<table>
<thead>
<tr>
<th>Advisory Note 03</th>
<th>Polycarbonate sheeting used for roofs in bushfire prone areas.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>To provide guidance on situations where polycarbonate sheeting can be used for roofs in bushfire-prone areas.</td>
</tr>
<tr>
<td>Version</td>
<td>1</td>
</tr>
<tr>
<td>Previous Advisory Notes</td>
<td>Nil</td>
</tr>
</tbody>
</table>
| Determination    | Having regard to the functional requirements of roofs within AS3959 – 2009 Construction of buildings in bushfire-prone areas there are circumstances where polycarbonate sheeting products may be used in roofs and similar assemblies:  
   a) The bushfire attack level is BAL19 or below; and  
   b) The assembly is installed so that it does not provide a place for embers to lodge which may ignite the adjacent surfaces such as walls, roofs, eaves and facias; and  
   c) The roof is not required to provide ember-proofing for an enclosed space. |
| Background       | **Regulatory Requirements**  
   • The Building Code of Australia adopts AS3959 – 2009 Construction of buildings in bushfire-prone areas as the acceptable construction manual for buildings in bushfire prone areas.  
   • AS3959 – 2009 requires that roof tiles, roof sheets and roof-covering accessories shall be non-combustible for Bushfire Attack Levels of BAL 12.5, 19, 29 and 40 (clauses 5.6.1 (a), 6.6.1 (a), 7.6.1 (a), 8.6.1 (a)). BAL FZ assemblies are required to be tested to AS1530.8.2.  
   • AS3959 – 2009 defines non-combustible as “Not deemed combustible as determined by AS1530.1 or not deemed combustible in accordance with the BCA” (clause 1.5.19).  
   • Polycarbonate sheeting is used in a variety of ways as a roofing material and for awnings over doors and windows. However polycarbonate sheeting is not deemed non-combustible. Thus this material is currently unable to be accepted as a deemed to satisfy solution in bushfire prone areas anywhere in Australia.  
   **Functional Requirements of AS3959 – 2009**  
   AS3959 requires roofs to serve three functions:  
   • Resistance to ignition  
   • Prevention of the lodgement of embers which may ignite of adjacent surfaces.  
   • Prevention of ember intrusion to interior spaces. |
Performance of polycarbonate sheeting in bushfire-prone areas

- Polycarbonate sheeting has been subjected to fire testing in the past. Polycarbonate sheeting is not deemed to be non-combustible for the purposes of the BCA. However, in 2006 CSIRO issued an appraisal to the effect that polycarbonate sheeting was acceptable in high radiation exposures\(^1\).
- Very high levels of radiation will soften and melt polycarbonate sheeting and indeed ultimately ignite it. At very low levels of radiation and without flames then embers are not likely to ignite the material.
- Exposures close to BAL 29 have been made and so polycarbonate sheet material assemblies can be used in exposures below BAL 29 (i.e. BAL Low, BAL 12.5 and BAL 19).
- AS3959 contains requirements which reduce the potential for ember lodgement as well as for the protection of adjacent surfaces if embers do lodge on a roof or similar assembly such as an awning or pergola.
- There are spaces covered by roofs which are otherwise open to the exterior of the building such as roofs over doorways, carports, pergolas and open verandas. These roofs do not perform the ember-proofing function.
- If the material is used in a roof it will need to conform to the remainder of the roofing requirements determined by the BAL provided the roof concerned is not required to prevent embers from entering an enclosed space.
- The following diagrams show ideas for acceptable installations when ember-proofing is not required.
- An Alternative Solution supporting this Advice is attached.

---

| Chief Officer's Signature | Mike Brown  
Chief Officer  
Tasmania Fire Service |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>01 OCT 2014</td>
</tr>
</tbody>
</table>

Polycarbonate sheeting installed at angle of 18° or more so embers fall off

Polycarbonate sheeting installed at angle of less than 18° so adjacent wall cladding needs to be non-combustible for 400mm above

Attachment: Alternative Solution: Polycarbonate Sheeting Use for Roofs in Bushfire-prone Areas (v1.0, September 2014)
Alternative Solution: Polycarbonate Sheeting Use for Roofs in Bushfire-prone Areas

Application:

The acceptable construction manual for buildings in bushfire prone areas is AS3959 – 2009 Construction of buildings in bushfire-prone areas. AS3959 – 2009 requires roof materials to be deemed non-combustible or appropriately tested. Polycarbonate sheeting used for roofs is not deemed non-combustible and has not been appropriately tested and so is not acceptable for use in bushfire-prone areas.

Alternative solution:

Notwithstanding the requirement in AS3959 – 2009 for roof materials to be non-combustible, polycarbonate sheeting and similar materials may be used for roofs when:

a) The bushfire attack level is BAL19 or below; and
b) The assembly is installed so that it does not provide a place for embers to lodge which may ignite the adjacent surfaces such as walls, roofs, eaves and facias; and
c) The roof is not required to provide ember-proofing for an enclosed space.

Deemed to Satisfy and Performance Requirements Relevant to this Alternative Solution

The BCA specifies certain buildings in bushfire-prone areas are to be constructed in compliance with the relevant construction manual which is AS3959 – 2009 Construction in bushfire-prone areas.

The deemed to satisfy requirement which is proposed to be varied is to use a material for roofs (polycarbonate sheeting) which is not deemed non-combustible and which has not been specifically tested for suitability. An alternative solution is proposed.

An alternative solution is required to conform to BCA 2014 Vol.1 A0.10 and Vol. 2 1.0.10. Therefore:

(a) BCA 2014 Volume 1 G5.2 and Volume 2 Tas 3.7.4.0 (a) will not be met and an alternative solution will be proposed.

(b) The alternate solution will address BCA 2014 Volume 1 Tas GP5.1 (a) and BCA 2014 Volume 2 Tas P2.3.4 (a).

---

2 Version 1.0, September 2104.
3 This statement complies with BCA 2014 Vol.1 A0.10 (a) and Vol. 2 1.0.10 (a).
(c) The alternate solution will not affect any other Sections or Parts and no other performance requirements need to be addressed\(^4\).

**BCA Performance Requirements**

The use of polycarbonate sheeting in roofs can be supported provided it can be shown the use meets the identified performance requirements of the Building Code of Australia which are:

**Volume 1**

**Tas GP5.1 (a)** designed and constructed to reduce the risk of ignition from a bushfire, appropriate to the—

(i) potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and

(ii) intensity of the bushfire attack on the building; and......

**Volume 2**

**Tas P2.3.4**

A Class 1 building or a Class 10a building or deck associated with a Class 1 building that is constructed in a designated bushfire prone area must, to the degree necessary, be—

(a) designed and constructed to reduce the risk of ignition from a bushfire, appropriate to the—

(i) potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and

(ii) intensity of the bushfire attack on the building; and......

**Assumption**

All other aspects of the building conform to relevant requirements of the Building Code of Australia and AS3959 – 2009.

**Assessment Method**

Expert Judgment

---

\(^4\) This statement complies with BCA 2014 Vol.1 A0.10 (b) and Vol. 2 1.0.10 (b).

\(^5\) This statement complies with BCA 2014 Vol.1 A0.10 (c) and Vol. 2 1.0.10 (c).
Methodology

AS3959 – 2009 Requirements

1. AS3959 – 2009 (hereafter AS3959) is the acceptable construction manual for buildings in bushfire-prone areas (BCA 2014 Volume 1 G5.2 and Volume 2 Tas 3.7.4.0 (a)).

2. AS3959 requires that roof tiles, roof sheets and roof-covering accessories shall be non-combustible for Bushfire Attack Levels of BAL 12.5, 19, 29 and 40 (clauses 5.6.1 (a), 6.6.1 (a), 7.6.1 (a), 8.6.1 (a)). BAL FZ assemblies are required to be tested to AS1530.8.2 so being described as non-combustible is not relevant.

3. AS3959 (clause 1.5.19) defines non-combustible as “Not deemed combustible as determined by AS1530.1 or not deemed combustible in accordance with the BCA”\(^6\).

4. In addition, AS3959 (clause 3.8) will accept the use of materials and assemblies which have been tested to either AS1530.8.1\(^7\) or AS1530.8.2\(^8\).

5. Polycarbonate sheeting and similar materials are used in a variety of ways as roofing material and for awnings over doors and windows. However polycarbonate sheeting is not deemed non-combustible. Further, successful test results for either AS1530.8.1 or AS1530.8.2 are not available for this material. Thus assemblies using this material are currently unacceptable for use in bushfire prone areas anywhere in Australia.

Functional Requirements of Roofs in AS3959

6. AS3959 requires roofs to serve three functions:

   i. Resistance to ignition

      Roofs must resist ignition by the embers, radiant heat and flames associated with an approaching bushfire. Ignition of roofing elements may spread the fire by igniting adjacent building surfaces such as walls, eaves and facias, or by burning through into spaces which are required to be ember proof.

   ii. Prevention of lodgement of embers causing ignition of adjacent surfaces.

      Roofs must not provide a location where embers may lodge on the exterior of the building and ignite either the roof or adjacent surfaces such as walls, eaves and facias.

      In AS3959 embers are deemed not able to lodge on a roof (or other surface) if the slope of the roof (or other surface) is 18° or more to the horizontal (clause 5.4.1, 5.5.2 (c), 5.5.3 (c) (iv), 6.4.1, 6.5.2 (c), 6.5.3 (c), 7.5.2 (b), 7.5.3 (c), 7.6.5 (f), 8.5.3 (b), 8.6.5 (c), Figure D3).

---

\(^6\) AS1530.1 – Combustibility test for materials.
\(^7\) AS1530.8.1 – Tests on elements of construction for buildings exposed to simulated bushfire attack – Radiant heat and small flaming sources.
\(^8\) AS1530.8.2 – Tests on elements of construction for buildings exposed to simulated bushfire attack – Large flaming sources.
If a roof (or surface) is not at a slope of 18° or more, then the Standard requires the adjacent materials to be non-combustible for a height of 400mm above the surface. At high BAL levels, all materials are required to be non-combustible.

iii. Prevention of ember intrusion to interior spaces

Roofs are required to prevent embers from entering the interior spaces of a building to avoid ignition of the building’s interior. This is achieved through gap sealing as well as using non-combustible materials. However, there are spaces covered by roofs which are otherwise open to the exterior of the building such as roofs over doorways, carports, pergolas and open verandas. These roofs are therefore not required to perform the ember-proofing function while they do need to perform the functions of not igniting or being a site for embers to lodge and ignite adjacent surfaces.

Performance of polycarbonate sheeting in bushfire-prone areas

7. The available information was reviewed to identify the fire exposures and construction limitations to allow the use of this material in bushfire-prone areas by consideration of the functions of roofs discussed above.

8. Considering Section 6. above, an upper BAL exposure needs to be identified where ignition of the material is considered unlikely. Further, appropriate installation requirements need to be specified.

i. Resistance to ignition

Polycarbonate sheeting has been subjected to fire testing in the past. CSIRO issued an appraisal in 2006 to the effect that polycarbonate sheeting was acceptable in high radiation exposures. Unfortunately the assessment was made against the 1999 edition of AS3959 which had a different scheme for describing construction requirements.

It appears there are no testing results available based on AS1530.8.1 which is the specific test for acceptance for use by AS3959 – 2009 (and which was not available in 2006). Nonetheless, exposures to radiation close to BAL 29 were made and so polycarbonate sheet material assemblies can be used in exposures below BAL29 (i.e. BAL Low, BAL 12.5 and BAL 19).

Very high levels of radiation will soften and melt polycarbonate sheeting and indeed may ultimately ignite it. At very low levels of radiation and without flames, embers are not likely to ignite polycarbonate sheeting. This means that the use of the material is not going to increase the potential fire load at the lower BAL and will likely perform better than the timbers listed in Table E1 of AS3959. As more test results become available it may be appropriate to increase the range of exposures in the future.

---

ii. Prevention of lodgement of embers causing ignition to adjacent surfaces.

The material needs to be installed in a manner that will prevent or minimise the lodgement of embers which may ignite adjacent surfaces such as walls, eaves and facias. AS3959 has clear advice on the angle of the roof surface and the protection needed for adjacent surfaces. Conforming to these requirements will reduce the potential for the exterior of the building to be ignited if embers lodge on polycarbonate sheeting in a roof or similar assembly.

iii. Prevention of ember intrusion to interior spaces

The material should not be installed as part of a roof required to provide ember protection for an enclosed space due to the potential for melting or other deformation which may allow embers to access the interior space and cause ignition within the space.

Conclusions

9. There should be no significant reduction in fire safety if polycarbonate sheeting is installed appropriately as a roofing material for BAL 19 and lower.

10. Polycarbonate sheeting meets the Performance Requirements of the BCA 2014 Volume 1 Tas GP5.1 (a) and BCA 2014 Volume 2 Tas P2.3.4 (a) providing it meets with the following proposed Alternate Solution:

   *Notwithstanding the requirement in AS3959 – 2009 for roof materials to be non-combustible, polycarbonate sheeting and similar materials may be used for roofs when:*

   a) The bushfire attack level is BAL 19 or below; and
   b) The assembly is installed so that it does not provide a place for embers to lodge which may ignite the adjacent surfaces such as walls, roofs, eaves and facias; and
   c) The roof is not required to provide ember-proofing for an enclosed space.
Signed

Mark Chladil
BSc (Hons), Grad Dip Environmental Planning, Member of Standards Australia Committee FP – 020 Construction in bushfire prone areas.
Fire Management Planning Officer, Tasmania Fire Service

Reviewed:

Jeff Knight
Graduate Certificate in Performance-based Building and Fire Codes
District Officer, Building Safety, Tasmania Fire Service

Date: 30-9-14