Automatic Fire Suppression Systems for Covered Balconies in Residential Buildings

Final Decision RIS

June 2016

This Regulation Impact Analysis accords with the requirements of *Best Practice Regulation: A Guide for Ministerial Councils and National Standard Setting Bodies* endorsed by the Council of Australian Governments in 2007. Its purpose is to assess the cost-effectiveness of including new requirements for sprinkler protection of covered balcony areas in all new high rise residential buildings.

The Australian Building Codes Board

The Australian Building Codes Board (ABCB) is a joint initiative of all levels of government in Australia, together with the building industry. Its mission is to oversee issues relating to health, safety, amenity and sustainability in buildings. The ABCB promotes efficiency in the design, construction and performance of buildings through the National Construction Code (NCC), and the development of effective regulatory and non-regulatory approaches. The Board aims to establish effective and proportional codes, standards and regulatory systems that are consistent between States and Territories. For more information see the ABCB website.

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Glossary

Term	Definition
Class 2 building	A building containing 2 or more sole-occupancy units each being a separate dwelling.
Class 3 building	A residential building, other than a building of Class 1 or 2, which is a common place of long term or transient living for a number of unrelated persons, including— (a) a boarding house, guest house, hostel, lodging house or backpacker's accommodation; or (b) a residential part of a hotel or motel; or (c) a residential part of a school; or (d) accommodation for the aged, children or people with disabilities; or (e) a residential part of a health-care building which accommodates members of staff; or (f) a residential part of a detention centre.
Class 4 building	A dwelling in a building that is Class 5, 6, 7, 8, or 9 if it is the only dwelling in the building.
Class 9a building	A health-care building, including those parts of the building set aside as a laboratory.
Class 9c building	An aged-care building.

Acronym

Abbreviation	Full Name
ABCB	Australian Building Codes Board
AIA	Australian Institute of Architects
AFAC	Australasian Fire and Emergency Service Authorities Council
BCA	Building Code of Australia
BMF	Building Ministers' Forum
COAG	Council of Australian Governments
DtS	Deemed-to-Satisfy
HIA	Housing Industry Association
MFS	Metropolitan Fire Service South Australia
NCC	National Construction Code
NFIA	National Fire Industry Association
OBPR	Office of Best Practice Regulation
PCA	Property Council of Australia
RIS	Regulation Impact Statement

The Problem

The problem is the risk to life safety of building occupants from a fire igniting on a balcony of a residential building, where the interior of the building is protected by a fire sprinkler system but where the balcony is not sprinkler protected.

Currently, the Deemed to Satisfy (DtS) provisions of NCC Volume One require all new residential buildings over 25 metres in effective height be fitted with a fire sprinkler system throughout the building complying with Australian Standard AS 2118.1 'Automatic Fire Sprinkler Systems'. The Australian Standard permits fire sprinklers to be omitted from certain areas and sprinkler protected buildings, including some balconies. Balconies that do not exceed 6m² in floor area or which do not have a depth in excess of 2 metres are not required to be sprinkler protected. Hence, the problem arises where the building is over 25 metres, where the interior is sprinkler protected, but where the balcony area is not.

Building Ministers were presented with information about this problem at the July 2015 Building Ministers' Forum (BMF). Ministers requested that the ABCB consider and report on possible amendments to the NCC to require sprinkler protection to all covered balconies irrespective of their size, in Class 2, Class 3, Class 4 and Class 9 buildings.

Two recent fire events were considered by Building Ministers, who are now considering whether the current fire safety requirements in the NCC adequately safeguard occupants from injury or fatality in high-rise buildings. It is considered that the two fire events may have been less severe if the fire sprinkler system had also served the balconies. However, as described below there are other factors that contributed to the severity of these fires which sprinklers alone may not have addressed.

The first fire event occurred on a balcony in a Class 2 residential apartment building in Bankstown on 6 September 2012. The apartment building was not fitted with a fire sprinkler system as the building was less than 25 metres in effective height as per the requirements of the NCC. The fire scenario and fire behaviour is thought to be the result of high wind and the presence of high fuel load on the balcony. It is understood that the building had a number of NCC non-compliances which may have contributed to the development of the fire and the lack of alarm notification to the building occupants. Tragically, one fatality occurred and another person was severely injured. The Coroners Court, in its report, was critical of the lack of a fire sprinkler system and subsequently recommended that the ABCB consider amending the NCC to require the installation of fit-for-purpose sprinkler systems in all new Class 2 and 3 buildings below 25 metres. Consideration of this recommendation is being progressed via a separate ABCB project.

Had a fire sprinkler system been installed in the building the Coroner concluded that it was very likely that no fatality or serious injury would have resulted. The Coroner, in its summation of the circumstances that led to the fatality, expressed most concern at the lack of an internal sprinkler system rather than the lack of sprinkler protection of the balcony.

The second fire event occurred in an apartment complex in Docklands, Melbourne on 25 November 2014. The fire commenced on the balcony of an apartment on the 8th floor and rapidly spread vertically affecting 16 apartments. The fire scenario and fire behaviour encountered by the

fire brigade was said to be a scenario not commonly encountered by a fire brigade attending high-rise buildings.

Key observations that contributed to the severity of the scenario included:

- Use of combustible external wall cladding in contravention of the NCC's (DtS) requirements.
- The Emergency Warning and Intercommunication System to warn building occupants of the threat of fire was compromised.
- Fire extinguishers not being accessible to building occupants.
- Apartment smoke alarms had been tampered with.

From the information available it is understood that the building's facade did not comply with the requirements of the NCC which resulted in the rapid vertical spread of fire from the balcony area. The balcony on which the fire initiated was not sprinkler protected due to its size. It is also understood that fire did not spread to within the building as a result of the activation of the internal fire sprinkler system. No fatalities occurred as a result of this fire event.

These two recent building fires indicate that a key factor that contributed to the risk to life safety was documented NCC non-compliances. No evidence is available to suggest that the provisions of the NCC are inadequate in addressing the risk to life safety from a balcony fire in a residential building. There is also no information about injuries or fatalities that have occurred as a consequence of balcony fires in buildings with a fire sprinkler system installed.

Balcony areas of residential buildings often contain combustible material including tables, chairs, air conditioning appliances, barbeques and gas bottles. This is particularly the case in Class 2 buildings where balconies are also used as a convenient location for storage that can create a potential fuel load. The presence of combustible material on residential balconies adds to the potential of a fire starting on a balcony and the possible severity of the fire.

The Melbourne Dockland's fire event has highlighted the potential consequences associated with NCC non-compliance. It is acknowledged that the issue of non-compliance is a separate matter and although the mandatory installation of fire sprinklers on all balconies would mitigate risks associated with a similar incident, it should not be used as a solution if non-compliance is the problem. Had the building façade been constructed to comply with the NCC and had the other fire safety features (fire extinguishers, smoke detectors) been made available to occupants, it is considered that the rapid spread of fire may not have occurred and that the fire would have been contained to the balcony of fire origin.

In the report 'Fire Hazards of Exterior Wall Assemblies Containing Combustible Components' commissioned by the Fire Protection Research Foundation (June 2014) the conclusion states "*The percentage of exterior wall fires occurring in buildings with sprinkler systems installed ranges from 15-39% for the building height groups considered. This indicates that whilst sprinklers may have some positive influence, a significant percentage of external wall fires still occur in sprinkler protected buildings, which may be due to both external fire sources or failure of sprinklers.*" This indicates that in the case of the Dockland's building fire the provision of sprinkler protection to the balcony may not have lessened the impact of the fire.

There are a number of other issues that relate to the problem of risk to life safety on non-sprinkler protected balconies. The first of these is the changing nature of habitation. There has been a significant change in where and how we live and a significant proportion of the population is moving from detached housing to apartment living. With this change in lifestyle we have continued to entertain outside and cook on barbeques. Both of these activities present a level of risk to a fire starting on a balcony.

Many people downsizing find they have more possessions than space to store them so the balcony often defaults as a makeshift storage area. This point is supported by the Metropolitan Fire Brigade's post incident analysis report on the Dockland's building fire. Air-conditioning is also a prerequisite of modern living and as such the majority of balconies house the heat pump for the apartment's heating and cooling system. It is understood that the fuel load associated with the heat pump significantly contributed to the fire in the case of the Bankstown fire.

Densities within apartments, particularly within city centres, appear to be increasing. There have been a number of recent media reports that indicate rental supply is tightening to the point where rooms are available for share (twin beds) and make shift rooms are being created to accommodate more people per unit, which reduces the cost of rent for individuals. The apartment (balcony) in which the Bankstown fire originated included a make shift room that was separated from the living area. The potential risk of injury or death due to a fire increases as the number of occupants per unit increases. The NCC does not regulate occupancy numbers within apartments, although there may be pertinent planning regulations and body corporate rules that address this issue.

There is no known Australian academic literature available on the nature of the specific problem identified although there is one recent international study - Fire Chief Len Gari and Dr. Joseph Clare (2013) *Fires that Commence on Balconies of Multi-Residential Buildings,* University of the Fraser Valley, Canada.

In summarising the findings of this study, fires that commenced on balconies of multi-residential buildings were found to be:

- Less likely to activate a smoke alarm and more likely to require visual sighting of some other means of personal detection.
- More likely to require fire brigade intervention.
- Less likely to have burned out on their own, less likely to have been controlled by the removal/shut-off of fuel, and less likely to have been controlled by sprinklers.
- More likely to extend further than the building of fire origin.

The above findings highlight the risk of fire on balconies including the risk of a fire not being detected or extinguished once developed. There is a risk of fires starting on balconies and the possibility of these fires becoming severe. This information demonstrates a risk of fire that can have life safety implications. It equally demonstrates that sprinklers on balconies would lessen the spread of fire that otherwise needs to be visually sighted before it is recognised as a risk to life safety.

It should be noted that this risk is addressed through the current provisions of the NCC that require an internal fire sprinkler system in all residential units above 25 metres. On the basis of available evidence it would appear that the operation of the internal fire sprinkler systems is adequate to

protect life safety as there are no examples of fatalities occurring in compliant sprinkler-protected buildings.

The Consultation RIS asked stakeholders how they would characterise the nature of the problem.

The majority of submitters felt that the description of the problem had been adequately characterised in the Consultation RIS.

One submitter provided further context on the problem:

"The RIS does not address the increased risk identified from the study on fire spread to other buildings and impacts on fire brigade intervention, which are both high level objectives of the NCC".

The ABCB acknowledges that avoiding fire spread to other buildings and facilitation of fire brigade intervention are objectives of the NCC. There is, however, no evidence to support a problem in regard to these two aspects of the code in compliant buildings. Fire occurring on a balcony of a compliant high rise building should be contained to the sole-occupancy unit in which the fire occurs and other building features should adequately facilitate fire brigade intervention.

One other submitter commented on the issue of non-compliance being a contributing factor in both fire events described in the Consultation RIS:

"Whilst the two fire incidence in New South Wales and Victoria are significant and a response should be taken to minimise the risk of fatalities occurring in large building fires, they both point to an issue of non-compliance with its current design requirements rather than a failure of the current standard to protect both the building and its occupants."

The ABCB recognises that any changes to the NCC should be assessed in conjunction with other possible changes to the fire safety requirements for high-rise buildings. A related piece of work is the Consultation RIS that assesses the problem of non-compliant use of external cladding products. This analysis can be found at the ABCB website. Building Ministers will consider both issues jointly when considering these matters.

The Board is also undertaking separate work in relation to holistically reviewing fire safety measures for Class 2 and 3 buildings below an effective height of 25 metres, which is the appropriate time to consider sprinklers on balconies for these buildings.

The Consultation RIS asked stakeholders whether they had any other information on the extent of the problem.

Submitters generally felt that the risk of fire occurring on balconies had increased. This was described as being the result of higher density development and the consequential behavioural response, such as storing items on balconies, which may produce a fuel load.
One submitter provided statistical data on the number of external balcony fires occurring each year in residential buildings which excluded Class 1 buildings. The data was collected over a seven year period (2008-2015) and indicated that on average approximately 60 balcony fires occur each year.

It should be noted that some of these fires would be occurring in residential buildings under 25 metres in height and therefore would not contain a fire sprinkler system. This data also relates to all buildings, including existing buildings, which represent a large proportion of the building stock and less relevant to new buildings.

The Consultation RIS asked stakeholders whether they had any information on the number of fatalities or injuries that have occurred as a result of fire in compliant buildings.

No information was received which identified fatalities or injuries occurring in compliant sprinkler protected buildings.

Objective

The goal of the Building Code of Australia (BCA) is to enable the achievement of nationally consistent, minimum necessary standards of relevant safety (including structural safety and safety from fire), health, amenity and sustainability objectives efficiently.

The objective of this RIS is to assess options that safeguard occupants of new residential buildings over 25 metres in effective height through measures that respond effectively to a fire event on a balcony.

Options

Building Ministers, at the July 2015 Building Ministers' Forum, requested that the ABCB consider and report on possible amendments to the NCC to require sprinkler protection to all covered balconies, irrespective of their size, in Class 2, Class 3, Class 4 and Class 9 buildings.

Three options are presented for the consideration of Building Ministers.

Option 1 - The Status Quo

The Status Quo is the default choice for decision-makers in considering alternatives to achieve the objectives. Where the incremental impacts of other options would result in more costs than benefits, or would be ineffective in addressing the problem or achieving the objectives, this RIA will conclude in favour of the Status Quo.

The Status Quo will be regarded as a baseline, as a basis to determine the incremental impacts of the other options.

Option 2 – Remove exemption for Class 2 buildings

This option would transfer the list of permitted exemptions in the Australian Standard to the NCC. The NCC would then remove the permitted exemption for balconies in Class 2 buildings and require sprinkler protection regardless of size.

Option 3 – Remove the exemption for Class 2, 3, 4 and 9 buildings

This option would transfer the list of permitted exemptions in the Australian Standard to the NCC. The NCC would then remove the permitted exemption for balconies in Class 2, 3, 4 and 9 buildings and require sprinkler protection regardless of size.

Options removed from the Consultation RIS

The Consultation RIS included two further options that have been discontinued in this Final RIS. These options were developed as lower cost options and considered reducing the current concession threshold in AS 2118. Many stakeholders objected to these options on the basis that the concession threshold adjustment was arbitrary and not based on technical data. The ABCB agrees with this view and accordingly the options have been discontinued.

Impact Analysis

This section provides an assessment of the incremental costs and benefits of Options 2 and 3 compared with the status quo baseline.

Number of Buildings

The Australian Bureau of Statistics reported that in 2014 there were approximately 70,500 residential sole-occupancy units completed in Australia[1].

The estimated distribution of sole-occupancy units in each building Class is shown in Table 1.

Table 1 - Estimated distribution of sole-occupancy units across each building class

Building Class	Expected number of sole-occupancy units
Class 2	59,925 (85%)
Class 3	7,050 (10%)
Class 4	350 (0.5%)
Class 9a	1060 (1.5%)
Class 9c	2,115 (3%)
Total	70,500 (100%)

Assumptions

The following assumptions have been used in preparation of this cost-benefit analysis:

1. Thirty percent of all residential buildings within scope are required to be sprinkler protected.
2. Twenty percent of all balconies currently require a fire sprinkler system as they do not meet the exemption criteria in AS2118.
3. The distribution of sole-occupancy units between building classifications is unknown. For the purposes of this analysis it has been assumed that the high majority of sole-occupancy units completed in 2014 were apartments (Class 2 buildings), followed by hotels/motels (Class 3 buildings).
4. Advice from Rider Levett Bucknall (RLB) indicates that new Class 9a buildings and Class 4 parts of buildings are not typically constructed with balconies. These sole-occupancy units have been excluded from the analysis as shown.

The Consultation RIS asked stakeholders whether they agreed with the assumptions used in the analysis.

[1] Australian Bureau of Statistics (2015), "*Building Activity*", ABS Cat. No. 8752, ABS, Canberra.

The majority of submitters felt that the costings undertaken by RLB were too high. Three submitters provided quotations on the expected per unit costs of sprinkler protecting balconies which were considerably less than the RLB costings. The average costs of these quotations were $630 per balcony and ranged between $450 and $800 compared with $2000 reported by RLB. The impact analysis has been revised to reflect this advice and reports two sets of costings: the costings reported in the Consultation RIS and the revised costings incorporating submitter views.

On the basis that the submissions were received from different and reputable areas of the building industry, the average costs reported from submissions is taken as the central case. The sensitivity analysis and the break-even analysis have also been amended to assume a $630 per sprinkler head cost.

Submitters were not able to provide information on the percentage of sprinkler protected buildings or the distribution of sole-occupancy units across building classifications. One submitter suggested that further sensitivity analysis should be undertaken to test the impact of these assumptions, however, further testing is not considered necessary due to the relatively conservative nature of the assumptions used in the analysis.

Option 2 – Remove exemption for Class 2 buildings.

This Option would require all balconies in all new Class 2 buildings over an effective height of 25 metres to be sprinkler protected. The costs of Option 2 are shown in Table 2.

Table 2 - Cost of sprinkler protecting all balconies in Class 2 buildings

Description	Consultation RIS	Revised Impacts from Stakeholder Submissions
Number of sole-occupancy units constructed annually in Class 2 buildings (85%)	59,925	59,925
Number of sole-occupancy units in sprinkler protected buildings (30%)	17,978	17,978
Number of sole-occupancy units in sprinkler protected buildings that contain non-sprinkler protected balconies (80%)	14,382	14,382
Cost per sole-occupancy unit	$2,000	$630
Total installation cost	$28,764,000	$9,060,660
Present Value installation cost	$216,168,140	$68,092,964

The costs of Option 2 have been revised to reflect stakeholder submissions. The total Present Value cost of this Option is estimated to be $68,092,964.

Option 3 – Remove the exemption for Class 2, 3, 4 and 9 buildings.

This Option would require all balconies in all new Class 2, 3, 4, 9a and 9c buildings over an effective height of 25 metres to be sprinkler protected.

The costs of Option 3 have been revised to reflect stakeholder submissions. The cost difference is shown in Tables 3.1 and 3.2. The cost difference is due to a reduction in per sprinkler head costs from $2000 to $630.

Table 3.1 - Cost of sprinkler protecting all balconies in Class 2, 3, 4, 9a and 9c buildings – Consultation RIS

Description	Class 2	Class 3	Class 4	Class 9a	Class 9c
Number of sole-occupancy units constructed annually	59,925	7,050	353	1,058	2,115
Number of sole-occupancy units in sprinkler protected buildings (30%)	17,978	2,115	106	317	635
Number of sole-occupancy units in sprinkler protected buildings that contain non-sprinkler protected balconies (80%)	14,382	1,692	0	0	508
Cost per sole-occupancy unit	$2,000	$3,000	$2,000	$2,000	$2,000
Total installation cost	$28,764,000	$5,076,000	$0	$0	$1,015,200
Present Value installation cost	$216,168,140	$38,147,319	$0	$0	$7,629,464

Table 3.2 - Cost of sprinkler protecting all balconies in Class 2, 3, 4, 9a and 9c buildings – Revised

Description	Class 2	Class 3	Class 4	Class 9a	Class 9c
Number of sole-occupancy units constructed annually	59,925	7,050	353	1,058	2,115
Number of sole-occupancy units in sprinkler protected buildings (30%)	17,978	2,115	106	317	635
Number of sole-occupancy units in sprinkler protected buildings that contain non-sprinkler protected balconies (80%)	14,382	1,692	0	0	508
Cost per sole-occupancy unit	$630	$630	$630	$630	$630
Total installation cost	$9,060,660	$1,065,960	$0	$0	$319,788
Present Value installation cost	$68,092,964	$8,010,937	$0	$0	$2,403,281

The total Present Value cost of this Option is estimated to be $78,507,182.

Maintenance Costs

Ongoing maintenance and replacement costs were investigated as part of this analysis. Findings on this investigation suggest that the costs associated with maintenance and replacement is difficult to accurately quantify and may vary.

The Consultation RIS asked stakeholders whether they had information on how much it costs to maintain a fire sprinkler system on a per sprinkler head basis over the life of a building.

One stakeholder felt that the additional maintenance costs of each proposal was negligible as sprinklers on balconies would simply be an extension of the whole system which would already be required to be maintained. The Final RIS considers that this opinion is true and as such, incremental maintenance costs have been excluded from the analysis.

Benefits

There are benefits from extending internal sprinkler protection to the balconies in controlling fires that start on balconies and so reduce occupants' risk to life safety from these fires.

The issue is how much will the risk to life safety be reduced? The internal fire sprinkler systems are already adequate in protecting occupants' life safety inside the residential unit. It is possible to improve upon an "adequate" level of protection, however, that improvement may be imperceptible.

The value of an additional level of protection in extending sprinklers to all residential balconies is ultimately a subjective assessment. There would be an incremental improvement in protecting life safety, however, that improvement will be difficult to measure in terms of additional injuries and fatalities avoided.

As noted in the description of the problem, the fuel load on balconies is a critical factor in the severity of a fire. Where balconies are used as storage areas, as often happens in Class 2 buildings, the fuel load will be higher and a fire will be more severe. Hence Option 2 focuses on Class 2 buildings only where the fuel load would be greatest and the risk of a severe fire more acute.

Option 3 includes other residential buildings where fuel load on the balconies is much less of an issue in practice. The additional protection of the other residential buildings may not be much benefit to occupants in practice.

Avoided Property Loss

Some stakeholders raised the issue of why the benefits did not include avoided property loss. It is considered that in a compliant building the structure of a balcony would sustain minimal damage during a fire. Property loss would be essentially the contents on the balcony such as tables and chairs. The amount of contents property loss would be comparatively small for occupants and, given the low incidence of fires occurring on the balconies of new buildings, this impact is considered to be immaterial.

For example, data on fire starts shows that 1 fire a year occurs on a new balcony. At an average value of property on a balcony of $1,000 the benefit in Present Value terms over forty years would be $107,000. This is insignificant when compared with the costs involved.

Break Even Analysis

There is no available evidence to indicate the extent of the problem in terms of recorded fatalities. In these circumstances a break-even analysis can be helpful to indicate the reasonableness or otherwise of the possible benefits of the Options. A break-even analysis calculates the benefits

needed to equal the costs using a key assumption. In this case the key assumption is the number of fatalities per year that might be avoided under each Option – the assumed reduction in the risk of death from a fire event occurring on a balcony which isn't sprinkler protected in a compliant high rise building. Benefits are calculated by multiplying the key assumption by the Value of a Statistical Life[2].

The break-even analysis has been revised to reflect the change of costs associated with each Option. The Final RIS also includes a methodological correction in calculating the break-even analysis.

The number of fatalities required to be avoided per year for the calculated benefits to equal the costs are shown in Table 4 for each Option.

Table 4 - Break-Even Analysis of Options

	Present Value Costs	Annual number of fatalities per year required to be avoided
Option 2	$68,092,964	0.15
Option 3	$78,507,182	0.18

Notes:

1. Present value costs calculated using a 7% discount rate over a ten year period.
2. Present value benefits calculated using a 7% discount rate over a forty year period for 10 cohorts of new buildings.

The break-even analysis shows that between 0.15 and 0.18 fatalities are needed to be avoided per year for the benefits to equal the costs. This equates to one avoided fatality every 7 years for Option 2 and approximately one avoided fatality every 5 years for Option 3. These rates of avoidance are small but still differ from the recent history of no recorded fatalities in compliant sprinkler protected buildings.

Sensitivity Analysis

This section examines the sensitivity of the quantitative analysis to variations in key assumptions underpinning the aggregate gross impact analysis. The sensitivity analysis has been conducted on three areas noting:

- A real discount rate of 7% has been used in the quantitative analysis, and sensitivity will be tested from a lower bound of 3% to an upper bound of 11%.
- Construction costs may vary between States and Territories. The sensitivity analysis will test a variance of ±20%.
- The approval rate of sole-occupancy units that currently contain non-sprinkler protected balconies is not known, although thought to be the large majority. The sensitivity analysis will test a variance of ±10%.

The outcomes of the sensitivity analysis are summarised in the table below, in present value terms, with the impact of each on the assessed level of quantitative costs provided.

[2] The value of statistical life is an estimate of the financial value society places on reducing the average number of deaths by one and is calculated as $4.2 million per life saved which aligns with the Office of Best Practice Regulation Guidance Note.

Table 2 - Sensitivity Analysis

Sensitivity	Option 2	Option 3
Lower bound discount rate (3%)	$79,607,946	$91,783,279
Upper bound discount rate (11%)	$59,229,965	$68,288,666
Lower bound construction costs (-20%)	$54,474,371	$62,805,746
Upper bound construction costs (+20%)	$81,711,557	$94,208,619
Lower bound number of non- sprinkler protected balconies (70%)	$59,581,344	$68,693,784
Upper bound number of non-sprinkler protected balconies (90%)	$76,604,585	$88,320,580

Consultation

Consultation is the cornerstone of the ABCB's commitment to create a contemporary and relevant construction code that delivers good societal outcomes for health, safety, amenity and sustainability in the built environment. This must be achieved in the context of good regulatory practice that evaluates the costs and benefits to society, as per the objective of the ABCB's Inter-Government Agreement. The ABCB recognises the value of engaging constructively with the community and industry in order to achieve this.

There were 8 submissions to the Consultation RIS. Submissions were received from the following stakeholders:

1. Australasian Fire and Emergency Services Authorities Council (AFAC)
2. Australian Institute of Architects (AIA)
3. Housing Industry Association (HIA)
4. Fire Protection Association Australia (FPA)
5. Metropolitan Fire Service South Australia (MFS)
6. National Fire Industry Association (NFIA)
7. Property Council of Australia (PCA)
8. An individual.

Responses to consultation questions have been included throughout this document.

Conclusion

The problem is the risk to life safety of occupants from a fire igniting on a balcony of a residential building, where the interior of the building is protected by a fire sprinkler system but where the balcony is not sprinkler protected.

Balcony areas of residential buildings often contain combustible material including tables, chairs, air conditioning appliances, barbeques and gas bottles. This is particularly the case in Class 2 buildings where balconies are also used as a convenient location for storage that can create a potential fuel load. The presence of combustible material on residential balconies adds to the likelihood of a fire starting on a balcony and the possible severity of the fire. Fires on balconies have potential life safety implications.

The risk of fire is addressed through the current provisions of the NCC that require an internal fire sprinkler system in all residential units above 25 metres. On the basis of available evidence it would appear that the operation of internal fire sprinkler systems is adequate to protect life safety.

The objective of this RIS relates to the safety of occupants in new residential buildings with internal fire safety systems.

Building Ministers, at the July 2015 Building Ministers' Forum, requested that the ABCB consider and report on possible amendments to the NCC to require sprinkler protection to all covered balconies irrespective of their size, in Class 2, Class 3, Class 4 and Class 9 buildings.

Three options are presented for the consideration of Building Ministers in the Final Decision RIS.

1. The Status Quo
2. Remove the exemption for Class 2 buildings
3. Remove the exemption for Class 2, 3, 4 and 9 buildings

The revised annual cost of Option 2 is estimated to be $9,060,660 with a Present Value cost of $68,092,964. The revised annual cost of Option 3 is estimated to be $10,446,398 with a Present Value cost of $78,507,182. Sensitivity Analysis was undertaken to test the volatility of outcomes based on key parameters. All scenarios tested produced moderate net costs.

There are benefits from extending internal sprinkler protection to the balconies in controlling fires that start on balconies and so reduce occupants' risk to life safety from these fires. The issue is how much will the risk to life safety be reduced? The internal fire sprinkler systems are already adequate in protecting occupants' life safety inside the residential unit. It is possible to improve upon an "adequate" level of protection, however, that improvement may be imperceptible. The value of an additional level of protection in extending sprinklers to all residential balconies is ultimately a subjective assessment.

In lieu of complete quantitative data on the expected benefits of the options, a break-even analysis demonstrated that between 0.15 and 0.18 lives would be required to be avoided per year for the calculated benefits to equal the estimated costs.

The cost of the options in this context are considered moderate in terms of achieving community welfare, however, the rate of avoidance is unlikely due to no recorded fatalities in compliant sprinkler protected buildings.

In comparing benefits that are subjective and difficult to measure with moderate costs, the conclusion of this RIS is that Options 2 and 3 would result in net costs to society. Option 1, the Status Quo, is therefore supported.