INTEGRATED DESIGN FOR BUSHFIRE RESILIENT HOUSING

Dr Ian Weir Research Architect
Issues discussed

Cost savings through holistic design: landscape, buildings, components and human behaviour.

Strategies for reconciling biodiversity conservation and bush fire safety.

Affordable BAL-40 house design approaches (with reference to the ‘Karri Fire House’, Denmark WA)

Examples of bush fire responsive architecture in Australia and overseas.
Bushfire Research

- Adviser to Black Saturday Royal Commission
- Adviser to survivors of Black Saturday
- Invited appearances on ABC New Inventors, SBS Insight
- Expert Advisor Bushfire Building Council of Australia
- Committee member of AS3959 Bushfire Standard (FP-020)
- Advisor to Local Government
- Volunteer Fire Fighter
- Advocate for architecture + bushfire in public and professional media (radio, television, newspapers, trade journals, expert opinion pieces).
We can build homes to survive bushfires, so why don’t we?

January 8, 2015 6.27am AEDT

- Misinformation on Cost
- Poor application of AS3959
- Poor Planning Regulations
- False Sense of Security Myth
- Passive & Active Design
Bushfire Practice

- *Ford House*, Bremer Bay, 1997
- *H House*, Bremer Bay, 2007
- *McLean House*, Steels Creek House, Vic, 2009
- *Wormald House*, Murrindindi, Vic, 2009 (unbuilt)
- *Downie House*, Nornalup, 2012 (unbuilt)
- *Karri Fire House*, Denmark, 2014 (with Kylie Feher Architect)
- *Camera Botanica*, Bremer Bay WA
- *Lightsite Permanent*, Bremer Bay WA
- *Pursell House*, Bremer Bay WA
- *Longbreak*, Denmark, WA
Karri Fire House (BAL-40) (with Kylie Feher Architect)
Camera Botanica (BAL-40+) 2105
Lightsite Permanent (BAL-Flame Zone)
Houses burn trees!
Problem of National Significance
AS3959:2009

Part 1
Assessment
Bushfire
Attack Level
(6)

Part 2
Construction
Standards
(6)
# AS3959 – Bushfire Attack Levels

<table>
<thead>
<tr>
<th>BAL-LOW</th>
<th>Very Low risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAL-12.5</td>
<td>Low Risk</td>
</tr>
<tr>
<td></td>
<td>Ember attack &amp; radiant heat up to an including 12.5 kW/m²</td>
</tr>
<tr>
<td>BAL-19</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>12.5 – 19 kW/m²</td>
</tr>
<tr>
<td>BAL-29</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>19 – 29 kW/m²</td>
</tr>
<tr>
<td>BAL-40</td>
<td>Very High</td>
</tr>
<tr>
<td></td>
<td>Ember attack, increased likelihood of flame contact &amp; radiant heat 29 – 40 kW/m²</td>
</tr>
<tr>
<td>BAL-FZ</td>
<td>Extreme – Flame Zone</td>
</tr>
<tr>
<td></td>
<td>40+ kW/m² - ember attack, burning debris, direct exposure of flames from the fire</td>
</tr>
</tbody>
</table>
BAL – 12.5 (@ 15 t/ha)
BAL – 19 (@ 15 t/ha)
BAL – 29 (@ 15 t/ha)
BAL – 40 @ 15 t/ha)
BAL – FZ (@ 15 t/ha)
<table>
<thead>
<tr>
<th>BAL-LOW</th>
<th>BAL-12.5</th>
<th>BAL-19</th>
<th>BAL-29</th>
<th>BAL-40</th>
<th>BAL-FZ (FLAME ZONE)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUBFLOOR SUPPORTS</strong></td>
<td>No special construction requirements</td>
<td>No special construction requirements</td>
<td>No special construction requirements</td>
<td>Concrete slab on ground or encased by external wall or protection of materials with a non-combustible material such as flow-concrete or non-combustible or treated for bundling resistance to AS 1530.1.</td>
<td>Concrete slab on ground or encased by external wall or protection of materials with a non-combustible material such as flow-concrete or non-combustible or treated for bundling resistance to AS 1530.1.</td>
</tr>
<tr>
<td><strong>FLOORS</strong></td>
<td>No special construction requirements</td>
<td>No special construction requirements</td>
<td>No special construction requirements</td>
<td>Concrete slab on ground or encased by external wall, metal mesh as above or floorless less than 400 mm above ground level to be non-combustible, naturally fire resistant timber or protected on the underside with vermiculite mineral wool isolation.</td>
<td>Concrete slab on ground or encased by external wall or protection of materials with a non-combustible material such as flow-concrete or non-combustible or treated for bundling resistance to AS 1530.1.</td>
</tr>
<tr>
<td><strong>EXTERNAL WALLS</strong></td>
<td>As for BAL-19</td>
<td>As for BAL-19 except that 4 mm Grade A safety glass can be used in place of 6.3 mm toughened glass</td>
<td>Non-combustible material (masonry, brick veneer, metal stud, exposed concrete, concrete, timber framed, steel framed) walls lined on the outside and clad with 6 mm fire-resistance rated external wall cladding, if used on the inside and clad with 6 mm fire-resistance rated external wall cladding</td>
<td>Non-combustible material (masonry, brick veneer, metal stud, exposed concrete, concrete) or timber framed or steel framed walls backed on the outside, clad with 6 mm fire-resistance rated external wall cladding, or non-combustible timber.</td>
<td>Non-combustible material (masonry, brick veneer, metal stud, exposed concrete, concrete) or timber framed or steel framed walls backed on the outside, clad with 6 mm fire-resistance rated external wall cladding. Can be used with AS 1530.2.</td>
</tr>
<tr>
<td><strong>EXTERNAL WINDOWS</strong></td>
<td>As for BAL-19 except that 4 mm Grade A safety glass can be used in place of 6.3 mm toughened glass</td>
<td>As for BAL-19 except that door-framing can be made from any fire-resistant timber (high density timber)</td>
<td>Protected by bundling shutter, or reinforced with 40 mm timber with a 6 mm toughened glazing and 30 mm fire-resistance rated external wall cladding.</td>
<td>Protected by bundling shutter, or reinforced with 60 mm toughened glazing and 30 mm fire-resistance rated external wall cladding.</td>
<td>Protected by bundling shutter, or reinforced with 60 mm toughened glazing.</td>
</tr>
<tr>
<td><strong>EXTERNAL DOORS</strong></td>
<td>As for BAL-19 (including needs to be fully operable)</td>
<td>As for BAL-19 (including needs to be fully operable)</td>
<td>Non-combustible covering, Render/Wall junction sealed. Openings fitted with non-combustible external covers. Roof to be fully surfaced.</td>
<td>Non-combustible covering, Render/Wall junction sealed. Openings fitted with non-combustible external covers. Roof to be fully surfaced.</td>
<td>Non-combustible covering, Render/Wall junction sealed. Openings fitted with non-combustible external covers. Roof to be fully surfaced.</td>
</tr>
<tr>
<td><strong>VERANDAS DECKS ETC.</strong></td>
<td>No special construction requirements</td>
<td>No special construction requirements</td>
<td>Enclosed mid-floor space or non-combustible or bundling resistant timber supports. Decking be non-combustible or bundling resistant timber.</td>
<td>Enclosed mid-floor space or non-combustible or bundling resistant timber supports. Decking be non-combustible or bundling resistant timber.</td>
<td>Enclosed mid-floor space or non-combustible or bundling resistant timber supports. Decking be non-combustible or bundling resistant timber.</td>
</tr>
</tbody>
</table>
**BAL-12.5**
Ember attack radiant heat below 12.5 kW/m².

**BAL-19**
Increasing ember attack and windborne debris, radiant heat between 12.5 kW/m² and 19 kW/m².

**BAL-29**
Increasing ember attack and windborne debris, radiant heat between 19 kW/m² and 29 kW/m².

**BAL-40**
Increasing ember attack and windborne debris, radiant heat between 29 kW/m² and 40 kW/m². Exposure to flames from fire front likely.

**BAL-FZ**
Direct exposure to flames, radiant heat and embers from the fire front.
BAL-12.5
Ember attack
radian heat below
12.5 kW/m².

BAL-19
Increasing ember
attack and
windborne debris,
radian heat
between
12.5 kW/m²
and 19 kW/m².

BAL-29
Increasing ember
attack and
windborne debris,
radian heat
between 19 kW/m²
and 29 kW/m².

BAL-40
Increasing ember
attack and
windborne debris,
radian heat
between 29 kW/m²
and 40 kW/m².
Exposure to
flames from fire
front likely.

Direct exposure to
flames, radiant
heat and embers
from the fire front.
- BAL-12.5: Ember attack radiant heat below 12.5 kW/m².
- BAL-19: Increasing ember attack and windborne debris, radiant heat between 12.5 kW/m² and 19 kW/m².
- BAL-29: Increasing ember attack and windborne debris, radiant heat between 19 kW/m² and 29 kW/m².
- BAL-40: Increasing ember attack and windborne debris, radiant heat between 29 kW/m² and 40 kW/m². Exposure to flames from fire front likely.

Innovation: Direct exposure to flames, radiant heat and embers from the fire front.
Rosco McGlashan and the Aussie Invader
1000 MPH
Solid Aluminum Wheels:
10,000 RPM.
50,000G @ 1000Mph
Fire Danger Index (FDI)
Fire Danger Index (FDI)

<table>
<thead>
<tr>
<th>AS3959 FDI Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
</tr>
<tr>
<td>NSW</td>
</tr>
<tr>
<td>NT</td>
</tr>
<tr>
<td>QLD</td>
</tr>
<tr>
<td>SA</td>
</tr>
<tr>
<td>Tas</td>
</tr>
<tr>
<td>Vic</td>
</tr>
<tr>
<td>WA</td>
</tr>
</tbody>
</table>
Adapted from Blong R J, Sinai D and Packham C, 2000, Natural Perils in Australia and New Zealand, Swiss Reinsurance, Sydney
State Planning Policies

- Building Protection Zones
- Asset Protection Zones
- Low Threat Vegetation
- Emergency Vehicle Access
- Water Supply
- Constraints on Development
- Bans on BAL 40 and Flame Zone
- State based variations
- Conflation of Hazard and Risk
- Unrealistic requirements on landowners and their neighbours
Well-prepared property

You can reduce the impact of fire on your home by preparing your property before summer.

- Mature trees can help shield against radiant heat and embers. They must be strategically located and well managed.
- Keep grass cut or less than 10cm.
- Keep woodpiles away from house.
- Remove flammable items from decks and verandahs, such as hoses, furniture and deckmates.
- Store flammable liquids away from house.
- Cut back overhanging branches - no branches within 1m of buildings.
- Prune lower branches of shrubs to separate from surface fuels underneath.
- Prune shrubs well away from tree branches.
- Do not have large shrubs next to or under windows.
- Use pebbles or rocks in your garden (not flammable mulch).
- Get rid of dry grass, leaves, limbs and loose bark.
Bushfire Planning Conditions

Diagram E4.1b and E4.2b Hazard separation zones within subdivisions, including (Ref. P4, A4.1, A4.2)

BPZ 2 t/ha