PROGRAM D1

PROGRAM D1 EXPERIMENTAL PROGRAMS & AUSTRALIAN STANDARD FOR BUILDING IN BUSHFIRE PRONE AREAS

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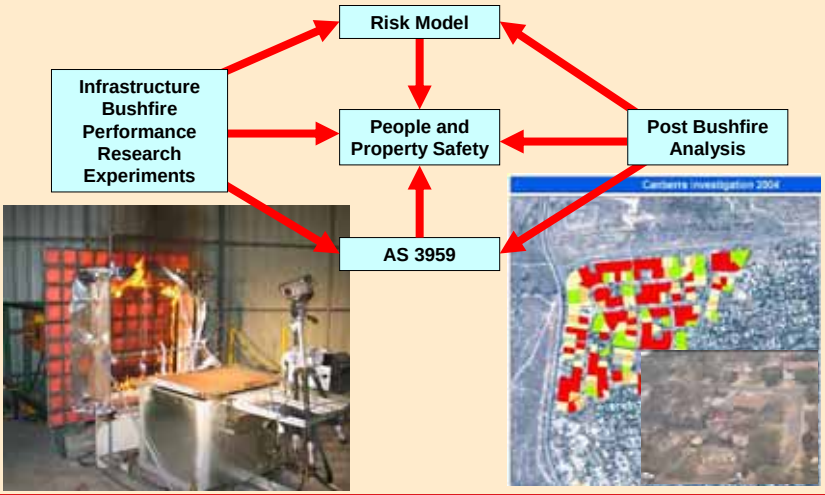
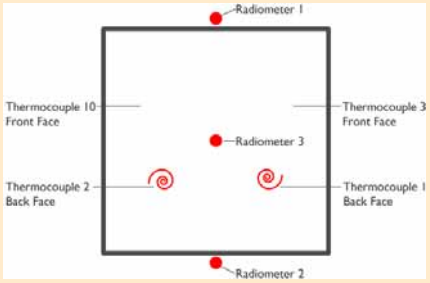
Program D1 Summary



Window Performance

Window Performance – Apparatus



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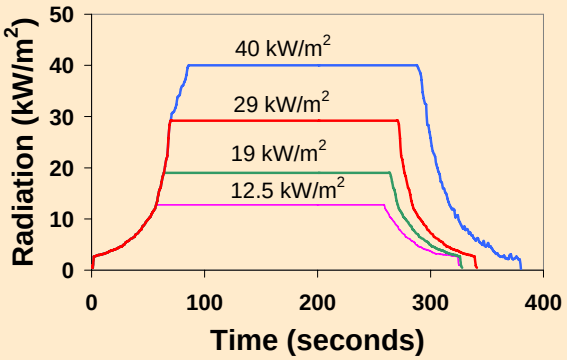
Window Performance – Exposure Profiles

Different radiation exposures representing slow and fast moving bushfires of different intensities were applied

Example radiant heat exposure curve



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Window Performance - Key results

- Dependence on glass imperfections results in variability and poor predictability
- Annealed (plain) glass fails at heat fluxes > 12.5 kW/m^2
  - Standard laminated glass perform better but is very variable due to adhesive layer
  - Toughened glass performed well up to 40 kW/m^2 radiant exposure but is sensitive to thermal stresses and frame/seal performance.

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Window Performance - Key Results

•Window performance is dependant on system of materials including glass, sealants and frames.

•PVC beading and foam seals soften and may burn at 29-40 kW/m2.

•Flaming of frames effects glass performance

•Due to unpredictable performance in severe bushfire exposures metal fly screens or shutters are highly recommended

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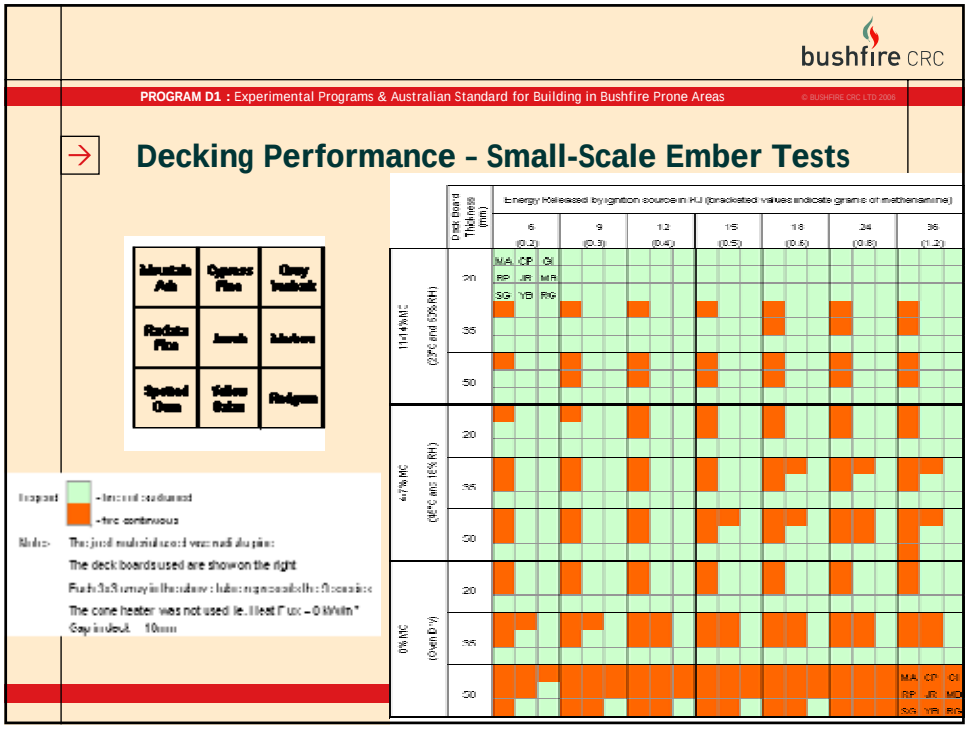
Decking Performance - Small-Scale Ember Tests

Methenamine tablets used to simulate embers

Joist-deck "U" connection tested in Mass loss cone calorimeter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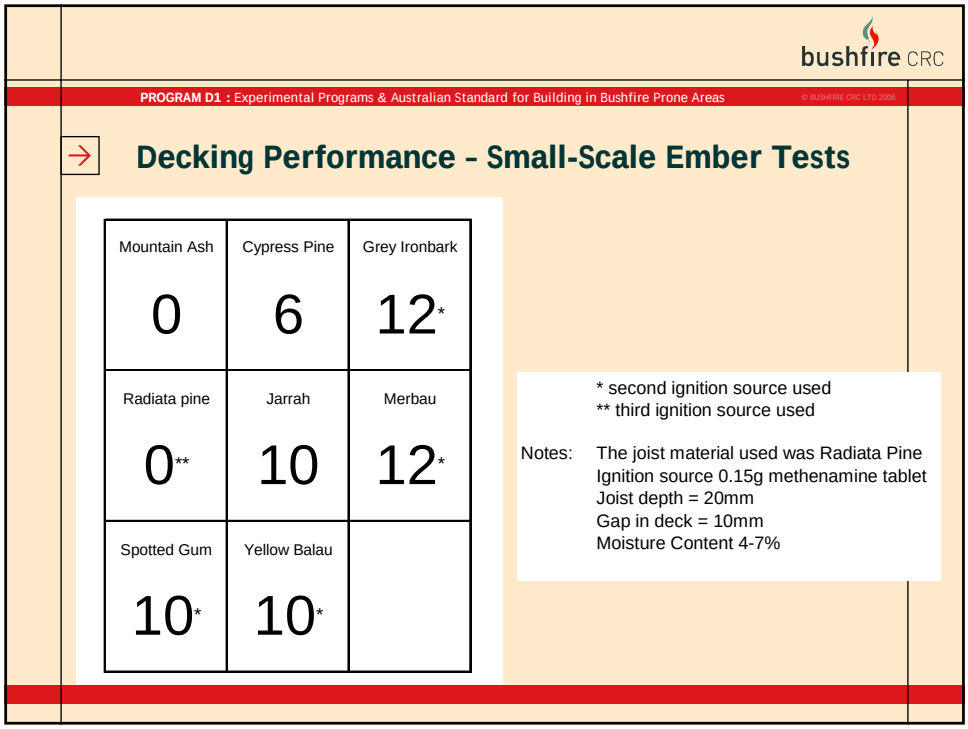
Decking Performance – Small-Scale Ember Tests
Mountain Ash
Cypress Pine
Grey Ironbark
Radiata Pine
Jarrah
Merbau
Spotted Gum
Yellow Balau
Redgum
Energy Released by ignition source in MJ (bracketed values indicate grams of methenamine)
Deck Board Thickness (mm)
6 (0.2)
9 (0.3)
12 (0.4)
15 (0.5)
18 (0.6)
24 (0.8)
36 (1.2)
11-14% MC (23°C and 50% RH)
6-7% MC (26°C and 15% RH)
0% MC (Oven Dry)
20
35
50
MA RP SG
CP JR YB
GI MB RG
- fire continuous
The deck boards used are shown on the right
The cone heater was not used ie. Heat Flux ~ 0 kW/m²
Gap in deck 10mm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Decking Performance – Small-Scale Ember Tests
Mountain Ash 0
Cypress Pine 6
Grey Ironbark 12*
Radiata pine 0**
Jarrah 10
Merbau 12*
Spotted Gum 10*
Yellow Balau 10*
* second ignition source used
** third ignition source used
Notes: The joist material used was Radiata Pine
Ignition source 0.15g methenamine tablet
Joist depth = 20mm
Gap in deck = 10mm
Moisture Content 4-7%

Decking Performance – US Decking Test

US Urban wildland building interface standard

12-7A-5 Part A Fire resistive standard for decks

80 kW fire for 3 minutes

Decking Performance – CSIRO large scale tests

Burning debris and 1.25 kg timber cribs applied to decking – wall section with radiant heat exposure profiles

Decking Performance – Key Results

- Dense hardwoods such as Merbau and Spotted Gum perform better than softwoods such as Treated Pine
- Radiant heat (40 kW/m^2) less of an influence than burning debris/crib
- Below deck fire more sever than above deck fire
- Air flow enhances deck burning and fire spread

Recommendations

- Use dense hard woods
- Enclose decks and prevent build up of debris
- Use steel joists
- Isolate deck from walls
- Deck profiling or spacing

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Fence Performance

Objectives

- Investigate performance of common fence systems
- Investigate potential of fences for building protection
- Investigate fence behaviour that may contribute to risk of building or life loss

Method

- Small scale toxicity measurements
- Full scale bushfire simulations

Fence Performance – Full-Scale Simulation

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Fence Performance - Exposures

- Debris – 120L leaf litter distributed along fence
- Bushfire pre radiation – 10 min with radiation with peak of 30 kW/m
- Bushfire Flame Immersion – 10 min with radiation with peak of 30 kW/m and direct flame contact
- Structural Fire – 30 min direct flame contact (fire line intensity 5MW/m

Fence Performance

Treated Pine

Exposure to structure

COLORBOND

Fence Performance - Key Results

- COLORBOND steel maintained integrity for all exposures
- COLORBOND steel reduced radiant heat behind fence to 5 kW/m^2 and radiation at structure 9m away was reduced by factor of 2
- Closed slat hardwood performed better than open slat hardwood
- Closed slat Hardwood maintained integrity for exposures without flame contact
- Closed slat hardwood reduced radiation at structure 9 m away by factor of 3
- Both open and closed slat hardwood provide little protection in direct flame contact exposures
- Hardwood fences did not support lateral flame spread

Fence Performance - Key Results

- Treated pine supported lateral flame spread when exposed to burning debris and failed to maintain integrity
- Treated pine supported lateral flame spread and failed to maintain integrity for all radiation exposures.
- Treated pine presented additional risk to building from following
  - Additional radiant heat from burning fence
  - Fire spread along fence away from fire front taking the fire to the building

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Water Tank Performance

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Water Tank Performance

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Water Tank Performance

Water Tank Performance – Key Results

Metal Tanks

- Withstand all exposures but develop slow leaks due to failure of sealants with direct flame contact.
- Spiral wound performs better than traditional steel.
- Plastic coating on inside delaminates.

Poly Tanks

- Withstand debris attack.
- Melt and burn above waterline for severe radiation exposure.
- May burst due to hydrostatic pressure and softening of outer surface for sever radiation exposures and direct flame contact.
- Poly tanks should be installed with 30 m clearance from forest fuel and stored combustibles.

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Power Pole Performance

Power Pole Performance

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Power Pole Performance – Key Results

- Steel power poles maintained integrity and servicability for all fire exposures
- For bushfire exposure with flame immersion bot the steel and poly sleeves were damaged above ground but intact below ground
- For structural fire exposure the galvanised surface coating was damaged and may require subsequent coating.
- Steel power poles are suitable for bushfire prone areas.

AS 3959 Construction of Buildings in Bushfire Prone Areas

- AS 3959 (1999) current standard
- AS 3959 being revised with draft for public comment released in 2005
- CSIRO participates in AS 3959 development committee providing technical advice.
- Revised AS 3959 to be referenced in Building Code Of Australia

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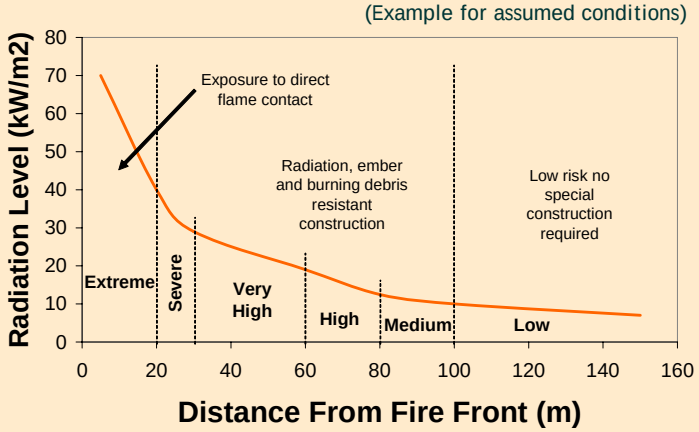
AS 3959 – Major Changes

- Categories of bushfire attack increased from 3 to 5.

(Example for assumed conditions)



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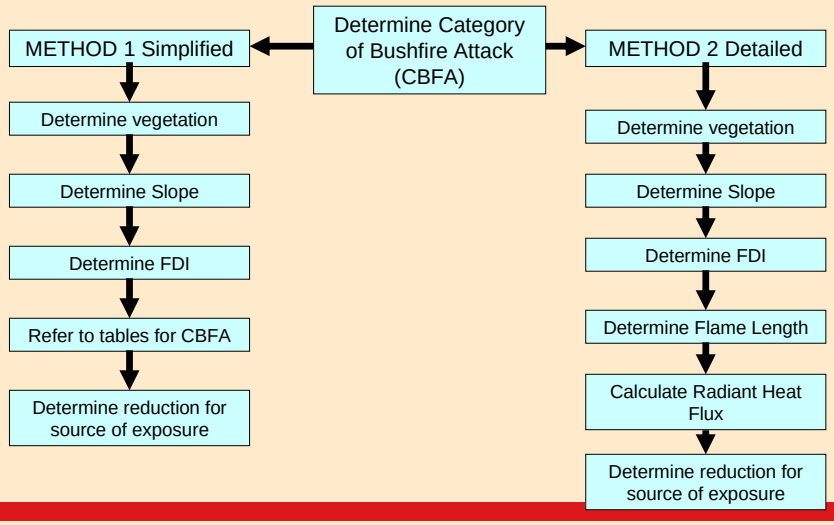
AS 3959 – Major Changes



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AS 3959 – Major Changes

- Construction and Material requirements have been revised
- AS 1530.8 - Alternative bushfire materials and assemblies test methods are being drafted as alternative to DTS requirements.

AS 3959 - Future Research

- Current revision is almost complete
- Best Judgement has been applied where existing knowledge is not sufficient.
- Research that may assist future amendments;
  - Prediction of bushfire exposure conditions
  - Bushfire behaviour of materials and assemblies
  - Evolution of bushfire test methods

Thank You

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