Bushfire protection for vulnerable use buildings

Department of Planning and Community Development

Regulatory Impact Statement – Bushfire protection for vulnerable use buildings

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Executive summary

This Regulatory Impact Statement (RIS) examines proposed regulations to provide increased bushfire protection for buildings occupied by people who are particularly vulnerable to bushfire attack because of vulnerabilities such as age, illness and acute and chronic disability (i.e. schools, kindergartens, child care facilities, aged care facilities and hospitals, collectively termed 'vulnerable use buildings') in bushfire prone areas ('BPA's).

In February 2009, one of the deadliest and most severe bushfires occurred in Victoria – known as 'Black Saturday'. Following this event, the Victorian Bushfires Royal Commission (the Commission) was established, and its analysis led to a series of both interim and final report recommendations. As part of its series of final recommendations, the Commission recommended that the Government impose bushfire protection construction requirements on vulnerable use buildings in bushfire prone areas. These potential requirements are the focus of this RIS.

Given that Victoria is one of the most bushfire prone areas in the world it is perhaps not surprising that, based on the best available science and vegetation information, approximately 85 per cent of the State is currently designated as bushfire prone. On Black Saturday, only about 30 per cent of Victoria was designated as bushfire prone. This large difference in the area of the State recognised as being subject to bushfires reflects the use of inadequate bushfire mapping predictors before Black Saturday. The Commission noted in its final report "it is telling that councils' designation of BPAs was a poor predictor of where bushfires burned on 7 February; most starkly, neither Kinglake nor Marysville was in a BPA".[1]

Nature and extent of the problem

Bushfires pose a risk to vulnerable use buildings in bushfire prone areas[2] and their occupants. During a bushfire, there are three ways in which buildings are commonly known to ignite. These mechanisms of ignition were recognised by the Commission as follows:

- Ember attack – burning debris or embers can ignite a building through direct contact, igniting combustible gases, entering through small gaps in the building structure or igniting something near the building
- Radiant heat – heat can cause structural failure (i.e. melting and cracking), ignite gases through heating building components and dry out surfaces, making them more flammable
- Flame contact – direct contact with flames from the fire front or other fire source (i.e. something that has ignited near the building) will ignite combustible materials.

An important factor in reducing the risk of ignition of a building from bushfire ignition mechanisms is through building construction and design. There are, however, a range of market failures that may prevent building owners from identifying and assessing bushfire risk and adequately addressing it through appropriate building materials and design. Given it is difficult to be specific about the relative extent of these failures in the vulnerable use building sector, further information is sought from stakeholders through consultation on the following question: Is there any further evidence regarding the extent of these market failures in the vulnerable use building sector?

There are several regulatory and non regulatory requirements and practices that serve to reduce aspects of bushfire risk associated with these buildings. For example, regulation that requires residential, accommodation and government buildings to be built to the Australian Standard 3959 for the construction of buildings in bushfire prone areas (AS 3959), planning schemes that apply to sites in the Bushfire Management Overlay

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1 Victorian Bushfires Royal Commission *Final Report, Volume II: Fire Preparation, Response and Recovery*, Chapter 6, July 2010, page 218.

2 'Vulnerable use buildings' is used in this report to refer to non-residential buildings that are occupied by people that are vulnerable to bushfire attack, including schools, kindergartens, child care facilities, aged care facilities and hospitals.

(BMO), industry specific regulations such as registration requirements for schools and non-regulatory measures such as the Bushfire Safety Policy Framework. Despite these requirements and practices, there is still a residual problem. That is, vulnerable use buildings are not being constructed to a sufficient standard to provide appropriate resistance to bushfire attack.

If this residual problem is not addressed, a range of costs could be incurred, such as:

- loss of life and injuries, including increased mortality for aged care residents if they need to be permanently relocated
- destroyed or damaged vulnerable use buildings, leading to reconstruction costs and other flow on impacts
- social disruption
- economic loss.

Previous bushfires such as Black Saturday can provide some indication of the extent of these costs. A number of vulnerable use buildings were damaged and destroyed on Black Saturday, although fortunately, there were no fatalities arising directly from these buildings being engulfed by bushfire. However, while previous bushfires such as Black Saturday can provide some indication of the extent of these costs, for a variety of reasons, it seems likely that the problem will get worse (and more costly) moving forward. For example, more people are expected to live in bushfire prone areas, and bushfires are expected to become more severe and frequent. Two scenarios are modelled to provide an indication of the size of the problem. Considering the potential cost over the expected life of a building's structure and materials, if we account for two sets of bushfires (a set being one major akin to Black Saturday and one minor), the scenarios suggest the cost of the problem could be between $39.6 million and $89.3 million net present value (NPV) over the useful lives of affected buildings.

Objectives and options

The Government's objective is to reduce the danger to life, and the risk of property damage, in relation to vulnerable use buildings in bushfire prone areas, through the most cost effective means. Three regulatory options have been assessed in this RIS as possible options to address the problem and meet this objective. There are a number of additional options that are identified but not considered feasible and therefore not considered in further analysis. These are discussed in the body of the report.

The means of achieving each of the three regulatory options considered in this RIS would be the imposition of all or some of the construction requirements in AS 3959 for the construction of vulnerable use buildings occupied by vulnerable people in designated bushfire prone areas. The options can be summarised as follows:

- ***Option 1*** would require, in the construction of vulnerable use buildings, an assessment of the building's potential exposure to bushfire attack, and would impose specific construction requirements according to the assessed exposure to bushfire risk. The assessment method and specific construction requirements are those set out in AS 3959 and this option is referred to as "compliance with AS 3959".
- ***Option 2*** would require, in the construction of vulnerable use buildings, an assessment of the building's potential exposure to bushfire attack, and would impose specific construction requirements according to the assessed exposure to bushfire risk, though with a minimum construction level that ensures each building has a measure of protection against ember attack. The assessment method and specific construction requirements are those set out in AS 3959, with construction to withstand ember attack being the construction requirements for a Bushfire Attack Level (BAL) of 12.5. This option is referred to as "compliance with AS 3959 and minimum construction to protect from ember attack (BAL-12.5)". This option is consistent with the relevant final report recommendations of the Commission and also the current construction performance requirements for residential buildings constructed in designated bushfire prone areas in Victoria.
- ***Option 3*** would require, in the construction of vulnerable use buildings, an assessment of the building's potential exposure to bushfire attack, and would impose a minimum construction level that aims to ensure that each building is better able to withstand ember attack. In addition, Option 3 would prevent the construction of buildings potentially exposed to a higher level of bushfire attack (beyond ember

attack). The assessment method and specific construction requirements are those set out in AS 3959, with construction to withstand ember attack being the construction requirements for a BAL of 12.5. Buildings potentially exposed to a higher level of bushfire attack (over and above ember attack) are those assessed at greater than BAL 12.5. If the Bushfire Attack Level of these buildings cannot be reduced to BAL-LOW or BAL-12.5, these buildings could not be constructed. This option is referred to as "compliance with AS 3959, construction to protect from ember attack (BAL-12.5) and prevention of construction where bushfire exposure is greater than ember attack (BAL-12.5)".

Standards Australia has made amendments to AS 3959-2009 since its publication and further work is being done to review, and potentially amend the testing methods prescribed. Two of the amendments made to the standard improved the extent to which it protects against ember attack by introducing further construction requirements such as maximum aperture sizes for screens and the use of sarking as a secondary form of ember protection to the roof space. While these developments have improved the standard, there has been no indication that Standards Australia is considering amending AS-3959 to provide ember protection at BAL-LOW. In an email submission to the Commission, Standards Australia "advised that it is not in a position to consider amending AS 3959-2009 to increase ember protection measures at lower Bushfire Attack Levels, until sufficient information is made available to support amending the standard".[3]

Costs and benefits of the options

For each of the three options, there are three categories of costs that have been quantified for this analysis:

- *BAL assessment costs* – this refers to the cost of having a professional surveyor undertake an assessment of the site's Bushfire Attack Level (BAL)

- *Construction costs* – which refers to the additional (or 'extra over') cost of constructing buildings to comply with AS 3959

- *Value of construction foregone* – this refers to the value of construction that is foregone due to the introduction of a level of compliance with AS 3959 meaning it is no longer feasible or possible to build/modify on a particular site.

The 'extra over' impact of each BAL on construction costs is based on analysis done for the Department of Planning and Community Development (DPCD) by PlanCost. In applying PlanCost's estimates to the three options, the following methodological matters should be noted:

- PlanCost's analysis shows the cost impact of constructing to the requirements of each BAL on a 'typical' private school, aged care facility, hospital, kindergarten and child care centre. According to PlanCost, typical building construction materials for Class 9A, 9B, and 9C buildings usually include concrete floor slabs, masonry walls, metal roofs and aluminium windows. These materials are the starting point for the 'extra over' impacts. While these building materials are 'typical', PlanCost do note that "variations to the 'example' building materials may affect the cost required to achieve the various BAL ratings". For example, if timber windows are used, the cost to comply may be higher. Further, smaller buildings such as kindergartens tend to have a higher external wall to floor area ratios than large buildings. Therefore as most of the additional cost associated with BAL ratings relate to external walls and windows, smaller buildings incur a higher percentage increase than other larger buildings.

- In PlanCost's report, where they have indicated that construction may be cost prohibitive, it is assumed that the construction would no longer go ahead and would therefore be 'foregone'. For example, PlanCost note that "achieving a BAL FZ rating on an existing building may require the complete reconstruction of the roof which would be cost prohibitive".[4] This is reflected by assuming that all relevant modifications to buildings on a site rated BAL-FZ would be foregone. PlanCost also note that "if a mandatory standard was imposed such that construction could only occur if the building was rated at BAL 12.5 or lower, many

3 Standards Australia, email to the Victorian Bushfire Royal Commission, 31 March 2010, page 3, available online at http://www.royalcommission.vic.gov.au/getdoc/5d1039c2-e422-4d38-a13c-1826928a92bc/CORR.1003.0288_R, accessed 28 March 2012.

4 PlanCost report, page 8.

building projects that required a BAL rating higher than BAL 12.5 could not or would not proceed".[5] This is reflected in the analysis by assuming that under Option 3, the construction of all BAL-40 and BAL-FZ buildings would be foregone and 50 per cent of buildings rated BAL-19 and BAL-29 would also be foregone. PlanCost note that the proportion of sites that would allow for the BAL to be reduced is unknown due to the wide variability of potential or existing sites. However to provide an indicative estimate of the costs under Option 3, an assumption of 50 per cent has been applied.

Based on estimates for the three costs outlined above, Option 1 has the lowest overall *quantified* cost at $1.3 million NPV over 10 years. Option 2 has an overall cost of $15.6 million NPV over 10 years and Option 3 has the highest cost at $32.5 to $32.9 million NPV over 10 years.

The main difference between the three regulatory options is the impact of requiring construction to a minimum BAL to provide a building with ember protection. Setting a construction minimum of BAL-12.5 means that all buildings rated as BAL-LOW would incur greater construction costs, as currently under AS 3959:2009 BAL-LOW buildings have no construction requirements. Given that about 95 per cent of vulnerable use buildings are expected to be BAL-LOW, this impact leads to a significant difference in cost. More detail on these cost estimates and a break down by the three cost categories is shown in Chapter 5.

In a practical sense, the potential benefits from the options being considered in this RIS are the avoided costs associated with bushfire events. Increasing a vulnerable use building's resistance to ignition from bushfire would help to reduce the problem identified in this RIS (set out in detail in Chapter 3) by addressing the three costs identified (loss of life, destroyed and damaged vulnerable use buildings, and social disruption).

In addition to this, by imposing a minimum of BAL-12.5, Option 2 and 3 would ensure that all buildings in bushfire prone areas in Victoria would have at least basic protection against ember attack. Ignition through wind borne embers is the most common way in which buildings are destroyed by bushfire and the threat from embers lasts much longer than the threat from the other two bushfire ignition mechanisms: flame or radiant heat. Without the minimum BAL-12.5, buildings assessed as BAL-LOW are likely to have no structural protection against ember attack. Requiring a building to have minimum protection against ember attack at the construction level significantly improves the effectiveness of Option 2 relative to the other options, as just over 95 per cent of buildings are estimated to be BAL-LOW.

In consultation with the Building Advisory Council (BAC), concerns were expressed regarding the effectiveness of applying AS 3959 to vulnerable use buildings. While the BAC acknowledged that the application of AS 3959 would be an appropriate interim solution in the absence of a specific and improved standard being developed, they also commented that a strong understanding of AS 3959 is needed by the community to ensure that its effect and aim is not misunderstood. That is, it would be necessary to ensure the community does not treat vulnerable use buildings as refuges simply because they comply with AS 3959. The BAC suggested that further information or education should be provided if regulation requiring compliance with the standard was introduced. The BAC also expressed a strong view that a mandatory BAL of 12.5 under Option 3 is not appropriate as it takes the assessment decision away from private land owners.

During consultations, the Department of Health expressed concerns that the minimum BAL requirement (expressed in this RIS as Option 2) would impose unnecessary costs during construction projects because a large proportion of its buildings were rated as BAL-LOW. In light of this view, this RIS has sought to quantify the nature and extent to such costs and consider the benefits associated with a mandatory BAL of 12.5.

Assessment of the options

In general, there is insufficient information with which to estimate the benefits associated with the three regulatory options more precisely than has been undertaken in this RIS. As a result, this RIS uses two tools to identify the preferred option. The first is breakeven analysis which can help to assist in ruling out options where costs are greater than benefits. The second tool this RIS uses to identify the preferred option is a multi-criteria analysis (MCA). Both of these tools are discussed briefly immediately below and also in more detail in the RIS.

5 PlanCost report, page 7.

Breakeven analysis

A break-even analysis identifies the minimum quantum of benefits needed for a regulatory proposal to provide a net positive outcome. A breakeven analysis is useful because it does not directly seek to value benefits, but tests the reasonableness of potential levels of benefit, compared with costs and is valuable in cases where benefits are difficult to quantify. A breakeven approach establishes the minimum benefits required to at least cover the total cost of a regulatory option. Where the breakeven target can be exceeded, the option provides a net benefit to the community.

For this analysis, the breakeven comparison of options focuses on those costs and benefits that are able to be quantified. In relation to costs, these are the costs of the options as set out earlier in this chapter (reducing the BAL, BAL assessment costs, construction costs and value of construction forgone). In terms of benefits these are the upper and lower bound estimates of the potential impact of the options in avoiding some of the cost of the problem.

The breakeven analysis of the three options assessed is summarised in Table 1.

Table 1 – Impact summary of the three options ($ million NPV)[6]

Impact	Option 1: AS 3959 as current	Option 2: Minimum BAL-12.5	Option 3: Mandatory BAL-12.5
Reducing the BAL	N/A	N/A	0.08 – 0.45
BAL assessments	0.46	0.46	0.46
Construction costs	0.62	15.0	14.4
Foregone construction	0.22	0.22	17.5
Total costs	**1.3**	**15.6**	**32.5 – 32.9**
Cost of the problem (lower – upper bounds)	**39.62 – 89.27**	**39.62 – 89.27**	**39.62 – 89.27**
Breakeven point where the range represents the lower and upper bound estimates	1 – 3%	18 – 39%	36 – 82%

Cost estimates are GST-exclusive

Note that the figures in this table may not sum due to rounding.

Analysis suggests that between 15 per cent and 31 per cent of the stock of vulnerable use buildings in bushfire prone areas is likely to be affected by the regulatory options (based on a range of assumptions, see Appendix B), but it is difficult to use this information to assess the breakeven points given the unpredictable nature of bushfires. What can be said is that:

- since Option 2 has higher costs than Option 1, the breakeven point should be higher, which it is.
- Option 3 would need to have a much greater impact on the problem than Option 2 to breakeven. It is not, however, clear that there would be a corresponding difference in the level of benefits between these two options (given that, as discussed elsewhere, Option 2 contains measures relating to the risk of buildings at certain BALs whereas under Option 3 certain buildings would simply not be constructed), which suggests that Option 2 is a better choice than Option 3.
- Option 2 is likely to achieve greater benefits than Option 1 given it provides structural protection against ember attack – this would be relevant if the two options had broadly similar breakeven points as it would

6 Note that the costs of the options are estimated over 10 years, whereas the cost of the problem is estimated over the life of vulnerable use buildings. Even if the regulations are only in place for the next 10 years, the buildings that are built to comply with the proposed regulations during that period would outlast the regulations as their expected lifespan is over 40 years (based on unpublished data provided by the Department of Health on Aged care facilities and hospitals).

suggest that Option 2 is a better choice than Option 1. However because the breakeven points differ, the following section undertakes multi-criteria analysis on the options.

1.1.1 Multi-criteria analysis

Given the above, this RIS uses MCA to identify the preferred option. In the absence of definitive estimates of benefits, MCA is a transparent mechanism for assessing different approaches against clearly defined assessment criteria.

MCA is a specific form of cost–benefit analysis that brings a degree of structure, analysis and openness to decision-making. It is particularly useful in circumstances where it is necessary to consider a range of economic, environmental and social costs and benefits which cannot be precisely quantified and/or valued. MCA does allow, however, the inclusion of monetary valuations where available alongside other quantitative and qualitative valuations.

MCA establishes preferences between options by reference to an explicit set of objectives and measurable criteria to assess the extent to which the objectives have been achieved. In simple circumstances, the process of identifying objectives and criteria may alone provide enough information for decision-makers. However, where a level of detail is required MCA offers a number of ways of aggregating the data on individual criteria to provide indicators of the overall performance of options.

The criteria and weightings used in this multi-criteria analysis are:

- reduction in risk of ignition from bushfire of vulnerable use buildings in bushfire prone areas (as outlined in the problem chapter, such risk primarily relates to buildings but also encompasses the potential impact on lives and injuries, as well as flow on social impacts) (50%)

- substantive compliance costs (25%) and the value of foregone construction (25%) – the relative importance of compliance costs versus the value of forgone construction varies according to the proposed regulatory option, which is why equal weights are given so as to not prejudge a particular outcome.

These weightings reflect the fact that cost criteria should generally be weighted 50% collectively. Each option is scored on a scale from -10 to +10 relative to the base case. A score of 0 reflects no change compared to the base case, whereas a positive (negative) score reflects a benefit (cost) to society compared to the base case.

Reduction of risk of ignition for vulnerable use buildings

In terms of the impact on the risk of ignition for vulnerable use buildings, the MCA scores in this regard reflect the following:

- The options are all expected to better protect vulnerable use buildings over an extended period in areas that have been identified as being prone to bushfires, and in the context of bushfires becoming more frequent and severe moving forward – as such, the assessment is that there would be a reduction in the risk of ignition given affected buildings would be better able to withstand bushfires as a result of the options.

- Even though only some (between 15 and 31 per cent) of the stock of such buildings is affected, given the unpredictability of bushfires, this doesn't necessarily mean that the benefit is correspondingly small.

- Option 1 is expected to only marginally reduce the risk of ignition for vulnerable use buildings in bushfire prone areas, given it does not contain specific measures to protect against ember attack at BAL-LOW levels. Given it is estimated that BAL-LOW buildings represent about 95 per cent of buildings in bushfire prone areas and protection against ember attack is crucial to building survival, the lack of ember protection at BAL-LOW limits the effectiveness of this option in targeting and therefore addressing the problem. It was clear from the Commission's findings that ember protection is seen as an important factor in the protection of vulnerable use buildings. As a result, the Commission recommended a minimum BAL 12.5 for non-residential buildings to ensure appropriate protection against ember attack into the future. For this reason, it is assessed as only representing a small improvement over the base case (due to the fact that the standard affords protection from the other elements of ignition) and scores +0.5 to +1. This score is presented as a range to reflect the unpredictability of bushfires.

- Options 2 and 3 score more highly than Option 1 as they:
  - both contain requirements that seek to protect buildings against ember attack, which is why the scores are higher for these options relative to Option 1. The lower bounds of these scores reflect a conservative assessment about the additional gains that the options represent over the base case relative to Option 1 (for example if future bushfires *generally* do not recur in areas currently rebuilding or that will build over the next ten years). Both options have relatively high upper scores reflecting a view that the benefits could be sizeable to the extent that future bushfires do recur in areas currently rebuilding.
  - both options would see some construction forgone, which effectively eliminates the risk for some buildings insofar as they simply would not be built as a result of the option. This is more of an issue for Option 3, which is why it generally scores higher than Option 2 against this criterion (although it should be acknowledged that Option 2 attempts to address risk for buildings with a graduated set of requirements depending on the BAL assessment).
  - neither Option 2 nor 3 receives a perfect score as even buildings built to the higher standard may still succumb to bushfires (that is, the options reduce risk, but only eliminate it in respect of foregone construction).
- In light of these factors, the score for Option 2 is +3 to +8, and for Option 3 is +4 to +9.

Substantive compliance costs

Each of the options imposes substantive compliance costs in terms of obtaining a BAL assessment and constructing to the relevant requirements of a certain BAL. In this respect, Option 1 is expected to cost $1.1 million NPV over ten years, Option 2 $15.4 million NPV over ten years, and Option 3 about $15.0 million NPV over ten years.[7] Based on the relative magnitude of these costs, Option 1 scores - 0.5, and Options 2 and 3 score - 7, where a negative score reflects the fact that the option is more costly than the base case in terms of substantive compliance costs imposed.

Foregone construction

The other cost element of the options relates to foregone construction. That is, as a result of the options some construction will not proceed because the requirements would make doing so 'cost prohibitive'. This is minor for both Options 1 and 2 ($0.22 million NPV over ten years), but significant for Option 3 ($17.5 million NPV over ten years). Based on the relative magnitude of these costs, Options 1 and 2 score - 0.1 and Option 3 scores - 8.

Overall assessment

As can be seen by the scores, the potential gains - relative to the criteria that have been considered - vary across the options. This means that it is somewhat challenging to definitively identify an option that is a standout relative to the others. What can be identified is that, of all three options:

- Whereas Option 1 seems likely to represent a small improvement over the base case, it does not target a key aspect of the problem, and so while it is 'low cost', it is also 'low benefit'.
- Options 2 and 3 better target the problem, but in doing so have higher costs than Option 1 – the overall scores for these options have upper bounds that are positive (suggesting an improvement over the base case) and lower bounds that are negative (suggesting the opposite). The range for Option 2 is overwhelmingly positive and the lower bound is based on a conservative view about the likely effect of future bushfires. The range for Option 3 is largely negative, and Option 3 has also been assessed as unlikely to achieve the breakeven point (see discussion above).

Of the three options considered, based on a balanced view as to the most likely overall outcome in light of the points above, the potential gains flowing from Option 2 in proportion to the costs of that option suggest that this is the option that should be adopted. It is the considered view of the Department that Option 2 provides the

7 Calculated as the sum of all costs other than foregone value, based on the figures provided in Table 13.

most likely approach to achieve the greatest potential gain at a proportionally acceptable cost. There are, however, degrees of uncertainty attached to the likely outcome from these options, and feedback is sought on the reasonableness of the proposed preferred approach.

Table 2 – Multi-criteria analysis

Building type	Option 1		Option 2		Option 3	
	Assigned score	Weighted score (50%)	Assigned score	Weighted score (25%)	Assigned score	Weighted score (25%)
Reduced risk of ignition for vulnerable use buildings	+ 0.5 to + 1	+ 0.3 to +0.5	+ 3 to + 8	+ 1.5 to + 4	+ 4 to + 9	+ 2 to + 4.5
Compliance costs	- 0.5	- 0.1	- 7	- 1.8	- 7	- 1.8
Foregone construction	- 0.1	- 0.03	- 0.1	- 0.03	- 8	- 2
Total weighted score		**+ 0.1 to + 0.4**		**- 0.3 to + 2.2**		**- 1.8 to + 0.8**

The preferred option

Of the three proposed regulatory options, the preferred option is Option 2, which requires the application of AS 3959 and construction, as a minimum, to BAL-12.5. Under this option, buildings assessed as BAL-LOW will have to be constructed to the standards set for BAL-12.5. As the preferred option only sets a *minimum* standard of BAL-12.5, any building assessed as being above BAL-12.5 will still be required to comply with the higher building standards appropriate to the site's assessed BAL.

Implementing the preferred option, Option 2, involves an amendment to the Building Regulations 2006 (Vic) (the Building Regulations) to adopt bushfire performance standards to the construction of, and significant modification to, vulnerable use buildings in designated bushfire prone areas in Victoria (the Proposed Regulations).

The Proposed Regulations will amend the Building Regulations to:

- Insert a new definition into the Building Regulations, being a "special bushfire protection building". This term will define the types of vulnerable use buildings to which the performance standard in the Proposed Regulations will apply.
- Insert a bushfire performance standard for the construction of a special bushfire protection building.
- Create a new stand alone part G6 of the BCA 2011 (Volume One).[8]

The Commission's recommendation 49.3 expressly states that a minimum AS 3959-2009 construction level of BAL-12.5 is to apply to all new vulnerable use buildings and extensions in bushfire-prone areas, *other than in exceptional circumstances*. While the Commission provided no guidance on the definition of exceptional circumstances, in a different context, they did provide some guidance as to what might constitute an exceptional circumstance to allow new development to occur with less than the required minimum defendable space (the vegetation clearing requirements imposed through planning mechanisms). In this context, the Commission suggested that the role of alternative safety measures such as bunkers could be considered when

8 Building Amendment (Bushfire Construction – Buildings) Regulations 2012, Draft prepared by the Office of Chief Parliamentary Counsel Victoria. Part G6 will be reflected as a schedule in the proposed regulations and will therefore be available to the general public.

determining what might constitute exceptional circumstances sufficient to exempt a developer from the requirement to ensure a site complied with its assessed minimum requirement for defendable space.[9]

Exemptions from the minimum construction level of BAL 12.5 have not been included in the proposal. The reason for this is that DPCD is not presently aware of any specific circumstances that would warrant such an exemption.

While a variety of different stakeholders were consulted for the purposes of preparing this RIS, this document will be subject to a public consultation period during which public comments and submissions can be made to the Department of Planning and Community Development (DPCD). Details regarding how comments and submissions can be made are provided later in this RIS.

Competition assessment

Any new legislation in Victoria must not restrict competition unless it can be demonstrated that:

- the benefits of the restriction, as a whole, outweigh the costs, and
- the objectives of the legislation can only be achieved by restricting competition.

A legislative amendment is considered to have an impact on competition if any of the questions in Table 16 in the body of this RIS can be answered in the affirmative. For example, would the costs/benefits associated with the proposed measure affect some firms or individuals substantially more than others (e.g. small firms, part–time participants in occupations, etc)? The answer to this question would be yes because small buildings such as kindergartens tend to have higher external wall to floor area ratios and so may incur a higher percentage increase associated with BAL ratings than other larger buildings.

While four of these questions are answered with a yes, meaning there are some potential impacts on competition, the analysis in this RIS demonstrates that these impacts on competition are necessary and that the associated benefits are likely to outweigh the costs.

Implementation and enforcement

Implementation may involve activities to raise the awareness of the introduction of the Proposed Regulations. This would be conducted by the Building Commission and associated bodies that may also run seminars for building surveyors, major builders and construction companies specialising in the construction and modification of vulnerable use buildings.

Building activities and building standards in Victoria are determined by the *Building Act 1993* (Vic) (the Building Act), Building Regulations and the Building Code of Australia (the BCA). Enforcement of building standards is currently carried out by public and private building surveyors, authorised officers from the Building Commission and the associated bodies, local governments and authorised officers of the Metropolitan Fire and Emergency Services Board (MFB) and the Country Fire Authority (CFA).

Evaluation strategy

It is difficult to predict and therefore measure the number of lives and buildings that could potentially be saved as a result of the Proposed Regulations. Nevertheless, DPCD will continue to monitor the impact of the Proposed Regulations; with a view to ensuring that these regulations are operating as intended and that industry is sufficiently informed of the new requirements and how to satisfy them.

For example, in the wake of future bushfires there may be evidence (even anecdotally) about the extent to which vulnerable use buildings that are built to a higher standard as a result of the Proposed Regulations are better able to withstand bushfire ignition mechanisms such as ember attack as compared to those that are not.

Standards Australia is also continuing to discuss and develop a future work program including potential research activities that could inform further Standards development work in relation to ember attack across the

9 VBRC Final Report 31 July 2010, Chapter 6 'Planning & Building' at paragraph 6.4.4.

BALs. To this end, Standards Australia would be likely to be consulted in the context of any future evaluation of the operation of the Proposed Regulations.

Consultation

Feedback is sought on the analysis in, and findings of, this RIS. Most importantly, feedback is sought on the merit of the proposed regulations, that is:

- Do you support the proposed regulations?
- If not, why?
- What alternative (if any) would you propose?

Specific consultation questions are posed throughout this RIS. These are reproduced below:

1 Is there any further evidence regarding the extent of these market failures in the vulnerable use building sector?

2 How likely is that each option will reduce the risk of ignition for vulnerable use buildings, to the extent suggested by the scores in the MCA? How reasonable are the assumptions regarding estimates for compliance costs and forgone construction?

3 Are all vulnerable use buildings suitably identified in the proposed regulations?

4 Are there any 'exceptional circumstances' that may exist to warrant a new or substantially modified vulnerable use building, in a designated bushfire prone area, assessed as BAL-LOW, to be exempted from the minimum AS 3959-2009 construction level of BAL-12.5?

5 How, and to what extent, are small businesses affected by the Proposed Regulations?

6 To what extent are there costs associated with implementing/enforcing these requirements for building surveyors?

The consultation period on the RIS – during which submissions will be accepted - is 6 weeks, and the Proposed Regulations are expected to commence by September 2012. Submissions are required to be made in writing and can be emailed to: building.submissions@dpcd.vic.gov.au or posted to:

The Manager
Building Regulatory Reform, Housing & Building Policy
Department of Planning and Community Development
Level 27, 1 Spring Street
Melbourne VIC 3001

Please note that all submissions will be treated as public information unless you request otherwise. Submissions may be published on the DPCD website unless you clearly indicate that you prefer that all or part of your submission is not published. Any content considered to be defamatory, vilifying or otherwise inappropriate will not be published.

You should be aware that, whether or not it is made available on the DPCD website, your submission may be subject to the *Freedom of Information Act 1982*.

Personal information may be used to contact you regarding your submission and/or the outcomes of the consultation. Please clearly state in your submission if you do not wish for this to occur.

If you have any questions about the consultation process, please telephone Natasha Hammersley, Senior Policy Officer, on (03) 9223 1813.

Contents

The Proposed Regulations are attached at the conclusion of this report.

A report produced by PlanCost Australia that provides supporting research on the incremental costs associated with the implementation of AS 3959 is also attached at the conclusion of this RIS.

Abbreviations

Abbreviation	Description
ABCB	Australian Building Codes Board
AS 3959:2009	Australian Standard 3959 (Construction of buildings in bushfire-prone areas) as initially published on 10 March 2009 and amended on 16 November 2009, 15 February 2011 and 11 November 2011.
AS 3959	Australian Standard 3959 (Construction of buildings in bushfire-prone areas)
Authority	Victorian Registration and Qualifications Authority
BAC	Building Advisory Council
BAL	Bushfire Attack Level under AS 3959
BPA	Designated bushfire prone area
BCA	Building Code of Australia
BFSA	Bush Fire Safety Authority
BMO	Bushfire Management Overlay
CFA	Country Fire Authority
COAG	Council of Australian Governments
Code Red Day	The highest risk rating on the Fire Danger Rating forecast by the Bureau of Meteorology during the fire season and is based on weather and other environmental conditions. A Code Red day represents the worst conditions for bushfires.
Commission	2009 Victorian Bushfires Royal Commission
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth
DEECD	Department of Education and Early Childhood Development
DPCD	Department of Planning and Community Development
DSE	Department of Sustainability and Environment
ECEC	Early childhood education and care
FZ	Flame Zone
GAA	Growth Areas Authority
GST	Goods and Services Tax (GST) means the tax that is payable under the GST law imposed as goods and services tax under *A New Tax System (Goods and Services Tax) Act 1999.*
LGA	Local Government Area
MCA	Multi-criteria analysis
MD3	Ministerial Direction No. 3 (Bushfire Provisions for Buildings of a Public Nature) issued by the Minister for Planning on 1 February 2010 (under section 30 of the

Abbreviation	Description
	Project Development and Construction Management Act 1994)
MEMP	Municipal Emergency Management Plan
MFB	Metropolitan Fire and Emergency Services Board
NCC	National Construction Code
NPV	Net Present Value
NQF	National Quality Framework
NSW	New South Wales
Proposed Regulations	Proposed Building Amendment (Construction Requirements for Special Bushfire Protection Buildings) Regulations 2012
RFS	Rural Fire Service
RIS	Regulatory Impact Statement
School Guidelines	Bushfire Preparedness Guidelines for Schools
SFPP	Special Fire Protection Purpose
SLA	*Subordinate Legislation Act 1994 (Vic)*
Substantially modified buildings	Under regulation 608, buildings that are altered or extended by more than 50 per cent (by volume) over a period of three years.
The Aged Care Act	*The Aged Care Act 1997 (Cth)*
The Building Act	*Building Act 1993 (Vic)*
The Health Services Act	*The Health Services Act 1988 (Vic)*
The Planning Act	*Planning and Environment Act 1987 (Vic)*
Vic	Victoria
VPP	Victoria Planning Provisions
Vulnerable use buildings	Schools, kindergartens, child care facilities, aged care facilities and hospitals.
WMO	Wildfire Management Overlay

1 About this Regulatory Impact Statement

1.1 Introduction and purpose of this Regulatory Impact Statement

PwC has been engaged by the Department of Planning and Community Development (DPCD) to prepare this Regulatory Impact Statement (RIS) in relation to proposed amendments to Victoria's regulations for building, the Building Regulations (the amendments are referred to in this RIS as the Proposed Regulations).

Under section 7 of the *Subordinate Legislation Act 1994* (the SLA), a RIS must be prepared for the Proposed Regulations, unless an exemption is issued by the Premier or the responsible Minister. In general terms, a RIS is required for any subordinate legislation that imposes a significant economic or social burden on a sector of the community.

A RIS forms an essential part of the regulatory development process as it considers the appropriateness of regulation in comparison to other non-regulatory options available to Government and the costs and benefits of all regulatory and non-regulatory options. It should also consider the sectors of the community where the costs and benefits will be attributed. The RIS process should ensure that:

- the implementation of regulation only occurs where there is a justified need
- only the most efficient forms of regulation are adopted
- there is an adequate level of public consultation in the development of regulatory measures.

To meet these objectives and adhere to the requirements of the SLA, the purpose of this RIS is to:

- identify, establish and determine the extent of the problem that the Government is seeking to address
- specify the desired objectives of intervention
- identify a set of options for Government to address the identified problems
- assess the costs and benefits of these options, and the effectiveness of each option in addressing the problem before establishing a preferred option for Government action, and
- develop an implementation and evaluation strategy for the preferred option.

This RIS adheres to the requirements of the SLA and associated guidelines issued by the Premier under section 26 of the SLA. It is also drafted with reference to the Victorian Guide to Regulation[10], which provides guidance on RIS requirements.

1.2 Structure of this report

This RIS is structured as follows:

- Chapter 2 provides background into the issue that the Victorian Government is seeking to address
- Chapter 3 describes the nature and extent of the problem and the regulatory gap that currently exists

[10] Department of Treasury and Finance (Victoria), 'Victorian Guide to Regulation', Edition 2.1, Melbourne, August 2011.

- Chapter 4 outlines the objective of Government action and considers the policy options available to Government to address the problem
- Chapter 5 assesses the costs and benefits of each option
- Chapter 6 discusses the preferred option
- Supporting appendices provide:
  - an outline of who was consulted with for the purposes of this RIS (Appendix A)
  - the methodologies and assumptions made in the cost benefit analysis (Appendix B)
  - an outline of the NSW Approach to 'Special Fire Protection Purpose' buildings (Appendix C)
  - a list of references used in this report (Appendix D)

The Proposed Regulations are attached at the conclusion of this report.

A report produced by PlanCost Australia that provides supporting research on costs of the incremental application of AS 3959 to construction of certain vulnerable use buildings is also attached at the conclusion of this RIS.

2 Background

2.1 Bushfire in Victoria

Victoria has a long history of deadly and destructive bushfires. In just over 160 years of recorded history, 53 major bushfire events have occurred in Victoria (two thirds of them in the last 60 years)[11] resulting in over 550 deaths, the destruction of over 14,000 buildings, and millions of hectares of Victorian land burnt across the State.[12]

On public land alone, it is estimated that on average around 600 bushfires occur in Victoria each year.[13] No one fire is the same. The actual damage and loss caused by a particular bushfire event depends on a wide range of variables, including a fire's ignition point, the surrounding topography, low humidity levels, high temperatures, severe drought conditions, strong winds and the presence of large amounts of combustible fuel. When all or most of these conditions occur simultaneously the risk of a major bushfire event occurring is enhanced. The risk to life and property is most pronounced when these conditions force major bushfires to encroach on populated areas.

2.1.1 2009 Victorian bushfires

The Black Saturday bushfires are the most recent example of the impact a major bushfire can have in Victoria. In late January 2009 Victoria endured one of its most severe and prolonged heat waves where daily maximum temperatures in Melbourne lingered above 43°C for three consecutive days. On 7 February 2009, now known as 'Black Saturday', temperatures reached a record 46.4°C in Melbourne and together with strong winds fuelled bushfires which had broken out across the State.

The effects of the 2009 Black Saturday bushfires were devastating. One hundred and seventy three lives were lost. Many more people were injured, with Victorian public hospitals providing care to more than 800 people and admitting 130 patients with fire-related injuries or illnesses.[14] In the extended 72 hours from 7 February 2009, 414 people were admitted to hospital emergency departments.[15]

As well as the loss of life and injuries, the fires resulted in the destruction or damage of some 3,553 buildings.[16] Approximately 80 communities were directly impacted by the fires and entire towns were left unrecognisable.

Following what is now considered as one of Australia's worst natural disasters, the 2009 Victorian Bushfires Royal Commission (the Commission) was established to investigate the cause and the responses to the Black Saturday bushfires.

2.2 The 2009 Victorian Bushfires Royal Commission

The Commission was established on 16 February 2009 to investigate the causes and responses to the bushfires which swept through parts of Victoria in late January and February 2009 with the final report delivered 31 July 2010.[17]

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[11] Victorian Bushfires Royal Commission Final Report, Volume I: The Fires and the Fire-related Deaths, The January-February 2009 Fires – Overview at page 2, 2009.

[12] Victorian Bushfires Royal Commission Final Report, Volume I: The Fires and the Fire-related Deaths, Appendix C – Fire in Victoria: A Summary, 2009.

[13] Department of Sustainability and Environment, 'What Causes Bushfires on Public Land in Victoria?', available online at http://www.dse.vic.gov.au/fire-and-other-emergencies/fire-management/causes-of-bushfire, accessed 21 April 2012.

[14] Victorian Bushfires Royal Commission Final Report, Volume I, Appendix A: Estimated Costs of the Fires, 2009.

[15] Cameron, PA, Mitra, B, Fitzgerald, M, Scheinkestel, CD, Stripp, A, Batey, C, Niggemeyer, L, Truesdale, M, Holman, P, Mehra, R, Wasiak, J and Cleland, H, MJA 2009; 191 (1): 11-16 available at http://www.mja.com.au/public/issues/191_01_060709/cam10194_fm.html.

[16] Data obtained from the Building Commission showing the number of buildings affected by Black Saturday bushfires.

[17] The Commission's final report was preceded by two interim reports, its first being released on 17 August 2009 and its second on 24 November 2009.

The Commission focused primarily on developing an understanding of precisely what took place on and around Black Saturday before reflecting on how the risks of a reoccurrence of such an event could be reduced. In undertaking the investigation into the bushfires and developing recommendations for future bushfire policy, the Commission placed the protection of human life as the main priority.

In its final report, the Commission paid careful attention to 15 of the most destructive fires that burned on Black Saturday. These 15 fires were targeted because they had the greatest impact (or the potential to cause the greatest impact) on communities in terms of loss of life and property. The Commission investigated how these fires started, how the fires spread, the areas affected by the fires, the losses caused by the fires, and the human response through fire-fighting, community warnings, roadblocks and emergency relief.

2.2.1 Causes of Black Saturday Bushfires

The Commission found the direct or indirect cause of the ignitions for the most destructive Black Saturday bushfires was human activity[18], through the failure of electricity assets and accidental and deliberate ignitions. One fire was thought to have been caused by lightning and the Royal Commission made no finding as to the cause of four of the 15 fires.

The Commission also found these fires shared a number of common features:

1 Rapid fire spread following ignition, which responding crews could not contain.

2 Fires crowned in forested areas, which made them impossible for ground crews to control.

3 Powerful convection columns were generated above the fires.

4 Extensive forward spotting occurred as a result of the fuel type, the weather conditions and the topography.

5 Late in the day a wind change altered the direction of fire spread and extended the fire front.[19] In terms of fire behaviour, the Commission identified wind change as one of the most crucial factors influencing a fire's path, change in direction and intensity.[20]

2.2.2 Cost of Black Saturday

The loss and damage suffered by the 80 communities directly impacted by the Black Saturday bushfires was extensive, with entire towns being destroyed. While the Commission noted that it was extremely difficult to quantify the cost of Black Saturday, it estimated the total cost at more than $4 billion.

In all, the 2009 Black Saturday bushfires resulted in the loss of 173 lives and the destruction or damage of 3,553 buildings.[21] The range of buildings damaged or destroyed included houses, businesses, schools, kindergartens, police stations, fire and emergency services facilities, churches, community halls and sporting clubs. Over 430,000 hectares of land across the State was burnt.

2.2.3 The Commission's Recommendations – an Overview

The Commission gave priority to the preservation of human life when making 67 recommendations in its Final Report on a number of key and integrated measures designed to better prepare Victoria for future bushfires. The Commission also recognised the shared role and responsibilities of individuals, fire agencies and Commonwealth, State and Local Governments in preparation for fire and the safety of individuals.[22]

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18 Victorian Bushfires Royal Commission Final Report, Volume I: Chapter 15, Conclusion, paragraph 15.1 – Fire causes. The Commission found that human activity was the direct or indirect cause of 9 of the 15 most damaging bushfires, 2009.

19 Victorian Bushfires Royal Commission Final Report, Summary July 2010 at page 3, 2009.

20 Victorian Bushfires Royal Commission Final Report, Volume I: Chapter 15, Conclusion, paragraph 15.2.2 – Wind change, 2009.

21 Data obtained from the Building Commission showing the number of buildings affected by Black Saturday bushfires.

22 Fire Services Commissioner – Victoria, 'Victorian Bushfire Safety Policy Framework', December 2010.

Generally, the Commission made recommendations in relation to the following matters:

- Measures to improve planning and preparation for bushfires through education, enhanced warnings and response options including evacuation and shelter options (Recommendations 1 – 7)
- Improved emergency and incident management and foreground response (Recommendations 8 – 26)
- Measures to prevent or reduce ignitions (Recommendations 27 – 36)
- Measures to reduce the impact of bushfires by:
  - Reducing fuel load on public land (Recommendations 56 – 59)
  - Improving the management of fuel loads on roadsides (Recommendations 60- 62)
  - Identifying high risk areas through improved mapping (Recommendation 37) and limiting development in these areas though the planning system, including encouraging people who live in high risk areas to relocate (Recommendations 38 -46 and 52 - 55)
  - Requiring buildings to be constructed to a standard proportionate to the bushfire risk of the proposed building's surrounding environment (Recommendations 47 – 51)
- The implementation of an improved organisational structure to coordinate Victoria's response to future bushfires, including the appointment of a Fire Services Commissioner (Recommendations 63 – 64).

In response to the events of Black Saturday and also the Commission's recommendations, the State and Local Governments have made changes to their policies, practices and relevant regulatory frameworks. Changes to the planning and building regulatory framework are one aspect of the integrated approach recommended by the Commission, and taken by the State to date, to reduce Victoria's future exposure to bushfire. This integrated approach is discussed in greater detail in section 2.3.2.

Recommendations 49.2 and 49.3

While early evacuation remains the preferred bushfire safety policy, particularly on days where the risk of bushfire is high, the Commission also recognised the importance of building and planning provisions noting that "planning and building controls are crucial factors affecting safety in a bushfire".[23] In the case where early evacuation is no longer possible and where people may be unexpectedly caught in a building during a bushfire, the Commission also acknowledges the importance of maximising the ability of buildings in areas of Victoria at risk from bushfire to withstand bushfires.[24]

On review of the existing planning and building regimes in Victoria, the Commission found that building regulations fail to cover the construction of vulnerable use buildings in bushfire prone areas of the State.[25] During the Black Saturday bushfires, many of the buildings destroyed were of this kind.

Vulnerabilities such as age, illness and acute and chronic disability affect a person's capacity to survive bushfire. For various reasons, such as difficulties with mobility and/or the ability to comprehend risk and/or a lack of capacity to make appropriate decisions to reduce risk, vulnerable people are unlikely to be self-reliant when escaping bushfire. These vulnerabilities increase the possibility that people in this category will suffer a fatality during a bushfire, especially where emergency resources and other forms of community assistance are stretched, limited or at a capacity.

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[23] Victorian Bushfires Royal Commission final report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, page 214, July 2010.

[24] Victorian Bushfires Royal Commission final report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, page 214, July 2010.

[25] 'Vulnerable use buildings' is used in this report to refer to non-residential buildings that are occupied by people that are vulnerable to bushfire attack, including schools, kindergartens, child care facilities, aged care facilities and hospitals.

In this regard, the Commission recommended:

- Recommendation 48.5: The Australian Building Codes Board to include in the Building Code of Australia bushfire construction provisions for non-residential buildings that will be occupied by people who are particularly vulnerable to bushfire attack, such as schools, kindergartens, child care centres, hospitals and aged care facilities.

- Recommendation 49.2 & 49.3: The State modify its adoption of the Building Code of Australia for the following purposes:

  – to apply bushfire construction provisions to non-residential buildings that will be occupied by people who are particularly vulnerable to bushfire attack, such as schools, kindergartens, child care centres, hospitals and aged care facilities

  – other than in exceptional circumstances, to apply a minimum Australian Standard 3959-2009 (AS 3959-2009, outlined below) construction level of BAL-12.5 (Bushfire Attack Level 12.5, outlined below) to all new buildings and extensions in bushfire-prone areas.[26]

The catalyst for this RIS and the associated analysis was these particular recommendations. It is important to note, however, that while these recommendations and the response to Black Saturday were the catalyst for this analysis, the focus of this report is wider than a direct response to Black Saturday as it focuses on future disaster planning to ensure Victoria is addressing its exposure to future bushfires which potentially could be more devastating than Black Saturday.

The Proposed Regulations focus on the Commission's recommendation relating to the provision of greater protection for vulnerable use buildings. The location of vulnerable use buildings, the standard of these buildings and how these standards are maintained are critical factors in determining an occupant's exposure to bushfire risk and the probability of such a building surviving bushfire attack.

2.3 Government response

2.3.1 Establishing Bushfire Construction Requirements in Victoria

Following the recent bushfires the Government has introduced higher building standards for residential buildings in bushfire prone areas in Victoria within its building regulatory framework. These changes complement changes to the planning system, which are discussed in section 2.3.2 of this RIS, and are intended to implement the integrated approach to bushfire risk recommended by the Commission.

Victoria's Building Regulatory Framework

All building work must comply with the Building Act, Building Regulations and the Building Code of Australia unless specifically exempted.

The Building Act

The Building Act regulates building work and building standards in Victoria.[27] Under the Building Act 'building work' means work for or in connection with the construction, demolition or removal of a building.[28] Building work cannot be carried out unless a building permit in respect of the work has been issued and the work is carried out in accordance with the Building Act, the Building Regulations and the permit itself. [29] Building permits are issued by local councils or private building surveyors.

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[26] Victorian Bushfires Royal Commission Final Report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, July 2010.

[27] *Building Act 1993*, section 1(a).

[28] *Building Act 1993*, section 3(1).

[29] *Building Act 1993*, section 16(1).

The Building Regulations

Building standards are established by the Building Regulations.[30] The Building Regulations are derived from the Building Act and contain amongst other things, the requirements relating to building permits, building inspections, occupancy permits, and enforcement of the Building Regulations and maintenance of buildings. The BCA is, adopted by and forms part of the Building Regulations as modified by Part 1 of those regulations.

Under regulation 810 of the Building Regulations, the Minister for Planning has determined areas which are subject to, or which are likely to be subject to, bushfires. These areas are known as 'designated bushfire prone areas'. The Minister's designation is based on mapping that has been developed using the best available science, taking into account factors such as weather, topography and vegetation.[31] A map of the State showing designated bushfire prone areas has been prepared by the Minister and is freely available to the public online[32] and through their local council.

Building Code of Australia

The BCA is a uniform set of technical requirements, amended annually, for the design and construction of buildings and other structures throughout Australia. Technical standards are largely governed by the BCA. The objective of the BCA is to ensure that acceptable standards of structural sufficiency, fire safety, health, and amenity are maintained for the benefit of occupiers and the community.[33]

The BCA characterises buildings into various classes according to the purpose for which they are designed, constructed or adapted to be used.[34] Classes of buildings are required, amongst other things, to comply with various Australian Standards incorporated into the BCA.

Table 3 – Classification of building in the BCA

Residential Classes of Buildings		Non-residential Classes of Buildings	
Class 1a	a house;	Class 5	an office or other commercial building;
Class 1b	a boarding house, guest house or hostel etc;	Class 6	a shop, restaurant or showroom;
Class 2	an apartment or block of flats;	Class 7	a car park or warehouse;
Class 3	hotel, motel, residential part of a school, health care building or detention centre, accommodation for the aged or people with disabilities;	Class 8	a laboratory, factory or other industrial building
Class 4	a single dwelling (such as a caretaker's residence) that is Class 5, 6, 7, 8 or 9 if it is the only dwelling in the building;	Class 9	a building of a public nature , including a: • Class 9a health care building • Class 9b an assembly building • Class 9c aged care building.
		Class 10	a non habitable building structure.

30 *Building Act 1993*, section 7.

31 For further information, see the Building Commission's fact sheet 'Victoria's Bushfire Mapping System' at http://www.buildingcommission.com.au/resources/documents/Victoria's_Bushfire_Mapping_System_Nov_2011.pdf.

32 See the interactive map at www.land.vic.gov.au. The map allows a user to enter a property address and see immediately if it is within a designated bushfire prone area. See: http://services.land.vic.gov.au/landchannel/jsp/map/BushfireProneMapsIntro.jsp.

33 Encyclopaedic Australian Legal Dictionary, definition of '*Building Code of Australia*'.

34 *Building Code of Australia,* November 2011, Part A3.

AS 3959-2009 – Construction of buildings in bushfire prone areas (AS 3959)

AS 3959 is an Australian Standard setting out the methodology for determining construction requirements for buildings in bushfire prone areas. AS 3959 is concerned with improving the ability of a building located in a bushfire prone area to resist bushfire attack.[35] In general terms, AS 3959 prescribes particular construction measures for buildings to reduce the risk of ignition from a bushfire. The construction requirements are those considered to be appropriate to the building's assessed potential for ignition caused by burning embers, radiant heat and/or flame contact generated by bushfire, and the potential intensity of the bushfire attack on the building.

Australian Standards, in general terms, are practical documents published by Standards Australia to provide benchmarks for quality and safety in products, processes, and services. They are 'based on sound industrial, scientific and consumer experience and are constantly reviewed to ensure they keep pace with new technologies.'[36]

AS 3959 was first published in 1991. The third and most recent edition is AS 3959-2009 which was published on 10 March 2009. The revision of AS 3959 and publication of AS 3959-2009 was undertaken in response to developments in research into the effects of bushfire on buildings and construction techniques to maximise a building's resistance to bushfire attack and was prepared by a Committee of individuals representing peak bodies with technical expertise relevant to the construction of buildings in bushfire prone areas.[37]

Determination of Bushfire Attack Level under AS 3959

AS 3959 prescribes construction requirements on a scale according to a site's assessed level of risk to bushfire attack.

AS 3959 sets out a methodology for assessing a proposed site's risk of bushfire attack. The proposed site's risk is expressed as one of a range of six Bushfire Attack Levels (BALs) that reflect the increasing level of a site's risk to bushfire attack. A BAL represents the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact (using increments of radiant heat expressed in kilowatts per square metre) and is the basis for establishing the requirements for construction to improve the protection of a building from the elements of bushfire attack.[38] The six BALs adopted in AS 3959 are (in order of increasing exposure to bushfire risk): BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ.

However, "although there are no specific construction requirements in the BAL designated as LOW, this does not imply these buildings are not at risk".[39]

Nature of AS 3959

As the level of assessed risk and severity of bushfire attack (expressed as BAL) increases, so to do the minimum construction requirements prescribed by AS 3959.

AS 3959 contains a range of bushfire construction measures for each BAL. These apply to major external elements of the structure of a building (for example to roofs, external walls, windows, floors, verandas, decks and external doors). AS 3959 does not contain requirements for the interior construction elements of a building or the contents of a building. Further, AS 3959 only applies to proposed construction of specific classes of building in designated bushfire prone areas.

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35 Australian Standard AS 3959 – 2009, Construction of buildings in bushfire-prone areas, at paragraph 1.1 'Scope'.

36 Standards Australia website: http://www.standards.org.au , 'What is a Standard?'.

37 The following entities were represented on the Committee which developed AS 3959-2009: Australasian Fire and Emergency Service Authorities Council, Australian Building Codes Board, Australian Institute of Architects, Australian Institute of Building Surveyors, Australian Steel Institute, Australian Window Association Inc, CSIRO, Engineers Australia, Fire Protection Association Australia, Housing Industry Association, Master Builders Australia, Plastics and Chemicals Industries Association Incorporated, Property Council Australia, Think Brick Australia, Timber Preserves Association of Australia and the Wood Council of Australia.

38 Part 1.5.3A of AS 3959-2009 at page 10.

39 Part 1.3 of AS 3959-2009 at page 8.

After reviewing AS 3959 and the construction guidelines contained in that standard, the Commission considered that this standard only adequately protected a building from ignition from ember attack at or above a construction level of BAL-12.5.

The Application of AS 3959 in Victoria

As discussed above, AS 3959 applies to certain buildings constructed in designated bushfire prone areas mapped in Victoria. The purpose of mapping bushfire prone areas is to identify areas subject to bushfire risk so that bushfire safety provisions can be applied to buildings constructed in these areas.

Areas of Victoria have been designated as bushfire prone by local councils since 1994. A designated bushfire prone area is now an area determined by the Minister pursuant to regulation 810 of the Building Regulations rather than by local councils. The Minister determines areas as bushfire prone where they are likely to be subject to bushfires.[40]

In response to the Commission's report expressing concerns about how these areas were designated due to the use of inadequate predictors of where bushfires burned on Black Saturday, a re-mapping of these areas using the best available science and vegetation information has been completed. The re-mapping of designated bushfire prone areas in Victoria satisfies recommendation 37.2 of the Commission. This scientific approach to bushfire hazard mapping is discussed in greater detail at section 2.3.2.

Improvements to mapping bushfire prone areas was based on the Commission's finding that most buildings damaged or destroyed in major bushfire events were ignited by embers and that once ignition of a building occurred, it was more likely than not to burn to the ground.

The most recent determination of designated bushfire prone areas in Victoria came into effect on 8 September 2011.[41] Given that Victoria is one of the most bushfire prone areas in the world it is perhaps not surprising that approximately 85 per cent of the State has been designated as a bushfire prone area. Prior to the re-mapping exercise, when the Commission made their recommendations, only about 30 per cent of Victoria was designated as a bushfire prone area. It is not the purpose of this RIS to assess whether the mapping of bushfire prone areas is appropriate. This mapping has been the result of work outside of this analysis.[42] The re-mapping exercise was completed because the previous system "had a number of shortcomings".[43] The Commission noted in their final report "it is telling that councils' designation of BPAs was a poor predictor of where bushfires burned on 7 February; most starkly, neither Kinglake nor Marysville was in a BPA".[44]

Current Construction Requirements in Victoria

Under the BCA, the types of buildings that are already required to be constructed to comply with AS 3959, if constructed in a designated bushfire prone area are houses[45], apartments, flats, hotels, motels, and residential parts of schools, health care buildings and detention centres.[46] Garages, carports and sheds associated with these residential buildings are also required to be constructed to comply with AS 3959-2009. (For ease of reference, buildings that are currently required to be constructed to comply with AS 3959 are collectively referred to in this RIS as 'AS 3959 residential buildings').

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40 *Building Code of Australia,* Part A1.1 Definitions.

41 Victorian Government Gazette, *Determination that Specified Areas are Designated Bushfire Prone Areas,* No. S 291, Wednesday, 7 September 2011.

42 The verification of this mapping is subject to a separate consultation process between DPCD, the Growth Areas Authority (GAA), the CFA, the Department of Sustainability and Environment (DSE) and local councils.

43 Victorian Bushfires Royal Commission *Final Report, Volume II: Fire Preparation, Response and Recovery*, Chapter 6, July 2010, page 218.

44 Victorian Bushfires Royal Commission *Final Report, Volume II: Fire Preparation, Response and Recovery*, Chapter 6, July 2010, page 218.

45 The Building Code of Australia, Volume 2, Part 2.3.4 'Bushfire areas' - For Class 1 buildings in a designated bushfire prone area, Part 2.3 Performance Requirement P2.3.4 requires the building to be designed and constructed to reduce the risk of ignition from a bushfire while the fire front passes. This is deemed to be satisfied by constructing in accordance with AS 3959 (Part 3.7.4). These sections of the Building Code of Australia essentially mean that all residential buildings such as homes and retirement villages must currently comply with AS 3959.

46 The Building Code of Australia, Volume 1, Part G 5.

Following a previous amendment to the Building Regulations,[47] all new AS 3959 residential buildings or alterations/additions to these buildings are required to be constructed to meet a minimum BAL of 12.5.

In addition to these bushfire performance standards for residential buildings, a Ministerial Direction issued by the Minister for Planning on 1 February 2010 requires Government departments and public bodies (including statutory authorities and state-owned corporations) to comply with AS 3959 when constructing or making significant modifications to buildings of a public nature, including public hospitals, nursing homes, clinics, assembly buildings such as schools, early childhood centres, preschools, public halls and aged care buildings (public construction).[48]

However, Ministerial Direction No. 3 does not apply to private buildings of a public nature. This means that some privately owned schools, kindergartens, child care centres, aged care facilities and health care buildings such as private hospitals in bushfire prone areas are built without mandatory protections from bushfire attack at the construction level.

The Commission expressed serious reservations with new construction that does not meet a minimum BAL of 12.5. The significance of constructing to BAL-12.5 is that a building constructed to this level is provided with a degree of protection from ember attack. The Commission found resistance to ignition by embers is crucial to the survival of all buildings in bushfire prone areas.[49]

2.3.2 Integrating the Building and Planning Regulatory Framework

Planning is another mechanism that is used to manage development in areas thought to have an unacceptably high bushfire risk. The Planning framework ensures future development is adapted to the proposed site's level of bushfire risk. The State has responded to the Commission's recommendations in relation to the planning and building regulatory systems by bringing these together into an Integrated Planning and Building Framework.

Currently in place are bushfire planning provisions, which coupled with existing bushfire construction requirements in the Building Regulations, aim to ensure that new development is more resilient to bushfire and that landowners can maintain their property in a fire-ready condition.

The Planning System and the Development of Land

The planning framework is governed by:

- the *Planning and Environment Act 1987* (the Planning Act)
- Planning Schemes
- the Victoria Planning Provisions (VPP).

Planning decisions are made by local councils in accordance with the planning permit process provided in the *Planning and Environment Act 1987* and in accordance with the applicable municipal council's planning scheme.

***Planning and Environment Act 1987* (the Planning Act)**

The purpose of the Planning Act is to "establish a framework for planning the use, development and protection of land in Victoria in the present and long-term interests of all Victorians".[50] The primary tool for regulating development of land within the planning framework is through planning schemes.

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47 By means of the Building Amendment (Bushfire Construction) Regulations 2011 which commenced on 8 September 2011.

48 Ministerial Direction No. 3 (Bushfire Provisions for Buildings of a Public Nature) issued by the Minister for Planning on 1 February 2010. See a further explanation of the operation of Ministerial Direction no 3 on page 18 of this RIS

49 Victorian Bushfires Royal Commission Final Report, July 2010, Volume II: Fire Preparation, Response and Recovery, Chapter 6 at page 260.

50 Section 1, *Planning and Environment Act 1987.*

Planning Schemes

Each municipality in Victoria has its own planning scheme which applies to both public and private land. Planning schemes consist of maps, which show, amongst other things, how land is zoned and the overlays affecting land in a particular municipality.

Zones show the nature of the land, whether residential, industrial or rural and indicate the use of land that is appropriate to a particular zone. Overlays are planning controls and are mapped in addition to zones to ensure significant aspects of the land are recognised.

To facilitate a consistent and coordinated framework of planning schemes across the State, the Minister for Planning approved standard planning provisions called the Victoria Planning Provisions.

Victoria Planning Provisions

The Victoria Planning Provisions are not a planning scheme but a State-wide source document from which planning schemes are constructed. The planning authority for each municipality (usually the local council) must select appropriate zones and overlays from the Victoria Planning Provisions for inclusion in the planning scheme for its municipality. The local council is also responsible for administering and enforcing its planning scheme.

Bushfire Hazard Mapping and Bushfire Management Overlays

As stated above, the mapping of bushfire hazard areas is the starting point for all planning and building decisions in bushfire prone areas.[51] Incorporated into each municipal council's planning scheme is the State Planning Policy for Bushfire[52], which seeks to mitigate bushfire risk. This policy requires the consideration of bushfire risk in planning by ensuring that important bushfire protection measures are part of new development. Local councils are required to ensure that in high risk areas a planning scheme has proper regard to this policy.

In the planning framework all bushfire-specific protection measures are applied in areas that are identified and mapped as a 'Bushfire Management Overlay' (BMO) (previously termed a 'Wildfire Management Overlay'). A BMO is considered to be at the highest risk of bushfire.[53]

Bushfire construction requirements only apply to certain types of buildings constructed in a designated bushfire prone area, whereas all buildings in a BMO are subject to the bushfire protection requirements in the planning framework. A building can be located in a designated bushfire prone area that is subject to a BMO.

Requirements in a designated bushfire prone area are distinct to requirements imposed by a BMO. Building construction requirements, such as AS 3959, apply to certain types of buildings constructed in areas mapped as a designated bushfire prone area, whereas requirements in a BMO do not apply to the construction of the building but rather how the site is developed.

A number of deficiencies in the approach to mapping these hazard areas were identified by the Commission, as indicated earlier under section 2.3.2. These flaws became obvious when Black Saturday fires burned across large areas of Victoria that had not been mapped as Wildfire Management Overlay (WMO) or a bushfire prone area. Shortfalls in mapping were put down to the inconsistent and in some instances sparse application of ambiguous mapping criteria by individual municipal councils across Victoria.

In response to these shortcomings, the Commission recommended mapping criteria be standardised and based on the best available science that addresses all aspects of bushfire risk. Following these recommendations, relevant agencies have worked together and are continuing to do so to better map and verify areas that should be subject to the BMO or building construction requirements in a designated bushfire prone area, based on the best available bushfire hazard information.

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[51] Victorian Bushfires Royal Commission *Final Report, Volume II: Fire Preparation, Response and Recovery*, Chapter 6, July 2010, page 215.

[52] Clause 13.05, 'Bushfire' of the Victoria Planning Provisions.

[53] Note that the 'wildfire management overlay' (WMO) was the term previously used to indicate these high risk areas. However, once these areas were re-mapped in 2012, the newly mapped overlay is known as the BMO. Both of these terms are used throughout this document to distinguish between areas that come under the previously mapped WMO and the newly mapped BMO.

Planning Permit Requirements

The 2009 Victorian Bushfires Royal Commission highlighted the importance of ongoing compliance with planning permit conditions for managing bushfire risk and to ensure important bushfire protection measures required in planning permits are implemented.

Where the BMO applies to land, a planning permit is required to construct a building or construct or carry out works associated with land uses that are likely to increase the number of people in the overlay area. These land uses include: accommodation (including a Dependent person's unit), child care centre, education centre, and hospital.[54]

All planning permit applications in the BMO will be referred to the relevant fire authority for review. This will be either the Country Fire Authority (CFA) or the Metropolitan Fire and Emergency Services Board. The fire authority will advise the responsible authority if any specific planning permit conditions are needed or if it objects to the granting of a planning permit. The fire authority can also ask for more information from the applicant.

A planning permit application to carry out building and construction work on land in a BMO must contain a Bushfire Management Statement. This statement must contain a Bushfire Site Assessment, which is prepared to determine the requirements for defendable space and building construction for a new development. Bushfire protection construction requirements for construction of certain classes of building in designated bushfire prone areas are determined in a site assessment by reference to a development's potential exposure to bushfire attack, measured in BAL as defined in AS 3959. The assessment of a site's BAL is also a requirement for a building permit under the Building Act. Where a BAL is specified in a planning permit the relevant building surveyor must accept this assessment for the purpose of determining the Bushfire Attack Level of the site and the applicable construction requirements for the building (if required by the BCA for that particular class of building).[55] Accordingly, where a Bushfire Site Assessment is done as part of a planning permit application, a further site assessment is not required at the building permit stage.[56]

Bushfire Protection Controls in the Planning System

Clearing and maintaining defendable space around a building can increase the chances of a building surviving bushfire.

Insofar as the planning system is concerned, the Commission considered there was scope for further controls to restrict development in areas of unacceptably high bushfire risk. It recommended that new development is approved only where a minimum defendable space could be created and maintained on the site. For existing buildings in a BMO it was suggested planning controls should allow vegetation clearing for fire protection purposes. It also considered it necessary to identify different levels of bushfire risk within a BMO.

Under the planning provisions that came into operation in November 2011, only other occupied building sites (which includes vulnerable use buildings) assessed as having a BAL-12.5 or below will be given planning approval.[57] Similarly, under the planning provisions prior to November 2011, it is understood that the aim of the CFA was to ensure building sites were BAL-29 or below before approved.

New planning provisions for creating defendable space and managing vegetation are now included in all local council's planning schemes and apply to all councils with areas within their municipality mapped in the BMO. The provisions provide certainty and guidance about vegetation removal, both with and without a planning permit. For new developments, the appropriate level of defendable space is based on the requirements of the BMO and is determined as part of the planning permit application process.

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54 Department of Planning and Community Development, 'Victoria Planning Provisions Practice Note 65', *Bushfire Management Overlay and bushfire protection: planning requirements*, November 2011, page 2.

55 Regulation 811(2) of the *Building Regulations 2006*.

56 Department of Planning and Community Development, 'Victoria Planning Provisions Practice Note 65', *Bushfire Management Overlay and bushfire protection: planning requirements*, November 2011, page 7.

57 Other than subdivisions, for 'other occupied building', a site is required to be BAL-12.5. 'Bushfire Management Overlay and bushfire protection: planning requirements', Practice Note 65, November 2011, available at http://www.dpcd.vic.gov.au/__data/assets/pdf_file/0011/86492/PN65-Bushfire-Management-Overlay-and-bushfire-protection_planning-requirements.pdf.

Planning schemes contain provisions which can increase a building's chances of survival in a bushfire by creating defendable space around it, for example through siting or the clearance of vegetation. For new developments, the appropriate level of defendable space is based on requirements set out in the BMO and is determined as part of the planning permit application. For existing dwellings in the BMO, provision is made for vegetation clearance.

In accordance with the Commission's recommendations, the BMO was developed to replace the WMO. The BMO includes statutory provisions in planning schemes and a map showing where the provisions apply to specific land. The requirements for development in a BMO are set out in the applicable planning schemes. Development in a BMO necessitates consideration of bushfire safety issues such as the siting of a building, the provision of defendable space around a building and emergency vehicle and water access. The purpose of the BMO provisions is to ensure that development in high risk bushfire areas will only take place after consideration of a full range of bushfire safety issues and where the risk to life and property from bushfire cannot be reduced to an acceptable level the development will not proceed. Specific objectives, standards and decision guidelines are set out in clause 52.47 of all planning schemes and these inform decisions under the BMO.[58]

Emergency Management Plans

There are a number of other pieces of legislation in Victoria that enable communities to come together to create plans to manage fire risk in the most critical areas of concern.

The *Emergency Management Act 1986* (Vic) requires Municipal Councils in Victoria to produce a Municipal Emergency Management Plan (MEMP) through the establishment of Municipal Emergency Management Planning committees in accordance with the guidelines contained in the Emergency Management Manual Victoria. Emergency management plans must take into account all risks, including bushfire risks.

In addition, Part IV of the *Country Fire Authority Act 1958* requires Municipal Councils to prepare municipal fire prevention plans. The purpose of the fire prevention plan is to chart the planned and co-ordinated response measures that will minimise the occurrence, and mitigate the effect, of all fires, on the community, including bushfire and grassfires, residential fires, industrial fires. A fire prevention plan can form a component of an MEMP prepared under the *Emergency Management Act 1986*, which will suffice for the purposes of the *Country Fire Authority Act 1958*.

[58] Practice Note 64, Local Planning for Bushfire Protection. November 2011, prepared by the Department of Planning and Community Development.

3 Nature and extent of the problem

3.1 Overview of the problem

Bushfires pose a risk to vulnerable use buildings in designated bushfire prone areas in Victoria and their occupants, and an important means of reducing that risk is through building construction and design measures. There are, however, a range of market failures that may prevent building owners from identifying and assessing bushfire risk and adequately addressing it through appropriate building materials and design. While there are several regulatory and non regulatory requirements and practices currently in place that serve to reduce aspects of bushfire risk associated with these buildings, there is still a residual problem that is not addressed by current bushfire protection measures. That is, vulnerable use buildings are not currently being constructed to a standard sufficient to provide appropriate resistance to bushfire attack, thus providing a measure of protection to the building's occupants.

If this residual problem is not addressed, a range of costs could be incurred, such as:

- loss of life and injuries, including increased mortality for aged care residents if they need to be permanently relocated
- destroyed or damaged vulnerable use buildings, leading to reconstruction costs and other flow on economic impacts
- social disruption.

While previous bushfires such as Black Saturday can provide some indication of the extent of these costs, for a variety of reasons it seems likely that the problem will get worse (and more costly) moving forward. For example, more people are expected to live in bushfire prone areas, and bushfires are expected to become more severe and frequent. Two scenarios are modelled to provide an indication of the size of the problem when next a major/minor bushfire occurs. The scenarios suggest the cost of the problem could be between $39.6 million and $89.3 million NPV, although in one sense the potential problem addressed by the Proposed Regulations will be larger than quantified in these two scenarios to the extent that the useful life of buildings affected by the Proposed Regulations spans a number of major/minor bushfire events (rather than the one such event estimated here in the scenarios).

3.2 Nature of the problem

3.2.1 Exposure to bushfire risk for vulnerable use buildings and their occupants

It is clear from the examples of the devastating impacts of previous bushfires in Victoria, such as Black Saturday and Ash Wednesday, that bushfires pose a significant risk to both buildings and their occupants. This RIS focuses on the risk posed to vulnerable use buildings, such as schools, hospitals, aged care facilities, child care facilities and kindergartens, and the occupants of these buildings.

Buildings and bushfire risk

In general terms, all buildings comprise six major external elements of construction.[59] These are the building's external walls, the roof (including eaves, fascias, gables etc), external glazed elements (windows and doors), floors, subfloor supports and verandas and decks.[60]

[59] Standards Australia Handbook 330-2009, 'Living in bushfire-prone areas' at page 26.

[60] Standards Australia Handbook 330-2009, 'Living in bushfire-prone areas' at page 26.

During a bushfire, there are three ways in which buildings are commonly known to catch on fire which can be related back to a building's major external elements of construction. These mechanisms of ignition were recognised by the Commission as follows:

- Ember attack – burning debris or embers can ignite a building through direct contact with external surfaces, igniting combustible gases, entering through small gaps in the building's structure or igniting objects near the building

- Radiant heat – heat can cause structural failure (i.e. melting and cracking), ignite gases through heating building components and dry out surfaces, making them more flammable

- Flame contact – direct contact with flames from the fire front or other fire source (i.e. an object that has ignited near the building) will ignite combustible materials.

These are the direct ways in which bushfires can ignite and therefore impact on buildings. Strong and hot winds can also play a role. Hot air can dry out a building and its surroundings, increasing a building's susceptibility to ignition causing the shrinking of timber, leaving gaps in the building's facade. Strong winds can dislodge building components and expose the interior to ignition, create air pressure differences that drive flames through small gaps in the building and increase the rate of moisture loss.[61]

Ember attack

The term 'embers' is used to describe small particles of burning material, which are usually windborne pieces of bark and other burning material .[62] The vulnerability of a building to ember attack depends on its design and construction. There are a number of potential weak points in the major external elements of a building which increase its vulnerability to ignition from embers. These can be summarised as follows:

- Building surface – ignition of the building surface (for example external walls, roof, doors etc) can occur if the surface is made from combustible material (for example timber)

- Inside building – where embers can penetrate a building, through gaps in building materials, they have the potential to cause ignition of the internal parts of a building. For example, embers blown into the roof space of a building or wall cavities can ignite any combustible element present in that space. Further, windows may be broken by heat or windblown debris resulting in embers landing in a room which can cause ignition of the contents of the room

- Under building – ignition can occur under a building if the building floor or supporting structure is constructed of combustible material (for example timber).[63]

Many factors affect the density of ember attack, including the presence of combustible fuel available to form embers, the level of humidity (which affects the moisture content in fuel), temperature, wind speed and the intensity of the fire itself. Embers can be driven forward in large quantities by the wind and may also be carried upwards and forward long distances ahead of the fire front.[64]

Much of the research conducted on buildings surviving bushfire has focused on residential buildings. Research into the nature and causes of damage and destruction of residential buildings from past bushfires across Australia has indicated that ember attack is the most prevalent cause of building loss.[65] Buildings are exposed to

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61 Victorian Bushfires Royal Commission Final Report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, July 2010.

62 Ramsay, Caird; Rudolph, Lisle 2003, Landscape and Building Design for Bushfire Areas, e-book, accessed 27 March 2012, http://unimelb.eblib.com.au.ezp.lib.unimelb.edu.au/patron/FullRecord.aspx?p=276176 at page 8.

63 Ramsay, Caird; Rudolph, Lisle 2003, Landscape and Building Design for Bushfire Areas, e-book, accessed 27 March 2012, http://unimelb.eblib.com.au.ezp.lib.unimelb.edu.au/patron/FullRecord.aspx?p=276176 at page 16.

64 Ramsay, Caird; Rudolph, Lisle 2003, Landscape and Building Design for Bushfire Areas, e-book, accessed 27 March 2012, http://unimelb.eblib.com.au.ezp.lib.unimelb.edu.au/patron/FullRecord.aspx?p=276176 at page 8.

65 Ramsay (1987) and Leonard & Blanchi (2005) cited in Leonard, J., Commonwealth Scientific and Industrial Research Organisation Sustainable Ecosystems, 'Report to the 2009 Victorian Bushfires Royal Commission: Building performance in Bushfires', August 2009, page 23.

ember attack for a longer time period relative to other bushfire attack mechanisms (up to an hour and a half).[66] Embers can travel vast distances (up to 15 kilometres).[67] For this reason, small ignitions caused by ember attack can occur to a building irrespective of the location of the fire front and whether or not the fire front actually reaches the building itself.[68]

Research also demonstrates that, during bushfires, most building fires start with small ignitions. [69] At first, these small ignitions progress slowly and then accelerate through the whole building. The larger fire which eventually destroys the building can be prevented if small ignitions can be prevented at first instance.[70] When embers come into contact with combustible parts of a building, they have the potential to cause these small ignitions.

Radiant Heat

Buildings are also destroyed by radiant heat, coming directly from the fire-front or from combustible elements.[71] Radiant heat is the heat produced from a bushfire which can be transmitted to a building. A building may be exposed to radiant heat from the fire front itself or from combustible materials ignited by embers. Building elements that may fail as a result of radiant heat include any element constructed of a combustible material, glass that may crack or shatter, and metal products that may lose their integrity and become distorted.

Flame Contact

Flame contact is the third ignition mechanism associated with bushfires and is characterised when a building is subject to direct and sustained contact from flame from any source (fire front, spot fires or burning debris).[72] Any building element made of combustible material will be vulnerable to ignition from direct flame contact. The combination of high levels of radiant heat in combustible materials will aid the ignition process.

The role of building materials in the level of risk exposure

A building's initial exposure to bushfire risk depends on a variety of factors that affect how likely a building is to survive a bushfire. These factors can be split into two categories, those that impact the *intensity of exposure to bushfire attack* and those that affect the *vulnerability of the building* and therefore susceptibility to bushfire attack. Mitigation of bushfire risk should address both of these categories.

The intensity of exposure, as will be demonstrated below, is the subject of most of the existing regulatory and non-regulatory responses in place to protect vulnerable people and vulnerable use buildings from bushfire attack.

The focus of this RIS is on the latter – the vulnerability of the building and therefore the building's susceptibility to bushfire attack – which is strongly influenced by building design and construction.[73] Research has found that, once a building catches fire, it will most likely burn to the ground, meaning any risk reduction measures implemented to prevent damage to buildings must focus on factors that operate to reduce the initial ignition of a building.[74]

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66 Ramsay, Caird; Rudolph, Lisle 2003, Landscape and Building Design for Bushfire Areas, e-book, accessed 27 March 2012, http://unimelb.eblib.com.au.ezp.lib.unimelb.edu.au/patron/FullRecord.aspx?p=276176 at page 18.

67 VBRC Final Report, Volume IV, Murrindindi fire, see: http://vol4.royalcommission.vic.gov.au/index.php?pid=31#

68 Standards Australia Handbook 330-2009, 'Living in bushfire-prone areas' at page 12.

69 Ramsay, Caird; Rudolph, Lisle 2003, Landscape and Building Design for Bushfire Areas, e-book, accessed 27 March 2012, http://unimelb.eblib.com.au.ezp.lib.unimelb.edu.au/patron/FullRecord.aspx?p=276176 at page 13.

70 Ramsay, Caird; Rudolph, Lisle 2003, Landscape and Building Design for Bushfire Areas, e-book, accessed 27 March 2012, http://unimelb.eblib.com.au.ezp.lib.unimelb.edu.au/patron/FullRecord.aspx?p=276176 at page 13.

71 Leonard, J., Commonwealth Scientific and Industrial Research Organisation Sustainable Ecosystems, 'Report to the 2009 Victorian Bushfires Royal Commission: Building performance in Bushfires', August 2009, page 16.

72 Standards Australia Handbook 330-2009, 'Living in bushfire-prone areas' at page 14.

73 Leonard, J., Commonwealth Scientific and Industrial Research Organisation Sustainable Ecosystems, 'Report to the 2009 Victorian Bushfires Royal Commission: Building performance in Bushfires', August 2009.

74 Leonard & Blanchi (2005) cited in Leonard, J., Commonwealth Scientific and Industrial Research Organisation Sustainable Ecosystems, 'Report to the 2009 Victorian Bushfires Royal Commission: Building performance in Bushfires', August 2009

As is apparent from the ignition mechanisms discussed above, the materials used in construction will affect the likelihood of a building igniting, as some materials are more resistant to fire and heat. In addition, the design of the building will impact its resistance to heat and wind as well as the ability for embers to enter through small gaps in the building's facade. As such, a building's "design and materials are key parameters in defining vulnerability to the effects of embers", the most likely way for a building to ignite.[75] For example, increasing a building's resistance to ignition from ember attack is achieved by minimising the opportunity for the accumulation of embers on, in or against a building and by increasing the resistance of those surfaces to ignition. Measures that can achieve this objective at a construction level stem from the choice of material used in construction and also the design and construction choices made in relation to the building, for example, the removal of gaps through sarking, ember guards and overlapping joints.

While the focus of this RIS is on the susceptibility of buildings to bushfire attack, this must be considered in the context of the intensity of bushfire attack that a building will be exposed to. In considering the appropriate design and construction materials for a building, the intensity of exposure to bushfire must be considered. Factors such as vegetation and slope of the site will affect the type of construction requirements necessary to mitigate exposure to bushfire attack. Vegetation is combustible and can act as fuel for a bushfire. The slope also affects the intensity of bushfire attack because it affects the rate at which the bushfire spreads. Flames travel faster up hill, meaning a strong gradient in the land would expose the building to greater risk of attack, particularly if there is vegetation on the slope below the building. Rather than focusing on how to reduce these intensity factors (which may not always be possible), building design and construction can account for these factors when considering how best to decrease the susceptibility of a building and hence increase its resistance to bushfire attack.

While this RIS focuses on reduction of bushfire risk through building construction and design, other factors that are important but that are outside the scope of this RIS include:

- individual elements surrounding the building that are either a shield or an additional fuel source
- the amount of defendable space surrounding a building
- proximity to surrounding infrastructure
- access to the building and how that influences human behaviour and emergency services
- water supply for active and/or passive defence or to assist in evacuations
- power supply
- bushfire response planning.

3.2.2 Market failures

According to the *Victorian Guide to Regulation,* freely functioning markets generally provide the most efficient means of allocating goods and services between members of the community so as to maximise the well-being of the community. In some instances, however, the market does not deliver the best outcomes for society – for example, because of the existence of market distortions or imperfections. In such cases, the market is said to be 'failing' and, in some circumstances, Government intervention may be justified on the grounds that economic outcomes could be improved.

In February 2009, a COAG Decision RIS was published that assessed the proposal to revise the BCA requirements for construction in bushfire-prone areas. The RIS established a range of reasons that explain why the threat of bushfire damage is unlikely to be addressed appropriately by the market. These reasons are:

- imperfect individual responses

75 Leonard, J., Commonwealth Scientific and Industrial Research Organisation Sustainable Ecosystems, 'Report to the 2009 Victorian Bushfires Royal Commission: Building performance in Bushfires', August 2009, Pg 24.

- imperfect industry responses
- insurance market limitations
- unpriced negative externalities.[76]

The RIS found that imperfect responses would arise due to a number of market failures, including insufficient information, bounded rationality and information asymmetry. These four reasons are discussed below. Consultation provided some information in relation to one aspect of these market failures (imperfect industry responses, as set out below) however more broadly it is difficult to be more specific about the relative extent of these failures in the vulnerable use building sector. As such, further information is sought in accordance with the consultation question set out at the end of this section.

Imperfect individual responses

To determine the appropriate building construction standards to adopt, the building owner or person with control over the construction of the building would need to understand bushfire risk and the factors that influence it. The information required to understand this risk requires a certain level of technical expertise without which it may be difficult to make a proper evaluation of bushfire risk. It may be unrealistic therefore to expect building owners to have the capacity to generate a fully informed view of their building's bushfire risk and the associated bushfire risk reduction measures required.

While an expert could be commissioned to advise building owners on bushfire risk, studies have revealed that there are numerous factors influencing a person's perception of risk and people generally consider themselves or their property to be less at risk than their locality.[77] One theme that emerged from the evidence before the Commission is that people underestimated the threat posed by the bushfires, and that 'community memory' of ferocious fires is difficult to maintain.[78] As such, people may be less likely to commission expert advice when building.

Imperfect industry responses

The benefits of protecting a building through stricter construction standards do not accrue to the party that designs or constructs the building. Designers and builders have incentives to minimise their building costs to remain competitive in the building industry. Given that owners are likely to be price driven and may be unable to verify the benefits arising from an increase in building costs, the industry may have little incentive to offer and build to stricter requirements.

By the same token, consultation conducted for the purposes of this RIS indicated that potential users (or their representatives) of facilities like aged care facilities and schools do not generally seek or take into account information about the building's ability to withstand bushfire. That is, people may not place a strong focus on the level of fire resistance when choosing a facility, whether it is public or private.

Insurance market limitations

The insurance market is unlikely to provide an adequate response to bushfire risk because insurance:

- does not reduce the risk of a bushfire occurring or provide protection to a building from ignition from bushfire nor provide any level of protection from bushfire to a building's occupants (i.e. insurance only provides after the event compensation)
- may not compensate for the full impacts of a bushfire event, as it may not account for impacts such as economic and social disruption.

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[76] Australian Building Codes Board, 'Final Regulatory Impact Statement for Decision (RIS 2009-02): Proposal to Revise the Building Code of Australia requirements for Construction in Bushfire Prone Areas', February 2009.

[77] Bushfire CRC, 'Living on the Urban Edge', available online at http://www.bushfirecrc.com/news/living-urban-edge, accessed 28 March 2012.

[78] Victorian Bushfires Royal Commission Final Report, Volume II: Fire Preparation, Response and Recovery, Chapter 9, July 2010, Pages 355 to 356.

The Commission quoted evidence from an actuary that fire and bushfire risk is only one of many risks factored into the calculation of insurance premiums. Typically, all fire risk accounts for less than 30 per cent of domestic building insurance premiums and less than 15 per cent of contents policy premiums. Furthermore, a number of major insurers do not assess fire and bushfire risk in detail, meaning that their rates are not differentiated according to geographical locations. In short, domestic property premiums are an imperfect proxy for fire and bushfire risk, although fire risk appears to make up a higher proportion of the insurance premium for commercial property insurance than for domestic property.[79] It is not clear, however, how high this proportion is, which impacts on the extent to which premiums provide an incentive to facility operators to reduce bushfire risk. Even if fire risk makes up a high proportion of the insurance premium, that does not mean that any compensation payable accounts for the full impacts of a bushfire event.

The Insurance Council of Australia contends that 'the fire and bushfire risks to individual properties are rarely reflected in insurance premiums. Therefore, there are virtually no incentives upon individual policyholders to adopt risk mitigation measures to lower their premium cost'.[80]

Unpriced negative externalities

In bushfire prone areas, the level of protection for any one building is impacted by the actions taken by neighbouring building owners. Given the way in which fire can spread from one building to another, the non-action of one building owner can affect the probability of bushfire attack and ignition of the surrounding buildings, increasing their exposure to bushfire risk. This is an 'external effect' of the individual's actions that may not be considered when they make construction decisions. Given part of the cost of non-action is borne by surrounding building owners; there is little incentive for owners to minimise such effects by constructing to higher standards.

On balance, this impact is likely to be less significant than other factors outlined above because the owner still faces some incentive to reduce the risk of bushfire attack on their own property.

Consultation question 1:

Is there any further evidence regarding the extent of these market failures in the vulnerable use building sector?

3.2.3 Existing requirements or practices that impact vulnerable use buildings and their level of bushfire risk

Despite the market failures discussed above, there is a range of regulatory requirements and practices that nevertheless serve to reduce aspects of bushfire risk for vulnerable use buildings. These are discussed below and, as will be shown, despite these requirements and practices vulnerable use buildings remain exposed to bushfire risk. That is, the measures outlined below only reduce the risk in part for some buildings.

Regulatory requirements

Residential buildings

Construction standards to address bushfire risk for residential buildings are set out in the BCA, which is adopted by Victoria under s109 of the Building Regulations. Under regulation 608, buildings that are altered or extended by more than 50 per cent (by volume) over a period of three years ("substantially modified buildings") must be brought up to the standard required under the Building Regulations for newly constructed buildings.

As set out in Chapter 2 of this RIS, new or substantially modified residential buildings constructed in bushfire prone areas in Victoria are required to be constructed in compliance with AS3959, and all must be constructed to comply at a minimum with the construction requirements associated with BAL-12.5.

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79 Victorian Bushfires Royal Commission Final Report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, July 2010.

80 Insurance Council of Australia, 2009 Victorian Bushfires Royal Commission Insurance and Fire Services Levy – Submissions of the Insurance Council of Australia Limited, p.3.

Across Australia, Part G5 of the BCA provides for construction in bushfire prone areas. This section states that a Class 2 or 3 building located in a designated bushfire prone area must comply with AS 3959. For Class 1 buildings in a designated bushfire prone area, Part 2.3 Performance Requirement (Part 2.3.4) requires the building be designed and constructed to reduce the risk of ignition from a bushfire while a fire front passes. This requirement is deemed to be satisfied by constructing in accordance with AS 3959 (Part 3.7.4). These sections of the BCA mean that all residential buildings such as homes and retirement villages must currently comply with AS 3959.

Government owned and Government funded buildings

Government Departments and public bodies (including statutory authorities and state-owned corporations) already implement AS3959-2009 in the design process for public buildings (i.e. health care buildings, assembly buildings including schools and hospitals, aged care buildings). Under Ministerial Direction No. 3 (Bushfire Provisions for Buildings of a Public Nature)(MD3) issued by the Minister for Planning on 1 February 2010 (under section 30 of the *Project Development and Construction Management Act* 1994), Departments and public bodies are required to use a Bushfire Attack Level risk assessment from AS 3959-2009 in the design process of buildings of a public nature.

Under associated guidelines, Departments and public bodies must also identify an appropriate design response based on the risk assessment by obtaining and applying the advice of an appropriately qualified practitioner and consider and apply the design protection measures proposed by the practitioner to improve the resistance of the building to bushfire attack.

Preliminary consultation with relevant Departments has indicated that the effect of MD3 and its associated guidelines is that relevant facilities are being constructed to the standard, and in some cases to a higher BAL standard, than assessed to be required by AS3959-2009.

Bushfire Management Overlay

As discussed in Chapter 2 of this RIS, the purpose of the BMO is to:

- assist to strengthen community resilience to bushfire
- identify areas where the bushfire hazard requires specified bushfire protection measures for subdivision and buildings and works to be implemented
- ensure that the location, design and construction of development considers the need to implement bushfire protection measures
- ensure that development does not proceed unless the risk to life and property from bushfire can be reduced to an acceptable level.[81]

Other current or proposed regulatory requirements

Other current or proposed regulatory requirements relating to vulnerable use buildings address bushfire preparedness or safety at a level other than at the building construction level. Bushfire risk responses integrated into existing regulatory frameworks for privately owned vulnerable use buildings are outlined below.

Childcare Services – Regulatory Framework and Bushfire Safety

The legislative framework for Victorian child care services does not impose any specific requirements in relation to bushfire construction standards, beyond that included in generic building legislation such as the National Construction Code.

From 1 January 2012, most Victorian child care services fall under the National Quality Framework (NQF) – a new, national performance and regulatory framework for early childhood education and care (ECEC) services. The legislative framework for the NQF consists of the *Education and Care Services National Law Act 2010* (Vic) and the *Education and Care Services National Regulations 2011*. This framework replaces previous State

[81] Department of Planning and Community Development, 'Victoria Planning Provisions Practice Note 65', *Bushfire Management Overlay and bushfire protection: planning requirements*, November 2011, page 1.

and Territory-based legislation. Until 2012, Victorian child care services fell under the *Children's Service Act (1996)* and the *Children's Service Regulations 2009*.

The new *Education and Care Services National Regulations 2011* impose a number of specific requirements for the physical environment of services – including in relation to indoor and outdoor space, fencing, ventilation and natural light – however they do not directly address bushfire-related building provisions.

Residual building requirements that are not explicitly mentioned appear to be addressed through indirect reference to other building laws, including the National Construction Code (which includes the BCA). For example, under the Regulations, applications for 'approval' of services are required to include "a statement made by a building practitioner that states that the education and care premises complies with building requirements under a building law or planning and development law of the participating jurisdiction".[82] In addition, the published guide to the Regulations states "Approved Providers should be aware that they may be required to meet other legislative provisions in relation to their service premises, including the BCA"[83].

This approach is similar to the previous Victorian regulations, which include some specific requirements in relation to indoor and outdoor space, and fencing, and more generally require applications for approval to include a statement of compliance with the Building Act.

Kindergartens and child care facilities determined by the Department of Education and Early Childhood Development (DEECD) to be at a high risk of bushfire danger are placed on a Bushfire At-Risk Register and will close on days when a Code Red fire danger warning is issued. A Code Red Day is the highest risk rating on the Fire Danger Rating forecast prepared by the Bureau of Meteorology during the fire season and is based on weather and other environmental conditions. A Code Red day represents the worst conditions for bushfires. Closure of facilities on the Bushfire At-Risk Register on Code Red days will of course reduce the number of children present in these types of facilities on Code Red days.

Private Schools – Regulatory Framework and Bushfire Safety

As previously mentioned, the construction or significant modification of public schools in Victoria is already required to comply with AS 3959 under MD3. Private schools, however, are not. A private school is a non-government primary or secondary school that charges fees. Private schools (also known as independent schools) are usually run by an incorporated body that determines the level of fees charged and appoints staff, including a principal. Private schools are governed by the following regulatory framework:

- *Education and Training Reform Act 2006* (Vic)
- *Education and Training Reform Regulations 2007* (Vic)

The main purpose of the *Education and Training Reform Act* and *Education and Training Reform Regulations* is to set out a legislative framework that will underpin education delivery in Victoria. In particular, the *Education and Training Reform Act* includes a set of overarching principles upon which the practice of education is to be based.[84]

Registration – Requirements for Bushfire Preparedness

Private schools in Victoria are required to be registered with the Victorian Registration and Qualifications Authority (the Authority).[85] A register of private schools is kept and certificates of registration are issued to registered private schools by the Authority. The requirements for registration of a private school are that the school will provide adequate facilities and protection for the safety, health and welfare of its students and that

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82 *Education and Care Services National Regulations 2011*, s25

83 Australian Children's Education & Care Quality Authority (2011), 'Guide to the Education and Care Services National Law and the Education and Care Services National Regulations 2011', p72

84 DEECD fact sheet on the Education and Training Reform Act 2006 which may be accessed at: http://www.education.vic.gov.au/about/directions/reviewleg_2006facts.htm

85 ss 4.2.2(1)(a), 4.3.1 *Education and Training Reform Act 2006* (Vic).

the instruction provided at the school is acceptable to the Authority.[86] In Victoria, the provisions for inspection of a school are contained within the general powers of the Authority to review private schools to ensure that schools are complying with the standards required for registration.[87]

In one of the Commission's interim reports, it recommended the Authority ensure all schools are audited, as part of their registration requirements, to ensure they have adequate bushfire safety procedures in place. In response to this recommendation, the Authority developed guidelines entitled '*Bushfire Preparedness Guidelines for Schools'* (School Guidelines). These guidelines apply to all registered private schools in Victoria. The purpose of the guidelines is to help schools in high bushfire risk areas prepare for bushfire. Private schools are required to complete a statutory declaration declaring their compliance with these guidelines.

As part of compliance with the School Guidelines, schools must complete a Bushfire and Emergency Management Self Assessment Tool.[88] All schools must also maintain an Emergency Management Plan which must be reviewed at least annually and also immediately after a significant incident.[89] Part 3.6 to 3.8 (inclusive) of the School Guidelines covers protection of school infrastructure from bushfire. It states 'a school's buildings, facilities and grounds must comply with any laws that apply to the school including local laws and building, planning and occupational health and safety laws.'[90] It does not impose bushfire construction standards for school buildings independently of building regulation. In addition to compliance with existing legal standards, under the School Guidelines, a school must also manage materials that may easily be ignited around buildings and facilities and monitor emergency access to buildings and grounds. The School Guidelines subject schools on the Bushfire At-Risk Register to additional safety obligations. These additional obligations include the requirement to consult with local agencies, including the CFA, Metropolitan Fire and Emergency Services Board and the local council on the school's bushfire preparedness and compliance with local bushfire regulation of buildings, facilities and grounds.

In addition to compliance with the School Guidelines as with kindergartens and child care centres, all schools at the highest risk of bushfire danger are placed on the DEECDs Bushfire At-Risk Register. Inclusion on this register is a trigger for the school to pre-emptively close on days declared Code Red in their Bureau of Meteorology region.[91]

As previously discussed, new schools are also subject to specific bushfire protection mechanisms through the State's planning system. Where a new school is proposed to be constructed in a BMO a permit is required.[92] A permit application of this nature must be submitted with a description of the locality and site together with a Bushfire Management statement. The permit application must also meet the requirements of clause 52.47 of the local planning scheme (Bushfire Protection: Planning Requirements). The stated purpose of clause 52.47 is to 'ensure that development is only permitted if the risk to life, property and community infrastructure can be reduced to an acceptable level.' Specifically in relation to vulnerable use buildings such as schools, clause 52.47 requires defendable space be provided around school buildings that is appropriate to the number, age and mobility of its anticipated occupants. In addition to considerations pertaining to defendable space, new school buildings must be sited as far from the bushfire hazard as possible, having regard to slope, access, aspect, orientation and vegetation. These bushfire protection measures are to be maintained so long as the site is to be used as a school. As mentioned above, there are no requirements in this regulatory framework in relation to the physical construction of the exterior of a new or significantly modified school building in bushfire prone areas.

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86 s 4.3.1(c) *Education and Training Reform Act 2006 (Vic).*

87 s 4.3 *Education and Training Reform Act 2006 (Vic).*

88 Part 3.1 of the Victorian Registration & Qualifications Authority's 'Bushfire Preparedness Guidelines for Schools resulting from the Report of the Bushfire Royal Commission', see http://www.vrqa.vic.gov.au/registration/schools/bushfireguidelines.htm

89 Part 3.2 of the Victorian Registration & Qualifications Authority's 'Bushfire Preparedness Guidelines for Schools resulting from the Report of the Bushfire Royal Commission', see http://www.vrqa.vic.gov.au/registration/schools/bushfireguidelines.htm

90 Page 3 of the Victorian Registration & Qualifications Authority's 'Bushfire Preparedness Guidelines for Schools resulting from the Report of the Bushfire Royal Commission', see http://www.vrqa.vic.gov.au/registration/schools/bushfireguidelines.htm

91 DEECD's Bushfire At Risk Register, current to 15 December 2011.

92 Clause 44.06-1, Bushfire Management Overlay, Victoria Planning Provisions.

Private Hospitals – Regulatory Framework and Bushfire Safety

Private hospitals and private day procedure centres in Victoria are regulated by the Secretary to the Department of Health under Part 4 of the *Health Services Act 1988* (the Health Services Act). Both classes of facility are required to be registered before offering services to the public, and also to seek prior approval in principle before any construction of a new facility, or alteration or extension to an existing facility, can proceed. The Department's policy with respect to suitability for approval in principle is to consider the proposed facility's compliance with the Design Guidelines for Hospitals and Day Procedure Centres.[93] While the design guidelines impose construction requirements (essentially compliance with local building regulatory requirements supplemented by clinically-driven design requirements), they contain no specific provision for bushfire-resistance.

Minimum safety standards for private hospitals and day procedure centres are imposed by the Health Services (Private Hospitals and Day Procedure Centres) Regulations 2002. While these include a general requirement on a proprietor to ensure the facility is free of hazards or the accumulation of materials which are "likely to facilitate the outbreak of fire" (regulation 42), there are no specific bushfire safety standards imposed.

Private hospitals and day procedure centres that provide services for which health insurance benefits are payable are also required to comply with the *Private Health Insurance Act 2007* (Cth) and related rules which require relevant facilities to maintain private accreditation with an approved accrediting agency. Standards against which facilities are accredited vary according to the accrediting agency. Generally, however, their focus is quality and safety in clinical settings or in clinical governance. However, accrediting agencies may assess whether facilities meet standards with respect to emergency preparedness. For example, the Australian Council on Health Care Standards accreditation process, EQuiP5, includes the following standard/criteria, that: "Emergency and disaster management supports safe practice and a safe environment" (criteria 3.2.4).

Other Bushfire Safety requirements for Victorian Hospitals

The Department of Health (Vic) strongly encourages and supports public health facilities to plan for and respond to emergencies in accordance with an 'all hazards' approach. This includes having predetermined evacuation or relocation plans that may be enacted in response to a variety of emergencies or threats. The Department's planning response is also much broader than organisational level plans – State-wide resources, such as the Hospital Resilience Code Brown Policy Framework and the State Health Emergency Response Plan also focus on the co-ordination of the health sector on a State-wide basis to respond to major incidents, including surges in demand attributable to those incidents.

The Department's 2011-12 Bushfire Response: Clients and Services Policy ('the Bushfire Response Policy') is the policy framework intended to guide the Department and the health sector in planning, preparing responding and demonstrating organisational resilience to bushfires. It applies to services delivered from Department-owned, managed or funded facilities and supported residential services regulated by the Department.

The Bushfire Response Policy does not require the evacuation of relevant facilities on Code Red days. One reason for this is what is considered to be the appropriate level of Departmental involvement in decision making, i.e. that decisions regarding relocation or evacuation should be made locally by senior management in consultation with emergency services. In addition, the Bushfire Response Policy recognises that health agencies should have organisational emergency management plans considerate of their individual circumstance and environmental risk. It sets out that, in assessing the appropriate response to a Code Red forecast or a fire, a number of factors need to be considered, including:

- the nature of the threat – time, scope and proximity
- facility preparedness
- the location of the facility

93 Department of Human Services Victoria, 'Design Guidelines for Hospitals and Day Procedure Centres', available online at http://www.healthdesign.com.au/vic.dghdp/, accessed 12 April 2012.

- the current resident/patient profile – acuity, care needs, (including the capacity for clients to receive ongoing essential health care, e.g. Dialysis)
- the current staffing profile
- the capacity to reduce resident numbers prior to the day
- the availability of suitable and safe alternative accommodation
- the availability of transport and road access
- safety to travel
- defensibility of the facility – with our without support from fire agencies
- workforce and supplies availability.

Accordingly, the policy recognises that it may not be generally appropriate to evacuate facilities on Code Red days. It discusses a range of actions to be adopted on a forecast Code Red day, from relocation to cessation of services. It is strongly recommended that all services operating day programs, centre-based community services and community rehabilitation services from sites assessed as high risk develop a plan for ceasing services at those sites on Code Red days, and make a decision about whether to activate that plan by midday on the day prior. Decision making and planning is more complex in circumstances where people are, for example, resident or receiving acute care, or for which there may be limited alternative arrangements for care or accommodation.

The Department also encourages all health services, including private health services, to undertake emergency management planning and preparedness in a consistent manner, i.e. using departmental and other state-level resources as a guide whilst remaining considerate of local risk and circumstance. Information about bushfire planning is distributed to private hospitals in the course of the Department's regulatory functions, including in a self-assessment tool. When completing their self-assessment for the Department, private hospitals are prompted to indicate when they last reviewed their emergency management plan and whether they are situated in a high risk area. Private hospitals are also invited to health and aged care emergency management forums routinely conducted by the department prior to the summer season. The responsibility for bushfire planning and response however remains the responsibility of the services' proprietors.

Aged Care – Regulatory Framework and Bushfire Safety

An aged care building is a building used for residential accommodation of aged persons who, due to varying degrees of incapacity associated with the ageing process, are provided with personal care service and 24 hour staff assistance to evacuate a building during an emergency.[94] Planning, funding and regulation of residential aged care facilities are the responsibility of the Commonwealth Government. The regulatory framework for aged care is established under the *Aged Care Act 1997 (Cth)* (the Aged Care Act). This framework creates compliance obligations for aged care service providers which are designed to protect and foster quality of care and quality of life of residents of aged care facilities. Public funding to aged care service providers is contingent on a service provider's compliance with this regulatory framework.[95]

Aged care accreditation standards set out the obligations of aged care providers for emergency management arrangements, including evacuation plans and fire and evacuation drills. Public sector aged care services are subject to the Department of Health's 2011-2012 Bushfire Response Policy. This policy has the same application to public aged care facilities as it does for public health care facilities as described immediately above under the heading 'Other Bushfire Safety requirements for Victoria Hospitals'. The Department of Health, Victoria has

94 Part A1.1, Building Code of Australia, Volume One, definition of 'Aged care building'.

95 'A Literature Review and Description of the Regulatory Framework', November 2005, Commonwealth of Australia, at page x of the Executive Summary, available online at http://www.health.gov.au/internet/main/publishing.nsf/Content/8D7471B297492057CA257402008348A8/$File/Report%201%20-%20Literature%20Review.pdf, accessed 13 March.

also issued a '*Residential aged care services bushfire ready resource*'[96] which is one of a number of resources created to support Victorian public and private aged care facilities prepare for bushfire risk. This resource has been distributed to all aged care service providers in Victoria.

The Commonwealth Department of Health and Aging supports the position that planning and response to bushfire is the responsibility of the approved providers and executives of private sector aged care service providers. Each aged care facility, public and private, is required to have a facility specific emergency management plan in place which links into the local council's Municipal Emergency Management Plan. Evacuation of aged care facilities on days of high bushfire risk (including Code Red Days) is not mandated and a facility's decision to evacuate/relocate will depend on a series of factors including: resident health, risk assessment and availability of alternative accommodation and transport.

An aged care facility's emergency plan incorporates factors such as how that facility intends to respond where there is extreme heat and the potential for bushfire and also where there is an actual bushfire event. The aged care facility is responsible for making informed decisions about whether to leave through relocation or evacuation or staying and remaining on site during emergency events. As such, the emergency response plan will contemplate early relocation and evacuation and cover response elements such as residents' care needs, alternative accommodation, transportation, supplies, equipment and services, staffing, the physical environment and recovery.

Further, nursing homes applying for Federal Government-funded aged care places as part of the Aged Care Approval Round, are required to be 'familiar with the appropriate state/local authorities planning guidelines and requirements, particularly in regard to bushfire and flood mitigation and is the proposed development consistent with the relevant guidelines and requirement'.[97] Australian Government funded residential aged care facilities must also apply for certification. The aim of this process is to improve the physical quality of these buildings and one of the factors considered is fire safety. To be certified, an aged care facility must meet mandatory fire and safety standards relating to mechanisms such as sprinklers and fire suppression, fire fighting equipment, alarm detection, evacuation systems and smoke and fire compartmentalisation or separation. Again, there are no requirements regarding the physical construction of the exterior of the building.[98]

Non-regulatory responses of owners and vulnerable people

Other non-regulatory responses of owners and vulnerable people may also be relevant to the nature and extent of the problem addressed by the Proposed Regulations. The extent of the problem, in terms of the potential for loss of life, can be reduced by early evacuation. Early and safe evacuation is dependent on a number of factors including early and accurate warnings of an approaching bushfire, the implementation of a comprehensive and well practiced evacuation plan and available and adequate resources to execute a safe and planned evacuation. While evacuation addresses the priority policy position of saving lives, it does not address the secondary element of the proposal namely minimising building damage and destruction. In addition, as outlined above, some hospitals and aged care facilities may not be evacuated on Code Red days.

While these factors may reduce the risk of loss of life in the event of a bushfire, the buildings themselves may remain vulnerable to ignition caused by burning embers, radiant heat or flame generated by bushfire.

Bushfire Safety Policy Framework

In October 2010, in response to the Commission's recommendations, a *Bushfire Safety Policy Framework* (the framework) was developed by the Fire Services Commissioner. This framework provides advice to people about

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96 Victorian Department of Health (2009) 'Residential aged care services – Bushfire ready resource: Prepare Act Survive', available at http://www.dhs.vic.gov.au/__data/assets/pdf_file/0005/610880/racs_bushfire_resource2010.pdf, accessed on 13 March 2012.

97 Department of Health and Ageing, 2011 Aged Care Approvals Round Essential Guide, *Federal Government,* 2011, available at http://www.health.gov.au/acar2011.

98 Commonwealth Department of Health and Ageing, 'Aged care certification assessment instrument, November 2002 Revision', available at http://www.health.gov.au/internet/main/publishing.nsf/content/AFC49882AB33569DCA2570E70077E555/$File/assessin.pdf.

how to respond to bushfire risk and promotes an integrated approach to addressing this risk between Government, agencies, and communities.[99]

For the purpose of the proposed regulations, this framework has been reviewed by DPCD to determine its application to promoting the safety of occupants in vulnerable use buildings in bushfire prone areas who are particularly vulnerable to bushfire attack. Specifically, consideration is given to how the framework influences how many vulnerable people are likely to remain in vulnerable use buildings, by choice or otherwise, during a bushfire.

It should be noted at the outset, the framework does not deal with mitigation of bushfire risk through building regulation (or land use planning, land management, or operational planning). Its focus is to support a safe response to bushfire by engaging the community and providing processes and resources to facilitate a safe response to bushfire risk.[100]

The framework addresses bushfire risk by reference to the following priority areas:

- Engagement and education programs designed to increase a community's knowledge, awareness and understanding of how to manage bushfire risk.
- Bushfire preparation and planning measures which promote action to prepare properties for bushfire and plan how to respond in a bushfire.
- Local community fire planning that identifies vulnerable locations (such as the buildings under consideration in this RIS) and identifies specific shelter options and evacuation routes.
- Fire warnings and fire danger information to enable people to understand the level of fire danger and make informed decisions about how to respond to a particular bushfire.
- Bushfire safety and shelter options which identify a range of safety options from the safest response option (leaving bushfire prone areas on days of heightened risk) to evacuation to contingency plans such as identifying a list of places to shelter as a last resort. On Code Red days, vulnerable people are advised to leave 'the night before or early in the day'.

While the framework provides critical safety options for vulnerable people and their carers/guardians to respond to bushfire risk it recognises situations where, despite the existence of better bushfire safety options under the framework, such as early evacuation, people may be faced with a situation where it is no longer safe to leave a building and they are forced to rely more heavily on the building's resistance until it is safe to evacuate. This situation may arise for a number of reasons, for example, where a major bushfire starts on a lower fire danger day and a Code Red evacuation had not occurred or where for various reasons, a warning may not be given or received. For hospitals and aged care facilities, evacuation on Code Red days may not occur as the decision to evacuate remains the responsibility of the services' proprietors.

3.2.4 The residual problem

The market failures identified above have been addressed by regulatory requirements for some types of buildings (e.g. residential buildings). This is not the case for *privately owned* vulnerable use buildings in designated bushfire-prone areas in Victoria. For these buildings, the market failures have not been addressed and bushfire risk is not sufficiently being accounted for during construction, even with other regulatory bushfire protection measures and practices currently in place.

Further, while government buildings are covered by Ministerial Direction No. 3 and should be provided with at least basic protection against bushfire attack, there is no specific requirement that buildings on a BAL-LOW site be protected against embers. Achieving development outcomes of BAL-12.5 for vulnerable use buildings on a site in a BMO is a *planning* measure to manage and reduce damage to buildings from bushfire. It does not

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99 Bushfire Safety Policy Framework, September 2011, produced by the Fire Services Commissioner, at page 2.

100 Bushfire Safety Policy Framework, September 2011, produced by the Fire Services Commissioner, at page 5.

mean that buildings will be constructed to AS3959, and the problem of ember attack still exists for a building on a site in a BMO assessed at BAL 12.5 or below.

Given that wind borne embers pose the greatest threat of ignition to buildings, the problem may not be fully addressed for public vulnerable use buildings either.

Based on their findings, the Commission made specific recommendations on how to address this issue for vulnerable use buildings. One of the recommendations was for the Australian Building Codes Board (ABCB) to amend the BCA to include bushfire construction provisions for vulnerable use buildings that will be occupied by people who are particularly vulnerable to bushfire attack, such as schools, child care centres, kindergartens, hospitals and aged care facilities.[101] If this occurs, it would address the problem in Victoria because the BCA (incorporating any amendments made) is already adopted through the Building Regulations. It is not clear however, whether such changes will be made by the ABCB or how long it will take to make such amendments to the BCA. Therefore, it appears unlikely to be sufficient to rely on this solution to address the protection of vulnerable use buildings from bushfire attack in a timely way. In fact, the Commission also recognised this and made recommendations for Victoria to address this issue in the interim through changes to the Building Regulations.[102]

3.2.5 Potential costs if bushfire risk is not addressed

There are a variety of potential costs that could arise if bushfire risk is not adequately addressed for vulnerable use buildings through building construction and design performance standards. Some of these relate to the nature of these buildings, and the fact that they are occupied by vulnerable people. If vulnerable use buildings are not appropriately protected against bushfire attack, costs could be incurred relating to three key areas:

- loss of life and injuries, including the related healthcare and rehabilitation costs
- destroyed or damaged buildings, including the direct flow on impacts to the community from this
- social disruption, or flow on personal and social costs.

The nature of these costs and their relevance to this problem are discussed in the following sections. The extent and potential magnitude of these costs are then discussed in detail in section 3.3 of this chapter (Extent of the problem).

Loss of life & injury

Vulnerabilities such as age, illness and acute and chronic disability affect a person's capacity to respond to bushfire risk. For various reasons, such as difficulties with mobility, ability to comprehend risk and capacity to make appropriate decisions to reduce that risk, vulnerable people are more reliant on others to escape bushfire and manage their health, safety and wellbeing during this process. The same vulnerabilities increase the possibility that people in these categories will be seriously injured or die during a bushfire, especially where emergency resources are limited.

The Commission recognised the following vulnerabilities (by age, illness or lack of mobility) as increasing a person's susceptibility to injury and/or death during a bushfire. People considered by the Commission to be vulnerable were:

- children
- young people
- people with a disability
- frail aged people

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[101] Recommendation 48.5 , Victorian Bushfires Royal Commission Final Report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, July 2010.

[102] Recommendation 49.2, Victorian Bushfires Royal Commission Final Report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, July 2010.

- non-ambulant people
- people who require support in daily living
- people with a mental illness who are vulnerable and may have status under the Mental Health Act.[103]

The types of buildings likely to be occupied by people affected by these types of vulnerabilities have been previously identified in this RIS to include: schools, kindergartens, child care facilities, aged care facilities and hospitals (collectively referred to in this document as 'vulnerable use buildings').

Vulnerable people may also find themselves more likely to be in a building in a bushfire prone area during a bushfire event (where the building has not been evacuated), and/or are less able to leave such buildings in the event that a bushfire directly threatens that building. For example, the elderly, children, hospitalised patients, the disabled and other people who are under the care of others may be exposed to a higher level of risk to the extent that they are unable to reduce their exposure to bushfire through their own individual actions such as defending or evacuating when a fire is near.

As well as relying on others, the nature of their condition may make it more difficult to physically move these people to a safe area or evacuate them from a building. Therefore, these vulnerable people may place greater reliance on the building's resistance to bushfire attack. For example, in nursing homes and hospitals, the occupants are often bed ridden and may require medical equipment to be transported with them. In addition, moving some of these people in itself can cause health issues and take a certain amount of time and resources to organise.

Children in schools and child care facilities may be subject to a slightly lower risk when compared to the elderly and sick to the extent that it is easier to take a child out of school ahead of a bushfire, if the risk of bushfire is known ahead of time, such as on a Code Red day.

Relocation of the elderly

As well as the direct risk of being caught in a bushfire, some research has indicated that permanently relocating elderly residents/patients (as would be necessary where an aged care facility is destroyed by a bushfire) may lead to serious consequences for residents' health. "Relocation can have negative physical and psychological effects on patients in acute care and residents of long term care", especially for the elderly.[104] "According to the U.S Government's Administration on Ageing, *Transfer Trauma*, sudden and unexpected relocation can cause or contribute to depression, increased irritability, serious illness and elevated mortality risk for the frail elderly."[105] It has also been suggested that death rates can increase after relocation.

Research also indicates that relocation could negatively impact surgery patients or the critically ill in a similar way, potentially increasing the risk of mortality.[106]

As well as impacting existing patients, this movement could adversely impact other clients in the aged care market if they are not able to obtain a bed in a local facility due to the increased pressure imposed on that facility by the relocated occupants.

Destroyed and damaged vulnerable use buildings

As discussed above, during a bushfire, buildings are exposed to bushfire attack. This could lead to damage from radiant heat or if the building ignites the destruction of the building. As a consequence, these buildings would need to be re-built and reconstruction costs would be incurred.

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[103] Victorian Bushfires Royal Commission Final Report, July 2010, Volume II: Fire Preparation, Response and Recovery, Chapter 1 at page 49, 2009.

[104] Robinson, V. 'A brief literature review of the effects of relocation on the elderly', prepared for The Hospital Employees' Union of British Columbia, September 2002.

[105] Robinson, V. 'A brief literature review of the effects of relocation on the elderly', prepared for The Hospital Employees' Union of British Columbia, September 2002.

[106] Robinson, V. 'A brief literature review of the effects of relocation on the elderly', prepared for The Hospital Employees' Union of British Columbia, September 2002.

The destruction of one building should also be considered in the context of its neighbouring buildings. If one building catches alight, it can act as a fuel load to carry the fire and may allow the fire to spread to the surrounding buildings. The cost of reconstruction for the surrounding buildings should also be considered as a cost of the problem if a vulnerable use building is the initial point of ignition.

Flow on impacts

As well as the cost of reconstruction, there are other flow-on costs associated with the destruction of vulnerable use buildings. For example, in the event vulnerable use buildings are destroyed by fire, using an aged care building as an example, there is a potential cost associated with relocating and housing these residents (possibly up to 90 residents depending on the size of the facility).

The destruction or damage of vulnerable use buildings could also affect business continuity. After the Victorian bushfires in 2009, the Australian Government recognised the potential impact on income and provided an income recovery subsidy. Under this subsidy, immediate financial assistance was provided to employees, small business owners and farmers who experienced a loss of income as a direct result of the fires.[107]

3.2.6 Social disruption

Vulnerable use buildings, such as hospitals and schools, comprise an important part of the public infrastructure of a local community. Communities rely on these buildings to provide essential facilities that must be accessed to support a thriving community. Given bushfires are inherently disruptive to the community, if vulnerable use buildings are destroyed by a bushfire, it could further disrupt the community and its ability to adjust and re-establish itself after a bushfire event.

One factor leading to social disruption after a bushfire is the loss of community infrastructure.[108] Loss of schooling and other community services are factors that can lead to feelings of isolation by local communities.[109] Given the level of social disruption and potential feelings of isolation, individuals may also decide not to return to their home town and this may have adverse impacts on the prosperity of towns affected by bushfire. The Bushfire Cooperative Research Centre note that some individuals may leave a bushfire affected area due to a loss of support services or infrastructure.[110]

In addition, hospitals are a crucial part of a bushfire response. Hospitals are needed to provide healthcare for individuals injured by bushfire. In the Black Saturday bushfires, Victorian public hospitals provided care to more than 800 people and admitted 130 patients with a fire-related injury or illness. To cope with the high demand for health services, Victorian Medical Assistance Teams were deployed from metropolitan hospitals to various regional and rural hospitals to assist in treating those requiring medical care.[111] If regional and rural hospitals were destroyed or severely damaged during a bushfire, the pressure on the health system to cope with the increased demand for medical services would be even greater.

There can also be broader impacts associated with loss or damage of buildings, over and above lost property value. While not estimated by the Commission, a report on the impact of the Queensland floods found that:

> The Queensland Government currently estimates the damage to local government roads, water supplies and waste facilities, buildings and airports at around $2 billion, and the total damage to public infrastructure across the State at between $5 and $6 billion. There were also significant costs to the economy from production disruptions, particularly in the mining sector, and costs at the business and

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[107] Australian Tax Office, 'Victorian Bushfires', available at http://www.ato.gov.au/individuals/content.aspx?doc=/content/00183040.htm, accessed 12 April 2012.

[108] Morrison, M, 'A guide for estimating the non-market values associated with improved fire management', Bushfire Cooperative Research Centre, March 2009.

[109] RMIT Research Team, 'Socio-Economic Impact of Bushfires on Rural Communities and Local Government in Gippsland and North East Victoria', Centre for Rural and Regional Development, July 2003.

[110] Morrison, M, 'A guide for estimating the non-market values associated with improved fire management', Bushfire Cooperative Research Centre, March 2009.

[111] Victorian Bushfire Reconstruction and Recovery Authority, '100 Day Report', 2009.

household level, as damage is assessed and the rebuilding process of affected buildings and homes, with or without insurance, commences.[112]

3.3 Extent of the problem

The Commission has estimated that the total economic cost specifically associated with the Black Saturday bushfires in 2009 was $4 billion. This included $645 million from 173 deaths and $1.2 billion in property and motor vehicle damage.[113] The problem identified in this RIS however, relates specifically to vulnerable use buildings. As outlined in the nature of the problem section, there are three key cost areas associated with this problem. These are:

- loss of life and injuries, including the related healthcare, rehabilitation and possible relocation costs
- destroyed or damaged buildings
- social disruption, or flow on personal and social costs.

The third cost area, social disruption, cannot be quantified and as such is not discussed in further detail in this section. Information on the potential magnitude of the first two costs is provided below.

3.3.1 Loss of life & injury

It is difficult to predict the potential for loss of life or injury from future bushfires. Previous bushfires can provide some information, however the factors that influence the ignition and progression of a bushfire are so diverse that no two bushfires are the same. The specific outcomes of bushfires are influenced by known and controllable factors but also, to some extent, by chance or factors beyond human control. The Commission found for example, that one of the common features of the most severe Black Saturday bushfires was that, late in the day, a wind change altered the direction of the fire spread and extended the fire front.[114]

Experience from past bushfires

In the Black Saturday bushfires, 27 of the people who died were aged 70 years and over, and 16 people were aged 12 years and younger.[115] It is not clear how many of those that died suffered from a pre-existing serious illness or disability that might have made them vulnerable. The Building Commission of Victoria advised DPCD that although certain Class 9 buildings such as schools, child care centres, hospitals, and aged care facilities were destroyed, there were no fatalities arising directly from these buildings being engulfed by bushfire.

Many people were injured in the Black Saturday bushfires, including 414 who were admitted to hospital emergency departments in the following 72 hours (including many who subsequently died).[116] Research has indicated that those admitted to emergency departments after Black Saturday generally either died or survived with minor injuries (i.e. that only a relatively small number survived suffering major injuries), and that the 414 were comprised of 22 with burns injuries and the remainder were other bushfire related presentations.[117] Four of the burns victims were children. It is not known how many of the other injuries were to vulnerable people.

In relation to injuries, though the Commission noted that public hospitals provided emergency care to 800 people and admitted 130 people, it was unable to make an accurate assessment of the costs of injuries sustained during the fires as that would require data on hospitalisation costs together with an estimate of the costs of

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112 PwC 2011, Economic Impact of Queensland's natural disasters.

113 Victorian Bushfires Royal Commission final report, Volume I: The Fires and Fire-related Deaths, Appendix A – Estimated Costs of the Fires, July 2010.

114 Victorian Bushfires Royal Commission final summary report, July 2010. P.3.

115 Victorian Bushfires Royal Commission final summary report, Pg 1, July 2010. P.236.

116 Cameron, PA, Mitra, B, Fitzgerald, M, Scheinkestel, CD, Stripp, A, Batey, C, Niggemeyer, L, Truesdale, M, Holman, P, Mehra, R, Wasiak, J and Cleland, H, MJA 2009; 191 (1): 11-16 available at http://www.mja.com.au/public/issues/191_01_060709/cam10194_fm.html.

117 Ibid.

long-term treatment and the value of time lost from the workplace by those affected.[118] The costs of injuries to vulnerable people have not been estimated as part of this analysis for similar reasons. In addition, research suggests that the typical profile for casualties following major bushfires is that injuries sustained by survivors are predominantly minor.[119] Accordingly, it is likely that the potential cost of injuries to vulnerable people that might otherwise occur during a bushfire are likely to be represented predominantly by the avoidance of a number of minor injuries, and a very much smaller number of more serious injuries.

Information on this subject is somewhat more limited in relation to other Victorian bushfires, although the reports examined for this RIS suggest that in two previous bushfires there were no fatalities at vulnerable use buildings (although there may have been destruction of property).

In the **Ash Wednesday bushfires** in Victoria, there were 47 fatalities, 32 of these civilians.[120] Based on the analysis on multiple reports, it is suggested that no fatalities occurred in the facilities subject to this RIS. According to a study on civilian deaths in the 1983 Ash Wednesday Bushfires, all civilian deaths occurred in residential buildings, or on roads.[121]

The **Eastern Victorian alpine bushfires** occurred on 8 January 2003.[122] There were no fatalities recorded. It is estimated by the Insurance Council of Australia that the insurance cost of the damage was over $12 million.[123]

Potential impact of future bushfires

While it appears no lives have been lost to date in specific to vulnerable use buildings during previous major bushfires, this does not mean there is not a real threat to the life of vulnerable people from future bushfires in Victoria. Some vulnerable use buildings such as schools are generally evacuated on or before Code Red days to avoid exposing students to bushfire attack, but others such as aged care facilities and hospitals may not be evacuated on Code Red days as the decision is seen as the responsibility of the services' proprietors and is based on a wide range of factors (see 3.2.3 – Non-regulatory responses of owners and vulnerable people). It should also be noted that not all bushfires occur on days that have been identified as 'Code Red'.

As well, the factors that influence the spread of a bushfire are diverse and as such, bushfires can be unpredictable. As happened in each of the Black Saturday major bushfires, fire fronts can spread quickly following initiation, move forward rapidly by spotting (as a result of fuel type, weather conditions and topography) and change direction, spread and or be extended by unexpected changes in wind direction.[124]

Because of this, the number of deaths and injuries resulting from Black Saturday, and other bushfires, could easily have been different. The majority of the fatalities that occurred from Black Saturday occurred in the Kinglake and Marysville areas because of the Kilmore East and Murrindindi fires. These burned across wide areas of the Shires of Nillumbik, Yarra Ranges, Mitchell, the rural northern part of the City of Whittlesea (Kilmore East fires) and Murrindindi. Nillumbik, with 31 people per square kilometre, and Yarra Ranges (35) have been identified as being among the lowest density local government areas in the Melbourne Statistical

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118 Ibid.

119 Cameron, PA, Mitra, B, Fitzgerald, M, Scheinkestel, CD, Stripp, A, Batey, C, Niggemeyer, L, Truesdale, M, Holman, P, Mehra, R, Wasiak, J and Cleland, H, MJA 2009; 191 (1): 11-16 available at http://www.mja.com.au/public/issues/191_01_060709/cam10194_fm.html.

120 N. Krusel and S. N. Petris, A study of civilian deaths in the 1983 Ash Wednesday Bushfires Victoria, Australia, CFA Occasional Paper No. 1, December, 1992 [http://www.royalcommission.vic.gov.au/getdoc/adec5bc7-6c36-4c66-a8f4-17f2bf7f285e/WIT.3004.003.0201.pdf].

121 N. Krusel and S. N. Petris, A study of civilian deaths in the 1983 Ash Wednesday Bushfires Victoria, Australia, CFA Occasional Paper No. 1, December, 1992 [http://www.royalcommission.vic.gov.au/getdoc/adec5bc7-6c36-4c66-a8f4-17f2bf7f285e/WIT.3004.003.0201.pdf]

122 Department of Premier and Cabinet, Report of the Inquiry into the 2002-2003 Victorian Bushfires, 2003, [http://www.oesc.vic.gov.au/resources/8/a/8a6a9880405698dabd9ebfe505682c73/5_bushfire_report_parta.pdf]

123 Australian Government, Attorney-General's Department, Australian Emergency Management Institute, 'Event – Bushfire – North-Eastern Victoria, Alpine Region', available online at http://www.disasters.ema.gov.au/Browse%20Details/DisasterEventDetails.aspx?DisasterEventID=2072, accessed on 12 April 2012.

124 Victorian Bushfires Royal Commission final summary report, July 2010. P.3.

District.[125] Australian Bureau of Statistics local government area population estimates (2010) for the regional Shires of Mitchell and Murrindindi are 35,044 and 13,505[126], which represent population densities of 12.3 and 3.5 people per square kilometre. However, the Kilmore East fires also encroached onto the northern rural part of the City of Whittlesea, 70 per cent of which is rural and 30 per cent of which is urban. Whittlesea has a population of 155,113 and urban parts include city suburbs such Lalor and Epping. Areas up to the rural-urban interface have been mapped as bushfire prone.

Another example of the potential for Black Saturday to have caused much greater loss of life and injury can be seen in the Narre Warren and Upper Ferntree Gully fires. On Black Saturday, a number of small fires burned at the rural–urban interface in Melbourne's south-east, including three fires in Narre Warren and one in Upper Ferntree Gully, in grass reserves and scrubland, on residential streets, and in homes and gardens in these areas. As the Commission noted, each of the fires might have resulted in far greater and more widespread destruction than eventuated. In particular, the Harkaway and Upper Ferntree Gully fires could have caused severe damage, the latter having had the potential to run into the Dandenong Ranges. Fortunately, these fires were contained.

As will be discussed below, moving forward there will be more people living in bushfire prone areas, and the frequency and severity of bushfires is expected to increase in the future. These factors may make it more likely that a life or lives will be lost in the future. For illustrative purposes, if a life was to be lost, the 'value' of that life in statistical terms can be quantified, reflecting an "estimate of the financial value society places on reducing the average number of deaths by one".[127] This is estimated at **$3.96 million** (that is, this estimate reflects the Office of Best Practice Regulation's suggested value for a life, updated to be expressed in today's dollars).

Relocation of the elderly

Some studies examining patient groups that have been relocated or transferred have found that transferred patients had a mortality risk between 1.99 and 3.76 times that of patients not being relocated.[128]

Based on this increase in mortality risk, the statistical value of a life year and a range of other assumptions, it is estimated that permanently relocating the residents of one aged care facility could cost society **$4.71 million**. This cost is based on the average size of an aged care facility in Victoria, being a facility with 58 residents.[129] The cost to society reflects the potential lives that could be lost following the *permanent* relocation of aged care residents in the event of destruction of their home. While the residents may be evacuated during a bushfire, if their facility is destroyed, they would be permanently transferred to a separate facility. Further detail on how this cost has been calculated and the underlying assumptions is provided in Appendix B.

A retirement village in Marysville was destroyed as a result of the Black Saturday bushfires. While future bushfires are unpredictable, the destruction of an aged care facility and the impact of permanently relocating residents could be a potential consequence of future bushfires. Consultation has indicated that land clearing is common practice when building new aged care facilities. While this may reduce the inherent BAL of the site, it does not mean that the building itself would necessarily withstand or be resistant to bushfire attack from embers, radiant heat and/or flame contact.

3.3.2 Destroyed and damaged vulnerable use buildings

Information on the extent to which vulnerable use buildings are likely to be damaged or destroyed during a bushfire can be estimated by looking at the impacts experienced during previous bushfires.

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[125] Australian Bureau of Statistics , 3218.0 - Regional Population Growth, Australia, 2009-10 available at http://www.abs.gov.au/ausstats/abs@.nsf/Products/3218.0~2009-10~Main+Features~Victoria?OpenDocument#POPULATIONDENSITY

[126] Australian Bureau of Statistics, 3218.0 - Regional Population Growth, Australia, 2009-10, 3218.0 Population Estimates by Local Government Area, 2001 to 2010 available at http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02009-10.

[127] Department of Finance and Deregulation, Office of Best Practice Regulation, Best Practice Regulation Guidance Note – Value of statistical life', November 2008.

[128] Robinson, V. 'A brief literature review of the effects of relocation on the elderly', prepared for The Hospital Employees' Union of British Columbia, September 2002.

[129] Australian Institute of Health and Welfare, 'Residential Aged care in Australia 2009-10: A statistical overview', Aged care statistics series number 35, AIHW cat no. AGE 66, Canberra. Weighted average based on Table A1.4, page 74.

Black Saturday caused extensive damage to and destruction of buildings. Information on the specific types of vulnerable use buildings destroyed during the Black Saturday fires is limited as most research conducted on building damage and destruction concentrates on residential buildings. One media article gives some indication of the types of buildings destroyed beyond residential buildings.[130] Other sources of information are the submission of the DEECD to the Commission, which outlines the government owned schools and kindergartens that were destroyed, and the State-wide Reconstruction and Recovery Plan: Rebuilding Together. According to these sources, there were at least:

- three primary schools destroyed
- three kindergartens destroyed
- 47 schools partially damaged, including six primary schools
- a wide variety of other businesses lost (although the nature of these is not clear).[131]

The Rebuilding Together plan provides estimates of the reconstruction costs associated with most of these losses. The following points outline the funding that has either been spent or is budgeted for reconstruction in relation to the schools, kindergartens and other vulnerable use buildings that were destroyed during Black Saturday:

- Middle Kinglake education and community recreation precinct, which includes a primary school and an early education centre (including a kindergarten and maternal and child health services), will receive $8.6 million. Note that a further $2 million has been allocated to a community facility; however this may not be classed as a vulnerable use building. Similarly, a further $1.7 has already been allocated, but it is not clear on what facilities this funding will be spent. To be conservative, it is assumed that only the $8.6 million relates to vulnerable use buildings.
- Flowerdale early years facility, which incorporates a kindergarten and maternal/child health services will receive $2.2 million to replace the Flowerdale Kindergarten.
- Callignee community centre will receive $3 million and will replace the Callignee Mechanics Hall, old Callignee School and Callignee CFA shed with a new multipurpose facility that incorporates a community hall, playschool, CFA station and sporting changing rooms. It is assumed that given this multi-purpose building will be used as a children's centre, it would be classified as a vulnerable use building.
- Marysville Community Learning, Health and Recreation Hub would include a primary school, children's centre (childcare, maternal and child health, kindergarten and playgroup), multipurpose community meeting space, and community health service and recreation centre. This would receive $5.2 million on top of $1.8 million already provided for the primary school. Given that not all of the buildings that make up this 'hub' would be vulnerable use buildings (i.e. the meeting space and the recreation centre); only 50 per cent of the $5.2 million has been attributed to reconstructing vulnerable use buildings.
- Strathewan Primary School will receive $3.1 million to rebuild the school on the previous site.[132]

To estimate the reconstruction costs for the 47 damaged school buildings, a proportion of the estimate for Strathewan Primary school could be used. Assuming that 10 per cent of that cost is attributable to these buildings, the overall cost for the 47 damaged buildings would be $14.6 million.

Based on the funding and reconstruction cost estimates above, the total reconstruction cost of vulnerable use buildings impacted by Black Saturday is estimated to be $35.87 million. However, the buildings outlined above

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[130] The Age 2009, *The Road to Recovery*, 7 March 2009.

[131] The Age 2009, *The Road to Recovery*, 7 March 2009; Victorian Bushfire Reconstruction and Recovery Authority (2009), 'Rebuilding Together: A Statewide Plan for Bushfire Reconstruction and recovery', October 2009.

[132] Victorian Bushfire Reconstruction and Recovery Authority (2009), 'Rebuilding Together: A Statewide Plan for Bushfire Reconstruction and recovery', October 2009.

are all government owned buildings (other than the 47 damaged schools, where the ownership is unknown). Given that Government owned buildings with a BAL above BAL-LOW would already be covered by Ministerial Direction No. 3, the cost of the problem outlined in this RIS should only account for Government buildings that are BAL-LOW. Given it is assumed that about 95 per cent of buildings are BAL-LOW, the cost of reconstruction attributable to this analysis would be **$34.23 million**.

It is not clear what the specific cause of ignition was for particular buildings during Black Saturday. However, numerous reports, including Leonard's (CSIRO) submission to the Bushfires Royal Commission, point to ember attack being the main reason for loss and damage to buildings (all buildings, not just residential ones) during a bushfire:

- As stated above, research on a range of Australian bushfires indicates that ember attack accounts for most loss and damage to buildings during a bushfire. As the Handbook on AS 3959 notes – 'because ember attack can last for such a long period of time and travel vast distances, it is considered to be the major cause of the ignition of buildings during a bushfire and the greatest bushfire attack risk…embers can attack and destroy a building regardless of the location of the fire front.'[133]

- As stated elsewhere in this RIS, the Commission found that most buildings damaged or destroyed in major bushfire events were ignited by embers and that once ignition of a building occurred, it was more likely than not to burn to the ground. Accordingly, some of the recommendations of the Commission relate to increasing the extent to which vulnerable use buildings can withstand ember attack.

- Even if ember attack did not contribute to the destruction of all the buildings listed above, it needs to be reiterated that bushfires are unpredictable and so a broader perspective is required in terms of future disaster planning. Further, ember attack – although important – is not the only cause of damage and destruction of buildings.

3.3.3 *Future trends relevant to bushfire risk*

While the costs above provide some indication of the potential costs from bushfires in Victoria, these figures must be seen in the context of expectations about the future environment. This includes population, building construction, the movement of vulnerable people and the frequency and severity of future bushfires.

Population in Bushfire Prone Areas

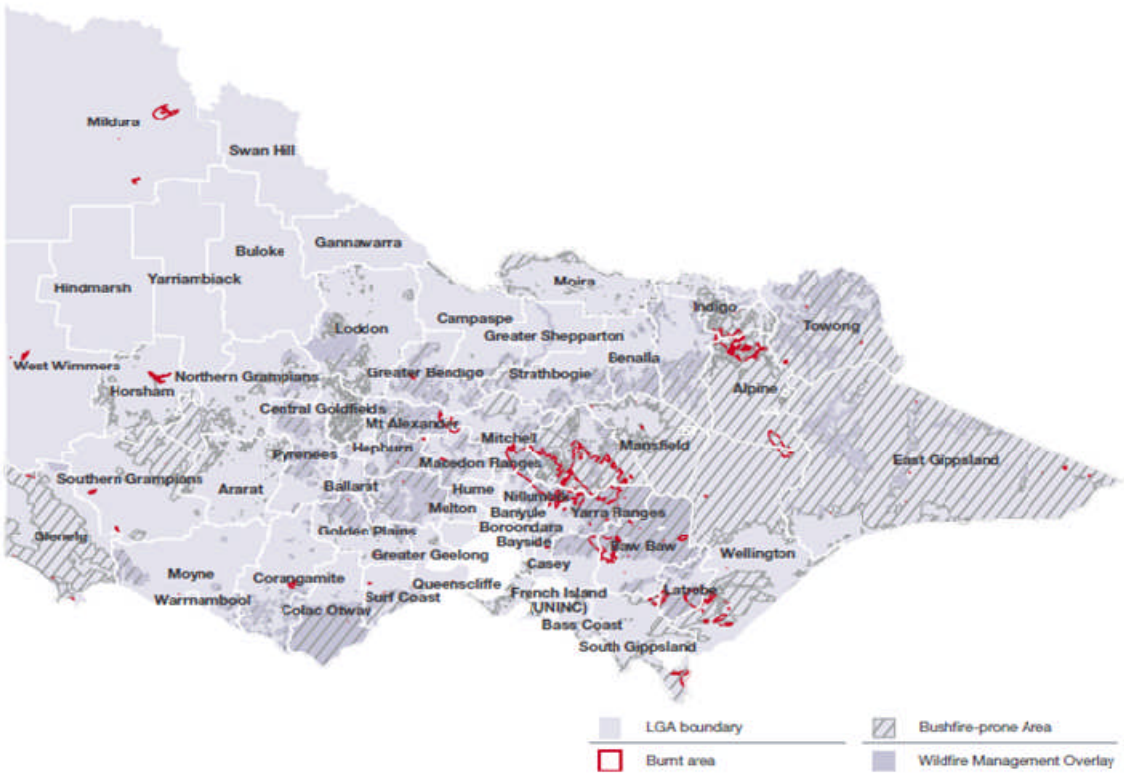
The re-mapping of bushfire prone areas which came into effect on 8 September 2011 shows that a much larger area of Victoria is bushfire prone than previously recognised (i.e. prior to Black Saturday). This means by necessity a much larger proportion of Victoria's existing population is now captured within a designated bushfire prone area.

On 8 September 2011 new standardised maps identifying areas at risk of bushfire were released by the Minister for Planning. As discussed in Chapter 2, these maps show areas of the State designated as bushfire prone areas (areas deemed to be susceptible to bushfires).

Prior to Black Saturday a significantly smaller proportion of the State was designated as bushfire prone than is presently recognised under the current BPA mapping system. This is illustrated by Figure 1 and Figure 2 below. Figure 1 shows the area of the State designated as bushfire prone prior to and on Black Saturday and Figure 2 shows the area of the State now designated as bushfire prone area. Bushfire prone areas are shown on Figure 1 as diagonal grey lines. Bushfire prone areas are shown on Figure 2 as orange shaded areas. A review of these two marked areas clearly shows the extent of the expansion of the area of the State now identified as being susceptible to bushfire than was previously recognised prior to Black Saturday.

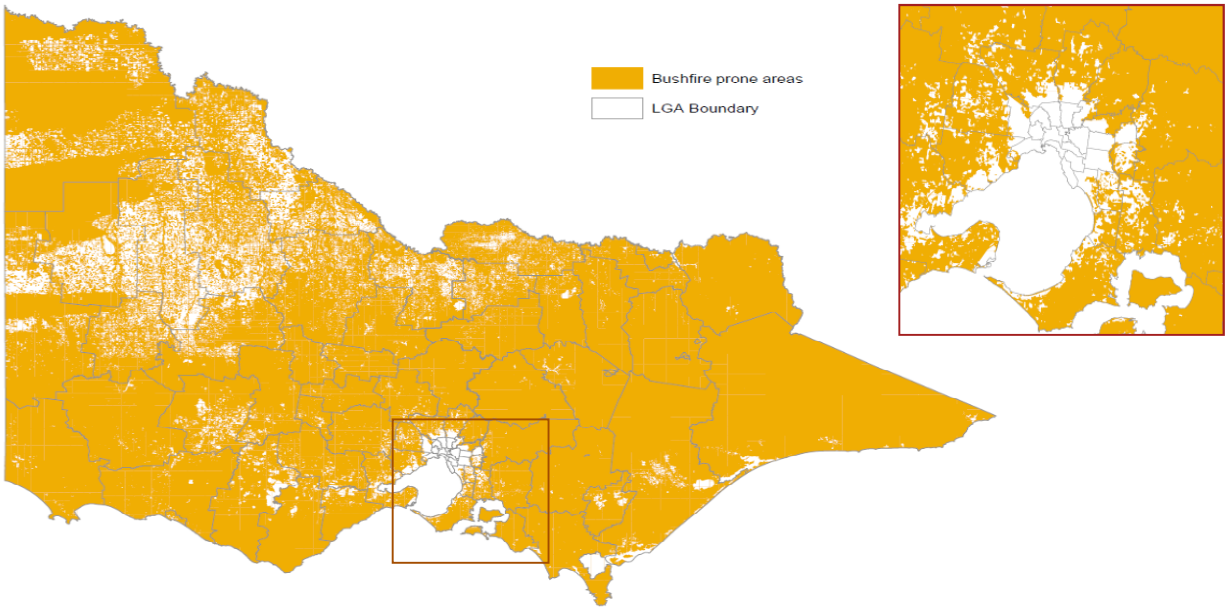
[133] Standards Australia, HB 330-2009 Living in bushfire prone areas – A guide to reducing the threat and impact of bushfire attack and an explanation of the basis of AS 3959.

Figure 1 – Map of Victoria's Bushfire Prone Area on and before Black Saturday



Source: 2009 Victorian Bushfires Royal Commission Final Report, July 2010, Volume II, Fire Preparation, Response and Recovery, Figure 6.1 at page 218. The 'Burnt area' represents the area burnt during Black Saturday.

Figure 2 – Map of Victoria's Bushfire prone areas

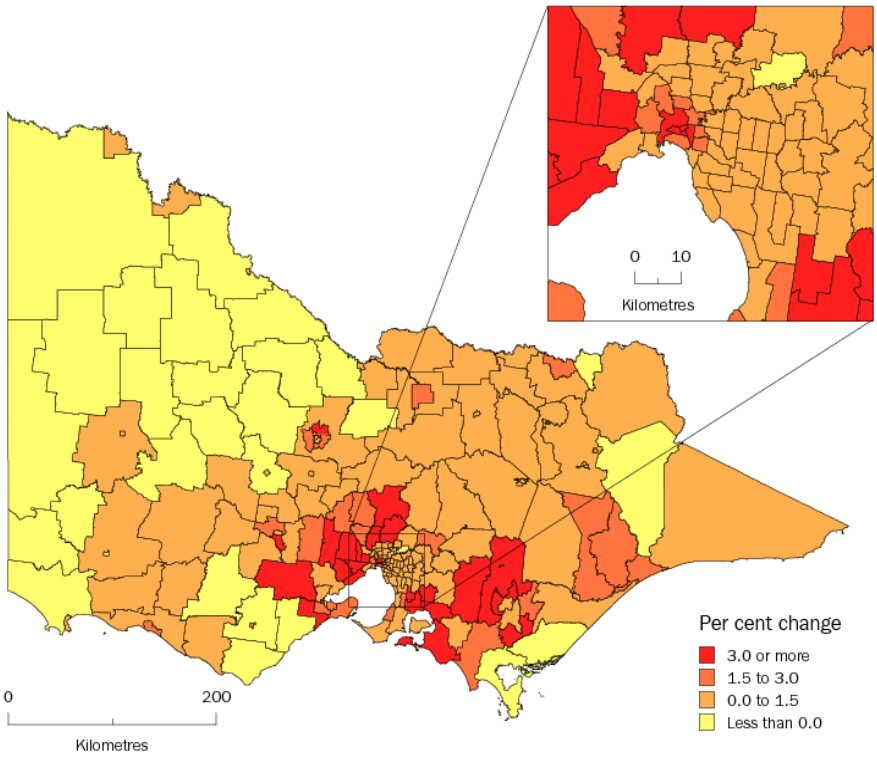


LGA: Local Government Area
Source: Department of Planning and Community Development, available at http://www.dpcd.vic.gov.au/__data/assets/pdf_file/0006/78999/BPA_with_Vic_Bdy.pdf, accessed on 21 September 2011.

In addition to capturing a larger proportion of Victoria's existing population, population growth rates in bushfire prone areas show that the existing population in bushfire prone areas is also increasing. For example, areas such as Cardinia and Whittlesea, which are classified as being over 75 per cent bushfire prone, are two of

the fastest growing population regions in Victoria, with six per cent increase in population in 2009-10. Baw Baw Shire, which has one of the highest proportions of bushfire prone areas in the State (at 99 per cent by area), has experienced 3.8 per cent growth in population in 2009-10.[134] Overall, the three year average growth rate of regional areas to June 2010 was 1.4 per cent. Given Victoria's ageing population, this means that a larger number of vulnerable people now live in bushfire prone areas, than was the case on Black Saturday and further that this population will continue to grow.

Figure 3 – Map of Victoria's population growth rate by Statistical Local Area: 2009-10



Source: Australian Bureau of Statistics, '3218.0 – Regional population growth, Australia', Summary, 2009-10, available at http://www.abs.gov.au/ausstats/abs@.nsf/Products/3218.0~2009-10~Main+Features~Victoria?OpenDocument#PARALINK54, accessed on 12 January 2012.

Number of vulnerable people and vulnerable use buildings in Bushfire Prone Areas

A larger population of vulnerable people in bushfire prone areas should translate more specifically into an increase in demand for new privately owned vulnerable use buildings.

Table 4 shows the current number of vulnerable use buildings in bushfire prone areas as well as the expected total expenditure to be outlaid on the construction or modification of these types of buildings in bushfire prone areas in coming years.

134 Australian Bureau of Statistics, '3218.0 – Regional population growth, Australia', Summary, 2009-10, available at http://www.abs.gov.au/ausstats/abs@.nsf/Products/3218.0~2009-10~Main+Features~Victoria?OpenDocument#PARALINK54, accessed on 12 January 2012.

Table 4 – Number and value of privately owned vulnerable use buildings occupied by vulnerable people in Bushfire Prone Areas in Victoria

Building type	Number of existing facilities	Building permits for new and significantly modified buildings[135]	
		Average number of permits expected per annum	Average value of building permit activity per annum (million)
School	344.40	89.76	$62.98
Kindergarten	433.44	5.66	$2.96
Child care	985.60	12.59	$6.60
Aged care facility	245.28	14.37	$33.23
Hospital	51.52	16.21	$16.65
Total	**2,060.24**	**138.59**	**$122.42**

Cost estimates are GST-exclusive

Note that the figures in this table may not sum due to rounding. The figures for the 'number of existing facilities' and the 'number of permits' are shown to two decimal place to demonstrate the exact numbers that have been used in estimating the costs associated with the Proposed Regulations. While it is not possible to build half of a building, these numbers are not whole numbers because they are taken as an average across several years of building permit data and also have a percentage applied to them to exclude buildings covered by the BMO.

Sources: *Existing facilities* – These figures are static figures from 2011 (except Kindergartens, which are estimated based on 2010 data). Estimated based on customised data on the number of existing facilities provided by DEECD and the Department of Health; Steering Committee for the Review of Government Service Provision, 'Report on Government Services 2011', Chapter 3 – Children's Services, Productivity Commission, Canberra, 2011. The Productivity Commission document has been use to identify the breakdown of private versus Government owned facilities in the Children's Services sector. The number of existing facilities has been adjusted to account only for the proportion of existing buildings assumed to be in an area covered by BPA (based on a weighted average) and excludes facilities in municipalities with no BPA. See Appendix B for further detail on the sources and assumptions underlying these estimates. Note that these estimates are based on actuals and should therefore be fairly accurate.

Number and value of building permits –Based on customised data on number and value of building permits for each building type from 2006-2010 provided by the Building Commission. To avoid the impacts of the Building Education Revolution, only years 2006 to 2008 have been used to estimate the future number of permits for schools. Permit data was adjusted to reflect the proportion of land in relevant municipalities covered by a designated bushfire prone area and the WMO, information provided by DPCD. For modifications, building permit data cannot be separated by those projects that modify 50 per cent or more of an existing building. In the absence of this information, to approximate the number of modification relevant to this proposal, it is assumed that 10 per cent of permits for modification projects represent modifications of 50 per cent or more. See Appendix B for further detail on the sources and assumptions underlying these estimates.

The parallel between areas of the State experiencing growth and those that are bushfire prone can be seen in the comparison of Figure 3.3 and Figure 3.2. Figure 3.3 shows the growth by Statistical Local Area in 2009-10, while a map of Victoria's current bushfire-prone areas is shown in Figure 3.2. According to these maps, almost 85 per cent of Victoria is now identified as bushfire prone, and many of these areas are shown to be experiencing population growth (Figure 3.3). Only 11 of Victoria's 79 council areas (local government areas) have been declared entirely free of bushfire prone area. This shows a clear picture of increased population in bushfire prone areas within Victoria.

Number and severity of future bushfires in Victoria

Bushfire has been a continual part of the Victorian landscape – the record of bushfire incidence in Victoria reaches back over 150 years, as summarised in the Victorian Bushfires Royal Commission (Vol 1, Appendix C).

The Department of Sustainability and Environment in Victoria's 2008 Bushfire Strategy 'Living with Fire' highlighted that the last decade had seen a significant increase in the number, intensity and area of the State burnt by bushfires. In 2006-07 a record number of fires occurred, with 1,083 ignitions on public land alone. At

[135] 'Significantly modified' is where modifications are being made to 50 per cent or more of an existing building.

the time, this figure was 45 per cent higher than the thirty year average. Further research shows that this trend is likely to continue in the future.

Using different simulations of Climate change in Victoria undertaken by CSIRO, the increase in days with very high and extreme Fire Danger Index was estimated between four and 25 per cent by 2020.[136] That is, the average number of days per year is likely to increase from nine to between 9.8 and 11.1. The range in these estimates takes into account uncertainty in climate sensitivity from Intergovernmental Panel on Climate Change projections. Along with increased fire danger days, the number of suitable days for controlled burning is expected to decrease, resulting in either increased resources required or a build-up of vegetation, as well as longer fire seasons and a greater potential for multiple fire events like those experienced previously in Victoria.[137]

3.3.4 The overall cost of the problem

The overall cost of the problem has been estimated under two different scenarios to reflect the uncertainty around future bushfires and to represent the potential range in costs. The two scenarios are a lower bound estimate and an upper bound estimate based on the costs identified above.

The lower bound scenario is based on the estimated cost of vulnerable use buildings destroyed on Black Saturday (of $34.2 million). This is likely to understate the full cost associated with such buildings and Black Saturday to the extent that other buildings caught alight as a result of ignition in the affected vulnerable use buildings. It also does not quantify the broader social costs associated with the loss of such buildings.

Reflecting the unpredictability of bushfires and the factors outlined above that point to increased risk in future, the upper bound estimate assumes that reconstruction costs are twice as great as those incurred during Black Saturday, one life is lost, and residents are permanently relocated from at least one aged care facility. This would bring the total cost of a bushfire to $77.1 million.

The costs identified above reflect the cost of one bushfire (of the magnitude of Black Saturday) if it were to occur in the present time period. To understand the overall cost of the problem under the lower and upper bound scenarios, it is necessary to try to predict when the next bushfires are likely to occur. Based on research conducted in 2010 on past bushfires and the likely increase in very high and extreme fire danger days, it is estimated that a bushfire of the same magnitude as Black Saturday may occur, on average, every 18 years.[138] Similarly, a smaller bushfire (around 30 per cent of the magnitude) is also expected to occur every 18 years.[139] Given that Black Saturday occurred two years ago in 2009, on average, another bushfire of the same magnitude as Black Saturday, along with a smaller bushfire, could be expected to occur sometime over the next 16 years (this RIS conservatively assumes that this would occur at the end of that period, in 2027). Further bushfires could then be expected sometime every 18 years after that.

If we consider the expected life of a building and its structural materials, we can approximate how many bushfires a building may be exposed to once constructed. Data from the Department of Heath indicates that on average, the 'structure, shell & building fabric' would last 42.5 years for an aged care facility and 46 years for a hospital.[140] In general terms, while there are several factors which affect the life of a building (including

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[136] Infrastructure and climate change risk assessment for Victoria, Report to the Victorian Government from CSIRO & others, March 2007.

[137] Commonwealth Scientific and Industrial Research Organisation, 'Q&A: Victorian Bushfires (fact Sheet)', available at http://www.csiro.au/resources/Victorian-Bushfires-QA.html#6, accessed 13 September 2011.

[138] Crompton, R; et al. Influence of Location, Population, and Climate on Building Damage and Fatalities due to Australian Bushfire: 1925-2009; Weather, Climate and Society, 2010, pp. 300-312; Infrastructure and climate change risk assessment for Victoria, Report to the Victorian Government from CSIRO & others, March 2007.

Analysis based on a graph of normalised housing losses from bushfire events and the estimated increase in very high and extreme fire danger days.

[139] Crompton, R; et al. Influence of Location, Population, and Climate on Building Damage and Fatalities due to Australian Bushfire: 1925-2009; Weather, Climate and Society, 2010, pp. 300-312. Analysis based on a graph of normalised housing losses from bushfire events and the estimated increase in very high and extreme fire danger days.

[140] Based on customised data provided by the Department of Health regarding the asset life of a building's 'structure, shell & building fabric'. The average life for a hospital was calculated based on estimates across three different hospital types (community, metro/base and teaching hospital) and estimates for differing number of stories. The average for an aged care facility was based on estimates for one story and two to four story nursing homes.

environmental factors, maintenance, materials, design and workmanship), ABCB guidance is that, under 'normal circumstances', buildings should be constructed to have a minimum design life of 50 years.[141].

It is not inconceivable, then, to assume that such buildings will be in use when Victoria experiences a number of future bushfires. If a set of bushfires (one of the same magnitude as Black Saturday and one smaller bushfire) occurred every 18 years, based on their expected life, vulnerable use buildings may be exposed to at least two sets of bushfires during their useful life.

Therefore, if we account for two sets of bushfires (one in 2027 and one in 2045), based on the costs above, the overall cost of the problem in net present value (NPV) terms would be:

- **$39.6 million NPV** under the lower bound scenario
- **$89.3 million NPV** under the upper bound scenario.

Further detail on how these scenarios were calculated is provided in Appendix B.

[141] See Table 1 on page 5 of the 2006 ABCB Handbook on Durability of Buildings, available at http://www.abcb.gov.au/education-events-resources/publications/~/media/Files/Download%20Documents/Education%20and%20Training/Handbooks/2006_durability_in_buildings.ashx

4 Objectives and options

4.1 Objectives

The Government's objective is to reduce the danger to life, and the risk of property damage, in relation to vulnerable use buildings in designated bushfire prone areas in Victoria, through the most cost effective means.

There are a number of options which could meet this objective. The Victorian Guide to Regulation sets out that all feasible forms of regulatory and non-regulatory measures should be considered.

This chapter sets out the feasible options to address the objectives that are assessed as part of this RIS. Beyond these options, there is also a discussion in relation to other non-feasible options that are not considered further in this analysis.

4.2 Base case

Under the status quo, the Victorian Government would do nothing in relation to building construction standards for privately owned vulnerable use buildings. This would mean the regulatory gap identified in Chapter 3 would not be addressed through a Victorian Government response.

The Commission recommended that the ABCB modify the BCA to provide bushfire construction provisions for non-residential buildings that will be occupied by people who are particularly vulnerable to bushfire attack, such as schools, child care centres, kindergartens, hospitals and aged care facilities (vulnerable use buildings).[142] If this recommendation were implemented, the problem identified would be addressed without any action by the Victorian Government. The timeframe within which this recommendation will be adopted and the timing of any changes to the BCA, however, are unknown. According to ABCB, the national position is that the ABCB does not intend to amend the BCA on a national level to require all Class 9 buildings (buildings of a public nature) to be constructed to comply with AS 3959. As such, this analysis conservatively assumes no such action over the next 10 years (which is the timeframe for the net present value analysis in the next chapter). While there may be other changes to the BCA over the next ten years, these are not expected to materially affect the costs and benefits of the options.

4.3 Options

There are three regulatory options considered for further analysis in this RIS. These options have been chosen because they are considered to be feasible ways to complement existing regulatory and non-regulatory measures in order to reduce the danger to life of vulnerable persons and the risk of property damage in relation to vulnerable use buildings in bushfire prone areas.

Each option considered involves imposing requirements on the construction of vulnerable use buildings occupied by vulnerable people in designated bushfire prone areas, in order to provide a measure of protection against bushfire to those buildings and their occupants.

All three options require an assessment of the BAL of a relevant building in accordance with the assessment method set out in AS 3959. The options differ as to the specific construction requirements (and level of protection against bushfire) required of the building. As set out in Chapter 2, AS 3959 sets out a methodology for assessing the BAL of a building site and also sets out specific construction requirements for buildings in each BAL, with the requirements becoming more stringent as the BAL rises, i.e. more stringent building requirements being imposed according to the vulnerability of the building to bushfire attack. While AS 3959 was designed for residential buildings and is only intended to be applied to such buildings, it is assumed that this standard is also applicable to vulnerable use buildings. The mechanisms of ignition of a building caused by bushfire outlined above (being ember attack, radiant heat and flame contact) relate to the major external construction elements of a building (for example floors, walls, windows, doors, roofs etc) and therefore should, by necessity, translate to all buildings which share the same common elements of construction.

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[142] Recommendation 48.5.

Standards Australia advised in 2009 that 'the standard addresses various building elements (floors, walls, windows, doors, roofs etc) that may be relevant to consider for other classes of buildings where those elements of construction are present', and that 'public buildings, such as schools might be improved by the construction requirements in AS 3959-2009'. Standards Australia also advised that 'the measures contained in the Standard cannot guarantee that a building will survive a bushfire on every occasion', and advised that public buildings 'would also need to have additional requirements that are outside the scope of the Standard. Protection of people in bushfire conditions is a package of measures as no one component will provide adequate protection'.[143] Other measures that are also available to property owners relate to the areas of planning, subdivision, siting, landscaping and maintaining fuel loads (i.e. vegetation).[144] To date, no further standards, or construction requirements outside the scope of AS3959-2009 have been developed. At this time therefore, AS 3959-2009 remains the only set of bushfire construction standards for common building elements such as floors, walls, windows, doors etc.

The requirements under all three regulatory options would be imposed through amendments to Building Regulations. Each option would apply both to new buildings and to existing buildings which are altered by more than 50 per cent (by original volume) over a period of three years. This is consistent with the imposition of building requirements generally under the regulations, as regulation 608 provides that, where alterations of more than this extent are made over a three year period, the entire building must be brought into conformity with the regulations.

The options considered are explained more fully in the following section, but can be summarised as follows:

- ***Option 1*** would require, in the construction of vulnerable use buildings, an assessment of the building's potential exposure to bushfire attack, and would impose specific construction requirements according to the assessed exposure to bushfire risk. The assessment method and specific construction requirements are those set out in AS 3959 and this option is referred to as "compliance with AS 3959".

- ***Option 2*** would require, in the construction of vulnerable use buildings, an assessment of the building's potential exposure to bushfire attack, and would impose specific construction requirements according to the assessed exposure to bushfire risk, though with a minimum construction level that ensures each building is able to withstand an ember attack. The assessment method and specific construction requirements are those set out in AS 3959, with construction to withstand ember attack being the construction requirements for a BAL of 12.5. This option is referred to as "compliance with AS 3959 and minimum construction to protect from ember attack (BAL-12.5)".

- ***Option 3*** would require, in the construction of vulnerable use buildings, an assessment of the building's potential exposure to bushfire attack, and would impose a minimum construction level that aims to ensure that each building is better able to withstand ember attack. In addition, Option 3 would prevent the construction of buildings potentially exposed to a higher level of bushfire attack (over and above ember attack). The assessment method and specific construction requirements are those set out in AS 3959, with construction to withstand ember attack being the construction requirements for a BAL of 12.5. Buildings potentially exposed to a higher level of bushfire attack (beyond ember attack) are those assessed at greater than BAL 12.5. If the Bushfire Attack Level of these buildings cannot be reduced to BAL-LOW or BAL-12.5, these buildings could not be constructed. This option is referred to as "compliance with AS 3959, construction to protect from ember attack (BAL-12.5) and prevention of construction where bushfire exposure is greater than ember attack (BAL-12.5)".

The Commission's recommendation 49.3 expressly states that a minimum AS 3959-2009 construction level of BAL-12.5 is to apply to all new vulnerable use buildings and extensions in bushfire-prone areas, *other than in exceptional circumstances*. While the Commission provided no guidance on the definition of exceptional circumstances, in a different context, they did provide some guidance as to what might constitute an exceptional circumstance to allow new development to occur with less than the required minimum defendable space (the vegetation clearing requirements imposed through planning mechanisms). In this context, the Commission suggested that the role of alternative safety measures such as bunkers could be considered when

143 Letter from Standards Australia to the Victorian Minister for Planning, 31 July 2009.

144 Australian Standard AS 3959 – 2009, Construction of buildings in bushfire-prone areas, at page 7 in the 'Forward'.

determining what might constitute exceptional circumstances sufficient to exempt a developer from the requirement to ensure a site complied with its assessed minimum requirement for defendable space.[145]

Exemptions from the minimum construction level of BAL 12.5 have not been included in the proposal. The reason for this is that DPCD is not presently aware of any specific circumstances that would warrant such an exemption.

Option 1: Compliance with AS 3959

Option 1 would be achieved by requiring compliance with AS3959 without any variations, meaning that a building to be constructed or altered by more than 50 per cent would have to have a BAL assessment and comply with the construction requirements set out for the assessed BAL. So, for example, a building assessed as BAL-12.5 would have to adhere to the requirements set out in the standard for BAL-12.5 buildings, those assessed at BAL-19 with the requirements for BAL-19 buildings, and so on.

It is important to note that BAL-LOW buildings have no further specific construction requirements under AS 3595 and thus under Option 1 such buildings would not incur any additional costs associated with construction requirements due to AS 3595.

Option 1 would not prevent construction to a standard above the assessed BAL of the building, i.e. buildings may comply with the requirement by voluntarily constructing to a higher BAL.

Some of the key implications of Option 1 would be that buildings that house vulnerable people in bushfire prone areas would be constructed:

- to a standard that reflects the specific assessed vulnerability of the building to bushfire attack
- where assessed as BAL-LOW, to a lower level of protection than class 1, 2 and 3 buildings (i.e. residential buildings including houses, apartments, boarding houses, hotels and motels) in bushfire prone areas which are required to be built to a minimum standard of BAL-12.5.

Option 2: Compliance with AS 3959 and minimum construction to protect from ember attack (BAL-12.5)

Option 2 would be achieved by requiring compliance with AS3959, but also requiring that, at a minimum, buildings would be required to meet the construction requirements for BAL-12.5. This means that a building assessed as BAL-LOW would have to comply with the construction standards for BAL-12.5 instead of BAL-LOW (which has no further specific construction requirements).

This option would only set a minimum standard of BAL-12.5. If a building was assessed as having a BAL above 12.5, it would have to be constructed to its assessed BAL. For example, a building assessed as BAL-40 would have to be constructed in accordance with the requirements for BAL-40.

Some of the key implications of Option 2 would be that buildings that house vulnerable people in bushfire prone areas would be constructed:

- to the level required to ensure the building is able to withstand ember attack, unless the building is assessed as having a higher vulnerability to bushfire attack, in which case it would be constructed to a standard that reflects that vulnerability
- to the same level of protection as class 1, 2 and 3 buildings (i.e. residential buildings including houses, apartments, boarding houses, hotels and motels) in bushfire prone areas.

[145] VBRC Final Report 31 July 2010, Chapter 6 'Planning & Building' at paragraph 6.4.4.

Option 3: Compliance with AS 3959, construction to protect from ember attack (BAL-12.5) and prevention of construction where bushfire exposure is greater than ember attack (BAL-12.5)

Option 3 would be achieved by requiring buildings to be constructed in accordance with AS 3959, but also making it mandatory to construct only to BAL-12.5. Given that buildings would still need to comply with AS 3959, this option would effectively prevent the construction of a building if its assessed BAL is above 12.5. Hence, this option would only allow the construction of vulnerable use buildings in bushfire prone areas if they have a BAL of LOW or 12.5.

4.4 Other options not considered feasible

There are a number of additional options which may be considered, however for the reasons set out below; they will not be included in further analysis.

In terms of how other jurisdictions currently deal with bushfire risk, the BCA Volumes 1 and 2 (which have been given the status of building regulations in all States and Territories) contain construction requirements based on AS 3959 that apply to residential buildings (i.e. class 1, 2 and 3 buildings and class 10a buildings associated with class 1, 2 and 3 buildings). As discussed, the adoption of the BCA has already been modified in Victoria to also require a minimum construction level of BAL 12.5 for these classes of buildings.

The only jurisdiction which modifies the BCA requirement by extending the classes of buildings beyond residential buildings to which minimum bushfire requirements apply is NSW. NSW has amended the application of the BCA in that State to apply bushfire construction standards based on AS 3959, in addition to residential buildings, to some types of public buildings that have a special fire protection purpose.[146] In NSW, a special fire protection purpose means a building which has a purpose including: a school, a child care centre, a hospital, a hotel, motel or other tourist accommodation, an establishment for mentally incapacitated persons, housing for older people or people with disabilities, a group home and a retirement village.[147] This RIS includes an analysis of NSW's relevant requirements in the appendices to this report (see Appendix C). Given Victoria is acknowledged as being amongst the most exposed to severe bushfires of any jurisdiction, it is relevant to focus on NSW's provisions which are potentially more onerous than recommended in the Proposed Regulations (NSW does not, for example, allow buildings to be built in high risk areas).

4.4.1 Non-regulatory option

Guidelines for building design and construction of vulnerable use buildings occupied by vulnerable people

Rather than making construction standards compulsory through regulation, this option would involve the development of guidelines that inform building owners of the appropriate building standards that should be followed. This option would essentially be the same as the regulatory option (i.e. Option 1: Compliance with AS 3959), but compliance with the guidelines would be voluntary because they would not be prescribed in regulation. The development of these guidelines could be supplemented with an information and education campaign to ensure that all relevant stakeholders are aware of the guidelines and what they mean.

While this option would help to provide information regarding the appropriate standard required to address bushfire risk, there would be little incentive for private construction companies to apply the standard. Stakeholder consultation has confirmed that private construction businesses are unlikely to respond to an unregulated environment because the competitiveness of the market drives a focus on the least cost option. The benefits of constructing a building to minimise bushfire risks do not accrue to the businesses which are responsible for the construction of these buildings and therefore it is unlikely that a non-regulatory response would be adequate to meet the objectives. In addition, as discussed above in relation to market failures, individuals' perceptions of risk may not align with the actual risk in their locality, meaning they may not identify the need for them to apply the guidelines and construct to the appropriate standard.

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[146] BCA, Volume 1, NSW GO5.

[147] Section 100B(6) of the Rural Fires Act 1997.

This option is not considered further in the analysis as it is not expected to address each of the issues set out in Chapter 3. While the provision of guidelines for building design will help to educate the market on what may constitute the best practice, industry does not have an incentive to apply these guidelines.

4.4.2 Regulatory options

Retrofitting

This option would involve the requirement for all current vulnerable use buildings to meet the requirements set out under AS 3959. This would involve significant costs and would impact all existing vulnerable use buildings, including 2,060 privately owned buildings and about 1,170 Government owned buildings.

There are a number of precedents where new requirements have not been applied retrospectively because of the significant cost involve. For example, retrofitting existing buildings was not considered as part of the changes to the BCA requirements for construction in bushfire prone areas, or as part of Ministerial Direction No. 3. Similarly, the Six Star Standard only applies to new homes or alterations to an existing home where the alteration is 50 per cent of the existing home. It is also recognised that as new buildings are built, and buildings are upgraded over time (triggering the 50 per cent modification requirements), there will be a natural shift to these buildings meeting AS 3959.

In light of these factors, retro-fitting is not considered in this analysis.

Only applying the requirements to modifications but not new buildings (or vice versa)

Regulation 608 of the Building Regulations applies to building work that is an alteration to an existing building (alteration works). It requires building work to alter an existing building to comply with all Building Regulations appropriate to the alteration works. This means that alteration works must conform to building standards and building safety features contained in the Building Regulations, which will potentially include (if applicable to the class and site of the building) the bushfire performance standards set out in the Proposed Regulations.

In certain circumstances the nature of proposed alteration works may also trigger a similar and additional requirement for the original building under regulation 608(3). That is, if alteration works of a particular volume (relative to the size of the original building) are planned, then the entire building must be made to conform to the appropriate building standards in force under the Building Regulations at the time.

The volume of proposed alteration works which trigger the requirements under regulation 608(3), are alteration works which represent more than half of the original volume of the existing building. When determining if this threshold test has been met, regulation 608(3) requires a cumulative consideration of the volume of the proposed alteration works together with the volume of any other alteration works to the original building completed or permitted within the three years prior to the most recently proposed alteration works.

Regulation 608 ensures that building work to alter an existing building, and the existing building itself (where regulation 608(3) is triggered) is subject to the current minimum building standards expected by the community.

The effect regulation 608 will have on the options presently under review in this RIS is that if alteration works to a vulnerable use building represents (cumulatively over a three year period or otherwise by itself) over half of the original volume of the existing vulnerable use building, the existing vulnerable use building must be made to comply with current minimum building standards, which under the proposals in the RIS, will include retrofitting the external structure of the original vulnerable use building to comply with AS 3959 to the standard required under the Building Regulations. In addition to this, the alteration works themselves must comply with AS 3959 to the required standard and both alteration works and the existing building must be made to conform to all other appropriate building standards and building safety features contained in the Building Regulations.

An option that only applied AS 3959 to alteration works and not to the original building as well (or vice versa, to the original building and not to the alteration works too), could potentially provide lower compliance costs to facility operators planning substantial modifications, which in turn may make it more feasible or possible to undertake these modifications. It may also have the potential to reduce the level of construction forgone as a

result of the introduction of new bushfire construction standards to vulnerable use buildings. However, such an option would be inconsistent with the current regulatory framework for the application of building standards, as compliance with all other safety and construction standards in the Building Regulations would still be required. This is inconsistent with the safety objectives that underpin the building regulatory framework. In effect, such an option would require a relevant building to be built in all other respects to current minimum building standards, except for in relation to bushfire construction requirements. This could be both confusing and inconsistent from a policy perspective, as other fire standards are imposed uniformly across new buildings and modifications, because of their safety imperative.

It is also relevant to note that there is already a mechanism in place under regulation 608(4) for a relevant building surveyor, in certain circumstances, to consent to partial compliance with regulation 608(2) (alteration works to comply with current Building Regulations) and 608(3) (entire building to comply with current Building Regulations). However, this discretion is only relevant in some circumstances, for example where compliance with the Building Regulations in full is technically difficult to achieve and may provide little, if any, benefit. The matters outlined in regulation 608(5) will assist a building surveyor to determine whether or not it is appropriate to exercise their discretion to allow partial compliance with the Building Regulations. The matters under regulation 608(5) that a building surveyor must take into account include the safety and health of people using the building and the need to avoid the spread of fire to or from any adjoining building. This means, in practice, because the mandatory considerations are aimed at ensuring safety from fire and the spread of fire, this power to allow partial compliance with building standards is not intended to be utilised in a way that reduces the level of fire protection accorded by BCA requirements.

5 Impact analysis

This chapter assesses the impacts, including both costs and benefits, of the regulatory options described in the previous chapter. In identifying the costs and benefits likely to arise from these regulatory options, each option is compared to the base case, which represents the 'status quo'. This is the position if the Victorian Government did nothing in relation to bushfire construction standards for privately owned vulnerable use buildings, as outlined in the previous chapter.

5.1 Approach to cost benefit analysis

The analysis is presented in terms of the net present value (NPV) of the impacts of the regulatory options. NPV is an expression of the total excess of benefits over costs, i.e. the 'net benefit', of a regulatory option or proposal. Where impacts occur over a period of time, for example over several years, the value of costs and benefits are 'discounted' to ensure they are assessed in constant dollar terms and in 'present day' value.

In terms of costs, the timeframe for the NPV analysis is 10 years, reflecting the period over which the Regulations would operate. Benefits extend beyond this timeframe, and are discounted back (along with costs) at a rate of 3.5 per cent per annum.

This chapter sets out the costs and benefits of the options, and then provides an assessment of the options using both breakeven analysis and multi-criteria analysis to identify the preferred option.

There are some important methodological matters to note for this analysis:

- Where buildings are referred to in this chapter, it means vulnerable use buildings in designated bushfire prone areas.

- References in this chapter to 'modified buildings', means existing vulnerable use buildings where extensions or modifications are made to 50 per cent or more of the building (by volume) within a period of three years, i.e. the circumstances in which the entire building must be brought up to the same level as a newly constructed building under regulation 608 of the Building Regulations. Where a school or other facility consists of a number of buildings and one of the buildings is modified by 50 per cent or more, then only that modified building must be brought up to the same performance standards required of a new building under the Building Regulations (the balance of the unmodified buildings on the site are not subject to this requirement and therefore do not need to be brought up to the standard of a new building under the Building Regulations).

- The 'extra over' or incremental impact of each BAL on construction costs is based on analysis done for DPCD by PlanCost. PlanCost is an Australian company that provides services in relation to quantity surveying, environmental cost engineering, aged care strategic planning, energy reports and value management. PlanCost was engaged by DPCD to provide a cost analysis of applying AS 3959 to vulnerable use buildings. This analysis of costs shows the cost impact of constructing to the requirements of each BAL on a 'typical' private school, aged care facility, hospital, kindergarten and child care centre. The cost impact of constructing to the requirements of AS 3959 for each BAL is expressed as percentage increase on the underlying cost of constructing that typical facility. PlanCost's report is attached in the appendices. According to PlanCost, typical building construction materials for Class 9A, 9B, and 9C buildings include concrete floor slabs, masonry walls, metal roofs and aluminium windows. These materials are the starting point for the 'extra over' impacts. While these building materials are 'typical', PlanCost do note that "variations to the 'example' building materials may affect the cost required to achieve the various BAL ratings". For example, if timber windows are used, the cost to comply may be higher. Further, smaller buildings such as kindergartens tend to have a higher external wall to floor area ratio than larger buildings. Therefore as most of the additional cost associated with BAL ratings relate to external walls and windows, smaller buildings incur a higher percentage increase than larger buildings.

- In PlanCost's report, where they have indicated that construction may be cost prohibitive, it is assumed that the construction would no longer go ahead and would therefore be 'foregone'. For example, PlanCost note that "achieving a BAL FZ rating on an existing building may require the complete reconstruction of

the roof which would be cost prohibitive".[148] This is reflected by assuming that all relevant modifications to buildings on a site rated BAL-FZ would be foregone. PlanCost also note that "if a mandatory standard was imposed such that construction could only occur if the building was rated at BAL 12.5 or lower, many building projects that required a BAL rating higher than BAL 12.5 could not or would not proceed".[149] This is reflected in the analysis by assuming that under Option 3, the construction of all BAL-40 and BAL-FZ buildings would be foregone and 50 per cent of buildings rated BAL-19 and BAL-29 would also be foregone. PlanCost note that the proportion of sites that would allow for the BAL to be reduced is unknown due to the wide variability of potential or existing sites. However to provide an indicative estimate of the costs under Option 3, an assumption of 50 per cent has been applied.

- In general, GST exclusive costs have been used to calculate costs (for example, PlanCost's estimates are GST exclusive and GST has been removed from building permit data). According to the Australian Taxation Office, certain medical, health and care services are GST free and so this RIS makes a simplifying assumption that the facilities that are the subject of this RIS provide services that are GST free.[150] According to informal advice from a GST lawyer, while the building materials, the construction of facilities and related supplies of goods and services will be subject to GST, the entities that run the buildings in question should be entitled to claim back this GST as an input tax credit on their Business Activity Statement (BAS), as they will use the goods and services for the purposes of providing GST-free health and education services. That is, the net cost to these entities will be the GST-exclusive value of the building materials and construction services. As such, the GST-exclusive value is the most appropriate value to use in estimating the cost.

- Additional costs or benefits that may accrue because of increased or decreased maintenance costs attributable to the construction requirements contained in AS 3959 have not been included in the analysis. It is considered that building to a higher standard is not generally likely to incur additional maintenance costs, as most of the specific requirements in AS 3959 are building solutions which make up the very structure of a building (i.e. the roof, walls, etc) and therefore would be expected to typically last the life of a building. Further, many building solutions in the standard, such as the removal of gaps in roofs or walls through measures such as sarking, ember guards, and overlapping joints are robust building solutions that require little or no maintenance over the life of the building. Indeed, these measures may also have additional maintenance-related benefits such as providing a dust barrier or storm protection to the building. However, to be conservative, the analysis not does include any maintenance impact.

5.2 Option 1: Compliance with AS 3959

5.2.1 Costs

There are three areas of cost estimates for this analysis:

- *BAL assessment costs* – this refers to the cost of having a professional surveyor undertake an assessment of the site's BAL

- *Construction costs* – which refers to the additional cost of constructing buildings to comply with AS 3959

- *Foregone construction* – this refers to the value of construction that is foregone due to the introduction of AS 3959.

Estimates for each of these categories of cost are provided in the following sections.

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[148] PlanCost report, page 8.

[149] PlanCost report, page 7.

[150] Australian Taxation Office, Guide to GST, www.ato.gov.au. Specific information available at http://www.ato.gov.au/businesses/content.aspx?menuid=0&doc=/content/00221985.htm&page=9#P258_15879.

BAL assessment cost

To apply AS 3959, a BAL assessment of the building must be undertaken, which imposes a cost on the building developer or owner. For the purposes of this RIS analysis, a BAL assessment is estimated to cost between $200 and $900, with an average cost of $525 (including GST).[151] The GST exclusive figure assumed and used in the analysis is $477.27. This cost is based on estimates provided by DPCD, the Department of Human Services and the Building Commission. Other BAL assessment cost estimates provided (by the Department of Health and DEECD) reflected the cost to do BAL assessments for a number of sites over a certain period of time under panel arrangements and so were considered to be less representative of likely costs here.

This cost is estimated on a per building basis. Some non-residential facilities occupied by vulnerable people may have several buildings on the one site, potentially increasing the cost of a BAL assessment (i.e. consultation has indicated that hospitals often have more than one building per facility). However, consultation with a building surveyor indicated that the number of buildings on a site is not a major factor in determining the cost of a BAL assessment. This is because most of the factors that determine the BAL, such as the vegetation types, the slope under the vegetation and the fire danger index would already have been assessed for the first building.

All vulnerable use buildings would be captured by Option 1 and be required to conduct a BAL assessment. Ministerial Direction No. 3 does, however, already set this requirement for Government and Government funded buildings. Hence, for this analysis (which compares the option to the base case), the cost of undertaking a BAL assessment is only attributed to private buildings.

Under the Victorian planning system, BAL assessments are also required for all building sites (including privately owned sites) in the BMO. Therefore, in this analysis, the cost of a BAL assessment is not attributable to buildings in the BMO.

Consultation with a building surveyor indicated that private buildings are not currently applying AS 3959 and hence would generally need to obtain a BAL assessment as a result of this option. Similarly, a project manager consulted for this RIS was only aware of isolated cases of BAL assessment being undertaken. Therefore, it has been assumed for this analysis that BAL assessments are not currently being undertaken for any private vulnerable use buildings, other than those in the BMO.

Based on the average number of building permits approved between 2006 and 2010, it is estimated that approximately 99 new and 16 significantly modified private buildings will be constructed in bushfire prone areas per annum (not including buildings covered by the Bushfire Management Overlay) in the 10 years covered by the cost-benefit analysis.[152] Based on this, and the average cost of an assessment, the total cost of undertaking BAL assessments under Option 1 would be about $457,000 NPV over 10 years. This consists of:

- $391,546 NPV over 10 years for new buildings
- $65,051 NPV over 10 years for modifications.

A breakdown of the expected number of buildings required to undertake a BAL assessment is provided in Table 5 below. For more detail on the assumptions underlying the numbers in Table 5 and the cost estimate for the BAL assessments, see Appendix B.

[151] Based on estimates provided during consultation conducted for the purposes of this RIS. Estimates were provided by the Department of Planning and Community Development, the Department of Human Services and the Building Commission.

[152] Based on customised building permit data from the Building Commission and data provided by the Department of Planning and Community Development regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO. To avoid the impacts of the Building Education Revolution, only years 2006 to 2008 have been used to estimate the future number of permits for schools. For modifications, building permit data cannot be separated by those projects that modify 50 per cent or more of an existing building. In the absence of this information, to approximate the number of modification relevant to this proposal, it is assumed that 10 per cent of permits for modification projects represent modifications of 50 per cent or more. See Appendix B for more detail.

Table 5 – Number of new or significantly modified private buildings expected *per annum* in bushfire prone areas, excluding buildings covered by the Bushfire Management Overlay

Building type	New buildings	Extensions or modifications	Total
School	64.94	9.57	74.50
Kindergarten	4.43	0.27	4.70
Child care facility	9.85	0.60	10.45
Aged care facility	9.58	2.35	11.93
Hospital	9.85	3.61	13.45
Total	**98.65**	**16.40**	**115.03**

Note that the figures in this table may not sum due to rounding. These figures represent the 'average' number per annum and are shown to one decimal place to demonstrate the exact numbers that have been used in estimating the costs associated with the Proposed Regulations. While it is not possible to build half of a building, these numbers are not integers because they are taken as an average across several years of building permit data and also have a percentage applied to them to exclude buildings covered by the BMO.

Sources: Based on customised building permit data from the Building Commission reflecting the number of building permits for new buildings from 2006-2010. Municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the proportion of land covered by a designated bushfire prone area, based on information provided by DPCD regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO. To avoid the impacts of the Building Education Revolution, only years 2006 to 2008 have been used to estimate the future number of permits for schools. For modifications, building permit data cannot be separated by those projects that modify 50 per cent or more of an existing building. In the absence of this information, to approximate the number of modification relevant to this proposal, it is assumed that 10 per cent of permits for modification projects represent modifications of 50 per cent or more. See Appendix B for more detail.

In order to conduct the BAL assessment, the assessor must use AS 3959, which costs $95.87.[153] For this analysis, we have assumed that assessors would already have this standard or, if not, that this cost would be passed on in the form of the fee for their service (which is included in the analysis through the cost above).

Additional construction costs

Once a BAL assessment had been done, applying AS 3959 would involve the construction of the building in accordance with the requirements set out in the standard. For privately owned buildings, these construction requirements would involve some construction materials and designs that are not ordinarily used in the construction of vulnerable use buildings. As a result, these requirements would lead to additional construction costs that would only be incurred in order to make the privately owned building comply with AS 3959. While it is possible that some buildings may incorporate certain requirements in AS 3959 as normal practice, the cost estimates provided by PlanCost have taken common building practices and any other regulatory requirements into account when identifying the costs to comply.

While all vulnerable use buildings would be captured by Option 1 and be required to construct to comply with AS 3959, Ministerial Direction No. 3 already effectively imposes this requirement on Government and Government funded buildings. Hence, for this analysis, compared to the base case there is no impact on the construction costs of Government and Government funded buildings.

Under Option 1, the building would have to comply with the construction requirements that are relevant to the assessed BAL rating of the building. In the standard's current form (AS 3959-2009), no specific construction requirements are set for BAL-LOW. Hence, the additional construction costs for these buildings would be $0. However, additional construction costs would be incurred for other new and modified buildings rated as BAL-12.5 or above.

The additional construction costs of complying with AS 3959 have been estimated by PlanCost in their report produced for DPCD. From these estimates, and from consultation, it is clear that as the BAL increases, the additional construction cost also rises. Due to the higher risk of bushfire attack at higher BALs, AS 3959

[153] SAI Global Limited, 'AS 3959 Construction of buildings in bushfire-prone areas', available at http://infostore.saiglobal.com/store/Details.aspx?ProductID=1101539&gclid=CKTz0tKfs6sCFaJKpgodvCY-bw, accessed 23 September 2011.

imposes more stringent construction requirements which lead to higher costs when compared to the materials and designs used in standard construction projects. The average costs of constructing a new building to comply with AS 3959 has been estimated by PlanCost and presented as a percentage of the building's value in Table 6 below.

Table 6 – Average cost increase to comply with AS 3959 during the construction of a 'typical' new building

Building type	BAL-LOW	BAL-12.5	BAL-19	BAL-29	BAL-40	BAL-FZ
School	0.0%	0.7%	0.9%	2.1%	4.0%	12.1%
Kindergarten	0.0%	1.0%	1.4%	4.6%	9.9%	18.4%
Child care facility	0.0%	0.8%	1.1%	3.4%	7.2%	15.1%
Aged care facility	0.0%	0.4%	0.5%	1.0%	1.7%	7.0%
Hospital	0.0%	0.3%	0.4%	0.8%	1.4%	5.5%

Source: PlanCost report (attached at the conclusion of this RIS).

The percentages above have been calculated for new buildings only. For modifications and alternations of more than 50 per cent, both the existing building as well as the newly constructed parts of the building would need to comply with AS 3959. Given this would likely involve retro-fitting parts of the existing building, the cost is expected to be higher than for a new building. In their report, PlanCost states that "the anticipated additional costs are highly variable and could be approximately two to three times the cost of achieving the same BAL rating on a new building". Hence, an average of 2.5 times the cost of complying with AS 3959 for new buildings has been assumed for this analysis.

The value of building activity for which this cost would be expected to be incurred is shown in Table 7 below. This table shows the annual value for private buildings only and is based on the average value of building permit activity between 2006 and 2010. The value of expected buildings has been discounted to account for the percentage of buildings likely to be located in bushfire prone areas. This percentage was calculated based on the proportion of land in each municipality covered by a designed bushfire prone area. For more detail on the assumptions underlying these estimates, see Appendix B.

Table 7 – Value of privately owned new or significantly modified buildings expected per annum in bushfire prone areas – including buildings covered by the BMO ($ millions)

Building type	New buildings	Extensions or modifications	Total
School	$47.89	$15.09	**$62.98**
Kindergarten	$2.80	$0.16	**$2.96**
Child care facility	$6.24	$0.36	**$6.60**
Aged care facility	$27.92	$5.31	**$33.23**
Hospital	$11.15	$5.50	**$16.65**
Total	**$96.00**	**$26.42**	**$122.42**

Cost estimates are GST-exclusive. Note that the figures in this table may not sum due to rounding

Sources: Based on customised building permit data from the Building Commission regarding the value construction reflected in building permits issued from 2006-2010. To avoid the impacts of the Building Education Revolution, only years 2006 to 2008 have been used to estimate the future value of permits for schools. Municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the proportion of land covered by a designated bushfire prone area, based on information provided by DPCD regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO. The value of building permits was also adjusted to exclude the cost of 'fit out', i.e. to reflect only the cost of construction, based on data from Rawlinson's Construction Cost Guide 2011. For modifications, building permit data cannot be separated by those projects that modify 50 per cent or more of an existing building. In the absence of this information, to approximate the value of modification relevant to this proposal, it is assumed that 50 per cent of permits for modification projects represent modifications of 50 per cent or more. See Appendix B for more detail.

Given that the additional construction costs increase as the BAL ratings rise, we have also assumed a given distribution across each BAL rating for these buildings. The distribution assumed has been based on permit data for residential buildings. Given that the location of vulnerable use buildings is expected to follow the market as indicated by domestic building activity, it is assumed that this distribution should be similar and relevant for vulnerable use buildings. While this relationship is not perfect, this data was the best available given that BAL assessments are not currently common for vulnerable use buildings. The assumed distribution used in this analysis is outlined in Table 8.

Table 8 – Assumed distribution of new and modified buildings across the BAL ratings

BAL-LOW	BAL-12.5	BAL-19	BAL-29	BAL-40	BAL-FZ
95.4%	2.7%	0.7%	0.9%	0.2%	0.1%

Source: Domestic building permit data on BAL distributions for residential buildings provided by DPCD, adjusted to exclude local Government areas that have no bushfire prone areas.

Under the planning provisions that came into operation in November 2011, vulnerable use building sites covered by the BMO must be assessed as BAL-12.5 before planning approval will be given.[154] Therefore, all new buildings built in the BMO over the next 10 years are expected to be BAL-12.5 or below. Similarly, it is understood that under the planning provisions prior to November 2011, the aim of the CFA was to ensure that only building sites rated BAL-29 or below would be approved. Hence, it is assumed that all existing buildings that are expected to be modified over the next 10 years are BAL-29 or below. To account for these factors, the above distribution has been adjusted for buildings in areas covered by the Bushfire Management Overlay. The adjusted distributions can be found in Appendix B.

Based on the analysis above, the additional construction costs under this option would be $624,490 NPV over 10 years. This cost has been broken down in Table 9 below to show the cost for each building type. For more detail on the assumptions underlying these cost estimates, see Appendix B.

Table 9 – Additional construction costs under Option 1 ($ NPV over 10 years)

Building type	New buildings	Extensions or modifications	Total
School	$238,930	$160,230	**$399,159**
Kindergarten	$24,608	$3,193	**$27,801**
Child care facility	$42,318	$5,397	**$47,715**
Aged care facility	$74,139	$29,043	**$103,182**
Hospital	$23,089	$23,543	**$46,632**
Total	**$403,084**	**$221,406**	**$624,489**

Cost estimates are GST-exclusive

[154] Other than subdivisions, for 'other occupied building', a site is required to be BAL-12.5. 'Bushfire Management Overlay and bushfire protection: planning requirements', Practice Note 65, November 2011, available at http://www.dpcd.vic.gov.au/__data/assets/pdf_file/0011/86492/PN65-Bushfire-Management-Overlay-and-bushfire-protection_planning-requirements.pdf.

Note that the figures in this table may not sum due to rounding

The cost is estimated to be greatest for schools and aged care facilities. These building types have the highest expected value of construction over the next 10 years.

Total Cost of Option 1

It was noted in PlanCost's report that making modifications to more than 50 per cent of a building classified as BAL-FZ would be cost prohibitive. To account for this, the value of modified private buildings under BAL-FZ over the next 10 years is assumed to be zero because these modifications would no longer go ahead under this option. By making these modifications cost prohibitive, the value of those projects is foregone. Based on the building permits data provided by the Building Commission and the BAL distribution assumed, this would lead to a loss of just over $26,000 per annum. This represents a cost of about $219,000 NPV over 10 years.

Given the BAL assessment costs, the construction costs and the foregone value, the total cost under Option 1 is expected to be **$1.3 million NPV** over 10 years, with $0.8 million attributable to new construction and $0.5 million to modifications.

The extent to which this cost is ultimately borne by developers or owners will depend on the ability for them to pass this cost onto users of the building. Services such as health care, education, child care and aged care may be in short supply, and the consumers may be price takers.[155] This would mean that part or all of this cost could be passed on to the users of the building, although the precise extent of any such effect is difficult to determine.

As stated elsewhere in this RIS, it is difficult to precisely estimate the extent to which costs would be passed through to the end user. For illustrative purposes though, for an aged care facility rated BAL-12.5 worth $16.38 million,[156] with 58 residents[157] with an average length of stay of 148 weeks,[158] then the per resident cost per annum is just under $400. This assumes that full costs are passed through to current residents. It is also possible that costs may be passed on over a longer period of time, which would impact on future residents, but would also suggest a lower per resident cost per annum.

5.2.2 Benefits

Applying AS 3959 during the construction of a building is intended to increase its likelihood of surviving a bushfire *and* increase the length of time before buildings catch alight. Not only would applying AS 3959 to a building mean that the building would be more resistant to catching a light, this may also prevent the spread of the bushfire to other buildings nearby, further protecting both the buildings and their occupants.

In a practical sense, the potential benefits from this option are *avoided costs* associated with bushfire events. That is, increasing the resistance of vulnerable use buildings would help to mitigate the problem identified in Chapter 3 by addressing the three costs discussed. This option has the potential to:

- save lives that may otherwise have been lost and prevent injuries that may otherwise occur during a bushfire
- prevent the destruction of or reduce damage to vulnerable use buildings, which would avoid reconstruction costs and the potential cost of disruption for users of those buildings (such as the costs of relocating aged care residents)
- reduce social disruption and support the community by avoiding the loss of important social infrastructure, ensuring it is available when most needed.

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155 A price taker in this instance has little influence over the price they pay for a service because their demand is relatively inelastic or price insensitive and the service is in short supply.

156 Based on the value of an aged care facility estimated in PlanCost's report.

157 Australian Institute of Health and Welfare, 'Residential Aged care in Australia 2009-10: A statistical overview', Aged care statistics series number 35, AIHW cat no. AGE 66, Canberra. Weighted average based on Table A1.4, page 74.

158 Based on data from the Australian Institute of Health and Welfare that suggests that the average length of stay for permanent residents who left residential aged care during 2007-08 (most commonly because they died) was 148 weeks.

This option does not, however, address risks associated with ember attacks at BAL-LOW, as discussed below.

In consultation with the Building Advisory Council (BAC), concerns were expressed regarding the effectiveness of applying AS 3959 to vulnerable use buildings. While the BAC acknowledged that the application of AS 3959 would be an appropriate interim solution in the absence of a specific and improved standard being developed, they also commented that a strong understanding of AS 3959 is needed by the community to ensure that its effect and aim is not misunderstood. That is, it would be necessary to ensure the community does not treat vulnerable use buildings as refuges simply because they comply with AS 3959. The BAC suggested that further information or education should be provided if regulation requiring compliance with the standard was introduced.

5.3 Option 2: Compliance with AS 3959 and minimum construction to protect from ember attack (BAL-12.5)

Similar to Option 1, Option 2 would require the application of AS 3959, so that it requires a specific BAL assessment for a site, and generally requires specific construction requirements according to the assessed level of risk of bushfire attack.

However, under Option 2, at a minimum, buildings would be required to comply with the construction requirements for BAL-12.5 (i.e. to protect from ember attack). This means that a building assessed as BAL-LOW would have to comply with the construction standards for BAL-12.5 instead of BAL-LOW which has no additional construction requirements. Option 2 departs from the site specific risk-assessment (BAL assessment) approach for construction requirements to address the fact that the area has been mapped bushfire-prone. As discussed above, BPA maps have been developed to map areas of the State subject to, or likely to be subject to, bushfire attack, based on factors such as weather, topography and vegetation. Option 2 preferences this evidence over the site-specific BAL assessment. It is also intended to generally address the issue that, although presently AS 3959 contains no specific construction requirements in the BAL assessed as BAL-LOW, this does not mean these buildings are not at risk from bushfire attack, particularly from ember attack.[159]

5.3.1 Costs

There are three areas of costs estimates for this analysis:

- *BAL assessment costs* – this refers to the cost of having a professional surveyor undertake an assessment of the site's BAL
- *Construction costs* – which refers to the additional cost of constructing buildings to comply with AS 3959
- *Foregone construction* – this refers to the value of construction that is foregone due to the introduction of AS 3959.

Estimates for each of these categories of cost are provided in the following sections.

BAL assessment cost

As for Option 1, BAL assessments would need to be conducted for all new or modified buildings. The cost of these BAL assessments would be the same under this option as for Option 1 because the cost does not depend on the BAL rating of the building. Hence, the total cost of undertaking BAL assessments under this option would be approximately $457,000 NPV over 10 years. For more detail on the assumptions underlying this cost, see Appendix B.

Additional construction costs

As for Option 1, this option would lead to additional construction costs for privately owned new and modified buildings because complying with AS 3959 requires construction materials and designs which otherwise may not be used in the construction of vulnerable use buildings. Under this option however, additional construction costs would also be incurred for buildings rated as BAL-LOW because they would be required to apply, at a

[159] Part 1.3 of AS 3959 at page 8.

minimum, the construction requirements for BAL-12.5. Given that AS 3959 sets no specific construction requirements for BAL-LOW buildings, setting a minimum of BAL-12.5 would mean BAL-LOW buildings would have additional construction costs where the cost would have otherwise been $0.

Introducing a minimum BAL of 12.5 would also have an impact on those government buildings with a BAL of LOW, because the current requirements under Ministerial Direction No. 3 do not require a minimum construction level of BAL-12.5. Based on assessments conducted by the Department of Health on aged care facilities, approximately 80 per cent of vulnerable use buildings are expected to be BAL-LOW. Table 10 shows the expected number of both private and public BAL-LOW buildings to be built or modified over the next 10 years.

It was indicated in consultation that some buildings, such as aged care facilities, may already be built to a high fire safety standard. It is difficult however, to identify whether this standard correlates with the construction requirements in AS 3959. To the extent that some buildings are already being constructed to comply with some or all of the construction requirements in AS 3959, the value of building projects impacted by this option (as estimated in Table 10) may be over-stated.

Table 10 – Value of new or significantly modified BAL-LOW buildings expected per annum in bushfire prone areas, including private and government buildings and including building in the BMO ($ million NPV over 10 years)

Building type	New buildings	Extensions or modifications	Total
School	$99.41	$32.22	**$131.63**
Kindergarten	$3.66	$0.45	**$4.10**
Child care facility	$8.14	$0.99	**$9.13**
Aged care facility	$30.15	$5.73	**$35.88**
Hospital	$19.32	$12.69	**$32.01**
Total	**$160.68**	**$52.08**	**$212.75**

Cost estimates are GST-exclusive. Note that the figures in this table may not sum due to rounding

Sources: Based on customised building permit data from the Building Commission regarding the value of construction for building permits issued from 2006-2010. Municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the proportion of land covered by a designated bushfire prone area, based on information provided by DPCD regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO. To avoid the impacts of the Building Education Revolution, only years 2006 to 2008 have been used to estimate the future value of permits for schools. For modifications, building permit data cannot be separated by those projects that modify 50 per cent or more of an existing building. In the absence of this information, to approximate the value of modification relevant to this proposal, it is assumed that 50 per cent of permits for modification projects represent modifications of 50 per cent or more. It is also assumed that about 95 per cent of buildings would be BAL-LOW. See Appendix B for more details.

For these buildings, the additional construction costs under this option would be about $14.3 million NPV over 10 years. For buildings with a BAL-12.5 or above, the costs under this option would be the same as for Option 1. Hence, the $14.3 million NPV additional construction cost for BAL-LOW buildings represents the difference between Option 2 and Option 1 and demonstrates the cost impact of introducing a minimum BAL-12.5.

Under Option 2, the total additional construction costs for private and public buildings across all BALs would be about $15 million NPV over 10 years. This cost has been broken down in Table 11 below to show the total cost for each building type. For more detail on the assumptions underlying these cost estimates, see Appendix B.

Table 11 – Additional Construction costs under Option 2 ($ million NPV over 10 years)

Building type	Privately owned buildings		Government buildings		Total
	New	Modifications	New	Modifications	
School	$2,898,904	$2,255,916	$3,127,139	$2,594,003	**$10,875,962**
Kindergarten	$246,941	$35,205	$81,723	$60,590	**$424,459**

Building type	Privately owned buildings		Government buildings		Total
Child care	$438,214	$62,398	$145,520	$107,889	**$754,021**
Aged care facility	$960,312	$450,272	$116,721	$55,671	**$1,582,976**
Hospital	$288,489	$351,092	$216,560	$464,231	**$1,320,372**
Total	**$4,832,860**	**$3,154,883**	**$3,687,663**	**$3,282,384**	**$14,957,790**

Cost estimates are GST-exclusive

Note that the figures in this table may not sum due to rounding.

Total Cost

As for Option 1, it is assumed under this option that no modifications to BAL-FZ buildings would occur. Hence, there is an additional cost of $219,000 NPV over 10 years for the foregone value of that construction activity.

Given the BAL assessment costs, the construction costs and this foregone value, the total cost under Option 2 is expected to be **$15.6 million NPV** over 10 years, with $8.9 million attributable to new construction and $6.7 million to modifications.

5.3.2 Benefits

This option has the potential to yield all of the same benefits as Option 1. In addition, however, the minimum BAL of 12.5 should also ensure that all buildings would have at least basic protection against ember attack, which is the most common form of bushfire attack on buildings. Without the minimum BAL-12.5, buildings that would be rated as BAL-LOW are likely to have no structural protection against ember attack. Hence, introducing a minimum standard should further protect the building from fire, provide better protection for its occupants and have greater potential to reduce the spread of bushfires where areas are subject to ember attack.

Ember protection is particularly important in mitigating against bushfire risk. The Commission noted that "although buildings' resistance to radiant heat and direct flame contact is important in the areas of highest risk, resistance to ignition by embers is crucial to the survival of all buildings in bushfire-prone areas".[160] Furthermore, it has been found that the risk of ignition is related to the weak links in the design and construction of a house.[161] As stated previously, the mechanisms of ignition of a building caused by bushfire (being ember attack, radiant heat and flame contact) relate to common elements of construction of a building (for example floors, walls, windows, doors, roofs etc) and therefore should be applicable to all buildings which share the same elements of construction. Based on these findings, the Commission recommended that a minimum BAL-12.5 be adopted to ensure that at least basic ember protection is required in the construction of all vulnerable use buildings. Further analysis of this key difference between Option 1 and Option 2 is considered in the breakeven analysis in section 6.5 of this chapter.

Standards Australia has made amendments to AS 3959-2009 since its publication and further work is being done to review, and potentially amend the testing methods prescribed. Two of the amendments made to the standard improved the extent to which it protects against ember attack by introducing further construction requirements such as maximum aperture sizes for screens and the use of sarking as a secondary form of ember protection to the roof space. While these developments have improved the standard, there has been no indication that Standards Australia is considering amending AS-3959 to provide ember protection at BAL-LOW. In an email submission to the Commission, Standards Australia "advised that it is not in a position to consider amending AS 3959-2009 to increase ember protection measures at lower Bushfire Attack Levels, until sufficient information is made available to support amending the standard".[162]

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[160] Victorian Bushfires Royal Commission Final Report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, page 160, July 2010.

[161] Victorian Bushfires Royal Commission Final Report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, Pg 253, July 2010.

[162] Standards Australia, email to the Victorian Bushfire Royal Commission, 31 March 2010, page 3, available online at http://www.royalcommission.vic.gov.au/getdoc/5d1039c2-e422-4d38-a13c-1826928a92bc/CORR.1003.0288_R, accessed 28 March 2012.

5.4 Option 3: Compliance with AS 3959, construction to protect from ember attack (BAL-12.5) and prevention of construction where bushfire exposure is greater than ember attack (BAL-12.5)

Option 3 is also regulatory and would require the application of AS 3959. However, under Option 3, buildings could only be constructed to meet the requirements for BAL-12.5. Rather than setting a minimum construction level, this option would make it mandatory to construct only to BAL-12.5. Given that buildings would still need to comply with AS 3959, this option would effectively prevent the construction of a building if its assessed BAL is above 12.5. Hence, this option would only allow the construction of vulnerable use buildings in bushfire prone areas if they have a BAL of LOW or 12.5.

5.4.1 Costs

Under this option, all buildings would be constructed to the meet the requirements for BAL-12.5. Given that not all buildings would be rated as 12.5 and they would still need to comply with AS 3959, the building industry would need to respond to this change by adjusting their construction projects accordingly. At this stage it is not clear how industry would respond. However, consultation has indicated that being able to reduce the BAL to 12.5 for a building initially rated as BAL-40 and BAL-FZ would be highly unlikely. In relation to BAL-19 and BAL-29, consultation suggests the potential to reduce the BAL is greater, but still uncertain. The ability to reduce the BAL of a site depends on site specific factors (as it is done by clearing land or re-locating the building to a different area of the site), meaning an over-arching assumption is difficult to estimate. Based on the limited information gained through consultation, for the purpose of this analysis, it is assumed that:

- buildings rated as BAL-LOW and BAL-12.5 would continue as planned, but be constructed in accordance with the requirements for BAL-12.5
- for buildings initially rated as BAL-19 and BAL-29, 50 per cent of them would be constructed or modified as planned after reducing the BAL to 12.5, and the remaining 50 per cent would no longer be constructed or modified, meaning the value of those projects would be foregone
- buildings rated as BAL-40 or BAL-FZ would no longer be constructed or modified, meaning the value of those projects would be foregone.

Under this option and the scenario outlined, there are four areas of costs estimates for this analysis:

- *BAL assessment costs* – this refers to the cost of having a professional surveyor undertake an assessment of the site's Bushfire Attack Level (BAL)
- *Cost of reducing the BAL* – this refers to the costs incurred in reducing the BAL of BAL-19 and BAL-29 sites down to BAL-12.5
- *Construction costs* – which refers to the additional cost of constructing buildings to comply with AS 3959
- *Foregone construction* – this refers to the value of construction that is foregone due to the introduction of AS 3959.

Estimates for each of these categories of cost are provided in the following sections.

BAL assessment cost

As for Option 1, BAL assessments would need to be conducted for all new or modified buildings. The cost of these BAL assessments would be the same under this option as for Option 1 because the cost does not depend on the BAL rating of the building. Hence, the total cost of undertaking BAL assessments under this option would be approximately $457,000 NPV over 10 years. For more detail on the assumptions underlying this cost, see Appendix B.

Cost of reducing the BAL

Under the assumed response of the industry to this option, 50 per cent of private and government owned buildings with a BAL of 19 or 29 would only have to construct to BAL-12.5. However, before this is possible, the BAL of the building would need to be reduced from 19 or 29 down to BAL-12.5. This could be done through clearing of vegetation to reduce the density and amount of vegetation and/or by re-locating the planned building to a different location on the site. Undertaking clearing and planning for a different building location of the site would likely have costs attached.

Limited information is available on the cost of reducing the BAL of a building site. A number of factors are considered in determining a site's BAL. These factors include consideration of the Fire Danger Index (rated at 50 for alpine areas and 100 for non-alpine areas), the type of surrounding vegetation (for example forest, woodland, shrub land, scrub, grassland etc) the distance of the site from this vegetation and the effective slope(s) under the vegetation. Each site is of course unique, the factors considered in a BAL assessment varying according to a site's location. This also means that the cost of reducing the BAL of a site is also highly variable. For this reason it is difficult to come up with a generic cost for reducing a site's BAL from 19 and 29 to BAL-12.5.

Some information on BAL related vegetation works has been provided by DEECD. Two estimates are available, both of which are based on work undertaken by the Department on Government schools in Victoria. Information on the two estimates is provided below.

- The average cost per school of undertaking vegetation works as part of the School Bushfire Protection Project was $4,518 (excluding GST). This project involved risk assessments and works identification to reduce the threat/impact of bushfire on vulnerable schools. The average per school estimate is based on works for 108 schools across seven regions of Victoria (Eastern Metropolitan, Northern Metropolitan, Southern Metropolitan, Barwon South Western & Grampians, Gippsland, Hume and Loddon Mallee).[163]

- The average cost of undertaking BAL vegetation works to reduce the BAL of 75 Government schools evaluated in early 2012 to assess the cost of complying with Ministerial Direction No. 3 was calculated to be $26,300 per school.[164] The impact assessment was undertaken for 75 building projects that were mostly associated with the Building Education Revolution. This data may overstate the cost however, as the work was generally done to reduce the rating at higher BALs.

While these estimates only relate to schools, in the absence of any other reliable and robust information, these estimates have been applied to child care, kindergartens and hospitals in the same way as schools. They have also been applied to both private and Government owned buildings. No estimates on similar vegetation or other related work was made available in relation to other facility types from other Government Departments and no public information has been found. While applying the estimates for Government schools could over or under estimate the impact for other facility types, this impact is not a significant cost driver of this option.

Consultation has indicated that land clearing is already common practice when building new aged care facilities. In this case, the cost of land clearing for aged care facilities should not be considered a cost of this option because it is already incurred under the base case. Therefore, for aged care facilities the cost of reducing the BAL is excluded. The extent to which land clearing is common practice for other vulnerable use buildings such as schools, child care or hospitals is unknown.

It should also be noted that no data is available about the feasibility or cost of measures, other than the clearing of vegetation, which could be done in order to reduce a BAL of 19 or 29 to 12.5. Notionally, resiting a previously proposed building location could involve considerably higher costs.

Based on permit data and other assumptions, it is estimated that the cost of reducing the BAL would only be incurred by about two buildings per annum, and over 10 years, about 19 new buildings and three modified buildings. These figures are low because only a small proportion of buildings are assumed to be BAL-19 or BAL-29 and only 50 per cent of those are assumed to be able to reduce the BAL. Based on these figures and taking

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163 DEECD and Aurecon (2011), 'Phase 1 – Works Summary 12 May 2011: School Bushfire Protection Project'.

164 This estimate was calculated and provided by DEECD.

the two available cost estimates as the upper and lower values of a range, the overall cost of reducing the BAL under Option 3 would be between $77,214 and $449,457 NPV over 10 years.

Additional construction costs

As for Option 1, this option would lead to additional construction costs for privately owned new and modified buildings because complying with AS 3959 requires construction materials and designs that are not ordinarily used in the construction on vulnerable use buildings.

In relation to the additional construction costs for privately owned buildings, under this option all buildings with a rating of BAL-29 or below (where construction goes ahead) would incur the additional costs of complying with the requirements for BAL-12.5. In relation to public buildings, compared to the requirements under Ministerial Direction No. 3 (which represents the 'base case' for public buildings), under this option:

- buildings rated as BAL-LOW would incur higher construction costs because they would have to comply with the construction requirements for BAL-12.5
- fifty per cent of buildings rated as BAL-19 and BAL-29 would incur lower construction costs because they would now only comply with the construction requirements for BAL-12.5 instead of a higher BAL that would have had more stringent and costly requirements.

Based on this scenario and the expected number of new buildings and significant modifications over the next 10 years, the additional construction costs under this option would be $14.4 million NPV over 10 years. This cost has been broken down in Table 12 below to show the cost for each building type. For public buildings, the cost shown is the overall *net* cost, as a benefit would be gained in relation to some Government buildings. That is, these figures incorporate the potential benefit of avoided or reduced construction costs for buildings rated above BAL-12.5. For more detail on the assumptions underlying these cost estimates, see Appendix B.

Table 12 – Additional Construction costs under Option 3

Building type	Privately owned buildings		Government buildings		Total
	New	Modifications	New	Modifications	
School	$2,762,339	$2,172,752	$3,016,531	$2,542,987	**$10,494,609**
Kindergarten	$230,889	$33,189	$77,680	$58,505	**$400,263**
Child care	$411,131	$59,098	$138,657	$104,523	**$713,408**
Aged care facility	$920,276	$436,719	$113,065	$54,846	**$1,524,906**
Hospital	$275,614	$339,594	$209,255	$456,524	**$1,280,987**
Total	**$4,600,249**	**$3,041,352**	**$3,555,188**	**$3,217,385**	**$14,414,173**

Cost estimates are GST-exclusive. Note that the figures in this table may not sum due to rounding.

Value of construction projects foregone

Under the assumed response to this option, projects to build or modify buildings with a BAL of 40 or FZ, and 50 per cent of buildings with a BAL of 19 or 29 are assumed to no longer occur. Therefore, the value of these building projects is foregone under this option. Based on the building permits data provided by the Building Commission and the BAL distribution assumed, this would lead to a loss of about $2.1 million per annum. This represents a cost of about $17.5 million NPV over 10 years, with $12.8 million attributable to new buildings and $4.7 million to modifications.

Total Cost of Option 3

Given the cost of reducing the BAL (being a range), the BAL assessment costs, the construction costs and the value of construction foregone, the total cost under Option 3 is expected to be between **$32.5 to $32.9 million NPV** over 10 years.

While this represents the cost that can be quantified, there may be other unintended negative consequences of this option. While we have assumed for this analysis that only BAL-40 and BAL-FZ and 50 per cent of BAL-19 and BAL-29 rated building sites would for forgone. If a BAL cannot be reduced on a particular site, there is potential for construction on any site with a BAL above 12.5 to be unable to proceed. By preventing vulnerable use building construction on these sites, Option 3 could reduce the value of these sites and potentially lead to lost income for individuals who purchased such sites with the intention of building.

As for previous options, the developers or owners of vulnerable use buildings will incur this cost directly, but this could be passed onto users of the building. The costs of this option could also impact on an owners' incentive to undertake construction work.

5.4.2 Benefits

This option has the potential to yield many of the same benefits as Option 2. In addition, the mandatory BAL of 12.5 would ensure that no higher BAL rated buildings are constructed. Buildings with a higher BAL have a higher level of bushfire risk and hence may place the occupants at greater risk in relation to their safety. In its final report, the Commission stated: "it should be recognised that some places are too dangerous for people to live there, and development should be strongly discouraged in these areas in the first instance".[165] Option 3 would apply this concept to vulnerable use buildings, preventing development on sites that are viewed as being of too high a risk.

It is important to note however, that the current version of AS 3959 would ordinarily account for this higher risk to some extent through more stringent construction standards at higher BALs. To the extent that this mitigates the higher risk for higher BAL buildings, this additional benefit of this option relative to Option 2 may be minimal.

5.5 Assessment of the options

In general, there is insufficient information with which to more precisely estimate the benefits associated with the options:

- As a result of the options, some – but not all – of the stock of existing vulnerable use buildings will conform to the higher standard. Existing vulnerable use buildings that are not significantly modified will remain broadly unchanged. Issues around data (outlined previously in this RIS) mean that this RIS has generally avoided estimates based on the number of buildings affected either in absolute terms or in relation to the overall stock of vulnerable use buildings (and instead focuses on construction value).

- Even if only a small proportion of the stock of vulnerable use buildings is affected by the Proposed Regulations, that is not to say that the expected benefits of the options would necessarily need to be adjusted down accordingly, given the unpredictable nature of bushfires. For example, a future bushfire or bushfires could occur mainly in areas that are still in the process of rebuilding after Black Saturday.

- While the options are expected to help vulnerable use buildings avoid destruction as a result of being built to a particular BAL standard, given the unpredictable nature of bushfires it is not possible to predict how many buildings that are built to the higher standard and that experience a bushfire will survive as a result of being built to that higher standard.

As a result, this RIS uses two tools to identify the preferred option. The first is breakeven analysis which can help to assist in ruling out options where benefits are greater than costs.

5.5.1 Breakeven analysis of options

The analysis presented in this section is in the form of a break-even analysis. A break-even analysis identifies the minimum quantum of benefits needed for a regulatory proposal to provide a net positive outcome. A breakeven analysis is useful because it does not directly seek to value benefits, but tests the reasonableness of potential levels of benefit, compared with costs. It is valuable in cases where benefits are difficult to quantify,

[165] Victorian Bushfires Royal Commission Final Report, Volume II: Fire Preparation, Response and Recovery, Chapter 6, pg 237, July 2010.

but where it is important to be able to compare options on the basis of their potential effectiveness (that is, their potential benefits in terms of being effective in reducing the costs associated with the problem).

A breakeven approach establishes the minimum benefits required to at least cover total costs. Where the breakeven target can be exceeded, the option provides a net benefit to the community.

For this analysis, the breakeven comparison of options focuses on those costs and benefits that are able to be quantified. In relation to costs, these are the costs of the options as set out earlier in this chapter, and in terms of benefits these are the upper and lower bound estimates of the potential damage to relevant vulnerable use buildings and their occupants associated with future bushfires as set out in the problem chapter.

The breakeven analysis of the three options assessed is summarised in Table 13.

Table 13 – Impact summary of the three options ($ million NPV)[166]

Impact	Option 1: AS 3959 as current	Option 2: Minimum BAL-12.5	Option 3: Mandatory BAL-12.5
Reducing the BAL	N/A	N/A	0.08 – 0.45
BAL assessments	0.46	0.46	0.46
Construction costs	0.62	15.0	14.4
Foregone construction	0.22	0.22	17.5
Total costs	**1.3**	**15.68**	**32.44 – 32.81**
Cost of the problem (lower – upper bounds)	**39.62 – 89.27**	**39.62 – 89.27**	**39.62 – 89.27**
Breakeven point where the range represents the lower and upper bound estimates	1 – 3%	18 – 39%	36 – 82%

Cost estimates are GST-exclusive

Note that the figures in this table may not sum due to rounding.

Analysis suggests that between 15 per cent and 31 per cent of the stock of vulnerable use buildings in bushfire prone areas is likely to be affected by the options (based on a range of assumptions, see Appendix B), but it is difficult to use this information to assess the breakeven points given the unpredictable nature of bushfires. That is, it is not possible to make a robust assessment of the likelihood of the break-even points being met under each option. The only thing that could be said in respect of the breakeven points is that:

- since Option 2 has higher costs than Option 1, the breakeven point should be higher, which it is.
- Option 3 would need to have a much greater impact on the problem than Option 2 to breakeven. It is not, however, clear that there would be a corresponding difference in the level of benefits between these two options (given that, as discussed elsewhere, Option 2 contains measures relating to the risk of buildings at certain BALs whereas under option 3 certain buildings would simply not be constructed), which suggests that Option 2 is a better choice than Option 3.
- Option 2 is likely to achieve greater benefits than Option 1 given it better protects against ember attack – this would be relevant if the two options had broadly similar breakeven points as it would suggest that Option 2 is a better choice than Option 1. However because the breakeven points differ, the following section undertakes MCA analysis on the options.

[166] Note that the costs are estimated over 10 years, whereas the cost of the problem is estimated over the life of vulnerable use buildings.

5.5.2 Multi-criteria analysis

Given the above, this RIS uses multi-criteria analysis to identify the preferred option. In the absence of definitive estimates of benefits, a multi-criteria analysis is a transparent mechanism for assessing different approaches against clearly defined assessment criteria.

Multi-criteria analysis (MCA) is a specific form of cost–benefit analysis that brings a degree of structure, analysis and openness to decision-making. It is particularly useful in circumstances where it is necessary to consider a range of economic, environmental and social costs and benefits which cannot be satisfactorily quantified and/or valued. MCA does allow, however, the inclusion of monetary valuations where available alongside other quantitative and qualitative valuations.

MCA establishes preferences between options by reference to an explicit set of objectives and measurable criteria to assess the extent to which the objectives have been achieved. In simple circumstances, the process of identifying objectives and criteria may alone provide enough information for decision-makers. However, where a level of detail is required MCA offers a number of ways of aggregating the data on individual criteria to provide indicators of the overall performance of options.

The criteria and weightings used in this multi-criteria analysis are:

- reduction in bushfire risk for vulnerable use buildings in bushfire prone areas (as outlined in the problem chapter, such risk primarily relates to buildings but also encompasses the potential impact on lives and injuries, as well as flow on social impacts) (50%)

- substantive compliance costs (25%) and the value of foregone construction (25%) – the relative importance of compliance costs versus the value of forgone construction varies according to the Option, which is why equal weights are given so as to not prejudge a particular outcome.

These weightings reflect the fact that cost criteria should generally be weighted 50% collectively. Each option is scored on a scale from -10 to +10 relative to the base case. A score of 0 reflects no change compared to the base case, whereas a positive (negative) score reflects a benefit (cost) to society compared to the base case.

Reduction of risk of ignition for vulnerable use buildings

In terms of the impact on the risk of ignition for vulnerable use buildings, the MCA scores in this regard reflect the following:

- The options are all expected to better protect vulnerable use buildings over an extended period in areas that have been identified as being prone to bushfires, and in the context of bushfires becoming more frequent and severe moving forward – as such, the assessment is that there would be a reduction in the risk of ignition given affected buildings would be better able to withstand bushfires as a result of the options.

- Even though only some (between 15 and 31 per cent) of the stock of such buildings is affected, given the unpredictability of bushfires, this doesn't necessarily mean that the benefit is correspondingly small.

- Option 1 is expected to only marginally reduce the risk of ignition for vulnerable use buildings in bushfire prone areas, given it does not contain specific measures to protect against ember attack at BAL-LOW levels. Given it is estimated that BAL-LOW buildings represent about 95 per cent of buildings in bushfire prone areas and protection against ember attack is crucial to building survival, the lack of ember protection at BAL-LOW limits the effectiveness of this option in targeting and therefore addressing the problem. It was clear from the Commission's findings that ember protection is seen as an important factor in the protection of vulnerable use buildings. As a result, the Commission recommended a minimum BAL 12.5 for non-residential buildings to ensure appropriate protection against ember attack into the future. For this reason, it is assessed as only representing a small improvement over the base case (due to the fact that the standard affords protection from the other elements of ignition) and scores +0.5 to +1. This score is presented as a range to reflect the unpredictability of bushfires.

- Options 2 and 3 score more highly than Option 1 as they:

  - both contain requirements that seek to protect buildings against ember attack, which is why the scores are higher for these options relative to Option 1. The lower bounds of these scores reflect a conservative assessment about the additional gains that the options represent over the base case relative to Option 1 (for example if future bushfires *generally* do not recur in areas currently rebuilding or that will build over the next ten years). Both options have relatively high upper scores reflecting a view that the benefits could be sizeable to the extent that future bushfires do recur in areas currently rebuilding.

  - both options would see some construction forgone, which effectively eliminates the risk for some buildings insofar as they simply would not be built as a result of the option. This is more of an issue for Option 3, which is why it generally scores higher than Option 2 against this criteria (although it should be acknowledged that Option 2 attempts to address risk for buildings with a graduated set of requirements depending on the BAL assessment).

  - neither option 2 nor 3 receives a perfect score as even buildings built to the higher standard may still succumb to bushfires (that is, the options reduce risk, but only eliminate it in respect of foregone construction).

- In light of these factors, the score for Option 2 is +3 to +8, and for Option 3 is +4 to +9.

Substantive compliance costs

Each of the options imposes substantive compliance costs in terms of obtaining a BAL assessment and constructing to the relevant requirements of a certain BAL. In this respect, Option 1 is expected to cost $1.1 million NPV over ten years, Option 2 $15.4 million NPV over ten years, and Option 3 about $15.0 million NPV over ten years.[167] Based on the relative magnitude of these costs, Option 1 scores - 0.5, and Options 2 and 3 score - 7, where a negative score reflects the fact that the option is more costly than the base case in terms of substantive compliance costs imposed.

Foregone construction

The other cost element of the options relates to foregone construction. That is, as a result of the options some construction will not proceed because the requirements would make doing so 'cost prohibitive'. This is minor for both Options 1 and 2 ($0.22 million NPV over ten years), but significant for Option 3 ($17.5 million NPV over ten years). Based on the relative magnitude of these costs, Options 1 and 2 score - 0.1 and Option 3 scores - 8.

Overall assessment

As can be seen by the scores, the potential gains - relative to the criteria that have been considered - vary across the options. This means that it is somewhat challenging to definitively identify an option that is a standout relative to the others. What can be identified is that, of all three options:

- Whereas Option 1 seems likely to represent a small improvement over the base case, it does not target a key aspect of the problem, and so while it is 'low cost', it is also 'low benefit'.

- Options 2 and 3 better target the problem, but in doing so have higher costs than Option 1 – the overall scores for these options have upper bounds that are positive (suggesting an improvement over the base case) and lower bounds that are negative (suggesting the opposite). The range for Option 2 is overwhelmingly positive and the lower bound is based on a conservative view about the likely effect of future bushfires. The range for Option 3 is largely negative, and Option 3 has also been assessed as unlikely to achieve the breakeven point (see discussion above).

Of the three options considered, based on a balanced view as to the most likely overall outcome in light of the points above, the potential gains flowing from Option 2 in proportion to the costs of that option suggest that this is the option that should be adopted. It is the considered view of the Department that Option 2 provides the most likely approach to achieve the greatest potential gain at a proportionally acceptable cost. There are,

[167] Calculated as the sum of all costs other than foregone value, based on the figures provided in Table 13.

however, degrees of uncertainty attached to the likely outcome from these options, and feedback is sought on the reasonableness of the proposed preferred approach.

Table 14 – Multi-criteria analysis

Building type	Option 1		Option 2		Option 3	
	Assigned score	Weighted score (50%)	Assigned score	Weighted score (25%)	Assigned score	Weighted score (25%)
Reduced risk of ignition for vulnerable use buildings	+ 0.5 to + 1	+ 0.3 to +0.5	+ 3 to + 8	+ 1.5 to + 4	+ 4 to + 9	+ 2 to + 4.5
Compliance costs	- 0.5	- 0.1	- 7	- 1.8	- 7	- 1.8
Foregone construction	- 0.1	- 0.03	- 0.1	- 0.03	- 8	- 2
Total weighted score		**+ 0.1 to + 0.4**		**- 0.3 to + 2.2**		**- 1.8 to + 0.8**

Consultation question 2:

How likely is that each option will reduce the risk of ignition for vulnerable use buildings, to the extent suggested by the scores in the MCA? How reasonable are the assumptions regarding estimates for compliance costs and forgone construction?

6 Preferred option

The preferred option is Option 2, which requires the application of AS 3959 and construction of vulnerable use buildings to a minimum BAL of 12.5. Under this option, buildings assessed as BAL-LOW will have to be constructed to the standard set in AS 3959 for BAL-12.5. As the preferred option only sets a *minimum* standard of BAL-12.5, any building assessed as being above BAL-12.5 will still be required to comply with the higher building standards.

The preferred option represents an amendment to the Building Regulations, such that the bushfire building standards defined within the BCA are adopted for vulnerable use buildings that will be occupied by vulnerable people in addition to residential buildings.

This option has been identified as representing an improvement over the current situation when considered in light of the Government's objectives to reduce the danger to lives and to reduce the risk of property damage during a bushfire. Option 2 is preferred over the alternative options as it best meets the Government's objectives.

For an overview of what regulated parties would need to do in practical terms to comply with the Proposed Regulations, refer to the attached PlanCost report. Further detail on the practical implications of adhering to AS 3959 is provided below at the end of section 6.1.

6.1 Preferred option in detail

A copy of the Proposed Regulations can be found at the conclusion of this RIS. The Proposed Regulations will amend the Building Regulations to:

- Insert a new definition into the Principal Regulations, being a "special bushfire protection building". This term will define vulnerable use buildings to which the performance standard will apply.
- Insert a new regulation which prescribes the construction requirements for special bushfire protection buildings.
- Create a new stand alone part G6 of the BCA 2012 (Volume One).[168]

Definition of "special bushfire protection building"

Regulation 115B of the Proposed Regulations provides a new definition, "special bushfire protection building" to be inserted into clause A1.1 of the BCA Volume One (Interpretation) and also for consistency into clause 1.1.1 of the BCA Volume Two.

The definition special bushfire protection building is intended to include only buildings generally occupied by people who are particularly vulnerable to bushfire attack. In its general findings, the Commission described people who are particularly vulnerable to bushfire attack as people under the age of 12 or over the age of 70 or people suffering from a disability or acute or chronic illness. In the context of its planning and building recommendations, the Commission referred to the application of bushfire construction provisions to 'non-residential buildings that will be occupied by people who are particularly vulnerable to bushfire attack, such as schools, child care centres, hospitals and aged care facilities'. In these recommendations, the Commission did not distinguish between primary and secondary schools. Secondary schools are in scope of the proposed regulations (as outlined below) due to the difficulty and potential arbitrariness in distinguishing between schools purely on the basis of the age of children who currently attend the school. Many secondary schools for example may have children under the age of 12 attending the school (for example a school that offers classes from Year 5 onwards) on a regular or occasional basis.

[168] Building Amendment (Bushfire Construction – Buildings) Regulations 2012, Draft prepared by the Office of Chief Parliamentary Counsel Victoria. Part G6 will be reflected as a schedule in the proposed regulations and will therefore be available to the general public.

Buildings intended to fall within the scope of the definition of special bushfire protection building are:

1 Public and private hospitals – Public and private hospital buildings are defined in Part A3 of the BCA as a Class 9a building.

2 Clinic, day surgery or procedure unit – Clinic, day surgery or procedure unit where the effects of the predominant treatment administered involve patients becoming non-ambulatory and requiring supervised medical care on the premises for some time after treatment are defined in Part A3 of the BCA as a Class 9a building.

3 Aged care – Buildings for residential accommodation of aged persons who, due to varying degrees of incapacity associated with the ageing process, are provided with personal care services and 24 hour staff assistance to evacuate the building during an emergency are defined in Part A3 of the BCA as a Class 9c building.

4 Primary Schools and Secondary Schools

The definition of school in Part A1 of the BCA falls within the ambit of a Class 9b building (assembly building) and includes 'college, university, or similar educational establishment'. These types of buildings in addition to those defined in parts (a), (c) and (d) of assembly building in Part A1 of the BCA, are not intended to fall within the scope of the Proposed Regulations as they are not predominantly occupied by people particularly vulnerable to bushfire attack. This means the term school in Part A1 of the BCA is too broad to be incorporated into the definition of special bushfire protection building.

A definition of school more suited to the objective of the Proposed Regulations and to the definition of special bushfire protection building is the definition of school used in section 1.1.3(1) of the *Education and Training Reform Act 2006* (ETRA):

> ***school*** means a place at or from which education is provided to children of compulsory school age during normal school hours, but does not include —
>
> a a place at which registered home schooling takes place;
>
> b a University;
>
> c a TAFE institute;
>
> d an education service exempted by Ministerial Order;
>
> e any other body exempted by the regulations;

This definition of school is to be inserted into the BCA only for the purposes of the proposed new Part G6: Construction of special bushfire protection buildings in designated bushfire prone areas (Part G6). The existing definition of school in Part A1.1 of the BCA, which is slightly broader, applies throughout the BCA in all other parts of the BCA other than Part G6.

The ETRA definition of school proposed for Part G6 does not cover residential buildings, such as homes, where home schooling may take place, as these types of dwellings are already covered by existing regulation. The ETRA definition of school also limits the types of school buildings covered by the performance standard in the Proposed Regulations to those operated during normal school hours (weekdays from 8:30am to 3:30am).[169] This ensures that the types of buildings at which children are educated on weekends, for example at Sunday schools or clubs, do not fall within the scope of the Proposed Regulations

5 Early childhood centre – An early childhood centre is a Class 9b building and is defined in Part A1 of the BCA to include either:

a Preschool

[169] See DEECD School Policy and Advisory Guide: School Hours, available online at http://www.education.vic.gov.au/management/governance/spag/management/operations/hours.htm

b Kindergarten

c Childminding centre.

Any part of a building classified as a child care centre will be covered by the Proposed Regulations, for example where an employer provides childcare facilities.

As discussed above, the definition of a Class 9b building, without restriction on the scope of building this definition covers, is not suitable for incorporation into the definition of special bushfire protection building as this class of building covers buildings not intended to be covered by the Proposed Regulations.

6 Class 4 part of a building associated with a Class 9a building, a Class 9c building, a school, retirement village or early childhood centre.

Examples of buildings not predominantly occupied by vulnerable people and not proposed to be included in the definition of special bushfire protection building are town halls, municipal offices, adult education institutes, universities, and police stations. Prisons and correctional institutions are also not intended to be covered by the proposed regulations.

'Exceptional circumstances'

The Commission's recommendation 49.3 expressly states that a minimum AS 3959-2009 construction level of BAL-12.5 is to apply to all new vulnerable use buildings and extensions in bushfire-prone areas, *other than in exceptional circumstances*. However, it provided no guidance as to what exceptional circumstances might operate to exempt construction from this prescribed minimum standard of bushfire protection.

In a different context, the Commission did provide some guidance as to what might constitute an exceptional circumstance to allow new development to occur with less than the required minimum defendable space (the vegetation clearing requirements imposed through planning mechanisms). In this context, the Commission suggested that the role of alternative safety measures such as bunkers could be considered when determining what might constitute exceptional circumstances sufficient to exempt a developer from the requirement to ensure a site complied with its assessed minimum requirement for defendable space.[170]

Exemptions from the minimum construction level of BAL 12.5 have not been included in the proposal. The reason for this is that DPCD is not presently aware of any specific circumstances that would warrant such an exemption. As it stands the proposal applies to new and significantly modified vulnerable use buildings in designated bushfire prone areas. An area is designated as bushfire prone if the State and local bushfire authorities consider that it is at threat from bushfire. The degree of that threat may of course vary from quite significant to less significant and this is the reason for generally imposing requirements corresponding to the requirement for the assessed BAL. This does not detract from the fact that, for areas designated as bushfire prone, there is a recognised threat from bushfire, which, at its very least must be to some level of ember attack. As such, without further information, any exemption to the minimum requirement to construct to BAL-12.5 in designated bushfire prone areas is considered by DPCD to undermine the policy intent of the preferred option, the function of bushfire mapping and the collective protection of the proposal to minimise fire spread. For similar reasons, no general exemptions to bushfire construction requirements for residential buildings in bushfire prone areas currently apply.

Consultation question 3:

Are all vulnerable use buildings suitably identified in the proposed regulations?

Consultation question 4:

Are there any 'exceptional circumstances' that may exist to warrant a new or substantially modified vulnerable use building, in a designated bushfire prone area, assessed as BAL-LOW, to be exempted from the minimum AS 3959-2009 construction level of BAL-12.5?

[170] VBRC Final Report 31 July 2010, Chapter 6 'Planning & Building' at paragraph 6.4.4.

Special bushfire protection building construction requirements

Proposed regulation 4 provides for a new Regulation 115B to be inserted into the Principal Regulations. New regulation 115B modifies the BCA to insert:

- the definition of special bushfire protection building;
- a new Part G6 into the BCA. Part G6 contains the performance requirements for special bushfire protection buildings.

Proposed regulation 5 provides for Part G6 in a new Schedule 1A to be inserted into the Principal Regulations.

New Schedule 1A inserted

Proposed regulation 5 creates a new Part G6 to be inserted into Volume One of the BCA by means of a new Schedule 1A to be inserted after Schedule 1 in the Principal Regulations. Part G6 contains the construction requirements for a special bushfire protection building in designated bushfire prone areas in Victoria. To satisfy the performance requirements set out in Part G6 of Schedule 1A in the Proposed Regulations, construction of these types of building must be carried out in accordance with AS 3959.

Protection

Existing regulation 811(3) of the *Building Regulations 2006* provides the minimum construction standard of BAL-12.5 for buildings in bushfire prone areas. Once the Proposed Regulations are made and the BCA is amended to require special bushfire protection buildings to be constructed in accordance with AS 3959, regulation 811(3) will then require these types of building, assessed as BAL-LOW, to be constructed to a minimum standard of BAL-12.5. As this minimum construction standard is already addressed in the principal regulations, it does not appear in the Proposed Regulations.

Practical implications of adhering to AS 3959

The Handbook on AS 3959 gives some examples of measures contained in the Standard that can be made to improve existing buildings, for example:

- Installing metal mesh screens that protect the entire window assembly rather than only that part of the window assembly that can be opened. Screens that cover the entire window assembly prevent embers from attacking the window and reduce the exposure of the entire window assembly to radiant heat.
- Installing bushfire shutters to prevent embers from attacking the entire window or door assemblies and to reduce their exposure to radiant heat. Bushfire shutters can serve a dual purpose by providing additional security.
- Installing gutters with mesh protection to avoid debris accumulation.
- Enclosing subfloor spaces to prevent ember entry and the likelihood of ignition of stored combustible material. Experience shows that if a subfloor space is available, someone will store something in the space.
- Reducing or eliminating gaps between building materials that might otherwise permit the entry of wind-blown embers to roof voids or wall cavities.
- Screening vents and weepholes where appropriate.
- Installing non-combustible thresholds, such as tiles, into or over timber decking that is adjacent to a glazed door.

6.2 Impact on small business

An assessment of small business impacts must consider matters such as:

- variation in the compliance burden

- whether any compliance flexibility options have been considered that will assist small businesses to meet the requirements of the proposed measure
- the likely extent of compliance by small versus large businesses
- the distribution of benefits arising from the proposed measure
- the relative impact of penalties and fines for non compliance.

From a broad community perspective, the extent to which small businesses are impacted will depend on how many of the privately owned facilities are owned or operated by small businesses. As set out in Chapter 3 and Table 15 below, it is estimated that there are currently 2,060 privately owned vulnerable use buildings in bushfire prone areas across Victoria.

Table 15 – Number of privately (non-government) owned vulnerable use buildings in bushfire prone areas

Building type	Number of facilities
School	344.40
Kindergarten	433.44
Child care facility	985.60
Aged care facility	245.28
Hospital	51.52
Total	**2060.24**

Note that the figures in this table may not sum due to rounding.

Source: Customised data from the DEECD and the Department of Health; Steering Committee for the Review of Government Service Provision, 'Report on Government Services 2011', Chapter 3 – Children's Services, Productivity Commission, Canberra, 2011. The numbers in this table are also discounted to account for the percentage of buildings likely to be located in bushfire prone areas, based on information regarding the proportion of municipalities in bushfire prone areas, provided by DPCD.

While it is not known how many of these are facilities are owned or operated by small businesses, it seems plausible that some kindergartens, child care centres and small medical clinics may be classed as small businesses.[171] Hospitals, schools and aged care facilities are generally larger facilities.

A number of impacts may be influenced by the size of the building (such as the cost of construction). To the extent that small businesses own or operate smaller sized buildings, then the compliance burden in some cases may be lower than that of larger businesses, all else being constant. In addition, smaller sized buildings may be located on smaller sites and hence have a lower BAL assessment cost.

On the other hand, even if smaller businesses have smaller facilities, such businesses may lack economies of scale and/or bargaining power (which can serve to increase costs). Further, some costs may be proportionally higher for smaller as opposed to larger businesses. Small buildings such as kindergartens tend to have higher external wall to floor area ratios and so may incur a higher percentage increase associated with BAL ratings than other larger buildings.

In the longer term, the preferred option may also have a positive impact on small businesses as a result of the economic ties which exist between vulnerable use buildings and small businesses. Vulnerable use buildings such as schools, hospitals and aged care facilities can form a key component of a local economy - especially in rural areas. Small businesses rely on the operation of these facilities to generate economic activity and business in the area. Small businesses may be negatively affected if a vulnerable use building suffers bushfire damage. In this case, the damaged vulnerable use building would not be able to operate which could result in less economic

[171] Small businesses are generally defined as having less than 20 employees.

activity in the area, and therefore less activity for local small businesses. Since the preferred option aims to improve the chances of a vulnerable use building surviving a bushfire, the potential for small businesses being affected by the closure of these buildings is reduced.

Consultation question 5:

How, and to what extent, are small businesses affected by the Proposed Regulations?

6.3 Competition assessment

Any new legislation in Victoria must not restrict competition unless it can be demonstrated that:

- the benefits of the restriction, as a whole, outweigh the costs, and
- the objectives of the legislation can only be achieved by restricting competition.

A legislative amendment is considered to have an impact on competition if any of the following questions in Table 16 can be answered in the affirmative. While there are some potential impacts on competition, the previous chapter demonstrate that these are necessary and that the associated benefits are likely to outweigh the costs.

Table 16 – Criteria for determining adverse competition impacts

Question	Answer	Significance
Is the proposed measure likely to affect the market structure of the affected sector(s) – i.e. will it reduce the number of participants in the market, or increase the size of incumbent firms?	Unlikely	Construction firms and builders have to comply with a range of building related requirements already. It seems unlikely that an increase in standards affecting all those who construct vulnerable use buildings would of itself cause some to leave the market or force consolidation. From the perspective of the owners and operators of affected buildings (and the markets that they serve), the proposed requirements (and the ability to pass such costs on) can affect the decision as to whether to undertake construction in order to maintain/upgrade/expand facilities. The analysis shows that only some requirements in certain circumstances would be cost prohibitive to comply with and that as a result, some construction is expected to be foregone. It seems unlikely that, more broadly, the proposed requirements will – of themselves – cause some participants to exit the market or increase in size.
Would it be more difficult for new firms or individuals to enter the industry after the imposition of the proposed measure?	Yes	The proposed measure will impose higher initial costs on new private entrants in aged care/health/school sectors that construct or significantly modify their facilities rather than purchase existing facilities.

Question	Answer	Significance
Would the costs/benefits associated with the proposed measure affect some firms or individuals substantially more than others (e.g. small firms, part–time participants in occupations, etc)?	Yes	Small buildings such as kindergartens tend to have higher external wall to floor area ratios and so may incur a higher percentage increase associated with BAL ratings than other larger buildings. On the other hand, to the extent that smaller facilities rent space they may not bear full construction costs in the short term. Kindergartens and childcare facilities are also often 'change of use' residential buildings and may already be subject to construction requirements that apply to residential buildings.
Would the proposed measure restrict the ability of businesses to choose the price, quality, range or location of their products?	Yes	Firms will not be able to build to a standard lower than that determined by the BAL. The proposed measure will also mean that firms face higher costs in bushfire prone areas. The estimated cost increase from complying with AS 3959 is between 0.3% and 18.4% depending of the type of facility and BAL rating of the site (see the PlanCost report).
Would the proposed measure lead to higher ongoing costs for new entrants that existing firms do not have to meet?	No	If anything, ongoing maintenance costs may decrease for those building to the higher standard. For a more detailed discussion, see section 5.1 of this report.
Is the ability or incentive to innovate or develop new products or services likely to be affected by the proposed measure?	Yes	Firms will not be able to build to a standard lower than that determined by the BAL.

Source: Department of Treasury and Finance (Victoria), 'Victorian Guide to Regulation', Edition 2.1, Melbourne, August 2011, page 88.

6.4 Implementation and enforcement issues

6.4.1 Implementation

Implementation may involve activities to raise the awareness of the new Regulations. This would be conducted by the Building Commission and associated bodies who may also run seminars for building surveyors, major builders and construction companies specialising in the construction and modification of vulnerable use buildings.

6.4.2 Enforcement

Building activities and building standards in Victoria are determined by the Building Act, Building Regulations and the BCA. Enforcement of building standards is currently carried out by public and private building surveyors, authorised officers from the Building Commission and the associated bodies, local governments and authorised officers of the Melbourne Fire Brigade and CFA. The Commission provided further information about the regulatory framework, see appendices.

Enforcement of building standards is carried out through the building permit process. Building surveyor approval is required for building works that trigger the need for a building permit (i.e. construction of new building, modifications to over 50 per cent of existing buildings, changing the use of a building). Permits will be issued once the building surveyor is satisfied that the plans meet the building standards as defined by the BCA. The findings of the building surveyor are also forwarded on to the Building Commission who conduct audit

programs. In 2010-11, 652 investigations were completed and 107 domestic office audits and 40 site audits were conducted.[172]

It is difficult to be certain about whether or not any additional time will be taken by building surveyors to undertake audits or inspections, and whether any costs in implementing/enforcing the requirements will be absorbed (noting that this would impose opportunity costs to the extent that it impacts on other activities). There is insufficient information with which to quantify the extent of any such opportunity costs and stakeholder feedback is sought in relation to this in the box below.

Consultation question 6:

To what extent are there costs associated with implementing/enforcing these requirements for building surveyors?

6.4.3 Transitional measures

The transitional provisions for the building regulations are in the Building Act 1993 - section 10. In particular, s10(2) which states that a building regulation or an amendment to a building regulation does not apply to the carrying out of building work if the relevant building surveyor is satisfied and certifies in writing that substantial progress was made on the design of the building before the building regulation or amendment commenced.

The estimates contained in this RIS are based on expected future construction in each of the next ten years (rather than construction already underway in a given year).

6.5 Evaluation strategy

It is difficult to predict and therefore measure the number of lives and buildings that will be saved as a result of the Proposed Regulations. Nevertheless, DPCD will monitor the impact of the Proposed Regulations; with a view to ensuring that these regulations operate as intended and that industry is sufficiently informed of the new requirements and how to comply with them.

In terms of collecting data and information to base an evaluation on, the following questions could be asked:

> Following future bushfires, of the vulnerable use buildings directly threatened by the bushfire attack that
> a) are destroyed, and
> b) survive
> what proportion were built to comply with AS 3959?

As a key performance indicator, the Proposed Regulations could be seen as effective or successful if the proportion that are built to AS 3959 that survive as opposed to being destroyed increases. This approach however, may be subject to the following issues:

- There may not be a bushfire in the next 10 years or a sufficient number of bushfires to allow comparisons in data over time. Based on the estimates in this RIS, this indicator could only be assessed in about 34 years.

- If the regulations are not re-made after sun setting in 10 years, a greater proportion of the stock would not be built to AS 3959 each year.

Given these limitations, it is very difficult to take a quantitative approach as above. However, a more qualitative approach may be possible. For example, in the wake of future bushfires there may be evidence (even anecdotal) about the extent to which vulnerable use buildings that are built to a higher standard as a result of the Proposed Regulations are better able to withstand things like ember attack compared to those that are not. The potential

[172] Building Commission Annual Report, Overview, page 2, June 2011

benefits could then be compared against the cost of the regulations, which could be monitored as they occur in practice once the regulations are in place.

Standards Australia is also continuing to discuss and develop a future work program including potential research activities that could inform further Standards development work in relation to ember attack across the BALs. To this end, Standards Australia would be likely to be consulted in the context of any future evaluation of the operation of the Proposed Regulations.

Appendices

Appendix A Consultation

In preparing this RIS document, on behalf of DPCD, we have consulted with representatives from the following Victorian Government bodies:

- Department of Education and Early Childhood Development
- Department of Human Services
- Department of Health
- Building Commission

We have also consulted with:

- the Building Advisory Council (BAC)
  - The BAC is a senior industry based advisory group that advises the Minister for Planning on the administration of the *Building Act* 1993 and *Building Regulations* 2006. Council members are appointed by the Minister for Planning, and presently comprise members from the following entities:
    - Clement Stone Town Planners
    - Jackson Clements Burrows Pty Ltd, Architects
    - Building Commission and Plumbing Industry Commission
    - Property Council of Australia, Victoria
    - Institute of Engineers Australia
    - Australian Institute of Building Surveyors
    - Housing Industry Association , Victoria
    - Master Builders Association of Victoria
    - Consumer Affairs Victoria
- CH Group, a building surveyor that works in the health and aged care sector
- Connect project management, project managers that work on aged care construction projects

These stakeholders were consulted in order to gather information and data in relation to the costs and benefit of the proposed options. In relation to the Government Departments, we were able to draw on their current experience applying Ministerial Direction No. 3. These departments were able to provide data on the cost of retro-fitting existing buildings and the cost of undertaking a BAL assessment. During consultations, the Department of Health expressed concerns that the minimum BAL requirement would impose unnecessary costs during construction projects because a large proportion of its buildings were rated as BAL-LOW. In light of this view, this RIS has sought to quantify the nature and extent to such costs and consider the benefits associated with a mandatory BAL of 12.5. The Department of Health also indicated that people may not place a strong focus on the level of fire resistance when choosing a facility, whether it is public or private. This has been reflected in the analysis of imperfect industry responses in relation to market failures in the body of this report.

In relation to the non-government stakeholders, the focus of our discussions was on understanding current construction practices and the cost of applying AS 3959 to vulnerable use buildings.

In consultation with the BAC, concerns were expressed regarding the effectiveness of applying AS 3959 to vulnerable use buildings. While the BAC acknowledged that the application of AS 3959 would be an appropriate interim solution in the absence of a specific and improved standard being developed, they also commented that a strong understanding of AS 3959 is needed by the community to ensure that its effect and aim is not misunderstood. That is, it would be necessary to ensure the community does not treat vulnerable use buildings as refuges simply because they comply with AS 3959. The BAC suggested that further information or education should be provided if regulation requiring compliance with the standard was introduced. The BAC also expressed a strong view that a mandatory BAL of 12.5 under option 3 is not appropriate as it takes the assessment decision away from private land owners.

Further to this, the BAC suggested that building construction standards should not be the only mitigation method used to address the risk exposure from bushfires. Some other relevant methods are planning schemes, fuel loads and evacuation planning. This is acknowledged in this report and the outcomes of this RIS are not intended to be seen as a standalone solution to all aspects of bushfire risk.

In addition to the consultation conducted on behalf of DPCD by PwC (outlined above), DPCD has also sought information, data and preliminary views from representatives of the following stakeholder peak bodies:

- Independent Schools Victoria
- Catholic Education Office of Victoria Ltd
- Aged & Community Care Victoria
- Australian Private Hospitals Association
- Child Care Centres Association of Victoria
- Kindergarten Parents Victoria
- Australian Institute of Building Surveyors
- Master Builders Association
- DPCD also sought information and data from the following Victorian Government bodies/representatives:
- Police and Emergency Management, Department of Justice
- Fires Services Commissioner
- Building Commission
- Office of Resources & Infrastructure, Department of Education and Early Childhood Development
- Health Emergency Management, Department of Health
- Capital Projects and Service Planning, Department of Health

Each of the bodies identified above were presented with an outline of the need for, and the scope of, the Proposed Regulations and the other options considered in this RIS. DPCD also invited feedback on the proposal, including on its potential costs and benefits, together with a request for information on the measures already implemented by these bodies to reduce bushfire risk and, in some cases, other specific information to support the analysis of the relative costs and benefits of each option presented in this RIS.

To ensure the process of preliminary consultation produced a cross-section of views of owners in the vulnerable use building sector, DPCD targeted the Victorian stakeholder peak bodies that represent the interests of these owners/facility operators. Relevant industry associations were also approached for preliminary feedback on the proposal. Where preliminary views and feedback were provided to DPCD, they were considered in formulating the Proposed Regulations and in preparing the RIS.

Independent Schools Victoria provided a summary of the regulatory framework applicable to independent schools in Victoria. It provided an outline of the Victorian Registration & Qualifications Authority's Bushfire Preparedness Guidelines for Schools, the Bushfire At-Risk Register in addition to registration requirements relevant to the proposal such as the requirement for schools to have emergency management plans, a critical incident plan and the requirement that a school's buildings and facilities comply with any laws that apply to the school including building, planning and safety laws.

The Catholic Education Office of Victoria Ltd (Catholic Education Office) indicated it supports any initiative that contributes to the safety and wellbeing of its students and staff. It identified that the imposition of bushfire construction standards to new and significantly modified Catholic school buildings would potentially increase the cost of those buildings and that this incremental cost would be difficult to quantify. The Catholic Education Office also provided a summary of existing bushfire management practices in place for its schools.

Aged & Community Care Victoria described existing fire reducing mechanisms currently implemented by Aged Care Centres, including sprinklers, wire screens and glazing.

The Australian Private Hospitals Association, Child Care Centres Association of Victoria, Kindergarten Parents Victoria Inc, Australian Institute of Building Surveyors, and the Master Builders Association did not provide specific views in response to preliminary consultation. Many of these organisations indicated a preference to respond to the RIS once finalised. Of the stakeholder peak bodies approached for feedback, only three organisations did not provide any response at all to the request.

Specialist technical advice was also sought from PlanCost Australia, who offer quantity surveying, construction cost planning and estimating services. PlanCost's report on the over cost of constructing to AS3959 is attached at the conclusion of this RIS.

Appendix B Cost benefit methodology and assumptions

The first three sections of the appendix outline some of the calculation methodologies used in the cost benefit analysis. All of the input assumptions used in these calculations and any other assumptions made in the cost benefit analysis are then outlined in the tables below.

In general, GST exclusive costs have been used to calculate costs (e.g. PlanCost's estimates are GST exclusive). According to the Australian Taxation Office, certain medical, health and care services are GST free and so this RIS makes a simplifying assumption that the facilities that are the subject of this RIS provide services that are GST free.[173]

1 Methodology for calculating construction costs

The methodology for calculating construction costs is outlined below. The cost is calculated on a per annum basis and is calculated at a disaggregated level to account for each of the following variables:

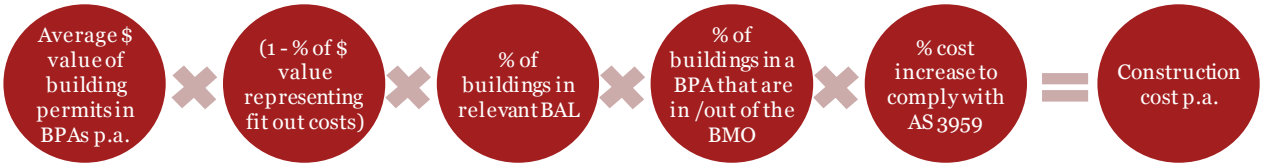
- new buildings versus modifications greater than 50%
- private versus public buildings
- within a BPA, buildings covered by the BMO versus buildings not in the BMO
- BAL
- building type (i.e. school, kindergarten etc.).

Accounting for each of these variables, this leads to 240 combinations (or specific building types). This includes 120 for private buildings and another 120 for public buildings. Note that not all options have a cost for all specific building types. For example, option 1 has no impact on public buildings and Option 2 only has an impact on public buildings rating as BAL-LOW.

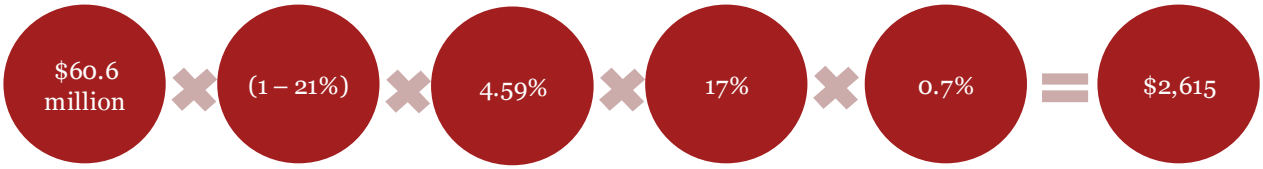
The calculation for each specific building type is shown in Figure 4. Each of the inputs in the calculation is explained in the sections below.

[173] Australian Taxation Office, Guide to GST, www.ato.gov.au. Specific information available at http://www.ato.gov.au/businesses/content.aspx?menuid=0&doc=/content/00221985.htm&page=9#P258_15879. According to informal advice from a GST lawyer, while the building materials, the construction of facilities and related supplies of goods and services will be subject to GST, the entities that run the buildings in question should be entitled to claim back this GST as an input tax credit on their Business Activity Statement (BAS), as they will use the goods and services for the purposes of providing GST-free health and education services. That is, the net cost to these entities will be the GST-exclusive value of the building materials and construction services. As such, the GST-exclusive value is the most appropriate value to use in estimating the cost.

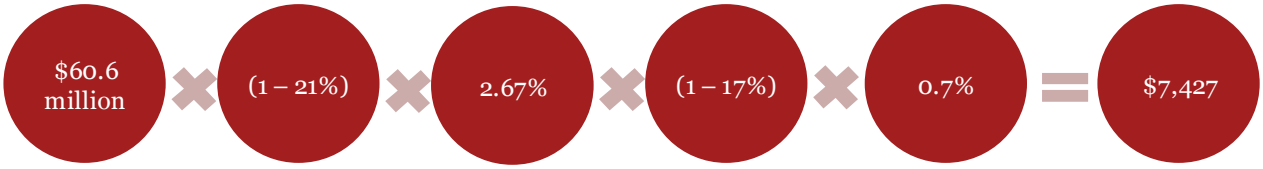
Figure 4 – Calculation methodology for construction costs



Example: Under Option 1, construction cost for new private schools in a BPA *covered* by the BMO that would be BAL-12.5



Example: Under Option 1, construction cost for new private schools in a BPA *not covered* by the BMO that would be BAL-12.5



Average dollar value of building permits in BPAs per annum

The annual value of building permit activity expected in the future is taken as an average across the last five years available (2006 to 2010). However, to avoid the impacts of the Building Education Revolution, only years 2006 to 2008 have been used to estimate the future value of permits for schools.

To approximate building activity in bushfire prone areas only, the building permit data for each municipality has been discounted by the percentage of the municipality's land area that represents a bushfire prone area. Inherent in this methodology is the assumption that buildings are evenly distributed across the municipality. Given that buildings are likely to be denser in non-bushfire prone areas, the value of building activity under this approach may overstate the actual dollar value in bushfire prone areas.

For modifications, the value of building activity has been discounted to ensure only modifications greater than 50 per cent of an existing building is included. The data on permits does not provide this separation and information on this is limited. While consultation has indicated that a small number of permits for modification work are large projects over 50 per cent, the value of these projects would also be expected to be larger than smaller projects. In the absence of any information or data on what proportion of permits represent this type of activity, we have assumed a discount rate of 50 per cent for the value of modification permits.

Percentage of value representing fit out costs

- The value of building permits includes the cost of internal fittings. This cost was not included in the estimates provided by PlanCost and as such a discount rate is applied to avoid counting this cost in the expected future value of new and modified buildings.

Percentage of buildings in relevant BAL

- The BAL distribution is assumed to be constant across all building types and is based on data from domestic buildings. A different distribution is assumed for buildings in the bushfire management overlay to account for the policies on BALs required under the planning schemes.

Percentage of buildings in a BPA that are in /out of the BMO

As discussed in the body of the report, the current and previous planning schemes impact on the current and likely BAL of building in the bushfire management overlay. Therefore, a different BAL distribution is used for buildings in the BMO and as such, the costs must be calculated separately. This percentage input in the calculation merely separates out the impact on building in and out of the BMO so that different parameters can be applied to each. The construction costs are for buildings not covered by the BMO are higher because there are more buildings not in the BMO.

Percentage cost increase to comply with AS 3959

This is the percentage increase in cost estimated by PlanCost. The percentage is specific to the BAL and the building type.

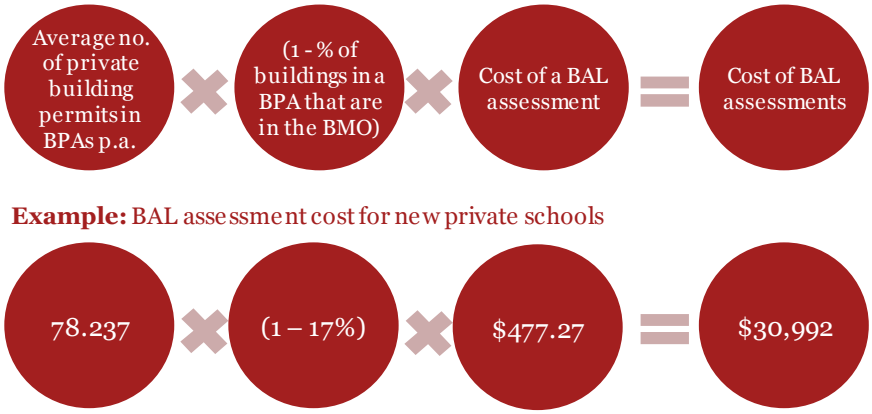
Calculating the cost across a 10 year period

We have assumed that the value of buildings that are build/modified each year remains constant over time, rather than growing this number each year. This assumption was used because of the high level of uncertainty in these estimates and that the five year data showed no obvious trend. Given this assumption, the non discounted cost expected over the next 10 years is calculated by multiplying the per annum figure by 10. Note that this will not equal to NPV over 10 years, as no discount rate has been applied.

2 Methodology for calculating the BAL assessment cost

The BAL assessment cost is calculated separately for each of the five building types (i.e. schools, kindergartens etc) and new versus modified buildings. The calculation is shown in Figure 5. Each of the inputs in the calculation is explained in the sections below.

Figure 5 – Calculation methodology for BAL assessment cost



Average number of building permits in BPAs per annum

This number is separated by new and modified private buildings per annum. The figure shown in the example is only for new buildings. The methodology for calculating this number and the assumptions underlying it are the same as for 'Average dollar value of building permits in BPAs per annum' (see above). As above, for modifications, the number of building activity has been discounted to ensure only modifications greater than 50 per cent of an existing building is included. In relation to the number of permits, consultation has indicated that only a small number of permits for modification work are large projects over 50 per cent. To reflect this, and in the absence of any specific information or data on correct separation, we have assumed 10 per cent of modification permits represent permits for modifications to 50 per cent or more of an existing building.

Percentage of buildings in a BPA that are not covered by the BMO

Buildings in the BMO are already required to undertake an assessment equivalent to a BAL assessment. Hence, we must discount the number of building permits by the proportion of buildings assumed to be in the BMO. It is assumed that 17 per cent of buildings are in the BMO. See tables below for more detail.

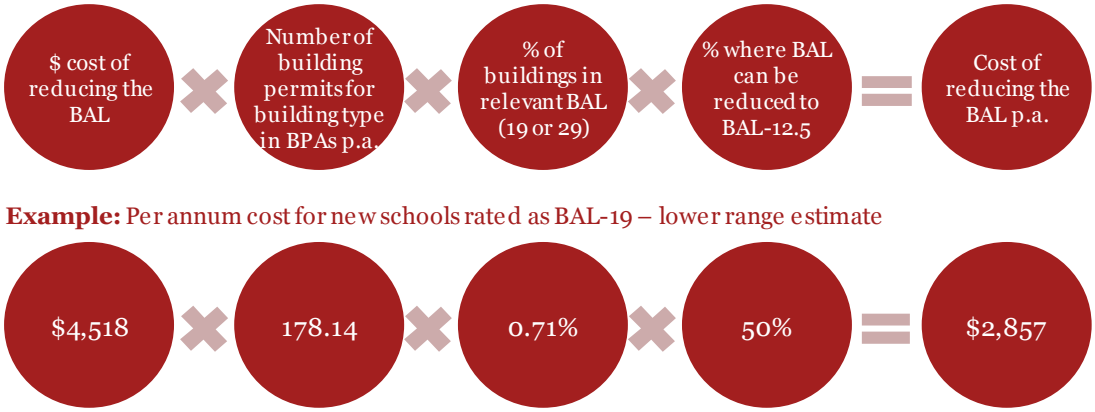
Cost of a BAL assessment

The cost of having a BAL assessment undertaken is assumed to be constant across all buildings types. The cost of a BAL assessment is assumed to be $477.27. This is the GST exclusive figure based on the GST inclusive figure of $525. See tables below for more detail.

3 Methodology of calculating the cost of reducing the BAL

The cost of reducing the BAL is calculated on a per annum basis and is calculated separately for each building type. The calculation for this cost, along with an example, is shown in Figure 6. The number of building permits includes both new and modified, as well as both private and public buildings. The example shown demonstrates the calculation for the lower range estimate of reducing the BAL. To estimate the upper range, the only difference is that the '$ cost of reducing the BAL' would be $26,300.

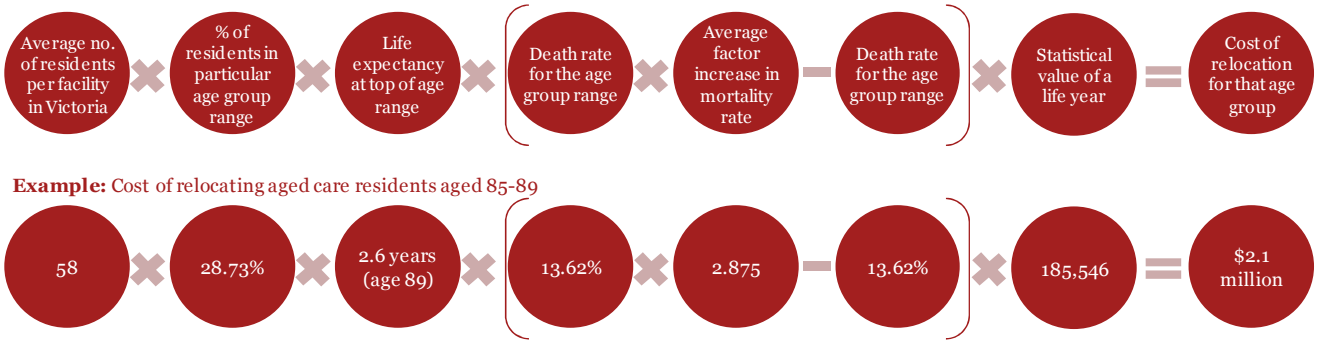
Figure 6 – Calculation for the cost of reducing the BAL



4 Methodology for calculating the cost of relocating aged care residents

The cost of relocating aged care residents was calculated for residents aged 65 and above and was calculated separately for each of the following age group ranges: 65-69, 70-74, 75-80, 85-89, 90-94, 95+. The calculation is shown in Figure 7.

Figure 7 – Calculation methodology for the cost of relocating aged care residents



The factor increase in mortality risk is an average of 1.99 and 3.76, being the range of results found through research projects in this area.[174] The statistical value of a life year is $163,895 (in 2007 dollars) multiplied by a CPI factor of 1.3121.[175] The source and value of all other inputs can be found in the assumptions tables below.

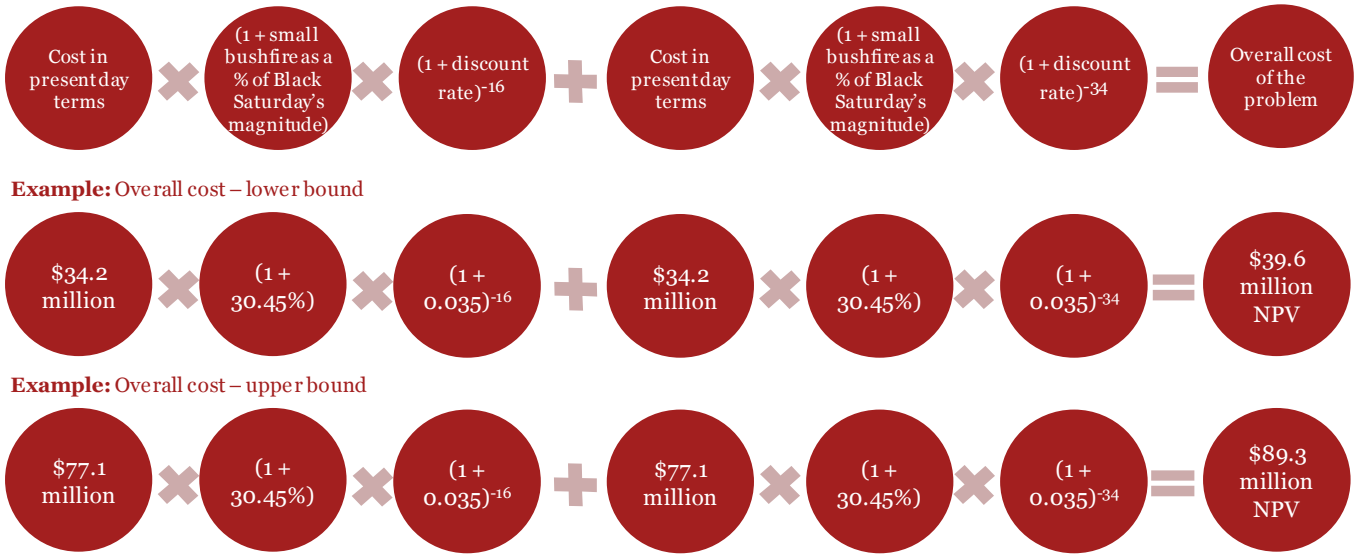
[174] Robinson, V. 'A brief literature review of the effects of relocation on the elderly', prepared for The Hospital Employees' Union of British Columbia, September 2002.

[175] Based on the statistical value of a life of $3.5 million in 2007 dollars: Department of Finance and Deregulation, Office of Best Practice Regulation, Best Practice Regulation Guidance Note – Value of statistical life', November 2008; Australian Bureau of Statistics, '6401.0: Consumer Price Index, Australia', All groups, 2011 – June 2007 to June 2011.

5 Methodology for calculating the overall cost of the problem

The overall cost of the problem is estimated in terms of two scenarios: a lower and an upper bound. Under both scenarios, the calculation for determining the overall cost is the same, however the cost is present day terms is assumed to be different. The equation is shown in below.

Figure 8 – Calculation for the overall cost of the problem



6 General assumptions

Assumption	Value	Unit	Source
Discount rate	3.50	% per annum	Department of Treasury and Finance (Victoria), 'Victorian Guide to Regulation', Edition 2.1, Melbourne, August 2011, Page 83; Partnerships Victoria, 'Use of Discount Rates in the Partnerships Victoria Process', Technical Note, July 2003.
Value of a statistical life (2007 dollars)	3.5	$ million per life	Department of Finance and Deregulation, Office of Best Practice Regulation, Best Practice Regulation Guidance Note – Value of statistical life', November 2008.
CPI factor (June 2007 to June 2011)	1.1321	Multiplication factor	Australian Bureau of Statistics, '6401.0: Consumer Price Index, Australia', All groups, 2011.
Proportion of buildings in a bushfire prone area that are assumed to be in an area covered by the bushfire management overlay	17	%	Data provided by the Department of Planning and Community Development regarding the bushfire prone areas and the WMO in Victoria; Department of Planning and Community Development, 'Planning Permit Activity in Victoria', Melbourne, 2009-10. This has been calculated as a weighted average across all LGAs, excluding LGAs with no BPA (as these were excluded from the number of current and expected new and modified buildings received from Departments). The weightings were base on the number of building permits in each LGA in 2009-10.
Proportion of existing buildings assumed to be in an area covered by BPA	56	%	
Cost multiplication factor for modifications on existing buildings	2.5	Multiplication factor	PlanCost report.

Assumption	Value	Unit	Source
Percentage of the *number* of building permits for modifications assumed to be covered by the 50% rule	10	%	For modifications, building permit data cannot be separated by those projects that modify 50 per cent or more of an existing building. In the absence of this information, to approximate the number of modification relevant to this proposal, it is assumed that 10 per cent of permits for modification projects represent modifications of 50 per cent or more. Consultation has indicated that only a small proportion of permits for modification work are large projects over 50 per cent.
Percentage of the *value* of building permits for modifications assumed to be covered by the 50% rule	50	%	For modifications, building permit data cannot be separated by those projects that modify 50 per cent or more of an existing building. In the absence of this information, to approximate the value of modification relevant to this proposal, it is assumed that 50 per cent of permits for modification projects represent modifications of 50 per cent or more. While consultation has indicated that a small proportion of permits for modification work are large projects over 50 per cent, the value of these projects would also be expected to be larger than smaller projects. Hence, a higher percentage is assumed for the *value* of permits.

7 BAL assessment cost

Assumption	Value	Unit	Source
Cost of conducting a BAL assessment	$477.27.00	$ per building	This is an average value based in information collected during consultation with various stakeholders. The average value collected during consultation was $525, however it is assumed that this is GST inclusive. Hence, $477.27 has been used to ensure the analysis is GST exclusive.

8 Number of current buildings/facilities

Assumption	Value	Unit	Source
Privately owned (or non-government) owned buildings/facilities			
School	615.0	Number as at 2011	Customised data from the Department of Education and Early Childhood Development, as at Feb 2011, adjusted to remove buildings in LGAs with no BPAs.
Kindergarten	770.0	Number as at 2010	Customised data from the Department of Education and Early Childhood Development, as at Feb 2011, adjusted to remove buildings in LGAs with no BPAs. 85% of child care facilities are assumed to be private or community owned – Steering Committee for the Review of Government Service Provision, 'Report on Government Services 2011', Chapter 3 – Children's Services, Productivity Commission, Canberra, 2011.

Assumption	Value	Unit	Source
Child care	1760.0	Number as at 2011	Customised data from the Department of Education and Early Childhood Development, as at Feb 2011, adjusted to remove buildings in LGAs with no BPAs. 85% of child care facilities are assumed to be private or community owned – Steering Committee for the Review of Government Service Provision, 'Report on Government Services 2011', Chapter 3 – Children's Services, Productivity Commission, Canberra, 2011.
Aged care facility	438.0	Number as at 2011	Customised data from the Department of Health, adjusted to remove buildings in LGAs with no BPAs. There may be some buildings that are not captured in this number that are also relevant to the proposed regulations, such as retirement villages. However, it is very difficult to identify whether these buildings are Class 9 buildings and therefore captured by the regulatory change. Based on their knowledge of government owned buildings, the Department of Health has indicated that these buildings are unlikely to be captured by the proposed regulations. This does not reflect uncertainty in the scope of the proposal, but more uncertainty in the data as detailed analysis of each individual building cannot be undertaken to ascertain which are currently Class 3 versus Class 9.
Hospital	92.0	Number as at 2011	Customised data from the Department of Health, adjusted to remove buildings in LGAs with no BPAs. There may be some other buildings that are also relevant to the proposed regulations such as community health centres or bush nursing facilities. However, it is very difficult to identify whether these buildings are Class 9 buildings and therefore captured by the regulatory change. Based on their knowledge of government owned buildings, the Department of Health has indicated that health related buildings other than hospitals are unlikely to be captured by the proposed regulations. This does not reflect uncertainty in the scope of the proposal, but more uncertainty in the data as detailed analysis of each individual building cannot be undertaken to ascertain which are currently Class 3 versus Class 9.
State Government owned buildings/facilities			
School	1334.0	Number as at 2011	Customised data from the Department of Education and Early Childhood Development, as at Feb 2011, adjusted to remove buildings in LGAs with no BPAs.
Kindergarten	137.0	Number as at 2010	Customised data from the Department of Education and Early Childhood Development, as at Feb 2011, adjusted to remove buildings in LGAs with no BPAs. 85% of child care facilities are assumed to be private or community owned – Steering Committee for the Review of Government Service Provision, 'Report on Government Services 2011', Chapter 3 – Children's Services, Productivity Commission, Canberra, 2011.
Child care	311.0	Number as at 2011	Customised data from the Department of Education and Early Childhood Development, as at Feb 2011, adjusted to remove buildings in LGAs with no BPAs. 85% of child care facilities are assumed to be private or community owned – Steering Committee for the Review of Government Service Provision, 'Report on Government Services 2011', Chapter 3 – Children's Services, Productivity Commission, Canberra, 2011.

Assumption	Value	Unit	Source
Aged care facility	181.0	Number as at 2011	Customised data from the Department of Health, adjusted to remove buildings in LGAs with no BPAs. There may be some buildings that are not captured in this number that are also relevant to the proposed regulations, such as retirement villages. However, it is very difficult to identify whether these buildings will be Class 9 buildings and therefore captured by the regulatory change. Based on their knowledge of government owned buildings, the Department of Health has indicated that these buildings are unlikely to be captured by the proposed regulations. This does not reflect uncertainty in the scope of the proposal, but more uncertainty in the data as detailed analysis of each individual building cannot be undertaken to ascertain which are currently Class 3 versus Class 9.
Hospital	127.0	Number as at 2011	Customised data from the Department of Health, adjusted to remove buildings in LGAs with no BPAs. There may be some other buildings that are also relevant to the proposed regulations such as community health centres or bush nursing facilities. However, it is very difficult to identify whether these buildings will be Class 9 buildings and therefore captured by the regulatory change. Based on their knowledge of government owned buildings, the Department of Health has indicated that health related buildings other than hospitals are unlikely to be captured by the proposed regulations. This does not reflect uncertainty in the scope of the proposal, but more uncertainty in the data as detailed analysis of each individual building cannot be undertaken to ascertain which are currently Class 3 versus Class 9.

9 Expected value of building permits per annum in bushfire prone areas

Assumption	Value	Unit	Source
Privately owned			
New buildings			
School	60,600,440	$ per annum	Customised building permit data provided by the Building Commission. To approximate building activity in bushfire prone areas only, municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the percentage of land covered by a designated bushfire prone area. These percentages are based on data provided by the Department of Planning and Community Development regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO. Note that these values are GST exclusive. The original permit data provided was GST inclusive and as such, these values were adjusted accordingly.
Kindergarten	3,554,677	$ per annum	
Child care	7,912,023	$ per annum	
Aged care facility	33,267,508	$ per annum	
Hospital	12,737,832	$ per annum	

Assumption	Value	Unit	Source
Extension or modifications (prior to discounting to gain only those greater than 50% of the existing building)			
School	38,195,714	$ per annum	Customised building permit data provided by the Building Commission. To approximate building activity in bushfire prone areas only, municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the percentage of land covered by a designated bushfire prone area. These percentages are based on data provided by the Department of Planning and Community Development regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO. Note that these values are GST exclusive. The original permit data provided was GST inclusive and as such, these values were adjusted accordingly.
Kindergarten	409,445	$ per annum	
Child care	911,346	$ per annum	
Aged care facility	12,650,553	$ per annum	
Hospital	12,576,525	$ per annum	
Government owned			
New buildings			
School	71,243,545	$ per annum	Customised building permit data provided by the Building Commission. To approximate building activity in bushfire prone areas only, municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the percentage of land covered by a designated bushfire prone area. These percentages are based on data provided by the Department of Planning and Community Development regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO. Note that these values are GST exclusive. The original permit data provided was GST inclusive and as such, these values were adjusted accordingly.
Kindergarten	1,306,603	$ per annum	
Child care	2,908,246	$ per annum	
Aged care facility	4,381,772	$ per annum	
Hospital	10,393,731	$ per annum	
Extension or modifications (prior to discounting to gain only those greater than 50% of the existing building)			
School	47,277,963	$ per annum	Customised building permit data provided by the Building Commission. To approximate building activity in bushfire prone areas only, municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the percentage of land covered by a designated bushfire prone area. These percentages are based on data provided by the Department of Planning and Community Development regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO. Note that these values are GST exclusive. The original permit data provided was GST inclusive and as such, these values were adjusted accordingly.
Kindergarten	774,975	$ per annum	
Child care	1,724,945	$ per annum	
Aged care facility	1,671,948	$ per annum	
Hospital	17,824,537	$ per annum	

10 Discount rate on the value of permits to account for fit out costs

Building type	Value	Unit	Source
School	21.0	%	Based on percentage cost of finishes and fittings (aggregated) for a single storey primary school, in 'Rawlinsons Australian Construction Handbook', 29th ed. (2011), *Rawlinsons Publishing*, Perth, p 73, Estimating – Elemental Costs of Buildings.
Kindergarten and child care	21.2	%	Based on percentage cost of finishes and fittings (aggregated) for a single storey childcare centre, in 'Rawlinsons Australian Construction Handbook', 29th ed. (2011), Rawlinsons Publishing, Perth, p 79, Estimating – Elemental Costs of Buildings.
Aged care facility	16.1	%	Based on percentage cost of finishes and fittings (aggregated) for a nursing home, in 'Rawlinsons Australian Construction Handbook', 29th ed. (2011), Rawlinsons Publishing, Perth, p 107, Estimating – Elemental Costs of Buildings.
Hospital	12.5	%	Based on percentage cost of finishes and fittings (aggregated) for a single storey private hospital, in 'Rawlinsons Australian Construction Handbook', 29th ed. (2011), Rawlinsons Publishing, Perth, p 78, Estimating – Elemental Costs of Buildings.

11 Expected number of building permits per annum

Assumption	Value	Unit	Source
Privately owned			
New buildings			
School	78.24	No. per annum	Customised building permit data provided by the Building Commission. To approximate building activity in bushfire prone areas only, municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the percentage of land covered by a designated bushfire prone area. These percentages are based on data provided by the Department of Planning and Community Development regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO.
Kindergarten	5.33	No. per annum	
Child care	11.87	No. per annum	
Aged care facility	11.54	No. per annum	
Hospital	11.86	No. per annum	

Assumption	Value	Unit	Source
Extension or modifications (prior to discounting to gain only those greater than 50% of the existing building)			
School	115.28	No. per annum	Customised building permit data provided by the Building Commission. To approximate building activity in bushfire prone areas only, municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the percentage of land covered by a designated bushfire prone area. These percentages are based on data provided by the Department of Planning and Community Development regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO.
Kindergarten	3.25	No. per annum	
Child care	7.22	No. per annum	
Aged care facility	28.26	No. per annum	
Hospital	43.44	No. per annum	
Government owned			
New buildings			
School	99.90	No. per annum	Customised building permit data provided by the Building Commission. To approximate building activity in bushfire prone areas only, municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the percentage of land covered by a designated bushfire prone area. These percentages are based on data provided by the Department of Planning and Community Development regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO.
Kindergarten	1.36	No. per annum	
Child care	3.03	No. per annum	
Aged care facility	0.90	No. per annum	
Hospital	5.41	No. per annum	
Extension or modifications (prior to discounting to gain only those greater than 50% of the existing building)			
School	137.79	No. per annum	Customised building permit data provided by the Building Commission. To approximate building activity in bushfire prone areas only, municipalities with no BPA were excluded, and for those with a BPA, permit data was adjusted to reflect the percentage of land covered by a designated bushfire prone area. These percentages are based on data provided by the Department of Planning and Community Development regarding the proportion of land in municipalities covered by a designated bushfire prone area and the WMO.
Kindergarten	4.40	No. per annum	
Child care	9.79	No. per annum	
Aged care facility	5.08	No. per annum	
Hospital	30.01	No. per annum	

12 Distribution of buildings across the BAL ratings

BAL-LOW	BAL-12.5	BAL-19	BAL-29	BAL-40	BAL-FZ	Source
Buildings not in areas covered by the BMO						
95.44%	2.67%	0.71%	0.92%	0.17%	0.12%	Data provided by Department of Planning and Community Development regarding domestic permits with BAL reported. Municipalities with no BPAs have been removed from this data before calculating the distribution.

BAL-LOW	BAL-12.5	BAL-19	BAL-29	BAL-40	BAL-FZ	Source
Buildings that are in areas covered by the BMO – new buildings						
95.44%	4.59%	0%	0%	0%	0%	Based on the distribution for buildings not in areas covered by the BMO. This distribution is based on consultations with the Department of Planning and Community Development regarding the planning scheme that came into operation in November 2011.
Buildings that are in areas covered by the BMO – modified buildings (50%+)						
95.44%	2.67%	0.71%	1.21%	0%	0%	Based on the distribution for buildings not in areas covered by the BMO. This distribution is based on consultations with the Department of Planning and Community Development regarding the planning scheme that came into operation in November 2011.

13 Cost of relocating aged care residents

Assumption	Value	Unit	Source
Average number of residents per facility in Victoria	58	No.	Australian Institute of Health and Welfare, 'Residential Aged care in Australia 2009-10: A statistical overview', Aged care statistics series number 35, AIHW cat no. AGE 66, Canberra. Weighted average based on Table A1.4, page 74.
Statistical value of a life year	163,895	2007 $	This is calculated based on the recommended statistical value of a life for cost benefit analysis of $3.5 million as per Department of Finance and Deregulation, Office of Best Practice Regulation, Best Practice Regulation Guidance Note – Value of statistical life', November 2008. This Note in turn draws on analysis by Ableson (2007) in 'Establishing a Monetary Value for Lives Saved: Issues and Controversies' which states that $3 million to $4 million would appear to be a plausible statistical value of a life for a healthy prime age individual in Australia. Their analysis explains that allowing 40 years of life lost and a utility discount rate of three per cent, a statistical value of a life of $3.5 million implies a statistical value of a life year of $151,000, being the constant annual sum which, taken over a remaining life span (40 years), has a discounted value equal to the estimated value of statistical life ($2.5m). Given the discount rate of 3.5 per cent used in this analysis, allowing 40 years and a statistical value of a life of $3.5 million implies a statistical value of a life year of $163,895. The CPI factor applied to this value for this RIS can be found under general assumptions in this Appendix.
Average increase in mortality risk	2.875	Multiplication factor	The factor increase in mortality risk is an average of 1.99 and 3.76, being the range of results found through research projects in this area. Robinson, V. 'A brief literature review of the effects of relocation on the elderly', prepared for The Hospital Employees' Union of British Columbia, September 2002.

Assumption	Value	Unit	Source
Life expectancy (adjusted to account for the individuals being in an aged care facility)			
Age 69	9.2	No. of years	The average life expectancy at each age group has been combined with information on the average length of stay for aged care residents to estimate an adjusted life expectancy for individuals in aged care facilities. If the life expectancies estimated by the ABS are used, the weighted average life expectancy of aged care residents would be about double the average length of stay. To ensure the life expectancies assumed are consistent with the length of stay, the life expectancies estimated by the ABS have been divided by two for this analysis. The figures in this table are the adjusted life expectancies.
Age 74	7.2	No. of years	
Age 79	5.4	No. of years	
Age 84	3.8	No. of years	
Age 89	2.6	No. of years	
Age 94	1.8	No. of years	
Age 100	1.4	No. of years	Unadjusted estimates: Australian Bureau of Statistics, 'Life Tables, Australia, 2008-2010'. Note that the value for 'Age 100' was used for the age range 95+.
Age distribution of aged care residents (% of residents in particular age group range)			
Ages 65-69	3.24	%	Australian Institute of Health and Welfare, 'ACFI characteristics of permanent residents in care at 30 June 2010', Aged care Data cubes, available at http://www.aihw.gov.au/aged-care-data-cube/?id=10737419848, accessed 12 January 2012.
Ages 70-74	5.34	%	
Ages 75-79	10.48	%	
Ages 80-84	20.50	%	
Ages 85-89	28.73	%	
Ages 90-94	19.41	%	
Ages 95+	8.69	%	
Death rates			
Ages 65-69	0.92	%	Percentage is based on the number of deaths per 1,000 population (persons). Australian Bureau of Statistics, 'Deaths, Australia, 2010 – Table 2.2 Death rates, Summary, Victoria'
Ages 70-74	1.68	%	
Ages 75-79	2.90	%	
Ages 80-84	5.43	%	
Ages 85 and over	13.62	%	

Stock of affected buildings

Based on information provided by government departments, it is estimated there are currently around 3,321 existing vulnerable use buildings across Victoria in bushfire prone areas (2,060 private and 1,170 government facilities).[176] Based on building permit data, over the next 10 years it is expected that there would be 2,295 new buildings built and 385 existing buildings significantly modified. The number of existing buildings and the number of building permits however are not directly comparable. Estimates of the existing stock relate to the number of 'facilities', whereas building permit data is based on individual buildings, of which there could be several within the one 'facility'. If these estimates were to be compared, it would suggest that 48 per cent of the stock in bushfire prone areas would be built to meet AS 3959 after 10 years. Given that building permit data

[176] See Appendix B for more detail on the assumptions underlying these figures.

would overestimate the number of new and significantly modified 'facilities', this percentage would likely represent the maximum proportion of the stock that would meet AS 3959 after 10 years.

To provide more indicative estimates, some assumptions could be made around the average number of individual buildings per facility so that the data is more comparable. Given that generalisations on the number of buildings per facility are difficult to make, several scenarios are shown below. The proportion of vulnerable use buildings in bushfire prone areas that would be built to meet the requirements of AS 3959 after 10 years would be about:

- 31 per cent if there were, on average, two buildings per facility
- 22 per cent if there were, on average, three buildings per facility
- 15 per cent if there were, on average, five buildings per facility.

Appendix C NSW Approach to 'Special Fire Protection Purpose' buildings[177]

NSW method for consideration

In NSW, the method of consideration is as follows:

1 Is the site located on "bush fire prone land" (being land identified in the bush fire prone land map)?

2 Is the development a residential or rural/residential subdivision or a Special Fire Protection Purpose (SFPP)?

3 If Yes to both, it must be an integrated development and the consent authority must refer the development application to the Rural Fire Service (RFS) for a bushfire safety authority (BFSA).

4 The consent authority then determines the development application and the BCA and AS 3959 construction standards will be applied, with detail to be provided at the construction certificate stage.

5 For all other development on bush fire prone land, section 79BA of the *Environmental Planning and Assessment Act* 1979 provides that development consent cannot be granted unless the consent authority is satisfied that the development conforms to the specifications and requirements of 'Planning for Bushfire Protection' or consultation has occurred with the commissioner of the RFS.

Points to note in relation to the NSW approach

There are several points to note in relation to the NSW approach. These are outlined below:

- There does not appear to be a distinction between high and medium risk areas in NSW. Bush fire prone land appears to cover all relevant land, as compared with the additional BMO area as a subset of bushfire prone land in Victoria.
- 'Planning for bushfire protection' confirms that "Class 3 (other than a detention centre) and Classes 9a and 9c buildings will be a special fire protection purpose for the purposes of section 100Bof the Rural Fires Act 1997".
- Where an SFPP is being considered, there is more reliance on space around buildings and less reliance on construction standards. Specific objectives of SFPP developments are specified in 'Planning for bushfire protection' as follows:
- Provide for the special characteristics and needs of occupants. Unlike residential subdivisions, which can be built to a construction standard to withstand the fire even, enabling occupants and fire fighters to provide property protection after the passage of fire, occupants of SFPP developments may not be able to assist in property protection. They are more likely to be adversely affected by smoke or heat while being evacuated.
- Provide for safe emergency evacuation procedures. SFPP developments are highly dependent on suitable emergency evacuation arrangements, which require greater separation from bush fire threats.

[177] The Appendix is based on information produced by the NSW Rural Fire Service. See 'Special Fire Protection Purpose (Vulnerable Members of the Community)' and related pages at http://www.rfs.nsw.gov.au.

- There are a range of bushfire protection measures (BPMs) set out in 'Planning for Bushfire Protection'. These include asset protection zones, construction standards, suitable access arrangements, water and utility services, emergency management arrangements and landscaping. Performance tables are included and the intent and performance criteria for each BPM must be satisfied for a SFPP. If a reduction in an asset protection zone is desired, exceptional circumstances must be demonstrated.

- Where an alteration or addition to a SFPP is proposed, both the BPMs and specifications and requirements for BPMs for infill development (at 4.3.5 of Planning for Bushfire Protection) must be fulfilled. Where this is difficult, the objectives listed above are to be followed. The new building work should also comply with AS3959 or be no closer to the hazard than the existing building.

- Once development consent has been provided through planning, the BCA modification for NSW provides that Class 9 buildings that are SFPPs must comply with AS 3959 or as modified by development consent through a BFSA issued by the RFS under section 100B.

Relevant definitions

BFSA: An approval of the Commissioner of the NSW RFS required for a subdivision for residential or rural residential purposes or for a SFPP listed under section 100B(6) of the Rural Fires Act. This form of development is considered to be an integrated development.

SFPP: Defined in section 100B(6) of the Rural Fires Act, below.

Section 100B of the *Rural Fires Act 1997*.[178]

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.

(3) A person must obtain such a bush fire safety authority before developing bush fire prone land for a purpose referred to in subsection (1).

(4) Application for a bush fire safety authority is to be made to the Commissioner in accordance with the regulations.

(5) Development to which subsection (1) applies:
(a) does not include the carrying out of internal alterations to any building, and
(a1)does not include the carrying out of any development excluded from the operation of this section by the regulations, and
(b) is not complying development for the purposes of the Environmental Planning and Assessment Act 1979, despite any environmental planning instrument.

(6) In this section:

special fire protection purpose means the purpose of the following:

(a) a school,
(b) a child care centre,

[178] *Rural Fires Act 1997*, see http://www.austlii.edu.au/au/legis/nsw/consol_act/rfa1997138/s100b.html.

(c) a hospital (including a hospital for the mentally ill or mentally disordered),
(d) a hotel, motel or other tourist accommodation,
(e) a building wholly or principally used as a home or other establishment for mentally incapacitated persons,
(f) seniors housing within the meaning of State Environment Planning Policy (Housing for Seniors or People with a Disability) 2004,
(g) a group home within the meaning of State Environmental Planning Policy No 9 – Group Homes,
(h) a retirement village,
(i) any other purpose prescribed by the regulations.

Modification to the BCA

The NSW modifications to the BCA are as follows:

OBJECTIVE
NSW GO5
The Objective of the Part is to –
(a) safeguard occupants from injury; and
(b) protect buildings,
from the effects of bushfire.

Application
NSW GO5 only applies, in a designated bushfire prone area, to –
(a) a Class 2 or 3 building;
(b) a Class 4 part of a building;
(c) a Class 9 building that is a special fire protection purpose; or
(d) a Class 10a building or deck associated with a building or part referred to in (a), (b) or (c).

FUNCTIONAL STATEMENT
NSW GF5.1
A building constructed in a designated bushfire prone area is to provide a resistance to bushfire in order to reduce the danger to life and minimise the risk of the loss of the building.

Application
NSW GF5.1 only applies, in a designated bushfire prone area, to –
(a) a Class 2 or 3 building;
(b) a Class 4 part of a building;
(c) a Class 9 building that is a special fire protection purpose; or
(d) a Class 10a building or deck associated with a building or part referred to in (a), (b) or (c).

PERFORMANCE REQUIREMENT
NSW GP5.1
A building that is constructed in a designated bushfire prone area must be designed and constructed to reduce the risk of ignition from a bushfire while the fire front passes.

Application
NSW GP5.1 only applies in a designated bushfire prone area, to –
(a) a Class 2 or 3 building;
(b) a Class 4 part of a building;
(c) a Class 9 building that is a special fire protection purpose; or
(d) a Class 10a building or deck associated with a building or part referred to in (a), (b) or (c).
NSW G5.2
Protection
In a designated bushfire prone area, a Class 2 building, a Class 3 building, a Class 4 part of a building or a Class 9 building that is a special fire protection purpose or a Class 10a building or deck associated with such a building or part, must comply with the following:

(a) AS 3959 except for Section 9 Construction for Bushfire Attack Level FZ (BAL-FZ). Buildings subject to BAL-FZ must comply with specific conditions of development consent for construction at this level; or

(b) The requirements of (a) above as modified by the development consent following consultation with the NSW Rural Fire Service under section 79BA of the Environmental Planning and Assessment Act 1979; or

(c) The requirements of (a) above as modified by development consent with a bushfire safety authority issued under section 100B of the Rural Fires Act 1997 for the purposes of integrated development.

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Building Amendment (Construction Requirements for Special Bushfire Protection Buildings) Regulations

Exposure Draft

TABLE OF PROPOSALS

Victoria

Building Amendment (Construction Requirements for Special Bushfire Protection Buildings) Regulations

Exposure Draft

1 Objective

The objective of these Regulations is to amend the Building Regulations 2006 to provide for bushfire construction requirements for certain classes of buildings located in designated bushfire prone areas that are occupied by people who are particularly vulnerable to bushfire attack.

2 Authorising provisions

These Regulations are made under sections 7, 9, 261 and 262 of the **Building Act 1993**.

3 Commencement

These Regulations come into operation [*date to be determined*].

4 New regulation 115B inserted

After regulation 115A of the **Building Regulations 2006**[1] **insert**—

'**115B Special bushfire protection building construction requirements**

(1) The BCA Volume One applies as if in clause A1.1, after the definition of **Sole-occupancy unit** there were inserted—

"**Special bushfire protection building** means any of the following buildings located in a *designated bushfire prone area*—

(a) a Class 9a building;

(b) a Class 9c building;

(c) a school within the meaning of section 1.1.3(1) of the **Education and Training Reform Act 2006**;

(d) a building from which an *early childhood centre* is operated;

(e) a Class 4 part of a building associated with a building referred to in paragraphs (a) to (d).

Note:

The definition of *school* in **Clause A1.1** applies throughout the BCA except in this definition where the definition of school within the meaning of section 1.1.3(1) of the Education and Training Reform Act 2006 applies instead. This definition is inserted only for the purposes of **Part G6**.".

(2) The BCA Volume One applies as if after Part G5 there were inserted Part G6 as set out in Schedule 1A.

(3) The BCA Volume Two applies as if in clause 1.1.1, after the definition of **Smoke-Developed Index** there were inserted—

"**Special bushfire protection building** means any of the following buildings located in a *designated bushfire prone area*—

(a) a Class 9a building;

(b) a Class 9c building;

(c) a school within the meaning of section 1.1.3(1) of the **Education and Training Reform Act 2006**;

(d) a building from which an *early childhood centre* is operated;

(e) a Class 4 part of a building associated with a building referred to in paragraphs (a) to (d).

Note:

The definition of *school* in **Clause 1.1.1** applies throughout the BCA except in this definition where the definition of school within the meaning of section 1.1.3(1) of the Education and Training Reform Act 2006 applies instead.".'.

5 New Schedule 1A inserted

After Schedule 1 to the Building Regulations 2006 **insert**—

"SCHEDULE 1A

Regulation 115B

INSERTION OF NEW PART G6 OF THE BCA VOLUME ONE

PART G6 CONSTRUCTION OF SPECIAL BUSHFIRE PROTECTION BUILDINGS IN DESIGNATED BUSHFIRE PRONE AREAS

OBJECTIVE

GO6

The *Objective* of this Part is to—

(a) safeguard occupants from injury; and

(b) protect buildings,

from the effects of bushfire.

Application

GO6 only applies to a *special bushfire protection building* located in a *designated bushfire prone area* and applies in addition to any other applicable provisions of the BCA.

FUNCTIONAL STATEMENT

GF6.1

A building constructed in a *designated bushfire prone area* is to provide a resistance to bushfires in order to reduce danger to life and minimise the risk of the loss of the building.

Application

GF6.1 only applies to a *special bushfire protection building* and applies in addition to any other applicable provisions of the BCA.

PERFORMANCE REQUIREMENT

GP6.1

A building that is constructed in *a designated bushfire prone area* must, to the degree necessary, be designed and constructed to reduce the risk of ignition from a bushfire appropriate to the—

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

(b) intensity of the bushfire attack on the building.

Application

GP6.1 only applies to a *special bushfire protection building* and applies in addition to any other applicable provisions of the BCA.

PART G6 CONSTRUCTION OF SPECIAL BUSHFIRE PROTECTION BUILDINGS IN DESIGNATED BUSHFIRE PRONE AREAS

Deemed-to-Satisfy Provisions

G6.0 Deemed-to-Satisfy Provisions

(a) Where a *Building Solution* is proposed to comply with the *Deemed-to-Satisfy Provisions, Performance Requirement* **GP6.1** is satisfied by complying with **G6.1** and **G6.2**.

(b) Where a *Building Solution* is proposed as an *Alternative Solution* to the *Deemed-to-Satisfy Provisions* of **G6.1** and **G6.2**, the relevant *Performance Requirements* must be determined in accordance with **A0.10**.

G6.1 Application of Part

The *Deemed-to-Satisfy Provisions* of this Part apply to a *special bushfire protection building* located in a *designated bushfire prone area*.

G6.2 Protection

A *special bushfire protection building* must comply with AS 3959.

_____".

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ENDNOTES

[1] Reg. 4: S.R. No. 68/2006. Reprint No. 2 as at 25 October 2011. Reprinted to S.R. No. 92/2011. Subsequently amended by S.R. Nos 73/2011 and xx/2012.

———

Table of Applied, Adopted or Incorporated Matter

The following table of applied, adopted or incorporated matter is included in accordance with the requirements of regulation 5 of the Subordinate Legislation Regulations 2004.

In this table—

BCA means the Building Code of Australia comprising—

(a) Volume One of the National Construction Code Series including any variations or additions in the Appendix Victoria set out in the Appendices to that Volume; and

(b) Volume Two of the National Construction Code Series including any Victoria additions set out in Appendix A of that Volume;

BCA Volume One means Volume One of the National Construction Code Series including any variations or additions in the Appendix Victoria set out in the Appendices to that Volume;

BCA Volume Two means Volume Two of the National Construction Code Series including any Victoria additions set out in Appendix A of that Volume;

National Construction Code Series means the National Construction Code Series 2011 published by the Australian Building Codes Board.

Statutory rule provision	**Title of applied, adopted or incorporated document**	**Matter in applied, adopted or incorporated document**
Regulation 4 which inserts regulation 115B in the Building Regulations 2006	The BCA Volume One The BCA Volume Two	Clause A1.1 Part G6 Clause 1.1.1

Statutory rule provision	**Title of applied, adopted or incorporated document**	**Matter in applied, adopted or incorporated document**
Regulation 5 which inserts Schedule 1A to the Building Regulations 2006	The BCA Volume One AS 3959—2009 Construction of buildings in bushfire-prone areas, published by Standards Australia on 10 March 2009, as amended on 16 November 2009, 15 February 2011 and 11 November 2011 as incorporated by the BCA	Part G6 The whole

Cost Study

The cost impact of complying with

AS 3959-2009 Construction of buildings in bushfire prone areas (incorporating Amendments 1, 2 and 3)

in

Non-residential buildings

12 April 2012

PlanCost Australia

JMA ARCHITECTS

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Cost Study

Acknowledgements

This Cost Study has been prepared by PlanCost Australia with the assistance of:

- JMA Architects
- Reddo Building Surveyors

The contribution from the Department of Planning and Community Development, Housing and Building Policy Division, and Price Waterhouse Coopers, is also gratefully acknowledged.

Contents

Foreward

Australian Standard AS 3959 - 2009 states that:

"This Standard specifies requirements for the construction of buildings in bushfire-prone areas in order to improve their resistance to bushfire attack from burning embers, radiant heat, flame contact and combinations of the three attack forms."

and

"The method of determining the Bushfire Attack Level (BAL) for a site comprises six categories, namely BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ. These categories are based on heat flux exposure thresholds."

This report identifies the overall design and cost implications of complying with the requirements of AS 3959 on non-residential buildings Class 9A, 9B (educational only) and 9C buildings.

The design and cost implications of AS 3959 will vary considerably depending upon the building type and building design. This report has been based upon a series of 'typical' buildings types that are indicative of the likely common building types in each category, including:

- Private schools
- Private kindergartens
- Private child care
- Private aged care
- Private hospitals

The report indicates the likely design and cost impacts on a range of 'example' buildings. It is not intended to provide specific advice to building designers nor is it intended to cover all possible scenarios.

A number of assumptions have been made in this report regarding the 'example' buildings used to establish the cost models, and these assumptions are identified within this report.

Introduction

The design and cost implications of complying with AS 3959 will vary considerably depending upon:

- The BAL rating
- The size and shape of the building
- The construction materials used
- The design options adopted to address the BAL rating requirements

The methodology used in preparing this report was as follows:

- The report identifies the design requirements of AS 3959 for the various BAL ratings (refer to Appendix C). The table in Appendix C is a summary only of the design implications of complying with AS 3959. It is not a complete list of all of the design requirements. Refer to AS 3959 for full details

- From the various design options listed AS 3959, the report indentifies typical design solution for each 'example' building (refer to Appendix C). This forms the basis of the additional construction cost estimates included in the report. Note: Appendix C only lists the additional design requirements from AS 3959 that are not otherwise required by other building regulations, licensing standards and common practice.

- The report identifies the 'example' building size, shape and construction type, for each building type (Refer to Appendix B). These are used to calculate overall building costs and additional construction costs for each 'example' building type.

The various 'example' buildings as based on the following assumed construction::

- Single storey
- Masonry clad
- Concrete slab
- Concrete verandahs
- Steel framed metal deck roof
- Aluminum windows.

This is typical of these types of buildings and requires the least changes to meet the BAL ratings.

This building type has been adopted to indicate the range of cost which may be incurred in meeting the various BAL ratings.

Variations to the 'example' building materials may affect the cost required to achieve the various BAL ratings.

Many building are, in fact, a combination of various building types and materials, and in certain building components timber is more prevalent than in others. For example, timber windows are often used as they provide better thermal performance than metal, whereas timber floors are less common as concrete slabs provide better performance.

Executive Summary

The cost impact of complying with AS 3959 for the designated 'example' buildings is as shown below:

Table 1 – Cost increase required to achieve BAL ratings

BAL	LOW	12.5	19	29	40	FZ
Private Schools	0%	0.7%	0.9%	2.1%	4.0%	12.1%
Private Kindergartens	0%	1.0%	1.4%	4.6%	9.9%	18.4%
Private Child Care	0%	0.8%	1.1%	3.4%	7.2%	15.1%
Private Aged Care	0%	0.4%	0.5%	1.0%	1.7%	7.0%
Private Hospitals	0%	0.3%	0.4%	0.8%	1.4%	5.5%

Refer to the attached appendices for further information on the methodology and assumptions made.

The costs represent the anticipated additional cost incurred for the various 'example' building types due to the additional requirements in AS 3959 to the various BAL ratings.

Commentary

Variability of % cost impact

1. The % cost impact of a BAL rating varies depending on the type of building. For example, a school building has a lower $/m² building cost rate than a hospital, therefore the same BAL rating on a school and hospital of the same size would result in a higher % increase for the school.

2. Smaller buildings such as kindergartens tend to have a higher external wall:floor area ratios than large buildings. Therefore, as most of the additional costs associated with BAL ratings relate to external walls and windows, smaller buildings like kindergartens incur a higher % increase than other larger buildings.

Typical construction materials

3. Typical building construction materials for Class 9A, 9B and 9C buildings usually include concrete floor slabs, masonry walls, metal roofs and aluminum windows. These meet most of the requirements of a BAL rating of 12.5, 19 and 29. This can be seen in Table 1 which shows the cost increase for BAL 12.5, 19 and 29 to be less than 2%.

Effect of mandatory BAL ratings

4. On most sites for Class 9 buildings there is some opportunity to relocate the building on the site in order to reduce the BAL rating. However it should be noted that in many cases, a combination of the constraints of the site dimensions, topography, vegetation, site access, site services, adjacency to public roads, etc make it either impossible or impractical to relocate the building sufficiently to reduce the BAL rating. Therefore, if a mandatory standard was imposed such that construction could only occur if the building was rated at BAL 12.5 or lower, many building projects that required a BAL rating higher than BAL 12.5 could not or would not proceed.
5. In some instances a relatively minor change to existing site vegetation or building location may result in a reduction of a BAL rating from 12.5 to LOW. Due to the wide variability of potential or existing sites, it is not possible to quantify what proportion of sites may allow for this, or what the anticipated cost might be.
6. A mandatory BAL rating could have a negative impact on the value of existing land if it precluded the opportunity of constructing a Class 9 building which would otherwise have been allowable.

BAL ratings on existing buildings

7. When more than 50% of the original building is added and/or modified, Building Regulation 608 requires the entire building to be brought into conformity with the current regulatory requirements. Therefore, if the bushfire construction provisions apply to a building type (i.e. BCA class 9A, 9B or 9C) and more than 50% of the building is added and/or altered, the existing external fabric of the building will need to meet the bushfire construction requirements as well as the new external construction. Whilst Building Regulation 608 does also offer Building Surveyors the discretion to not impose upgrade requirements to existing parts of a building being altered, it is hard to imagine a responsible Building Surveyor ignoring the bushfire construction provisions if the regulators impose such requirements on a particular building type.

7.1 It is difficult to determine the cost impact of a BAL rating on an existing building as it depends on the amount of refurbishment proposed and the construction type of the existing building.

7.2 On most existing Class 9A, 9B and 9C buildings with concrete slabs, masonry walls, aluminum windows and metal deck roofs, a BAL rating up to BAL 40 can be achieved without complete reconstruction of the existing facilities. The anticipated additional costs are highly variable and could be approximately two to three times the cost of achieving the same BAL rating on a new building.

7.3 Achieving a BAL FZ rating on an existing building may require the complete reconstruction of the roof which would be cost prohibitive.

7.4 If an existing building was constructed of a timber floor, timber frame, timber cladding, metal deck roof and timber windows, the cost of achieving a BAL rating of 12.5 or higher could be cost prohibitive as it may require the removal and replacement of all external wall cladding, new screens or shutters to the windows and total or partial reconstruction of the roof.

Appendix A - Cost Estimates

Using the typical design solutions (from Appendix C) for each BAL rating and the "example" buildings (from Appendix B) for each building type, estimates of the cost implications of AS 3959 on each building type for each BAL rating were calculated (refer below).

Table 2 – Additional costs required to achieve BAL ratings

BAL	LOW	12.5	19	29	40	FZ
Private Schools						
Anticipated Total Cost BAL-LOW	$5,670,000					
Cost of BAL rating	$0	$39,154	$49,841	$116,728	$225,805	$688,421
% increase	0%	0.7%	0.9%	2.1%	4.0%	12.1%
Private Kindergartens						
Anticipated Total Cost BAL-LOW	$720,000					
Cost of BAL rating	$0	$6,884	$10,269	$33,240	$71,561	$132,186
% increase	0%	1.0%	1.4%	4.6%	9.9%	18.4%
Private Child Care						
Anticipated Total Cost BAL-LOW	$1,390,000					
Cost of BAL rating	$0	$10,940	$15,717	$47,541	$100,563	$209,306
% increase	0%	0.8%	1.1%	3.4%	7.2%	15.1%
Private Aged Care						
Anticipated Total Cost BAL-LOW	$16,380,000					
Cost of BAL rating	$0	$64,825	$77,935	$155,763	$276,694	$1,153,638
% increase	0%	0.4%	0.5%	1.0%	1.7%	7.0%
Private Hospitals						
Anticipated Total Cost BAL-LOW	$18,380,000					
Cost of BAL rating	$0	$59,300	$71,752	$146,997	$265,752	$1,005,531
% increase	0%	0.3%	0.4%	0.8%	1.4%	5.5%

The Anticipated Total Costs is the cost of the building only and excludes:

- External works and external services
- Consultant fees
- Furniture and equipment
- Locality allowance
- Cost escalation after November 2011
- GST

Appendix B - 'Example' buildings

As the design and cost implications of AS 3959 will vary considerably depending upon the building design, this report has been based upon a series of 'example' buildings that are indicative of the likely common building types in each category.

These 'typical' buildings are as follows:

Table 3 - 'Example' Buildings

	Private Schools	Private Kindergartens	Private Child Care	Private Aged Care	Private Hospitals
Internal floor area (FECA)	3000m²	300m²	600m²	6000m²	5000m²
External covered areas (UCA)	150m²	15m²	30m²	300m²	250m²
External wall perimeter	330m	105m	145m	465m	425m
External wall area	1155m²	265m²	365m²	1090m²	1594m²
Window area	495m²	176m²	244m²	537m²	531m²
Roof area	3308m²	331m²	662m²	6615m²	5516m²

Appendix C - Design requirements of BAL ratings on 'typical' Class 9 buildings

Appendix C identifies the design requirements of AS 3959 for the various BAL ratings. It is a summary only of the design implications of complying with AS 3959. It is not a complete list of all of the design requirements. Refer to AS 3959 for full details

From the various design options listed AS 3959, Appendix C indentifies typical design solution for each 'example' building. This forms the basis of the additional construction cost estimates included in this appendix. Note: Appendix C only lists the additional design requirements which are not otherwise required by other building regulations or common practice.

Appendix C - Design requirements of BAL ratings on "Example" Class 9 buildings

Section 5 Construction for Bushfire Attack Level 12.5 (BAL 12.5)				Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 12.5	Additional cost for complying with BAL 12.5				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating			School	Kindergarten	Child care	Aged care	Hospital
				n/a = relevant part of AS 3959 not applicable to 'Example' building						
5.1	**GENERAL**									
5.2	**SUBFLOOR SUPPORTS**									
5.3	FLOORS									
5.3.1	Concrete slabs on ground	Nil	Nil	n/a	Nil	0	0	0	0	0
5.3.2	Elevated Floors	Nil	Nil	n/a	Nil	0	0	0	0	0
5.4	**EXTERNAL WALLS**									
5.4.1	Walls	Exposed external walls within 400mm of ground, deck, carport roof, awning or similar shall be:								
		a) non-combustible, or	Masonry cladding	Yes	Nil	0	0	0	0	0
		b) timber logs as per 6.4.1 (b), or	Not used	n/a	Nil	0	0	0	0	0
		c) cladding as per 6.4.1 (c), or	Not used	n/a	Nil	0	0	0	0	0
		d) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
5.4.2	Joints	All joints in external walls to be treated to prevent gaps greater than 3mm	No special gap treatment except as required to prevent excessive air, dust or vermin entry	No	Joints treated to prevent gaps greater than 3mm, including but not limited to: - ends of roof sheets at gutters, ridges, hips and valleys - around windows and doors - at eaves	5,775	1,323	1,827	5,452	7,969
5.4.3	Vents and weepholes	To be screened with mesh as per 5.4.3	Vents and weepholes not screened	No	To be screened with mesh as per 5.4.3	1,155	265	365	1,090	1,594
5.5	**EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS**									
5.5.1	Bushfire shutters	Where fitted, bushfire shutters are to be as per 3.7 and 5.5.1	Not used	n/a	Nil	0	0	0	0	0
5.5.1A	Screens for windows and doors	Where fitted, bushfire shutters are to be as per 5.5.1A	Not used	n/a	Nil	0	0	0	0	0
5.5.2	Windows	Windows shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		c) Windows shall comply with: (i) Windows within 400mm of ground, deck, carport roof, awning or similar shall be:								

Section 5 Construction for Bushfire Attack Level 12.5 (BAL 12.5)						Additional cost for complying with BAL 12.5				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 12.5	School	Kindergarten	Child care	Aged care	Hospital
		(A) Bushfire-resisting timber, or	Not used	n/a	Nil	0	0	0	0	0
		(B) A timber species as Paragraph E2, Appendix E, or	Not used	n/a	Nil	0	0	0	0	0
		(C) Metal, or	Aluminium	Yes	Nil	0	0	0	0	0
		(D) Metal-reinforced PVC-U, or	Not used	n/a	Nil	0	0	0	0	0
		(ii) External hardware to sashes shall be metal	Metal	Yes	Nil	0	0	0	0	0
		(iii) Glazing within 400mm of ground, deck, carport roof, awning or similar shall be 4mm Grade A safety glass or glass blocks	Safety glass used below 900mm	Yes	Nil	0	0	0	0	0
		(iv) Other glazing may be annealed glass	Annealed glass	Yes	Nil	0	0	0	0	0
		(v) Openable portions of windows to be screened with screens that comply with Clause 5.5.1A	Fibreglass mesh flyscreens	No	Upgrade flyscreens to aluminium mesh	2,475	882	1,218	2,685	2,656
5.5.3	Doors - side-hung external	Side-hung external doors shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		c) Doors and door frames comply with:								
		(i) Doors shall be:								
		(A) Non-combustible, or	Aluminium	Yes	Nil	0	0	0	0	0
		(B) solid timber, minimum thickness 35mm for the first 400mm above the threshold, or	Not used	n/a	Nil	0	0	0	0	0
		(C) have a non-combustible kickplate for the first 400mm above the threshold, or	Not used	n/a	Nil	0	0	0	0	0
		(D) be protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		(E) be made from materials specified for bushfire shutters, or from a timber species as specified in Paragraph E2, Appendix E	Not used	n/a	Nil	0	0	0	0	0
		(ii) glazing shall comply with the requirements for windows	Safety glass used to all doors	Yes	Nil	0	0	0	0	0
		(iii) Doors shall be tight fitting to the door frame and abutting doors	Doors shall be tight fitting to the door frame and abutting doors	Yes	Nil	0	0	0	0	0

Section 5 Construction for Bushfire Attack Level 12.5 (BAL 12.5)						Additional cost for complying with BAL 12.5				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 12.5	School	Kindergarten	Child care	Aged care	Hospital
		(iv) Door frame within 400mm of ground, deck, carport roof, awning or similar shall be:								
		(A) Bushfire-resisting timber	Not used	n/a	Nil	0	0	0	0	0
		(B) A timber species as Paragraph E2, Appendix E	Not used	n/a	Nil	0	0	0	0	0
		(C) Metal	Aluminium	Yes	Nil	0	0	0	0	0
		(D) metal-reinforced PVC-U	Not used	n/a	Nil	0	0	0	0	0
		(v) weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Yes	Nil	0	0	0	0	0
5.5.4	Doors - sliding doors	Sliding external doors shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		c) Door and door frame comply with:								
		(i) Glazing shall be Grade A safety glass	Safety glass used to all doors	Yes	Nil					
		(ii) Door and frame shall be:								
		(A) Bushfire-resisting timber	Not used	n/a	Nil	0	0	0	0	0
		(B) A timber species as Paragraph E2, Appendix E	Not used	n/a	Nil	0	0	0	0	0
		(C) Metal	Aluminium	Yes	Nil	0	0	0	0	0
		(D) metal-reinforced PVC-U	Not used	n/a	Nil	0	0	0	0	0
		(iii) No requirement for screens, but if screens are provided that must comply with Clause 5.5.1A.	Not used	n/a	Nil	0	0	0	0	0
		(iv) Sliding doors shall be tight-fitting in frames	Doors shall be tight fitting in frame	Yes	Nil	0	0	0	0	0
5.5.5	Doors - Vehicle access doors (garage doors)	Vehicle access doors shall be:								
		a) The lower portion of the door that is within 400mm of the ground when closed shall be:								
		(i) non-combustible material	Steel	Yes	Nil					
		(ii) Bushfire-resisting timber	Not used	n/a	Nil	0	0	0	0	0
		(iii) fibre-cement sheet, minimum 6mm thickness	Not used	n/a	Nil	0	0	0	0	0
		(iv) A timber species as Paragraph E1, Appendix E	Not used	n/a	Nil	0	0	0	0	0
		(v) A combination of any of the above	Not used	n/a	Nil	0	0	0	0	0

Section 5 Construction for Bushfire Attack Level 12.5 (BAL 12.5)						Additional cost for complying with BAL 12.5				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 12.5	School	Kindergarten	Child care	Aged care	Hospital
		(b) Panel lift, tilt up or side-hung doors shall have suitable weather strips, draught excluders, draught seals, guide tracks, as appropriate, with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0
		(c) Roller doors shall have guide tracks with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0
		(d) Vehicle access doors shall not have ventilation slots	Ventilation slots sometimes provided	No	Exclude ventilation slots (no cost)	0	0	0	0	0
5.6	**ROOFS**									
5.6.1	General	(a) Roof tiles, roof sheets and roof-covering accessories shall be non combustible	Steel	Yes	Nil	0	0	0	0	0
		(b) The roof/wall junction shall be sealed to prevent openings greater than 3mm either by the use of fascia and eaves linings or by sealing the top of the wall and the underside of the roof and between the rafters at the line of the wall	Fascia and eaves lining	Yes	Nil	0	0	0	0	0
		(c) Roof ventilation openings shall be fitted with suitable ember guards	Ventilation openings not fitted with ember guards	No	Fit ember guards to ventilation openings	1,654	165	331	3,308	2,756
5.6.2	Tiled roofs	Tiled roofs shall be fully sarked. The sarking shall:	Not used	n/a	Nil	0	0	0	0	0
		(a) be located on top of the roof faming (battens may be fixed above the sarking)	Not used	n/a	Nil	0	0	0	0	0
		(b) cover the entire roof including ridges and hips	Not used	n/a	Nil	0	0	0	0	0
		(c) extend into gutters and valleys	Not used	n/a	Nil	0	0	0	0	0
5.6.3	Sheet roofs	Sheet roofs shall:								
		(a) be fully sarked in accordance with 5.6.2 (foil backed insulation may be installed over battens)	Standard sarking treatment, not including ridges, hips, gutters, valleys	No	Extend sarking treatment to include ridges, hips, gutters, valleys	13,230	1,323	2,646	26,460	22,050

Section 5 Construction for Bushfire Attack Level 12.5 (BAL 12.5)						Additional cost for complying with BAL 12.5				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 12.5	School	Kindergarten	Child care	Aged care	Hospital
		(b) have any gaps greater than 3mm (such as under corrugations or ribs of sheet roofing and between roof components) sealed at the facsia or wall line and at valleys, hips and ridges by appropriate means as Clauses 5.6.3 (b) (i) to (iv)	No special gap treatment except as required to prevent excessive air, dust or vermin entry	No	Seal all gaps	6,600	2,100	2,900	9,300	8,500
5.6.4	Verandah, carport and awning roofs	The following apply to verandah, carport and awning roofs:								
		(a) if forming part of the main roof space, shall meet all requirements for the main roof	No sarking, ember guards or gap seal	No	Ember guards to ventilation openings - not required Provide sarking treatment to include ridges, hips, gutters, valleys Seal all gaps	1,650	165	330	3,300	2,750
		(b) is separated from the main roof by an external wall, shall have non-combustible roof covering	Steel roof	Yes	Nil	0	0	0	0	0
5.6.5	Roof penetrations	Roof penetrations to comply with the requirements of 5.6.5 (a), (b), (c), (d), (e), (f) and (g)	No special roof penetration treatment except as required to prevent water, excessive air, dust or vermin entry	No	Roof penetration treatment to minimum aperture sizes, upgrade glazing, upgrade tubular skylight flashings and evaporative cooler closers	6,615	662	1,323	13,230	11,025
5.6.6	Eaves linings, fascias and gables	(a) gables shall comply with Clause 5.4	Not used	n/a	Nil	0	0	0	0	0
		(b) eaves penetrations shall be protected the same as roof penetrations	Not used	n/a	Nil	0	0	0	0	0
		(c) eaves ventilation openings shall be fitted with suitable ember guards	Not used	n/a	Nil	0	0	0	0	0
5.6.7	Gutters and downpipes	Leaf guards to be non-combustible	Not used	n/a	Nil	0	0	0	0	0
		Box gutters to be non-combustible	Metal	Yes	Nil	0	0	0	0	0
5.7	**VERANDAHS, DECKS, STEPS, RAMPS AND LANDINGS**									
5.7.1	General	Nil	Nil	n/a	Nil	0	0	0	0	0
5.7.2	Enclosed sub-floor spaces of verandahs, decks, steps and landings									

Appendix C - Design requirements of BAL ratings on "Example" Class 9 buildings

Section 5 Construction for Bushfire Attack Level 12.5 (BAL 12.5)						Additional cost for complying with BAL 12.5				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 12.5	School	Kindergarten	Child care	Aged care	Hospital
5.7.2.1	Materials to enclose a sub-floor space	Where less than 400mm from the ground, shall comply with Clause 5.4	Nil	n/a	Nil	0	0	0	0	0
5.7.2.2	Supports	Nil	Nil	n/a	Nil	0	0	0	0	0
5.7.2.3	Framing	Nil	Nil	n/a	Nil	0	0	0	0	0
5.7.2.4	Decking, stair treads and the trafficable surfaces of ramps and landings	Where less than 300mm from a glazed element, shall be made from:								
		(a) non-combustible material, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) Bushfire-resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(c) A timber species as Paragraph E1, Appendix E, or	Not used	n/a	Nil	0	0	0	0	0
		(d) PVC-U, or	Not used	n/a	Nil	0	0	0	0	0
		(e) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
5.7.3	Unenclosed sub-floor spaces of verandahs, decks, steps and landings									
5.7.3.1	Supports	Nil	Nil	n/a	Nil	0	0	0	0	0
5.7.3.2	Framing	Nil	Nil	n/a	Nil	0	0	0	0	0
5.7.3.3	Decking, stair treads and the trafficable surfaces of ramps and landings	Where less than 300mm from a glazed element, shall be made from:								
		(a) non-combustible material, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) Bushfire-resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(c) A timber species as Paragraph E1, Appendix E, or	Not used	n/a	Nil	0	0	0	0	0
		(d) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
5.7.4	Balustrades, handrails or other barriers	Nil	Nil	n/a	Nil	0	0	0	0	0
5.8	**WATER AND GAS SUPPLY PIPES**									
	Above ground pipes	All above ground pipes shall be metal	Metal	Yes	Nil	0	0	0	0	0
					Total	**39,154**	**6,884**	**10,940**	**64,825**	**59,300**
					% of building cost	**0.7%**	**1.0%**	**0.8%**	**0.4%**	**0.3%**

Section 6 Construction for Bushfire Attack Level 19 (BAL 19)				Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice		Additional cost for complying with BAL 19				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating		Additional design requirements to meet BAL 19	School	Kindergarten	Child care	Aged care	Hospital
				n/a = relevant part of AS 3959 not applicable to 'Example' building						
6.1	**GENERAL**									
6.2	**SUBFLOOR SUPPORTS**									
6.3	FLOORS									
6.3.1	Concrete slabs on ground	Nil	Nil	n/a	Nil	0	0	0	0	0
6.3.2	Elevated Floors	Nil	Nil	n/a	Nil	0	0	0	0	0
6.4	**EXTERNAL WALLS**									
6.4.1	Walls	Exposed external walls within 400mm of ground, deck, carport roof, awning or similar shall be:								
		a) non-combustible, or	Masonry cladding	Yes	Nil	0	0	0	0	0
		b) timber logs as per 6.4.1 (b), or	Not used	n/a	Nil	0	0	0	0	0
		c) cladding as per 6.4.1 (c), or	Not used	n/a	Nil	0	0	0	0	0
		d) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
6.4.2	Joints	All joints in external walls to be treated to prevent gaps greater than 3mm	No special gap treatment except as required to prevent excessive air, dust or vermin entry	No	Joints treated to prevent gaps greater than 3mm, including but not limited to: - ends of roof sheets at gutters, ridges, hips and valleys - around windows and doors - at eaves	5,775	1,323	1,827	5,452	7,969
6.4.3	Vents and weepholes	To be screened with mesh as per 6.4.3	Vents and weepholes not screened	No	To be screened with mesh as per 5.4.3	1,155	265	365	1,090	1,594
6.5	**EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS**									
6.5.1	Bushfire shutters	Where fitted, bushfire shutters are to be as per Clauses 3.7 and 6.5.1	Not used	n/a	Nil	0	0	0	0	0
6.5.1A	Screens for windows and doors	Where fitted, bushfire shutters are to be as per Clause 6.5.1A	Not used	n/a	Nil	0	0	0	0	0
6.5.2	Windows	Windows shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		c) Windows shall comply with: (i) Windows within 400mm of ground, deck, carport roof, awning or similar shall be:								

Section 6 Construction for Bushfire Attack Level 19 (BAL 19)						Additional cost for complying with BAL 19				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 19	School	Kindergarten	Child care	Aged care	Hospital
		(A) Bushfire-resisting timber, or	Not used	n/a	Nil	0	0	0	0	0
		(B) A timber species as Paragraph E2, Appendix E, or	Not used	n/a	Nil	0	0	0	0	0
		(C) Metal, or	Aluminium	Yes	Nil	0	0	0	0	0
		(D) Metal-reinforced PVC-U, or	Not used	n/a	Nil	0	0	0	0	0
		(ii) External hardware to sashes shall be metal	Metal	Yes	Nil	0	0	0	0	0
		(iii) Glazing within 400mm of ground, deck, carport roof, awning or similar shall be toughened glass minimum 5mm thick	Safety glass used below 900mm	Yes	Upgrade glass below 400mm to toughened	5,940	2,117	2,923	6,445	6,375
		(iv) Other glazing may be annealed glass	Annealed glass	Yes	Nil	0	0	0	0	0
		(v) Toughened glass, where used, shall be minimum 5mm thickness and openable portions of windows to be screened with screens that comply with Clause 6.5.1A	Fibreglass mesh flyscreens	No	Upgrade flyscreens to aluminium mesh	2,475	882	1,218	2,685	2,656
		(vi) Glazed elements designed to take internal screens shall use toughened glass and the openable portion shall be screened with screens that comply with 6.5.1A	Annealed glass used	No	Upgrade glass to toughened to all windows where the screen is on the inside	3,094	1,103	1,523	3,357	3,320
6.5.3	Doors - side-hung external	Side-hung external doors shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		c) Doors and door frames comply with:								
		(i) Doors shall be:								
		(A) Non-combustible, or	Aluminium	Yes	Nil	0	0	0	0	0
		(B) solid timber, minimum thickness 35mm for the first 400mm above the threshold, or	Not used	n/a	Nil	0	0	0	0	0
		(C) have a non-combustible kickplate for the first 400mm above the threshold, or	Not used	n/a	Nil	0	0	0	0	0
		(D) be protected by screens, or	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 19 (BAL 19)						Additional cost for complying with BAL 19				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 19	School	Kindergarten	Child care	Aged care	Hospital
		(E) a fully framed glazed door where the framing is made from material required for bushfire shutters or from a timber species as Paragraph E2, Appendix E	Not used	n/a	Nil	0	0	0	0	0
		(ii) glazing shall comply with the requirements for windows	Safety glass used to all doors	Yes	Nil	0	0	0	0	0
		(iii) Doors shall be tight fitting to the door frame and abutting doors	Doors shall be tight fitting to the door frame and abutting doors	Yes	Nil	0	0	0	0	0
		(iv) Door frame within 400mm of ground, deck, carport roof, awning or similar shall be:								
		(A) Bushfire-resisting timber	Not used	n/a	Nil	0	0	0	0	0
		(B) A timber species as Paragraph E2, Appendix E	Not used	n/a	Nil	0	0	0	0	0
		(C) Metal	Aluminium	Yes	Nil	0	0	0	0	0
		(D) metal-reinforced PVC-U	Not used	n/a	Nil	0	0	0	0	0
		(v) weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Yes	Nil	0	0	0	0	0
6.5.4	Doors - sliding doors	Sliding external doors shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		c) Door and door frame comply with:								
		(i) Glazing shall be Grade A safety glass	Safety glass used to all doors	Yes	Nil					
		(ii) Door and frame shall be:								
		(A) Bushfire-resisting timber	Not used	n/a	Nil	0	0	0	0	0
		(B) A timber species as Paragraph E2, Appendix E	Not used	n/a	Nil	0	0	0	0	0
		(C) Metal	Aluminium	Yes	Nil	0	0	0	0	0
		(D) metal-reinforced PVC-U	Not used	n/a	Nil	0	0	0	0	0
		(iii) No requirement for screens, but if screens are provided that must comply with Clause 6.5.1A.	Not used	n/a	Nil	0	0	0	0	0
		(iv) Sliding doors shall be tight-fitting in frames	Doors shall be tight fitting in frame	Yes	Nil	0	0	0	0	0
6.5.5	Doors - Vehicle access doors	Vehicle access doors shall be:								

Section 6 Construction for Bushfire Attack Level 19 (BAL 19)						Additional cost for complying with BAL 19				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 19	School	Kindergarten	Child care	Aged care	Hospital
	(garage doors)	a) The lower portion of the door that is within 400mm of the ground when closed shall be:								
		(i) non-combustible material	Steel	Yes	Nil					
		(ii) Bushfire-resisting timber	Not used	n/a	Nil	0	0	0	0	0
		(iii) fibre-cement sheet, minimum 6mm thickness	Not used	n/a	Nil	0	0	0	0	0
		(iv) A timber species as Paragraph E1, Appendix E	Not used	n/a	Nil	0	0	0	0	0
		(v) A combination of any of the above	Not used	n/a	Nil	0	0	0	0	0
		(b) Panel lift, tilt up or side-hung doors shall have suitable weather strips, draught excluders, draught seals, guide tracks, as appropriate, with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0
		(c) Roller doors shall have guide tracks with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0
		(d) Vehicle access doors shall not have ventilation slots	Ventilation slots sometimes provided	No	Exclude ventilation slots (no cost)	0	0	0	0	0
6.6	**ROOFS**									
6.6.1	General	(a) Roof tiles, roof sheets and roof-covering accessories shall be non combustible	Steel	Yes	Nil	0	0	0	0	0
		(b) The roof/wall junction shall be sealed to prevent openings greater than 3mm either by the use of fascia and eaves linings or by sealing the top of the wall and the underside of the roof and between the rafters at the line of the wall	Fascia and eaves lining	Yes	Nil	0	0	0	0	0
		(c) Roof ventilation openings shall be fitted with suitable ember guards	Ventilation openings not fitted with ember guards	No	Fit ember guards to ventilation openings	1,654	165	331	3,308	2,756
6.6.2	Tiled roofs	Tiled roofs shall be fully sarked. The sarking shall:	Not used	n/a	Nil	0	0	0	0	0
		(a) be located on top of the roof faming (battens may be fixed above the sarking)	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 19 (BAL 19)						Additional cost for complying with BAL 19				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 19	School	Kindergarten	Child care	Aged care	Hospital
		(b) cover the entire roof including ridges and hips	Not used	n/a	Nil	0	0	0	0	0
		(c) extend into gutters and valleys	Not used	n/a	Nil	0	0	0	0	0
6.6.3	Sheet roofs	Sheet roofs shall:								
		(a) be fully sarked in accordance with 6.6.2 (foil backed insulation may be installed over battens)	Standard sarking treatment, not including ridges, hips, gutters, valleys	No	Extend sarking treatment to include ridges, hips, gutters, valleys	13,230	1,323	2,646	26,460	22,050
		(b) have any gaps greater than 3mm (such as under corrugations or ribs of sheet roofing and between roof components) sealed at the facsia or wall line and at valleys, hips and ridges by appropriate means as Clauses 6.6.3 (b) (i) to (iv)	No special gap treatment except as required to prevent excessive air, dust or vermin entry	No	Seal all gaps	6,600	2,100	2,900	9,300	8,500
6.6.4	Verandah, carport and awning roofs	The following apply to verandah, carport and awning roofs:								
		(a) if forming part of the main roof space, shall meet all requirements for the main roof	No sarking, ember guards or gap seal	No	Ember guards to ventilation openings - not required Provide sarking treatment to include ridges, hips, gutters, valleys Seal all gaps	1,650	165	330	3,300	2,750
		(b) is separated from the main roof by an external wall, shall have non-combustible roof covering	Steel roof	Yes	Nil	0	0	0	0	0
6.6.5	Roof penetrations	Roof penetrations to comply with the requirements of 6.6.5 (a), (b), (c), (d), (e) and (f)	No special roof penetration treatment except as required to prevent water, excessive air, dust or vermin entry. Vent pipes made from PVC.	No	Roof penetration treatment to minimum aperture sizes, upgrade glazing, upgrade tubular skylight flashings and evaporative cooler closers. Vent pipes made of metal.	8,269	827	1,654	16,538	13,781
6.6.6	Eaves linings, fascias and gables	(a) gables shall comply with Clause 6.4	Not used	n/a	Nil	0	0	0	0	0
		(b) eaves penetrations shall be protected the same as roof penetrations	Not used	n/a	Nil	0	0	0	0	0
		(c) eaves ventilation openings shall be fitted with suitable ember guards	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 19 (BAL 19)			Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 19	Additional cost for complying with BAL 19				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)				School	Kindergarten	Child care	Aged care	Hospital
6.6.7	Gutters and downpipes	Leaf guards to be non-combustible	Not used	n/a	Nil	0	0	0	0	0
		Box gutters to be non-combustible and flashed at the roof junction with non-combustible material	Metal	Yes	Nil	0	0	0	0	0
6.7	**VERANDAHS, DECKS, STEPS, RAMPS AND LANDINGS**									
6.7.1	General	Nil	Nil	n/a	Nil	0	0	0	0	0
6.7.2	Enclosed sub-floor spaces of verandahs, decks, steps and landings									
6.7.2.1	Materials to enclose a sub-floor space	Where less than 400mm from the ground, shall comply with Clause 6.4	Nil	n/a	Nil	0	0	0	0	0
6.7.2.2	Supports	Nil	Nil	n/a	Nil	0	0	0	0	0
6.7.2.3	Framing	Nil	Nil	n/a	Nil	0	0	0	0	0
6.7.2.4	Decking, stair treads and the trafficable surfaces of ramps and landings	Where less than 300mm from a glazed element, shall be made from:								
		(a) non-combustible material, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) Bushfire-resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(c) A timber species as Paragraph E1, Appendix E, or	Not used	n/a	Nil	0	0	0	0	0
		(d) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
6.7.3	Unenclosed sub-floor spaces of verandahs, decks, steps and landings									
6.7.3.1	Supports	Nil	Nil	n/a	Nil	0	0	0	0	0
6.7.3.2	Framing	Nil	Nil	n/a	Nil	0	0	0	0	0
6.7.3.3	Decking, stair treads and the trafficable surfaces of ramps and landings	Where less than 300mm from a glazed element, shall be made from:								
		(a) non-combustible material, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) Bushfire-resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(c) A timber species as Paragraph E1, Appendix E, or	Not used	n/a	Nil	0	0	0	0	0
		(d) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
6.7.2.5	Balustrades, handrails or other barriers	Nil	Nil	n/a	Nil	0	0	0	0	0
6.8	**WATER AND GAS SUPPLY PIPES**									

Appendix C - Design requirements of BAL ratings on "Example" Class 9 buildings

Section 6 Construction for Bushfire Attack Level 19 (BAL 19)						Additional cost for complying with BAL 19				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 19	School	Kindergarten	Child care	Aged care	Hospital
	Above ground pipes	All above ground pipes shall be metal	Metal	Yes	Nil	0	0	0	0	0
					Total	**49,841**	**10,269**	**15,717**	**77,935**	**71,752**
					% of building cost	**0.9%**	**1.4%**	**1.1%**	**0.5%**	**0.4%**

Section 6 Construction for Bushfire Attack Level 29 (BAL 29)						Additional cost for complying with BAL 29				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 29	School	Kindergarten	Child care	Aged care	Hospital
				n/a = relevant part of AS 3959 not applicable to 'Example' building						
7.1	**GENERAL**									
7.2	**SUBFLOOR SUPPORTS**	No requirements where subfloor space is enclosed with:								
		(a) a wall that complies with 7.4, or	Not used	n/a	Nil	0	0	0	0	0
		(b) mesh that complies with 7.2 (b), or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
		Where subfloor space is unenclosed, all support framing shall be:								
		(a) a non-combustible material, or	Not used	n/a	Nil	0	0	0	0	0
		(b) bushfire resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
7.3	FLOORS									
7.3.1	Concrete slabs on ground	Nil	Nil	n/a	Nil	0	0	0	0	0
7.3.2	Elevated Floors	Nil	Nil	n/a	Nil	0	0	0	0	0
7.3.2.1	Enclosed subfloor space	No requirements where subfloor space is enclosed with:								
		(a) a wall that complies with 7.4, or	Not used	n/a	Nil	0	0	0	0	0
		(b) mesh that complies with 7.2 (b), or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
7.3.2.2	Unenclosed subfloor space	Where the subfloor space is unenclosed, the bearers, joists and flooring less than 400mm above finished ground level shall be:								
		(a) Materials that comply with the following:	Not used	n/a	Nil	0	0	0	0	0
		(i) Bearers and joists shall be:	Not used	n/a	Nil	0	0	0	0	0
		(A) non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(B) bushfire resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(C) a combination of (A) and (B)	Not used	n/a	Nil	0	0	0	0	0
		(ii) Flooring shall be:	Not used	n/a	Nil	0	0	0	0	0
		(A) non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(B) bushfire resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(C) timber, particleboard or plywood where the underside is lined with sarking or mineral wool insulation	Not used	n/a	Nil	0	0	0	0	0
		(D) a combination of (A), (B) and (C)	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 29 (BAL 29)						Additional cost for complying with BAL 29				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 29	School	Kindergarten	Child care	Aged care	Hospital
		(b) a system complying with AS 1530.8.1	Not used	n/a	Nil	0	0	0	0	0
7.4	**EXTERNAL WALLS**									
7.4.1	Walls	Exposed external walls shall be:								
		a) non-combustible, or	Masonry cladding	Yes	Nil	0	0	0	0	0
		b) timber logs as per 7.4.1 (b), or	Not used	n/a	Nil	0	0	0	0	0
		c) cladding as per 7.4.1 (c) or	Not used	n/a	Nil	0	0	0	0	0
		d) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
7.4.2	Joints	All joints in external walls to be treated to prevent gaps greater than 3mm	No special gap treatment except as required to prevent excessive air, dust or vermin entry	No	Joints treated to prevent gaps greater than 3mm, including but not limited to: - ends of roof sheets at gutters, ridges, hips and valleys - around windows and doors - at eaves	5,775	1,323	1,827	5,452	7,969
7.4.3	Vents and weepholes	To be screened with mesh as per 7.4.3	Vents and weepholes not screened	No	To be screened with mesh as per 5.4.3	1,155	265	365	1,090	1,594
7.5	**EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS**									
7.5.1	Bushfire shutters	Where fitted, bushfire shutters are to be as per Clauses 3.7 and 7.5.1	Not used	n/a	Nil	0	0	0	0	0
7.5.1A	Screens for windows and doors	Where fitted, screens are to be as per Clause 7.5.1A	Not used	n/a	Nil	0	0	0	0	0
7.5.2	Windows	Windows shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) Windows shall be:								
		(i) Window frames and joinery shall be made from:								
		(A) Bushfire-resisting timber, or	Not used	n/a	Nil	0	0	0	0	0
		(B) Metal, or	Aluminium	Yes	Nil	0	0	0	0	0
		(C) Metal-reinforced PVC-U, or	Not used	n/a	Nil	0	0	0	0	0
		(ii) External hardware to sashes shall be metal	Metal	Yes	Nil	0	0	0	0	0
		(iii) Glazing shall be toughened glass minimum 5mm thick	Safety glass used below 900mm	No	Upgrade all glass to toughened	29,700	10,584	14,616	32,225	31,875
		(iv) Glazing within 400mm of ground, deck, carport roof, awning or similar shall be screened with screens that comply with 7.5.1A	No screens	No	Screens to all windows within 400mm of ground etc	24,750	8,820	12,180	26,854	26,563

Section 6 Construction for Bushfire Attack Level 29 (BAL 29)						Additional cost for complying with BAL 29				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 29	School	Kindergarten	Child care	Aged care	Hospital
		(v) Openable portions of windows to be screened with screens that comply with Clause 7.5.1A	Fibreglass mesh flyscreens	No	Upgrade flyscreens to aluminium mesh	2,475	882	1,218	2,685	2,656
7.5.3	Doors - side-hung external	Side-hung external doors shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		c) Doors and door frames comply with:								
		(i) Doors shall be:								
		(A) Non-combustible, or	Aluminium	Yes	Nil	0	0	0	0	0
		(B) solid timber, minimum thickness 35mm for the first 400mm above the threshold, or	Not used	n/a	Nil	0	0	0	0	0
		(C) be protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		(D) a fully framed glazed door where the framing is made from non-combustible materials or from bushfire-resisting timber	Not used	n/a	Nil	0	0	0	0	0
		(ii) externally fitted hardware shall be metal	Metal	Yes	Nil	0	0	0	0	0
		(iii) glazing shall be toughened glass minimum 6mm thick	Safety glass used	No	Upgrade all glass to toughened	1,485	529	731	1,611	1,594
		(iv) Glazing within 400mm of ground, deck, carport roof, awning or similar shall be screened with screens that comply with 7.5.1A	No screens	No	Screens to all glazed doors within 400mm of ground etc	6,188	2,205	3,045	6,713	6,641
		(v) Door frames shall be made from:								
		(A) Bushfire-resisting timber, or	Not used	n/a	Nil	0	0	0	0	0
		(B) Metal, or	Aluminium	Yes	Nil	0	0	0	0	0
		(C) Metal-reinforced PVC-U, or	Not used	n/a	Nil	0	0	0	0	0
		(vi) Doors shall be tight fitting to the door frame and abutting doors	Doors shall be tight fitting to the door frame and abutting doors	Yes	Nil	0	0	0	0	0
		(vii) weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Yes	Nil	0	0	0	0	0
7.5.4	Doors - sliding doors	Sliding external doors shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) protected by screens, or	Not used	n/a	Nil	0	0	0	0	0
		c) Shall comply with:								
		(i) Door and frame shall be made of:								
		(A) Bushfire-resisting timber, or	Not used	n/a	Nil	0	0	0	0	0
		(B) Metal, or	Aluminium	Yes	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 29 (BAL 29)						Additional cost for complying with BAL 29				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 29	School	Kindergarten	Child care	Aged care	Hospital
		(C) Metal-reinforced PVC-U, or	Not used	n/a	Nil	0	0	0	0	0
		(ii) externally fitted hardware shall be metal	Metal	Yes	Nil	0	0	0	0	0
		(iii) glazing shall be toughened glass minimum 6mm thick	Safety glass used	No	Upgrade all glass to toughened	594	212	292	644	638
		(iv) Sliding doors shall be tight-fitting in frames	Doors shall be tight fitting in frame	Yes	Nil	0	0	0	0	0
7.5.5	Doors - Vehicle access doors (garage doors)	Vehicle access doors:								
		a) Shall be made from:								
		(i) non-combustible material	Steel	Yes	Nil					
		(ii) Bushfire-resisting timber	Not used	n/a	Nil	0	0	0	0	0
		(iii) fibre-cement sheet, minimum 6mm thickness	Not used	n/a	Nil	0	0	0	0	0
		(iv) A combination of any of the above	Not used	n/a	Nil	0	0	0	0	0
		(b) Panel lift, tilt up or side-hung doors shall have suitable weather strips, draught excluders, draught seals, guide tracks, as appropriate, with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0
		(c) Roller doors shall have guide tracks with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0
		(d) Vehicle access doors shall not have ventilation slots	Ventilation slots sometimes provided	No	Exclude ventilation slots (no cost)	0	0	0	0	0
7.6	**ROOFS**									
7.6.1	General	(a) Roof tiles, roof sheets and roof-covering accessories shall be non combustible	Steel	Yes	Nil	0	0	0	0	0
		(b) The roof/wall junction shall be sealed to prevent openings greater than 3mm either by the use of fascia and eaves linings or by sealing the top of the wall and the underside of the roof and between the rafters at the line of the wall	Fascia and eaves lining	Yes	Nil	0	0	0	0	0
		(c) Roof ventilation openings shall be fitted with suitable ember guards	Ventilation openings not fitted with ember guards	No	Fit ember guards to ventilation openings	1,654	165	331	3,308	2,756
		(d) pipes or conduits that penetrate the roof covering shall be non-combustible	See 7.6.5		See 7.6.5	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 29 (BAL 29)						Additional cost for complying with BAL 29				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 29	School	Kindergarten	Child care	Aged care	Hospital
7.6.2	Tiled roofs	Tiled roofs shall be fully sarked. The sarking shall:	Not used	n/a	Nil	0	0	0	0	0
		(a) be located on top of the roof faming (battens may be fixed above the sarking)	Not used	n/a	Nil	0	0	0	0	0
		(b) cover the entire roof including ridges and hips	Not used	n/a	Nil	0	0	0	0	0
		(c) extend into gutters and valleys	Not used	n/a	Nil	0	0	0	0	0
7.6.3	Sheet roofs	Sheet roofs shall:								
		(a) be fully sarked in accordance with 7.6.2 (foil backed insulation may be installed over battens)	Standard sarking treatment, not including ridges, hips, gutters, valleys	No	Extend sarking treatment to include ridges, hips, gutters, valleys	13,230	1,323	2,646	26,460	22,050
		(b) have any gaps greater than 3mm (such as under corrugations or ribs of sheet roofing and between roof components) sealed at the facsia or wall line and at valleys, hips and ridges by appropriate means as Clauses 7.6.3 (b) (i) to (iv)	No special gap treatment except as required to prevent excessive air, dust or vermin entry	No	Seal all gaps	6,600	2,100	2,900	9,300	8,500
7.6.4	Verandah, carport and awning roofs	The following apply to verandah, carport and awning roofs:								
		(a) if forming part of the main roof space, shall meet all requirements for the main roof	No sarking, ember guards or gap seali	No	Ember guards to ventilation openings - not required Provide sarking treatment to include ridges, hips, gutters, valleys Seal all gaps	1,650	165	330	3,300	2,750
		(b) is separated from the main roof by an external wall, shall have non-combustible roof covering and the support structure shall comply with 7.6.4 (b) (i) to (iv)	Steel roof, steel framing and supports	Yes	Nil	0	0	0	0	0
7.6.5	Roof penetrations	Roof penetrations to comply with the requirements of 7.6.5 (a), (b), (c), (d), (e), (f), (g) and (h)	No special roof penetration treatment except as required to prevent water, excessive air, dust or vermin entry. Vent pipes made from PVC.	No	Roof penetration treatment to minimum aperture sizes, upgrade glazing, upgrade tubular skylight flashings, upgrade skylight glazing and evaporative cooler closers. Vent pipes made of metal.	9,923	992	1,985	19,845	16,538
7.6.6	Eaves linings, fascias and gables	(a) gables shall comply with Clause 7.4	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 29 (BAL 29)						Additional cost for complying with BAL 29				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 29	School	Kindergarten	Child care	Aged care	Hospital
		(b) Fascias and barge boards shall be:								
		(i) bushfire-resisting timber	Standard timber used	No	Upgrade to bushfire resistant timber	11,550	3,675	5,075	16,275	14,875
		(ii) metal fixed at 450mm centres	Not used	n/a	Nil	0	0	0	0	0
		(iii) a combination of (i) and (ii)	Not used	n/a	Nil	0	0	0	0	0
		(c) Eaves linings shall be:								
		(i) fibre cement sheet, minimum 4.5mm thickness	fc sheet, minimum 6mm thick	Yes	Nil	0	0	0	0	0
		(ii) bushfire-resisting timber	Not used	n/a	Nil	0	0	0	0	0
		(iii) a combination of (i) and (ii)	Not used	n/a	Nil	0	0	0	0	0
		(d) eaves penetrations shall be protected the same as roof penetrations	Not used	n/a	Nil	0	0	0	0	0
		(e) eaves ventilation openings shall be fitted with suitable ember guards	Not used	n/a	Nil	0	0	0	0	0
		(f) joints may be sealed with plastic joining strips or timebr storm moulds	Not used	n/a	Nil	0	0	0	0	0
7.6.7	Gutters and downpipes	Leaf guards to be non-combustible	Not used	n/a	Nil	0	0	0	0	0
		Box gutters to be non-combustible and flashed at the roof junction with non-combustible material	Metal	Yes	Nil	0	0	0	0	0
7.7	**VERANDAHS, DECKS, STEPS, RAMPS AND LANDINGS**									
7.7.1	General	Nil	Nil	n/a	Nil	0	0	0	0	0
7.7.2	Enclosed sub-floor spaces of verandahs, decks, steps and landings									
7.7.2.1	Materials to enclose a sub-floor space	The subfloor space is deemed to be enclosed when:	Nil	n/a	Nil	0	0	0	0	0
		(a) a material is used to enclose the subfloor space that complies with 7.4, or	Not used	n/a	Nil	0	0	0	0	0
		(b) all openings are screened as 7.7.2.1 (b)	Not used	n/a	Nil	0	0	0	0	0
7.7.2.2	Supports	Nil	Nil	n/a	Nil	0	0	0	0	0
7.7.2.3	Framing	Nil	Nil	n/a	Nil	0	0	0	0	0
7.7.2.4	Decking, stair treads and the trafficable surfaces of ramps and landings	Shall be made from:								
		(a) non-combustible material, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) Bushfire-resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(c) A timber species as Paragraph E1, Appendix E, or	Not used	n/a	Nil	0	0	0	0	0
		(d) a combination of the above	Not used	n/a	Nil	0	0	0	0	0

Appendix C - Design requirements of BAL ratings on "Example" Class 9 buildings

Section 6 Construction for Bushfire Attack Level 29 (BAL 29)			Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 29	Additional cost for complying with BAL 29				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)				School	Kindergarten	Child care	Aged care	Hospital
7.7.3	Unenclosed sub-floor spaces of verandahs, decks, steps and landings									
7.7.3.1	Supports	Nil	Nil	n/a	Nil	0	0	0	0	0
7.7.3.2	Framing	Supports and faming shall be	Nil	n/a	Nil	0	0	0	0	0
		(a) non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(b) bushfire resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
7.7.3.3	Decking, stair treads and the trafficable surfaces of ramps and landings	Shall be made from:								
		(a) non-combustible material, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) Bushfire-resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
7.7.2.5	Balustrades, handrails or other barriers	Balustrades and handrails less than 125mm from glazing shall be made from:								
		(a) non-combustible material, or	Steel	Yes	Nil	0	0	0	0	0
		(b) Bushfire-resisting timber (see Appendix F), or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
7.8	**WATER AND GAS SUPPLY PIPES**									
	Above ground pipes	All above ground pipes shall be metal	Metal	Yes	Nil	0	0	0	0	0
					Total	**116,728**	**33,240**	**47,541**	**155,763**	**146,997**
					% of building cost	**2.1%**	**4.6%**	**3.4%**	**1.0%**	**0.8%**

Section 6 Construction for Bushfire Attack Level 40 (BAL 40)				Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice		Additional cost for complying with BAL 40				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating		Additional design requirements to meet BAL 40	School	Kindergarten	Child care	Aged care	Hospital
				n/a = relevant part of AS 3959 not applicable to 'Example' building						
8.1	**GENERAL**									
8.2	**SUBFLOOR SUPPORTS**	No requirements where subfloor space is enclosed with a wall that complies with 8.4	Not used	n/a	Nil	0	0	0	0	0
		Where unenclosed, the supports and framing shall be:	Not used	n/a	Nil	0	0	0	0	0
		(a) of non-combustible material, or	Not used	n/a	Nil	0	0	0	0	0
		(b) a system complying with AS 1530.8.1, or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
8.3	FLOORS									
8.3.1	Concrete slabs on ground	Nil	Nil	n/a	Nil	0	0	0	0	0
8.3.2	Elevated Floors	Nil	Nil	n/a	Nil	0	0	0	0	0
8.3.2.1	Enclosed subfloor space	No requirements where subfloor space is enclosed with a wall that complies with 8.4.	Not used	n/a	Nil	0	0	0	0	0
8.3.2.2	Unenclosed subfloor space	Where the subfloor space is unenclosed, the bearers, joists and flooring shall:								
		(a) be non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(b) have the underside of the floor system lined with a non-combustible material, or	Not used	n/a	Nil	0	0	0	0	0
		(c) be a system complying with AS 1530.8.1	Not used	n/a	Nil	0	0	0	0	0
		(d) a combination of (a), (b) and (c)	Not used	n/a	Nil	0	0	0	0	0
8.4	**EXTERNAL WALLS**									
8.4.1	Walls	Exposed external walls shall be:								
		(a) non-combustible, or	Masonry cladding	Yes	Nil	0	0	0	0	0
		(b) cladding as per 8.4.1 (b) or	Not used	n/a	Nil	0	0	0	0	0
		(c) be a system complying with AS 1530.8.1	Not used	n/a	Nil	0	0	0	0	0
		(d) a combination of (a), (b) and (c)	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 40 (BAL 40)						Additional cost for complying with BAL 40				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 40	School	Kindergarten	Child care	Aged care	Hospital
8.4.2	Joints	All joints in external walls to be treated to prevent gaps greater than 3mm	No special gap treatment except as required to prevent excessive air, dust or vermin entry	No	Joints treated to prevent gaps greater than 3mm, including but not limited to: - ends of roof sheets at gutters, ridges, hips and valleys - around windows and doors - at eaves	5,775	1,323	1,827	5,452	7,969
8.4.3	Vents and weepholes	To be screened with mesh as per 8.4.3	Vents and weepholes not screened	No	To be screened with mesh as per 5.4.3	1,155	265	365	1,090	1,594
8.5	**EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS**									
8.5.1	Bushfire shutters	Where fitted, bushfire shutters are to be as per Clauses 3.7 and 8.5.1	Not used	n/a	Nil	0	0	0	0	0
8.5.1A	Screens for windows and doors	Where fitted, screens are to be as per Clause 8.5.1A	Not used	n/a	Nil	0	0	0	0	0
8.5.2	Windows	Windows shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) Windows shall be:								
		(i) Window frames and and hardware shall be metal	Metal	Yes	Nil	0	0	0	0	0
		(ii) Glazing shall be toughened glass minimum 6mm thick	Safety glass used below 900mm	No	Upgrade all glass to 6mm toughened	34,650	12,348	17,052	37,595	37,188
		(iii) Openable and fixed portions shall be screened with screens that comply with 8.5.1A	No screens	No	Screens to all windows	123,750	44,100	60,900	134,269	132,813
		(iv) Seals shall comply with 8.5.2 (b) (iv)	Standard seals used	No	Upgrade seals to comply with 8.5.2 (b) (iv)	2,475	882	1,218	2,685	2,656
8.5.3	Doors - side-hung external	Side-hung external doors shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) Doors and door frames comply with:								
		(i) Doors shall be:								
		(A) Non-combustible, or	Aluminium	Yes	Nil	0	0	0	0	0
		(B) solid timber, minimum thickness 35mm for the first 400mm above the threshold, or	Not used	n/a	Nil	0	0	0	0	0
		(C) a fully framed glazed door where the framing is made from non-combustible materials	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 40 (BAL 40)						Additional cost for complying with BAL 40				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 40	School	Kindergarten	Child care	Aged care	Hospital
		(ii) externally fitted hardware shall be metal	Metal	Yes	Nil	0	0	0	0	0
		(iii) glazing shall be toughened glass minimum 6mm thick	Safety glass used	No	Upgrade all glass to toughened	1,485	529	731	1,611	1,594
		(iv) Glazing within 400mm of ground, deck, carport roof, awning or similar shall be screened with screens that comply with 8.5.1A	No screens	No	Screens to all glazed doors within 400mm of ground etc	6,188	2,205	3,045	6,713	6,641
		(v) Seals shall comply with 8.5.3 (b) (v)	Standard seals used	No	Upgrade seals to comply with 8.5.3 (b) (v)	124	44	61	134	133
		(vi) Door frames shall be metal	Aluminium	Yes	Nil	0	0	0	0	0
		(vii) Doors shall be tight fitting to the door frame and abutting doors	Doors shall be tight fitting to the door frame and abutting doors	Yes	Nil	0	0	0	0	0
		(vii) weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Yes	Nil	0	0	0	0	0
8.5.4	Doors - sliding doors	Sliding external doors shall be:								
		a) protected by bushfire shutters, or	Not used	n/a	Nil	0	0	0	0	0
		b) Shall comply with:								
		(i) Door and frame shall be metal	Aluminium	Yes	Nil	0	0	0	0	0
		(ii) externally fitted hardware shall be metal	Metal	Yes	Nil	0	0	0	0	0
		(iii) glazing shall be toughened glass minimum 6mm thick	Safety glass used	No	Upgrade all glass to toughened	594	212	292	644	638
		(iv) Seals shall comply with 8.5.4 (b) (iv)	Standard seals used	No	Upgrade seals to comply with 8.5.3 (b) (v)	50	18	24	54	53
		(v) Sliding doors shall be tight-fitting in frames	Doors shall be tight fitting in frame	Yes	Nil	0	0	0	0	0
8.5.5	Doors - Vehicle access doors	Vehicle access doors:								
	(garage doors)	(a) Shall be non-combustible	Steel	Yes	Nil	0	0	0	0	0
		(b) Panel lift, tilt up or side-hung doors shall have suitable weather strips, draught excluders, draught seals, guide tracks, as appropriate, with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0
		(c) Roller doors shall have guide tracks with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 40 (BAL 40)						Additional cost for complying with BAL 40				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 40	School	Kindergarten	Child care	Aged care	Hospital
		(d) Vehicle access doors shall not have ventilation slots	Ventilation slots sometimes provided	No	Exclude ventilation slots (no cost)	0	0	0	0	0
8.6	**ROOFS**									
8.6.1	General	(a) Roof tiles, roof sheets and roof-covering accessories shall be non combustible	Steel	Yes	Nil	0	0	0	0	0
		(b) The roof/wall junction shall be sealed to prevent openings greater than 3mm either by the use of fascia and eaves linings or by sealing the top of the wall and the underside of the roof and between the rafters at the line of the wall	Fascia and eaves lining	Yes	Nil	0	0	0	0	0
		(c) Roof ventilation openings shall be fitted with suitable ember guards	Ventilation openings not fitted with ember guards	No	Fit ember guards to ventilation openings	1,654	165	331	3,308	2,756
		(d) pipes or conduits that penetrate the roof covering shall be non-combustible	See 8.6.5		See 8.6.5	0	0	0	0	0
		Roof mounted evaporative coolers are excluded	Not used	n/a	Nil	0	0	0	0	0
8.6.2	Tiled roofs	Tiled roofs shall be fully sarked. The sarking shall:	Not used	n/a	Nil	0	0	0	0	0
		(a) be located on top of the roof faming (battens may be fixed above the sarking)	Not used	n/a	Nil	0	0	0	0	0
		(b) cover the entire roof including ridges and hips	Not used	n/a	Nil	0	0	0	0	0
		(c) extend into gutters and valleys	Not used	n/a	Nil	0	0	0	0	0
8.6.3	Sheet roofs	Sheet roofs shall:								
		(a) be fully sarked in accordance with 8.6.2 (foil backed insulation may be installed over battens)	Standard sarking treatment, not including ridges, hips, gutters, valleys	No	Extend sarking treatment to include ridges, hips, gutters, valleys	13,230	1,323	2,646	26,460	22,050

Section 6 Construction for Bushfire Attack Level 40 (BAL 40)						Additional cost for complying with BAL 40				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 40	School	Kindergarten	Child care	Aged care	Hospital
		(b) have any gaps greater than 3mm (such as under corrugations or ribs of sheet roofing and between roof components) sealed at the facsia or wall line and at valleys, hips and ridges by appropriate means as Clauses 8.6.3 (b) (i) to (iv)	No special gap treatment except as required to prevent excessive air, dust or vermin entry	No	Seal all gaps	6,600	2,100	2,900	9,300	8,500
8.6.4	Verandah, carport and awning roofs	The following apply to verandah, carport and awning roofs:								
		(a) if forming part of the main roof space, shall meet all requirements for the main roof	No sarking, ember guards or gap sealing	No	Ember guards to ventilation openings - not required Provide sarking treatment to include ridges, hips, gutters, valleys Seal all gaps	1,650	165	330	3,300	2,750
		(b) is separated from the main roof by an external wall, shall have non-combustible roof covering and the support structure shall comply with 8.6.4 (b) (i) to (iv)	Steel roof, steel framing and supports	Yes	Nil	0	0	0	0	0
8.6.5	Roof penetrations	Roof penetrations to comply with the requirements of 8.6.5 (a), (b), (c) and (d)	No special roof penetration treatment except as required to prevent water, excessive air, dust or vermin entry. Vent pipes made from PVC.	No	Roof penetration treatment to minimum aperture sizes, upgrade glazing to FRL -/30/-, upgrade skylight glazing Vent pipes made of metal.	11,576	1,158	2,315	23,153	19,294
8.6.6	Eaves linings, fascias and gables	(a) gables shall comply with Clause 8.4	Not used	n/a	Nil	0	0	0	0	0
		(b) Fascias and barge boards comply with AS 1530.8.1	Standard timber used	No	Upgrade to comply with AS 1538.8.1	14,850	4,725	6,525	20,925	19,125
		(c) Eaves linings shall be:								
		(i) fibre cement sheet, minimum 65mm thickness	fc sheet, minimum 6mm thick	Yes	Nil	0	0	0	0	0
		(ii) calcium silicate sheet, a minimum of 6mm thick	Not used	n/a	Nil	0	0	0	0	0
		(iii) a combination of (i) and (ii)	Not used	n/a	Nil	0	0	0	0	0
		(d) eaves penetrations shall be protected the same as roof penetrations	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 40 (BAL 40)			Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 40	Additional cost for complying with BAL 40				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)				School	Kindergarten	Child care	Aged care	Hospital
		(e) eaves ventilation openings shall be fitted with suitable ember guards	Not used	n/a	Nil	0	0	0	0	0
		(f) joints may be sealed with plastic joining strips or timber storm moulds	Not used	n/a	Nil	0	0	0	0	0
8.6.7	Gutters and downpipes	Leaf guards to be non-combustible	Not used	n/a	Nil	0	0	0	0	0
		Box gutters to be non-combustible and flashed at the roof junction with non-combustible material	Metal	Yes	Nil	0	0	0	0	0
8.7	**VERANDAHS, DECKS, STEPS, RAMPS AND LANDINGS**									
8.7.1	General	Decking shall not be spaced	Not used	n/a	Nil	0	0	0	0	0
8.7.2	Enclosed sub-floor spaces of verandahs, decks, steps and landings									
8.7.2.1	Materials to enclose a sub-floor space	The subfloor space is deemed to be enclosed when:	Nil	n/a	Nil	0	0	0	0	0
		(a) a material is used to enclose the subfloor space that complies with 8.4, or	Not used	n/a	Nil	0	0	0	0	0
		(b) all openings are screened as 8.7.2.1 (b)	Not used	n/a	Nil	0	0	0	0	0
8.7.2.2	Supports	Nil	Nil	n/a	Nil	0	0	0	0	0
8.7.2.3	Framing	Nil	Nil	n/a	Nil	0	0	0	0	0
8.7.2.4	Decking, stair treads and the trafficable surfaces of ramps and landings	Shall be made from:								
		(a) non-combustible material, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) a system complying with AS 1530.8.1, or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of the above	Not used	n/a	Nil	0	0	0	0	0
8.7.3	Unenclosed sub-floor spaces of verandahs, decks, steps and landings									
8.7.3.1	Supports	Supports shall be	Nil	n/a	Nil	0	0	0	0	0
		(a) non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(b) a system complying with AS 1530.8.1, or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
8.7.3.2	Framing	Framing shall be	Nil	n/a	Nil	0	0	0	0	0
		(a) non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(b) a system complying with AS 1530.8.1, or	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level 40 (BAL 40)			Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL 40	Additional cost for complying with BAL 40				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)				School	Kindergarten	Child care	Aged care	Hospital
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
8.7.3.3	Decking, stair treads and the trafficable surfaces of ramps and landings	Shall be made from:								
		(a) non-combustible, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) a system complying with AS 1530.8.1, or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
8.7.2.5	Balustrades, handrails or other barriers	Balustrades and handrails less than 125mm from glazing shall be made from non-combustible material.	Steel	Yes	Nil	0	0	0	0	0
8.8	**WATER AND GAS SUPPLY PIPES**									
	Above ground pipes	All above ground pipes shall be metal	Metal	Yes	Nil	0	0	0	0	0
					Total	**225,805**	**71,561**	**100,563**	**276,694**	**265,752**
					% of building cost	**4.0%**	**9.9%**	**7.2%**	**1.7%**	**1.4%**

Section 6 Construction for Bushfire Attack Level FZ (BAL FZ)				Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice		Additional cost for complying with BAL FZ				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating		Additional design requirements to meet BAL FZ	School	Kindergarten	Child care	Aged care	Hospital
				n/a = relevant part of AS 3959 not applicable to 'Example' building						
9.1	**GENERAL**	Minimum setback from classified vegetation to be 10m or those elements which are less than 10m shall comply with AS 1530.8.2	10m setback provided	Yes	Nil	0	0	0	0	0
9.2	**SUBFLOOR SUPPORTS**	No requirements where subfloor space is enclosed with a wall that complies with 9.4	Not used	n/a	Nil	0	0	0	0	0
		Where unenclosed, the supports and framing shall be:	Not used	n/a	Nil	0	0	0	0	0
		(a) have an FRL of at least 30/-/- and shall be non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(b) a system complying with AS 1530.8.2, or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
9.3	FLOORS									
9.3.1	Concrete slabs on ground	Nil	Nil	n/a	Nil	0	0	0	0	0
9.3.2	Elevated Floors	Nil	Nil	n/a	Nil	0	0	0	0	0
9.3.2.1	Enclosed subfloor space	No requirements where subfloor space is enclosed with a wall that complies with 9.4.	Not used	n/a	Nil	0	0	0	0	0
9.3.2.2	Unenclosed subfloor space	Where the subfloor space is unenclosed, the bearers, joists and flooring shall:								
		(a) have an FRL of at least 30/30/30 and the surface material shall be non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(b) have the underside of the combustible elements of the floor system protected with a 30 min reistance to incipient spread of fire system, or	Not used	n/a	Nil	0	0	0	0	0
		(c) be a system complying with AS 1530.8.2	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level FZ (BAL FZ)			Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL FZ	Additional cost for complying with BAL FZ				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)				School	Kindergarten	Child care	Aged care	Hospital
		(d) a combination of (a), (b) and (c)	Not used	n/a	Nil	0	0	0	0	0
9.4	**EXTERNAL WALLS**									
9.4.1	Walls	Exposed external walls shall be:								
		(a) non-combustible, or	Masonry cladding	Yes	Nil	0	0	0	0	0
		(b) be a system complying with AS 1530.8.2	Not used	n/a	Nil	0	0	0	0	0
		(c) be a system with an FRL of 30/30/30 or -/30/30	Not used	n/a	Nil	0	0	0	0	0
		(d) a combination of (a), (b) and (c)	Not used	n/a	Nil	0	0	0	0	0
9.4.2	Joints	All joints in external walls to be treated to prevent gaps greater than 3mm	No special gap treatment except as required to prevent excessive air, dust or vermin entry	No	Joints treated to prevent gaps greater than 3mm, including but not limited to: - ends of roof sheets at gutters, ridges, hips and valleys - around windows and doors - at eaves	5,775	1,323	1,827	5,452	7,969
9.4.3	Vents and weepholes	To be screened with mesh as per 8.4.3	Vents and weepholes not screened	No	To be screened with mesh as per 5.4.3	1,155	265	365	1,090	1,594
9.5	**EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS**									
9.5.1	Bushfire shutters	Where fitted, bushfire shutters are to be as per Clauses 3.7 and 9.5.1	Not used	n/a	Nil	0	0	0	0	0
9.5.1A	Screens for windows and doors	Where fitted, screens are to be as per Clause 9.5.1A	Not used	n/a	Nil	0	0	0	0	0
9.5.2	Windows	Windows shall be:								
		a) protected by bushfire shutters, or	No bushfire shutters used	No	Bushfire shutters to all windows	198,000	70,560	97,440	214,830	212,500
		b) The openable portion of the window shall be screened with a screen that complies with Clause 9.5.1An and either:	Not used	n/a	Nil	0	0	0	0	0
		(i) the window system shall have an FRL of at least -/30/-, or	Not used	n/a	Nil	0	0	0	0	0
		(ii) the window system shall comply with AS 1530.8.2	Not used	n/a	Nil	0	0	0	0	0
9.5.3	Doors - side-hung external	Side-hung external doors shall be:								
		a) protected by bushfire shutters, or	No bushfire shutters used	No	Bushfire shutters to all windows	9,900	3,528	4,872	10,742	10,625
		b) Doors and door frames comply with:								
		(i) Doors and frames shall be:								

Section 6 Construction for Bushfire Attack Level FZ (BAL FZ)						Additional cost for complying with BAL FZ				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL FZ	School	Kindergarten	Child care	Aged care	Hospital
		(A) have an FRL of -/30/-, or	Not used	n/a	Nil	0	0	0	0	0
		(B) comply with AS 1530.8.2	Not used	n/a	Nil	0	0	0	0	0
		(C) a fully framed glazed door where the framing is made from non-combustible materials	Not used	n/a	Nil	0	0	0	0	0
		(ii) Doors shall be tight fitting to the door frame and abutting doors	Doors shall be tight fitting to the door frame and abutting doors	Yes	Nil	0	0	0	0	0
		(iii) weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Weather strips, draught excluders and draught seals shall be installed at the base of side-hung external doors	Yes	Nil	0	0	0	0	0
		(iv) seals shall not compromise FRL or performance achieved in AS 1530.4	Correct seals used	Yes	Nil	0	0	0	0	0
9.5.4	Doors - sliding doors	Sliding external doors shall be:								
		a) protected by bushfire shutters, or	No bushfire shutters used	No	Bushfire shutters to all windows	3,960	1,411	1,949	4,297	4,250
		b) Doors and door frames comply with:								
		(i) Doors and frames shall be:								
		(A) have an FRL of -/30/-, or	Not used	n/a	Nil	0	0	0	0	0
		(B) comply with AS 1530.8.2	Not used	n/a	Nil	0	0	0	0	0
		(C) a fully framed glazed door where the framing is made from non-combustible materials	Not used	n/a	Nil	0	0	0	0	0
		(ii) Doors shall be tight fitting to the door frame and abutting doors	Doors shall be tight fitting to the door frame and abutting doors	Yes	Nil	0	0	0	0	0
9.5.5	Doors - Vehicle access doors (garage doors)	Vehicle access doors:								
		(a) Shall be non-combustible	Steel	Yes	Nil	0	0	0	0	0
		(b) where the garage is attached to the building, the requirementrs of Clause 3.2.2(b) shall apply	Not used	n/a	Nil	0	0	0	0	0
		(b) Panel lift, tilt up or side-hung doors shall have suitable weather strips, draught excluders, draught seals, guide tracks, as appropriate, with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0
		(c) Roller doors shall have guide tracks with a maximum gap no greater than 3mm	Yes	Yes	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level FZ (BAL FZ)						Additional cost for complying with BAL FZ				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL FZ	School	Kindergarten	Child care	Aged care	Hospital
		(d) Vehicle access doors shall not have ventilation slots	Ventilation slots sometimes provided	No	Exclude ventilation slots (no cost)	0	0	0	0	0
9.6	**ROOFS**									
9.6.1	General	(a) The roof/wall junction shall be sealed to prevent openings greater than 3mm either by the use of fascia and eaves linings or by sealing the top of the wall and the underside of the roof and between the rafters at the line of the wall	Fascia and eaves lining	Yes	Nil	0	0	0	0	0
		(b) Roof ventilation openings shall be fitted with suitable ember guards	Ventilation openings not fitted with ember guards	No	Fit ember guards to ventilation openings	1,654	165	331	3,308	2,756
		(d) pipes or conduits that penetrate the roof covering shall be non-combustible	See 9.6.5		9.6.5	0	0	0	0	0
		Roof mounted evaporative coolers are excluded	Not used	n/a	Nil	0	0	0	0	0
		Appendix I provided two generic systems for roofs which shall be deemed to satify Clause 9.6 (BAL-FZ)	Metal roof	No	Roof system upgraded including plywood lining and other design requirements to meet Appendix I	380,363	38,036	76,073	760,725	633,938
9.6.2	Verandah, carport and awning roofs	(a) The following apply to verandah, carport and awning roofs:								
		(b) if forming part of the main roof space, shall meet all requirements for the main roof	Metal roof	No	Roof system upgraded including plywood lining and other design requirements to meet Appendix I	17,250	1,725	3,450	34,500	28,750
		(c) is separated from the main roof by an external wall, shall have non-combustible roof covering and the support structure shall comply with 9.6.2 (b) (i) to (iv)	Steel roof, steel framing and supports	Yes	Nil	0	0	0	0	0
9.6.3.	Roof penetrations	Roof penetrations to comply with the requirements of 9.6.3 (a) and (b)	No special roof penetration treatment except as required to prevent water, excessive air, dust or vermin entry. Vent pipes made from PVC.	No	Roof penetration sealed with mineral wool, upgrade rooflights and ventilators to AS 1530.8.2 Vent pipes made of metal.	33,075	3,308	6,615	66,150	55,125
9.6.4	Eaves linings, fascias and gables	(a) joints may be sealed with plastic joining strips or timebr storm moulds	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level FZ (BAL FZ)						Additional cost for complying with BAL FZ				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL FZ	School	Kindergarten	Child care	Aged care	Hospital
		(b) gables shall comply with Clause 9.4	Not used	n/a	Nil	0	0	0	0	0
		(c) Fascias and barge boards comply with AS 1530.8.2	Standard timber used	No	Upgrade to comply with AS 1538.8.2	16,500	5,250	7,250	23,250	21,250
		(d) Eaves linings shall be:								
		(i) a system with an FRL of -/30/30, or	fc sheet, minimum 6mm thick	No	Upgrade to a system of FRL of -/30/30	20,790	6,615	9,135	29,295	26,775
		(ii) a system complying with AS 1539.8.2	Not used	n/a	Nil	0	0	0	0	0
		(iii) a combination of (i) and (ii)	Not used	n/a	Nil	0	0	0	0	0
		(e) eaves penetrations shall be protected the same as roof penetrations	Not used	n/a	Nil	0	0	0	0	0
		(f) eaves ventilation openings shall be fitted with suitable ember guards	Not used	n/a	Nil	0	0	0	0	0
9.6.7	Gutters and downpipes	Leaf guards to be non-combustible	Not used	n/a	Nil	0	0	0	0	0
		Box gutters to be non-combustible and flashed at the roof junction with non-combustible material	Metal	Yes	Nil	0	0	0	0	0
9.7	**VERANDAHS, DECKS, STEPS, RAMPS AND LANDINGS**									
9.7.1	General	Decking shall not be spaced	Not used	n/a	Nil	0	0	0	0	0
9.7.2	Enclosed sub-floor spaces of verandahs, decks, steps and landings									
9.7.2.1	Materials to enclose a sub-floor space	The subfloor space is deemed to be enclosed when:	Nil	n/a	Nil	0	0	0	0	0
		(a) a material is used to enclose the subfloor space that complies with 9.4, or	Not used	n/a	Nil	0	0	0	0	0
		(b) all openings are screened as 9.7.2.1 (b)	Not used	n/a	Nil	0	0	0	0	0
9.7.2.2	Supports	Nil	Nil	n/a	Nil	0	0	0	0	0
9.7.2.3	Framing	Nil	Nil	n/a	Nil	0	0	0	0	0
9.7.2.4	Decking, stair treads and the trafficable surfaces of ramps and landings	Shall be made from:								
		(a) non-combustible material, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) of fibre-cement sheet	Not used	n/a	Nil	0	0	0	0	0
		(c) a system complying with AS 1530.8.2, or	Not used	n/a	Nil	0	0	0	0	0
		(d) a combination of the above	Not used	n/a	Nil	0	0	0	0	0

Section 6 Construction for Bushfire Attack Level FZ (BAL FZ)						Additional cost for complying with BAL FZ				
Clause from AS 3959		Construction Requirements of AS3959 (note: summary only, does not show full particulars)	Standard design for 'Example' buildings of BAL-LOW rating	Relevant parts of AS 3959 already met by building regulations, licensing requirements or common practice	Additional design requirements to meet BAL FZ	School	Kindergarten	Child care	Aged care	Hospital
9.7.3	Unenclosed sub-floor spaces of verandahs, decks, steps and landings									
9.7.3.1	Supports	Supports shall be	Nil	n/a	Nil	0	0	0	0	0
		(a) non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(b) a system complying with AS 1530.8.2, or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
9.7.3.2	Framing	Framing shall be	Nil	n/a	Nil	0	0	0	0	0
		(a) non-combustible, or	Not used	n/a	Nil	0	0	0	0	0
		(b) a system complying with AS 1530.8.2, or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a) and (b)	Not used	n/a	Nil	0	0	0	0	0
9.7.3.3	Decking, stair treads and the trafficable surfaces of ramps and landings	Shall be made from:								
		(a) non-combustible, or	Concrete	Yes	Nil	0	0	0	0	0
		(b) of fibre-cement sheet	Not used	n/a	Nil	0	0	0	0	0
		(c) a system complying with AS 1530.8.2, or	Not used	n/a	Nil	0	0	0	0	0
		(c) a combination of (a), (b) and (c)	Not used	n/a	Nil	0	0	0	0	0
9.7.2.5	Balustrades, handrails or other barriers	Balustrades and handrails less than 125mm from glazing shall be made from non-combustible material.	Steel	Yes	Nil	0	0	0	0	0
9.8	**WATER AND GAS SUPPLY PIPES**									
	Above ground pipes	All above ground pipes shall be metal	Metal	Yes	Nil	0	0	0	0	0
					Total	**688,421**	**132,186**	**209,306**	**1,153,638**	**1,005,531**
					% of building cost	**12.1%**	**18.4%**	**15.1%**	**7.0%**	**5.5%**