfire protection governed by Australian Standard 3959: Construction of buildings in bushfire prone areas or the National Association for Steel Framed Housing Standard





# Planning for Bush Fire Protection.

The aim of PBP is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment.

The objectives are to:

- afford buildings and their occupants protection from exposure to a bush fire;
- provide for a defensible space to be located around buildings;
- provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings;
- ensure that appropriate operational access and egress for emergency service personnel and occupants is available;
- provide for ongoing management and maintenance of BPMs;
- and ensure that utility services are adequate to meet the needs of firefighters.



# The Planning/Building System.

## Structural Fire

Construct - final approval

This stage involves the issue of occupancy certificates (including related documents such as a certificate of compliance). In particular, the FE may be required to verify that:

- the conditions of the regulatory approval have been met
- construction and commissioning meet the approved design
- appropriate management and maintenance regimes are in place.

## Bushfire

Design – final approval

Siting to achieve separation from vegetation

This stage involves the issue of development consent, construction and occupancy certificates. Increasingly, the Bushfire Consultant is asked to:

- recommend conditions of development consent.
- assess that conditions of development consent have been met in construction.
- prepare a Bushfire Emergency Management and Evacuation Plan

**Building siting**

**Access road network (including perimeter roads)**

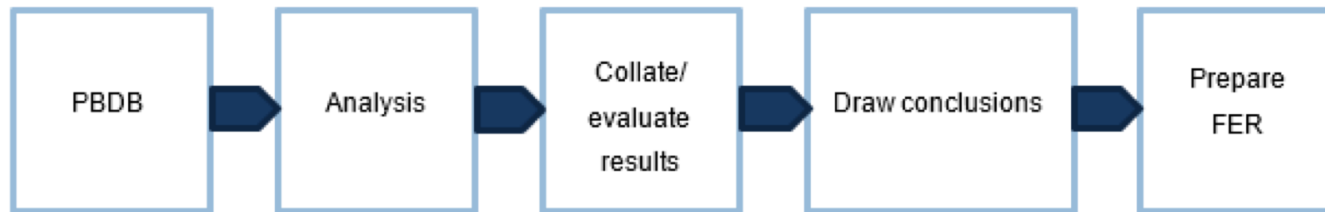
**Water supply**

**Electricity supply**



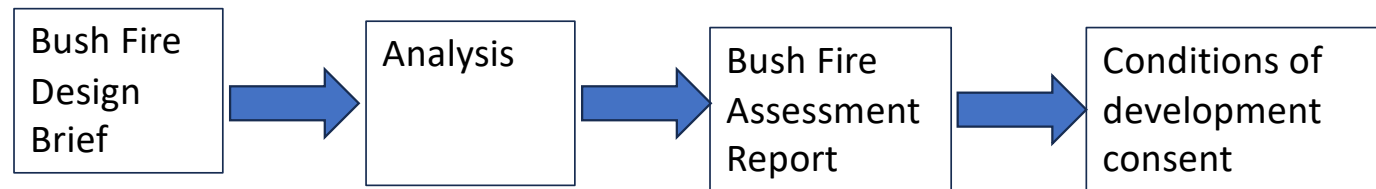
# Fire Engineering v Bushfire Design.

Figure 2.1.1 Typical fire engineering process



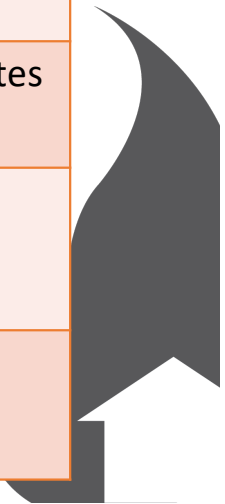
Source: AFEG

Typical Bushfire Design Process



# Overall Building Fire Safety System.

Sub-system A	<b>Ignition sources</b> - fires in the enclosure of fire origin as well as enclosures to which the fire has subsequently spread, and how fire initiation and development might be controlled.
Sub-system B	<b>Smoke development, spread and control</b> - development of smoke, its spread within the building, the properties of the smoke at locations of interest, and how the development and spread might be controlled.
Sub-system C	<b>Fire spread, impact and control</b> - spread of fire beyond an enclosure, the impact a fire might have on the structure, and how the spread and impact might be controlled.
Sub-system D	<b>Fire detection, warning and suppression</b> - this process enables estimates to be made of the effectiveness of suppression.
Sub-system E	<b>Occupant evacuation and control</b> - evacuation of the occupants of a building. This process enables estimates to be made of the times required for occupants to reach a place of safety.
Sub-system F	<b>Fire services intervention</b> - compatibility of the standard intervention activities of fire brigade services with a fire according to the FBIM.





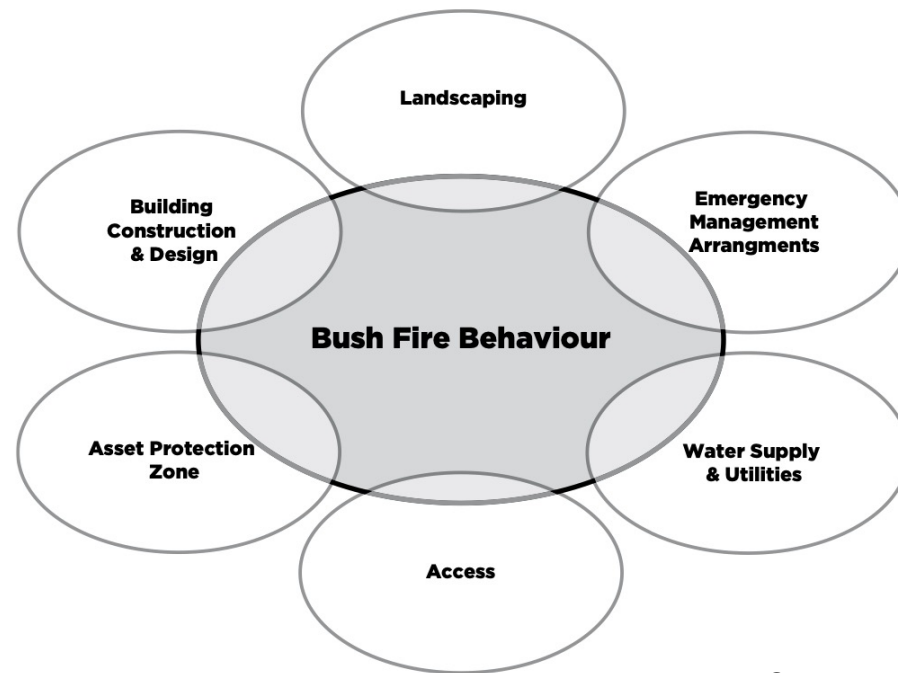
# Typical Building Interventions.

- Sprinkler systems
- Fire extinguishers
- Wall construction
- Smoke alarms
- Compartmentalisation
- Exit management
- Access to services



# Overall Bushfire Safety System.

Bushfire Protection Measures in combination



Source: PBP 2019



# Typical Building Interventions.

- Wall construction.
  - Window systems.
  - Roof systems.
  - Gap enclosures.
  - Landscape management.
- 
- Sprayer systems?



# Emergency Management.

- Understanding occupant characteristics
- Understanding triggers for emergency actions – evacuation/shelter in place
- Understanding the needs of occupants
- Understanding the warnings required
- Understanding the timing for evacuation

Structural fire = internal conditions

Bushfire = external conditions





# Evacuation.

## **Structural Fire**

- Generally outside is the safe space.
- The goal is to move people outside.

## **Bushfire**

- Generally outside is not a safe space.
- The goal is to move people away from the bushfire threat.



# DTS v Performance.

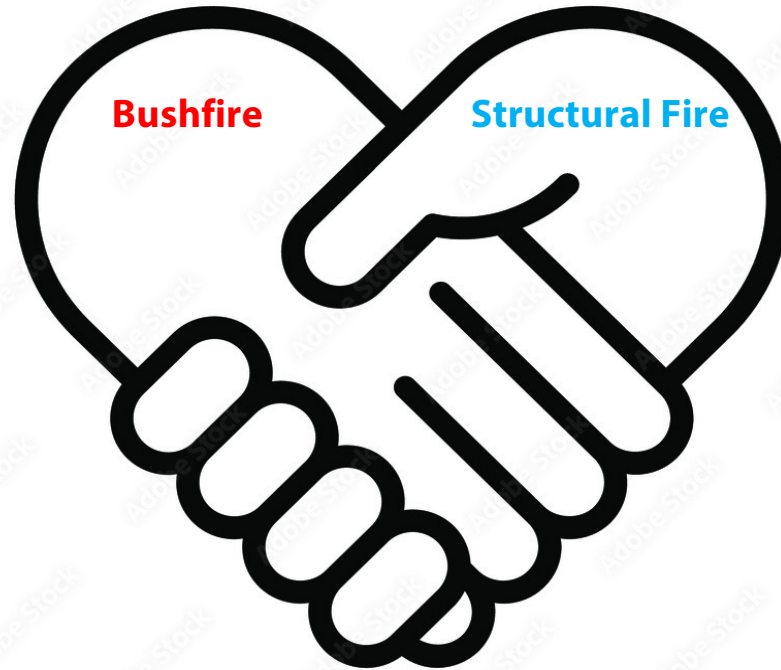
Both disciplines can operate in a DTS or Performance space.

- Modelling fire science
- Adapting protection measures
- Fire engineering performance space fairly well established
- Bushfire performance space continually evolving
- NSW RFS involvement in DA process

Essentially both sciences benefit from empirical evidence, real experiences and emerging understanding of fire science and human behaviour.



# Should the two systems cross and when should they?



# High Rise Buildings.

- Population – impact on existing community and infrastructure
- Location of building
- Design fire - both external and internal fire components
- Access and egress – what does evacuation look like?
- Building construction
- Car parking
- Warning and suppression systems

ISSUE	SPECIFIC CONCERN	TECHNICAL CONSIDERATIONS
Population	<ul style="list-style-type: none"> <li>➤ Impact on existing community and infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>➤ What capacity does the existing infrastructure have to allow evacuation of existing and proposed residents in the event of a bush fire?</li> </ul>
Location of Building	<ul style="list-style-type: none"> <li>➤ Locating on ridge tops emphasises the risk of convective plume interaction and wind related impacts.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Can the building be located away from ridge tops to areas that have a reduced bush fire exposure?</li> <li>➤ If unavoidable, what is the impact on the risk to the building?</li> <li>➤ Is this risk appropriate for the building and occupant numbers?</li> </ul>
Design Fire	<ul style="list-style-type: none"> <li>➤ Different elements of the flame could have different impacts on different levels of the building; and</li> <li>➤ The whole building could be impacted by ember attack and multiple floors could be alight simultaneously.</li> </ul>	<ul style="list-style-type: none"> <li>➤ What are the flame dimensions, including the flame angle?</li> <li>➤ Where is the hottest part of the flame located? How would this impact on the proposed building?</li> <li>➤ How would the warning and suppression systems in the building cope with this?</li> </ul>
Egress	<ul style="list-style-type: none"> <li>➤ Elevations exposed to bush fire risk.</li> </ul>	<ul style="list-style-type: none"> <li>➤ How does the emergency evacuation procedure take account of the location of bush fire prone vegetation?</li> </ul>
Building construction	<ul style="list-style-type: none"> <li>➤ Performance of the building façade in a bush fire scenario.</li> <li>➤ Balconies may contain external features which could ignite and contribute to building ignition and fuel loads.</li> </ul>	<ul style="list-style-type: none"> <li>➤ What wall and cladding materials are proposed and what is proposed for the openings/penetrations (i.e. windows and doors)?</li> <li>➤ How does the proposed building construction deal with fire spread from the vegetation to the inside of the building?</li> <li>➤ Is compliance with AS 3959 sufficient to ensure that the bush fire risk is mitigated?</li> <li>➤ Is this appropriate for the design fire scenario?</li> <li>➤ Are there balconies proposed?</li> <li>➤ What may be stored on the balconies?</li> <li>➤ Can there be restrictions on what is stored on the balconies due to fire risk?</li> </ul>
Car Parking	<ul style="list-style-type: none"> <li>➤ Lower storey car park could be subject to ember attack and high radiant heat loads.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Is the warning and suppression system designed to take account of bush fire impact?</li> <li>➤ Where are exits located? Are they guiding occupants away from the car park?</li> </ul>
Other Considerations	<ul style="list-style-type: none"> <li>➤ Access for fire fighters may be restricted or challenging; and</li> <li>➤ Risk implications of floor to floor fire spread.</li> </ul>	<ul style="list-style-type: none"> <li>➤ What would this mean for fire suppression?</li> <li>➤ How would warning and suppression systems take account of this?</li> <li>➤ What would this mean for evacuation?</li> </ul>

# Bush Fire Design Brief.



- Preparation of both Performance Based Design Brief and Bushfire Design Brief pre-DA
- Close the gaps between bushfire process and fire engineering process
- Flexible condition of development consent for bushfire
- Bushfire neatly handed over to structural fire





## Specification 43.

- Class 9 buildings, including: hospitals, schools, child care centres and residential care buildings.
- Vulnerable occupants.
- Construction, separation and access requirements.
- Compliance with NCC OR compliance with conditions of consent as modified by the Bush Fire Safety Authority (BFSA)



# Specification 43.

- Separation between buildings
- Separation from allotment boundaries and car parking areas
- Separation from hazards (such as liquified petroleum gas bottles, fuel storage, storage of combustible materials, waste bins, vehicles, machinery and the like)
- Non-combustible path around building
- Access pathways
- Exposed external areas
- Internal tenability
- Emergency power supply
- Signage

Where is the feedback loop?

If we don't design some of the fire engineering systems prior to DA consent, the consent conditions could work against fire system design later and require multiple DA modifications

Client best interests for both disciplines to work together from design-final approval



# Early Intervention.



- The benefits of fire engineering are greatest if this discipline is involved early in the design process
- Bushfire increasingly needs fire engineering prior to DA consent approval
- Entire bushfire/fire engineering systems are required both pre and post DA to work together
- Understanding the needs, overlaps and synergies early in the process is extremely important
- Both disciplines working together through the process
- Create the feedback loop

