ABCB

REGULATION IMPACT STATEMENT

FOR FINAL DECISION

Proposal to revise the Building Code of Australia to reduce the risk of slips, trips and falls in buildings

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June 2011

This Regulation Impact Statement (RIS) accords with the requirements of *Best Practice Regulation: A Guide for Ministerial Councils and National Standard Setting Bodies*, as endorsed by the Council of Australian Governments in 2007. Its purpose is to inform interested parties and to assist the Australian Building Codes Board in its decision making on proposals to reduce the risk of slips, trips and falls in buildings. The RIS draws extensively from an earlier Consultation RIS on this subject prepared by KPMG.

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Executive Summary

The main health and safety risks in buildings were identified in a report to the ABCB (Atech Group, 2003) to be from slips, trips and falls. A subsequent report to the ABCB by the Monash University Accident Research Centre, 2008, *The relationship between slips, trips and falls and the design and construction of buildings* (the Monash Report) documented the number of injuries and fatalities from slips, trips and falls in buildings, and calculated the cost of these injuries to be $3.1 billion over 2002 to 2005 and fatalities to be $1.2 billion over 2001 to 2005.

Government intervention is required in this instance because of inadequate individual responses to the risks of slips, trips and falls, and imperfect industry responses due to split incentives.

The Monash Report identified the principal risks associated with slips, trips and falls in buildings and recommended a number of areas where amendments to the BCA could address proven environmental risks and potentially reduce the incidence and costs associated with slips trips and falls. From these recommendations five proposals were determined to address the risks of slips, trips and falls in buildings, through amendments to the BCA. The proposals were:

1. **Handrails**: to be required in all private stairways.

2. **Riser and going dimensions**: to be subject to a narrower range.

3. **Barrier for openable windows**: 865mm barrier to be required for openable windows where the floor is more than one metre above the ground below.

4. **Non-climbable Zone**: to be required for balustrades where the floor is more than one metre above the ground below.

5. **Single steps**: to be no more than 180mm.

These proposals would satisfy a BCA objective to provide people with safe, equitable and dignified access and movement to and within a building.

The five proposals to amend the BCA are not mutually exclusive; more than one proposal could be recommended if it was supported by the cost benefit analysis. Alternatively, if any proposal was not supported by the cost benefit analysis then this report would recommend the status quo – no change to the BCA with respect to that proposal.

Stakeholder comments and data from public consultation were incorporated into the cost benefit analysis.

The Monash Report cited academic literature that handrails in private dwellings with stairs would be 30% effective in reducing slips, trips and falls. However the literature was silent on the contribution the built environment could make through the other proposals. Without an evidence base from the literature for the other proposals, explicit assumptions were made about their effectiveness. Hence the calculated estimates of these benefits should be understood to be indicative of the broad magnitudes, rather than precise numbers.

The net present value for the five proposals was calculated on the basis of the Consultation RIS costings and also on the basis of stakeholder costings. One proposal, namely requiring handrails in all private dwellings with stairs, would clearly deliver substantial net benefits to society, with a net present value of $65 million under Consultation RIS costings or $60 million under stakeholder costings:

The other proposals would involve net costs overall.

- The stair riser and going dimension proposal would deliver a high level of benefits, but would also involve higher costs.

- The non-climbable zones proposal would be unlikely to deliver benefits, given the small calculated benefits and the caveat on the benefit calculation methodology, and stakeholder comments relating to effectiveness. It would also incur substantial costs and an overall net cost to the community.

- The two proposals (i) barrier for openable windows and (ii) single steps would be unlikely to deliver benefits, given the small calculated benefits and the caveat on the benefit calculation methodology, and stakeholder comments concerning ineffectiveness of barriers for openable windows. Stakeholders also argued that costs would be incurred. Hence there would be a discernible risk that these proposals would result in a net cost to the community.

Sensitivity analysis was undertaken of the assumptions, with the analysis most sensitive to variation in the discount rate and effectiveness. The handrail proposal delivered net benefits under all assumptions.

In conclusion, the handrail proposal alone of the five proposals considered would cost-effectively address the risks of slips, trips and falls in buildings.

1 Introduction

1.1 Purpose of this document

The purpose of this Regulation Impact Statement (RIS) is to analyse the likely impact of adopting the proposed BCA amendments into the Building Code of Australia (BCA) to reduce the risk of slips, trips and falls in buildings.

Under Council of Australian Governments' (COAG) requirements, national standard-setting bodies such as the Australian Building Codes Board (ABCB) are required to develop a RIS for proposals that substantially alter existing regulatory arrangements. This requirement is reaffirmed in the ABCB's Inter-Government Agreement[1] (IGA) which requires that there must be a rigorously tested rationale for regulation.

A draft RIS was initially undertaken for the purposes of public consultation ('Consultation RIS'). The Consultation RIS was developed further following its public release, taking into account the outcomes from the community consultation. A Final RIS has now been developed for decision-makers. This entire process is undertaken in cooperation with the Office of Best Practice Regulation and in accordance with the process established in the COAG *Best Practice Regulation Guide*[2] and presents the rationale, costs and benefits, and impacts of the proposal.

The primary purpose of a RIS is to examine the policy choices through a rational, comparative framework and to determine whether the resulting regulatory proposal is likely to cause higher net benefits to the community than the identified alternatives.

1.2 Current regulatory arrangements

The BCA is a performance based document that contains the technical provisions for the design and construction of buildings and other structures, covering such matters as structure, fire resistance, access and egress, services and equipment, and energy efficiency as well as certain aspects of health and amenity. The BCA is given the status of building regulations by all States and Territories.

Each section of the BCA specifies Objectives which are considered to reflect community expectations. It also defines mandatory Performance Requirements,

[1] The ABCB IGA is located at www.abcb.gov.au
[2] COAG Best Practice Regulation, A Guide for Ministerial Councils and National Standard Setting Bodies, October 2007, available at http://www.finance.gov.au/obpr/proposal/coag-guidance.html

which state the level of performance a Building Solution must meet to achieve the related BCA Objectives.

The BCA allows compliance with the Performance Requirements through the adoption of acceptable Building Solutions, i.e.:

- implementing the deemed-to-satisfy (DTS) provisions, which are specific requirements contained either in the BCA or in BCA referenced documents such as Australian Standards that are deemed to satisfy the Performance Requirements of the BCA; or
- formulating an Alternative Solution that can be shown to be at least equivalent to the DTS provisions or which can be demonstrated as complying with the Performance Requirements; or
- a combination of both.

In the context of this RIS, the DTS requirements with regard to the safe movement of people in buildings are set out in:

- BCA Volume One, Section D (access and egress); and
- BCA Volume Two, Section 3.9 (safe movement and access).

The requirements contained within Volumes One and Two of the BCA are designed to support the achievement of the following Objectives outlined in the table below.

Table 1-1: Relevant BCA Objectives

Volume One	BCA Objective
Section D – Access and Egress	<u>DO1</u> The *Objective* of this Section is to– (a) provide, as far as is reasonable, people with safe, equitable and dignified access to– (i) a building; and (ii) the service and facilities within a building; and (b) safeguard occupants from illness or injury while evacuating in an emergency.

Volume Two	BCA Objective
Part 2.5 – Safe Movement and Access	O2.5 The *Objective* is to– (a) provide people with safe access to and within a building; and (b) safeguard young children from drowning or injury in a *swimming pool;* and (c) safeguard people from drowning or injury due to suction by a *swimming pool* water recirculation system.

Based on the above, it is evident that the key objectives of the BCA for building access relates to providing occupants/people with safe entry and passage throughout buildings.

1.3 Review of current arrangements

This RIS analyses the likely impact of adopting measures to reduce the risk of slips, trips and falls in buildings. These measures have been developed as a result of detailed research and evaluation over a number of years.

Table 1-2 below provides a summary of the review process undertaken to date.

Table 1-2: Review and research into building access and safety

Date	Description	Source	Comments
2003	Health and Safety Risks in Buildings	Atech Group	In 2003, the ABCB commissioned report found that the main health and safety risks in buildings (both commercial and residential) appeared to be from slips, trips and falls. The report recommended further work on identifying cost-effective building designs (or building components) that could reduce the incidence of slips, trips and falls.
2008	The relationship between slips, trips and falls and the design and construction of buildings (The Monash Report)	Monash University Accident Research Centre (MUARC)	In 2006, the ABCB commissioned research by MUARC to supplement the existing information to determine whether a relationship exists between the incidence of slips, trips and falls for the age group most at risk and the design and construction requirements for buildings. The Monash Report also ascertained whether current requirements in the

Date	Description	Source	Comments
			BCA provide an acceptable minimum standard of safety and made recommendations.
2008	Recommendations from the Monash Report	National Technical Summit	The recommendations from the Monash Report were considered at the National Technical Summit of that year and by the ABCB's Building Codes Committee (BCC).
2008	Preliminary Impact Assessments (PIAs)	Building Codes Committee	Preliminary Impact Assessments (PIAs) based on the Monash Report recommendations were considered by the BCC and the development of a RIS was recommended to the Board for decision.
2008	ABCB 2009/10 work program	Australian Building Codes Board	In November 2008, the Board agreed to move forward with the project and to have it included in the ABCB 2009/10 work program.
2010	Trips, Slips and Falls Project	Di Marzio Research Pty Ltd	The ABCB commissioned a report to help determine a current snapshot of typical riser and going stair dimensions and the provision of handrails used in private stairways.
2010	Cost Analysis Report	Turner & Townsend	The ABCB commissioned a report to analyse the construction cost implications of the proposed changes to the BCA.
2010	Consultation RIS	Australian Building Codes Board and KPMG	The ABCB commissioned a Consultation Regulation Impact Statement to analyse the economic impacts of the proposed BCA amendments.
2010	Proposed BCA amendments cited in draft BCA 2011 for public comment.	Australian Building Codes Board	Proposed BCA amendments for STF were placed into the public comment draft of BCA 2011 to elicit comment regarding the technical aspects of the amendments.

2 Nature and extent of the problem

2.1 Overview

The proposed BCA amendments seek to address the incidence of slips, trips and falls in buildings.

Where building purchasers do not perceive value from prevention measures of slips, trips and falls or are not aware of their level of exposure to the risk of slips, trips and falls, there is little or no incentive for builders to include such features in construction. This is because purchasers are unlikely to choose to meet the additional costs that builders may incur to provide these protections.

Further, to the extent that the current codes do not reflect current knowledge about the nature and extent of risks associated with current building design and construction requirements, the relationship with slips, trips and falls, and the effectiveness of different prevention measures in mitigating those risks, it may be timely to review the BCA. The need for a review is supported by COAG best practice regulation guidelines which requires regulation be reviewed periodically to ensure its relevance.

In this section, the nature and extent of this problem is explored. The incidence of slips, trips and falls and how they impact on vulnerable populations, as well as the costs associated with fall injuries and fatalities are discussed. We also consider whether the current regulatory requirements, individual responses and the market's response are adequate in trying to reduce the incidence of slips, trips and falls.

This discussion highlights the opportunity to reduce the incidence of slips, trips and falls, and the associated costs with minor modifications to current building designs and construction requirements. It also suggests that the magnitude of the problem will increase in years to come as the percentage of aged people in the population increases. Combined, these considerations underpin the case for Government intervention in this area.

2.2 Nature and extent of the problem

In 2003, the ABCB commissioned a report, *Health and Safety Risks in Buildings*[3]. The report found that the main health and safety risks in buildings (both commercial and residential) appeared to be from slips, trips and falls. However, based on information available at that time, it was not possible to readily determine the actual risk contribution of any number of relevant factors such as building design (or building component), obstacles that are not part of the structure that create a trip hazard, surface contaminants, the degree of

[3] Atech Group, *Health and Safety Risks in Buildings*, submitted to the ABCB, 2003.

alertness of the persons suffering the injury and the number of people exposed to each particular hazard.[4] A recommendation from the report stated that the ABCB should commission a literature review to indicate cost-effective building designs (or building components) that could be utilised in new or existing buildings to reduce the incidence of slips, trips and falls.[5]

2.2.1 Incidence of slips, trips and falls in buildings

In 2006, the ABCB commissioned the Monash University Accident Research Centre (MUARC) to investigate whether the design and construction of buildings contributes to slips, trips and falls. In 2008, MUARC submitted a report, *The relationship between Slips, Trips and Falls and the design and construction of buildings* (the Monash Report), which found that between 2002/03 and 2004/05 an average of 106,000 hospital admissions occurred each year as a result of falls in buildings.[6] The Monash Report found that slips, trips and falls disproportionately affected the vulnerable pockets of the population, particularly young children and older people.

For young children, the Monash Report found that :

- the most common cause of hospitalisation for children between the ages of 0 to 14 is fall related injury;
- in Australia, fall-related injuries occur at a rate of 628.1 per 100,000 hospitalisations in children, with children between the ages of 5 and 9 years having the highest rate at 654.6 fall-related injuries per 100,000 hospitalisations;[7] and
- even though fall mortality rates for children are lower, children carry the largest fall injury burden with nearly 50 per cent of the total number of disability-adjusted life years lost worldwide to falls, occurring in children under the age of 15 years.[8]

For older people, the Monash Report found that:

- around 30 per cent of persons aged 70 years and over were found to fall at least once a year with 19 per cent falling more than once;

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[4] ibid, p. 87.
[5] ibid, pp. 87-88.
[6] Monash University Accident Research Centre, *The relationship between slips, trips and falls and the design and construction of buildings*, funded by the ABCB, 2008.
[7] ibid, p. 12.
[8] ibid, p. ix

- older persons living in residential care facilities tend to sustain fall injuries more often than older persons in the community[9];

- those over the age of 65 accounted for over 92 per cent of acute public hospital costs per bed day related to fall injuries; and

- older people represent 75 per cent of fall fatalities and 10.9 per cent of all hospital bed days. These frequencies represent an over-representation by a factor of 6 for this age group.

The Australian Department of Health and Ageing (DHA) *National Slips and Falls Prevention Project* reported similar findings.[10] DHA found that falls are the leading cause of death and injury for people aged over 65 years and that 1 in 3 people aged over 65 years living in the community fall each year.[11] The DHA report listed the environment as one of the main risk factors for falls in older people, and identified steps with no handrails as one of the environmental hazards commonly associated with falls.[12]

The Monash Report established the major causes of falls were:

- slips, trips and stumbles on the same level (29.2 per cent);

- other falls on the same level (20.6 per cent);

- falls involving beds (6.6 per cent);

- falls on and from stairs and steps (6.0 per cent);

- combined falls from heights (including falls on and from ladders, falls from, out or through buildings or structures and other falls from one level to another) (5.8 per cent); and

- falls involving chairs (3.9 per cent).[13]

The reasons behind the remaining 25 per cent of hospital admissions caused by falls were not specified.

2.2.2 The costs of slips, trips and falls

The economic costs associated with falls in buildings can be separated into the following categories:

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[9] ibid, p. 12.
[10] Australian Department of Health and Ageing, *National Slips and Falls Prevention Project*, 2005.
[11] ibid, p. 4.
[12] ibid, p. 20.
[13] Monash University Accident Research Centre, *The relationship between slips, trips and falls and the design and construction of buildings*, funded by the ABCB, 2008, p. x.

- direct tangible costs;
- indirect tangible costs; and
- intangible costs.

Each of these costs are discussed in further detail below.

2.2.2.1 Direct tangible costs

The *direct tangible costs* associated with falls in buildings are driven by the medical and rehabilitation costs associated with treating an injury (e.g. time spent in hospital).

Injuries

The Monash Report estimated the total cost to the public health system from falls in buildings which resulted in injuries and hospitalisation. This calculation was based on:

- an average hospital admission of 3.7 days;
- an average acute public hospital bed cost per day of about $1,000; [14] and
- 3.39 million acute public hospital bed days resulting from falls most likely occurring in buildings for the years 2002 to 2005.

From 2002 to 2005, the total cost was estimated to be at $3.4 billion of which $3.1 billion can be attributed to people aged over 65 years as they account for 92 per cent of acute public hospital bed days attributed to falls.[15]

The reasons that fall injuries incur such high hospitalisation costs is largely because older people are more susceptible to falls[16] and possess a weaker body constitution (e.g. decreased vision, balance and bone density) resulting in the likelihood that more serious injuries would be sustained from falls (e.g. hip fractures) and hence longer stays in hospitals[17].

Falls are also a primary source of traumatic brain injury (29 per cent) and spinal cord injury (33 per cent) in Australia, second only to transport accidents.[18]

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[14] The Monash Report based this calculation on data from AIHW *Hospital Statistics 2005-06*. Updating to 2009-10 prices using the Hospital and Medical Services sub-group of ABS 6401.0 *Consumer Price Index*, increases this cost estimate to $1,260.
[15] ibid, p. xiii.
[16] ibid, p. 12.
[17] ibid, p. 23
[18] Access Economics, *The economic cost of spinal cord injury and traumatic brain injury in Australia*, 2009, p223, 24

Although these injuries are a relatively uncommon result of falls (representing less than one per cent of fall-related hospitalisation), the direct lifetime costs, including the provision of attendant care and healthcare services, can be quite substantial.[19] In 2008, the lifetime cost of new cases of brain and spinal cord injury was estimated at $3.02 billion.[20]

Brain Injury Australia referred to falls-related traumatic brain injury (TBI) data sourced from the Sydney Children's Hospital at Randwick and The Children's Hospital at Westmead, which noted that between 2003 and 2007, 23 children (14 boys and 9 girls) aged between 0 and 11 years were admitted to the Sydney Children's Hospital after falls out of a window. Of these, 11 children sustained a TBI and one child died in hospital as a result. Over the same period 42 children were admitted to The Children's Hospital at Westmead after falling out of windows, with 26 of the children sustaining a TBI and one fatality.[21]

Fatalities

The Monash Report also quantified the economic costs of fall fatalities in buildings. Using an assigned economic value of life of $729,727.90[22], the Monash Report estimated the total economic cost resulting from falls in buildings to be $1.25 billion from 2001 to 2005 or $250 million per annum. For the purpose of this RIS, the economic value of a life is valued at $3.8 million according to the guidance provided by the Office of Best Practice Regulation.[23]

The report also found that:

- over the period, building fall related fatalities increased by 24.5 per cent;
- males accounted for the majority (57.6 per cent) of building fall related fatalities, constituting a total cost of about $720 million while female deaths accounted for 42.4 per cent and cost about $530 million; and
- falls occurring in the home made up 52.4 per cent of building fall related fatalities, with 30.9 per cent occurring in hospitals or health service areas (including nursing homes).

[19] Monash University Accident Research Centre, *The relationship between slips, trips and falls and the design and construction of buildings*, funded by the ABCB, 2008, p. 104.
[20] Access Economics, *The economic cost of spinal cord injury and traumatic brain injury in Australia*, 2009, p. xiv
[21] Information provided by Brain Injury Australia to the ABCB.
[22] This figure represents the median value of life for Australians in March 2003 determined by a PricewaterhouseCoopers study ($650,000), adjusted for CPI between the March 2003 to September 2007 quarters.
[23] The average economic value of life is estimated to be $3.8 million according to guidance provided by the Office of Best Practice Regulation (http://www.finance.gov.au/obpr/docs/ValuingStatisticalLife.pdf), where a 2007 calculation of $3.5m was updated to 2009-10 prices using the ABS 6401.0 *Consumer Price index*.

It should also be noted that, although the Monash Report has estimated the economic costs of injuries and fatalities, the available data is likely to underestimate the true extent of hospitalisations and fatalities in Australia attributed to falls. While the impact of falls resulting in deaths is relatively easy to collect, many other injuries from falls may not be captured in the Monash Report's estimation. Fall related injuries that are treated by general practitioners, nurses, family and friends or by individuals themselves would not have been captured using public hospitalisation costs data.

2.2.2.2 *Indirect tangible costs*

The *indirect tangible costs* are more difficult to identify but arise as a consequence of the event and include:

- business disruption (e.g. legal and compensation costs);
- indirect production losses (as a result of increased staff absenteeism); and
- reduction in unpaid work (e.g. housekeeping or parenting).

While indirect tangible costs such as business disruptions and production losses are difficult to quantify, given that the majority of victims of falls are older persons and to a lesser extent children, it is likely that such costs would be marginal as older persons and children are unlikely to be actively contributing to business and other productive activities.

As an indication of the potential magnitude of indirect tangible costs:

- *Compensation awarded for a slip, trip or fall* – In 2006, a woman was awarded $277,000 compensation after a fall at the Bondi Hotel in Sydney.[24] The largest settlement to date in Australia for a single slip and fall accident is believed to be $2.75 million.[25]
- *Production losses* – Xie et al. (2008)[26] estimated the indirect cost affecting patients suffering from knee osteoarthritis affects a similar population demographic as slips, trips and falls (i.e. the majority of patients are retirees). The study found that indirect costs imposed on patients accounted for between 2.3 per cent to 3.6 per cent of the annual average household income. Higher indirect costs were borne by working patients while retirees and homemakers bore the lower end of the cost range.

[24] *CG Maloney Pty Ltd v Hutton– Potts & Or* [2006] NSWCA 136
[25] Best Non-Slip Solution Website, accessed on 26 February 2010, http://www.bestnonslip.com.au/
[26] Xie F., Thumboo J., Fong K.Y., Lo N.N., Yeo S.J., Yang K.Y. and Li S.C., A Study on Indirect and Intangible Costs for Patients with Knee Osteoarthritis in Singapore, *Value in Heath*, Vol II Supplement I, 2008, p. S86.

2.2.2.3 Intangible costs

Intangible costs largely relate to the pain and suffering of patients, which are usually measured by using the reduction in quality of life or through the elicitation of the willingness-to-pay for a cure.

Xie et al. (2008) estimated that the intangible costs imposed on patients suffering from knee osteoarthritis accounted for 3.3 per cent of average annual household income. Intangible costs are found to be influenced by the income levels of patients, with patients on higher income experiencing high intangible costs.[27]

2.2.3 Risk factors contributing to slips, trips and falls

The incidence and costs associated with injuries and fatalities resulting from slips, trips and falls in buildings are driven by a number of risk factors. These risk factors include:

- biological and medical risk factors such as muscle weakness and reduced physical fitness, impaired control of balance and gait, vision changes, chronic illness, physical disability, acute illness, cognitive impairments and depression;

- behavioural risk factors including a history of previous falls, risk-taking behaviour (e.g. seniors climbing ladders or standing on unsteady chairs), medication and multiple prescriptions, excessive alcohol and inappropriate footwear and clothing;

- environmental risk factors including stairs, factors in and about the home (e.g. absence of night lights, hazardous shower stalls and lack of grab bars or handrails), factors in the public environment where poor building design and inadequate maintenance of buildings can also contribute to falls and falls hazards in long term care settings and hospitals (e.g. bed heights, floor surfaces and bad lighting); and

- socio-economic risk factors such as income, education, housing and social connectedness are recognised social determinants of health and can have an impact on the likelihood of falls. Research has shown that financial strain was an independent predictor of both falls and injurious falls, particularly among the caregivers of veterans.[28]

[27] ibid, p. S86.
[28] Public Health _Agency of Canada, Report on Seniors' falls in Canada_, 2005, pp. 30-36.

While it is difficult to effectively influence biological, behavioural and socio-economic risk factors, it is possible to reduce the risks of slips, trips and falls from some environmental risk factors, which is the focus of this RIS.

The Monash Report made recommendations in five areas with regards to changes to the BCA that could potentially reduce the incidence and costs associated with slips, trips and falls by addressing proven environmental risk factors:

1 Stair and step geometry

- Background:
    - Studies have shown that up to 80 per cent of stairway falls occur during descent.[29] The Monash Report recognised that the narrow going width (the lower end of the allowable range of stair riser and going dimensions), currently allowed by the BCA could potentially encourage falls during descent.
- Recommendation:
    - Narrow the wide range of geometrical going and riser combination currently allowed in the BCA.

2 Provision, design for optimal height of handrails and balustrades

- Background:
    - Handrails: The BCA does not currently require handrails in private stairways (i.e. stairways in Class 1 buildings and in dwelling units of Class 2, 3 & 4 buildings). The Monash Report noted the potential for injury if the anchoring function provided by a handrail is absent. In public stairways, handrails must be provided to both sides where the stairway is two or more metres wide. If the stairway is less than two metres wide, handrails (a balustrade with a top rail would be sufficient) are required for at least one side. The Monash Report noted the potential for injury if the anchoring function provided by a handrail is absent. The potential for

[29] Studies included:
1. Jackson, P.L. and Cohen H.H., An in-depth investigation of 40 stairway accidents and the safety of stair literature, *Journal of Safety Research*, Vol. 26(3), 1995, pp. 115-159.
2. Salter, A.E., K.M. Khan, M.G. Donaldson et al., Community-dwelling seniors who present to the emergency department with a fall do not received Guideline care and their fall risk profile worsen significantly: a 6-month prospective study, *Osteoporosis International*, Vol. 17(5) May, 2006, pp. 672-683.
3. Tse T., The environment and falls prevention: Do environmental modifications make a difference?, *Australia Occupational Therapy Journal*, Vol. 52(4), 2005, pp. 271-281.

injury on stairs bound by solid walls is also increased by the possibility of colliding with those walls during a fall.

- Balustrades: The Report noted that current BCA regulations do not require verandas of less than one metre above the surface beneath in height to have a railing or balustrade even though falls from such low heights can have severe injury consequences.

• Recommendations:

- Amend the BCA to raise the minimum stairway handrail height from 865mm to over 900mm. This recommendation was assessed in an earlier Preliminary Impact Assessment. It was found that the existing injury data was not robust enough to allow for any meaningful disaggregation of fall injury data that would correlate to a person's centre of gravity.

- Include in the BCA provisions of non-climbable barriers of sufficient heights for verandas of less than 1000mm in height.

3 Slip resistance of flooring surfaces

• Background:

- Current BCA refers to terms 'non-slip', 'non-skid' and 'slip resistance' to describe the requirements of various surface finishes, but does not actually specify what constitutes a non-slip, non-skid or slip resistant surface finish.

• Recommendations:

- A definition of slip resistance be included in future editions of the BCA.

- Manufacturers and retailers to provide to consumers comparative information on slip resistance and the slip resistant properties of different surfaces.

4 Trip hazards

• Background

- The Monash Report describes trip hazards generally as those obstacles that, if removed, would have prevented a fall. Trip hazards can include door frames, steps, clutter or cables.

• Recommendation:

- A provision to recess or “rebate” structural trip hazards such as door frames, shower door frames and other structural trip hazards in new or renovated domestic dwellings, be considered in future editions of the BCA.

5 Falls from heights

- Background

  - Windows, balconies and verandahs: The Monash Report considered that current BCA provisions governing the required height of verandah balustrades and the acceptable minimum space of 125mm between the horizontal and vertical balcony railings are old and no longer applicable. Climbability of balcony and verandah railings was also considered unacceptable from a safety perspective. The Monash Report also commented that the current BCA does not require a railing or balustrade where verandahs are less than one metre in height above the surface beneath. Severe injuries can result from such falls and can be mitigated through more stringent balustrade/barrier and non-climbable design provisions.

  - Residential building maintenance and access to heights: The Monash Report noted that it is impossible to regulate domestic maintenance activity and that elimination of hazards is the only practical prevention strategy for hazards associated with domestic building maintenance and the accompanying need to access heights.

- Recommendations:

  - The ABCB, building industry, local councils and other stakeholders investigate the possibility of limiting or reducing the need to attain heights for domestic maintenance purposes.

  - The BCA should consider a provision for the required installation of window guards at second storey height in all domestic dwellings, irrespective of whether they exceed four meters in height above the surface beneath.

  - The BCA to be amended to require handrails for stairs in all domestic dwellings.

  - All balcony, stair and verandah balustrades, irrespective of height above ground level, should be of non-climbable design and adequate height to prevent toppling-over.

Due to the extensive nature of the Monash Report, not all recommendations could be addressed through the BCA and assessed through this RIS. The Monash report recommendation concerning the issue of slip resistance for example would require further extensive research and time to formulate an appropriate definition and testing protocol with industry. A suitable approach to achieve this has been found to be problematic in the past, when the issue of slip resistance has been raised. Stakeholder feedback to the Consultation RIS again raised this issue and identified voluntary Australian Standards concerning the slip resistance of pedestrian surfaces. This is noted. However a suitable approach to address the issue of slip resistance in buildings remains problematic.

The recommendation to raise the handrail height to at least 910mm due to an increase in the average person's centre of gravity was also not included as it would also require further extensive research. Furthermore, the Preliminary Impact Assessments demonstrated that the existing injury data was not robust enough to allow for any meaningful disaggregation of fall injuries that could be correlated to a person's centre of gravity. The same reasons found in the PIAs also precluded the recommendation to eliminate structural trip hazards such as door rebates and shower frames.

Other recommendations are simply outside the scope of the BCA. Existing BCA requirements were not investigated for their cost effectiveness in reducing slip trips and falls as this too is outside the scope of this RIS. This RIS therefore considers only those recommendations which have passed the impact analysis process (PFC, PIA and Consultation RIS processes) where its regulatory impact can be assessed without the need for further research and that are within the framework of the BCA. They include and relate to:

- revising stair riser and going dimensions;
- the regulation of single steps;
- provision of handrails on private stairways;
- barriers for openable windows where the distance from the floor to the surface below is greater than one metre; and
- a non-climbable zone in a balustrade/barrier where the distance from the floor to the surface below is greater than one metre.

2.2.4 Future risks

The incidence and costs imposed by slips, trips and falls are likely to increase going forward due to the following factors:

- changing population demographics; and
- increasing building activity.

2.2.4.1 Changes in population demographics

Ageing population

The number of injuries and fatalities attributed to falls of older people is expected to increase as the proportion of older persons rise.

The United Nations estimated that by the year 2050, the number of older persons worldwide will for the first time exceed the number of younger persons. The proportion of persons aged over 60 years then will be twice that compared to the year 2000.[30]

The Australian Treasury forecasted that Australians aged 65 years and over will increase from around 2.5 million in 2002 to 6.2 million in 2042. This implies that the proportion of persons aged over 65 years will increase from making up around 13 per cent of the population to around 25 per cent. For Australians aged 85 and over, the growth is even more rapid, from around 300,000 in 2002 to 1.1 million in 2042.[31]

Children

The proportion of people in Australia aged under 15 years is projected to decrease from 19 per cent in 2007 to between 15 per cent and 18 per cent in 2056 and to between 14 per cent and 17 per cent in 2101, with the lower percentage based on the assumptions of lower fertility levels and net overseas migrations. [32]

Even though the proportion of people aged under 15 years is forecast to decrease in the future, given that the Australian population is projected to reach between 30.9 to 42.5 million by 2056 and 33.7 to 62.2 million by 2101, the absolute number of children at risk from falls will increase.[33]

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[30] ibid, p.12.
[31] Australian Treasury website, *Australia's Demographic Challenges*, accessed 13th May 2010. http://demographics.treasury.gov.au/content/_download/australias_demographic_challenges/html/adc-04.asp
[32] Australian Bureau of Statistics website, Catalogue No. 3222.0 – Population Projections, Australia, 2006 to 2101, accessed 16th May 2010. http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3222.0Main+Features12006%20to%202101?OpenDocument
[33] ibid. http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3222.0Main+Features12006%20to%202101?OpenDocument

2.2.4.2 Increase in building activity

As a result of higher density living due to the urbanisation of the environment, it is more likely that people will access buildings more frequently or live in buildings that could contribute to higher occurrence of slips, trips and falls.

An increasing population in Australia will place pressure on the demand for housing. To accommodate an increasing population, construction activity is likely to focus on the building of higher density multi-storey dwellings. An increase in the number of such buildings could contribute to the occurrence of slips, trips and falls.

2.3 Current regulatory arrangements

2.3.1 Overview

There is a range of slips, trips and falls prevention measures available to building owners to mitigate their level of risk exposure to fall injuries and fatalities. Typically, these measures are designed to:

- provide, as far as is reasonable, people with safe, equitable and dignified access to a building and the service and facilities within a building; and
- safeguard occupants from illness or injury while evacuating in an emergency.

The following sections outline the provisions in the BCA that are designed to prevent or minimise the risks of injury caused by slips, trips and falls.

2.3.2 Stairways

The BCA currently prescribes a range of design requirements for the construction of stairs of all Classes of buildings, including:

- all goings and risers are to be constant throughout a flight of stairs;
- risers that have openings to not allow a 125mm sphere to pass through between the treads; and
- treads to have non-slip finishes.

In addition, the BCA establishes a maximum and minimum ratio for risers and goings using the quantity ratio (2R + G). The following table summarises the riser and going dimensions currently outlined in the BCA.

Table 2-1: Riser and going dimensions (summary of Table D2.13 and Figure 3.9.1.2 in the BCA)

	Riser (R) (mm)		Going (G) (mm)		Quantity (2R + G) (mm)	
Vol One - Table D2.13(Class 2-9 buildings)	Max	Min	Max	Min	Max	Min
Public stairways	190	115	355	250	700	550
Private stairways	190	115	355	240	700	550
Vol Two - Figure 3.9.1.2 (Class 1 & 10 buildings)	Max	Min	Max	Min	Max	Min
Stairs (other than spiral)	190	115	355	240	700	550
Spiral	220	140	370	210	680	590

According to the Monash Report the design, construction and regulation of stairs are based heavily on tradition rather than principals of ergonomics and universal design. Reliance on tradition does not necessarily mean that the current design of stairs is adequate. However stakeholder feedback during the public comment period argued that this notion is not correct. Stakeholders suggested that the use of the 2R+G dimensions provided a safe slope of the staircase and was developed to replace complicated, trigonometric calculations that can be used on site.

2.3.3 Handrails and balustrades

The requirements to build a barrier in the form of a balustrade or barriers along roofs, stairs, ramps and balconies etc in all types of buildings are outlined in BCA Volume One D2.16 and in BCA Volume 2, Part 3.9.2.2. The BCA provides that stairs meet the requirements if they are bounded by a wall.

At a summary level, these provisions cover:

- when a balustrade/barrier is required to be built – for example stairways, ramps, balconies, decks, verandas where the distance from the floor to the surface below is greater than one metre and windows where the distance from the floor to the surface below is greater than four metres; and
- the height and construction of the balustrade/barrier.

2.3.4 Non-climbable zone

To maximise the effectiveness of the balustrade provision, the BCA outlines a non-climbable zone provision. The non-climbable zone is required for balustrades/barriers where the distance from the floor to the surface below is greater than four metres. The building parameters of a non-climbable zone currently describe that any horizontal or near horizontal elements between 150mm and 760mm above the floor must not facilitate climbing.

There are no non-climbable zone provisions for balustrades/barriers where the height from the floor to the surface below is less than four metres.

2.3.5 Single step

There are no current provisions in the BCA that outline the requirements for a single step except at external door thresholds. BCA Volume One D2.15 and BCA Volume Two 3.9.1.5 currently requires external door thresholds to be no more than 190 mm, however for single steps elsewhere, there are no requirements and this would allow a single step at any height.

2.3.6 Conclusion – slips, trips and falls prevention

Some of the issues with the current provisions outlined above that aim to minimise or prevent slips, trips and falls include:

- the handrail provisions do not apply to private stairways – particularly an issue with multistorey Class 1 buildings and within private areas of Class 2 (buildings containing two or more dwellings), Class 3 (guest house, motel or backpacker accommodation) and Class 4 (single dwelling in a Class 5, 6, 7, 8 or 9) buildings;
- currently, the ranges for risers and goings are broad – particularly an issue in regard to narrow stair goings and tall risers. This makes the design and construction of stairs less consistent across all buildings. In addition, no regulation exists for the maximum height of a single step; and
- balustrade/barrier provisions are required only for openable windows where the distance is greater than four metres from the floor to the surface beneath.

2.4 Rationale for a review of current arrangements

The current review of the BCA requirements is necessary as:

- the Monash Report identified that slips, trips and falls are the second largest cause of unintentional injury deaths after road traffic injuries and that building design has the potential to mitigate many of these falls injuries and deaths in vulnerable populations;

- the Monash Report contended that the provisions for some building design components, such as those that relate to the construction of stair risers and treads, are based on traditional rules and not principles of ergonomics and universal design; and

- it is consistent with Government policy objectives, where COAG principles for best practice regulation states that "to ensure regulation remains relevant and effective over time it is important that all regulations be reviewed periodically". Over time, the understanding of risks which exist in the broader built environment improves and there is a better appreciation of how the risks can best be managed. There will also be changes in the stock of building materials as a result of technological developments. The BCA is the basis for the regulatory building standards in all of Australia's jurisdictions, therefore it is important that the BCA is reviewed on a regular basis to take account of these changes so its relevancy can be maintained and compliance burdens minimised.

2.5 The rationale for continued intervention – market failures

2.5.1 Introduction

In considering the appropriateness of existing arrangements, it is important to confirm the rationale for continued Government intervention in a particular area. Government intervention is necessary when an issue or problem (e.g. incidence of slips, trips and falls) imposes social or economic costs (e.g. hospitalisation and fatality costs) to the community but is not adequately addressed by individuals or the market.

Generally, in the event that a market does not deliver an efficient outcome, it is said to be 'failing' and Government intervention is justified on the grounds that it could improve economic outcomes and the economic welfare of society. The market can be inefficient due to a variety of factors that include:

- imperfect individual responses; and

- imperfect industry responses.

These imperfect responses arise due to an array of market failures including insufficient information and information asymmetry, and provide a rationale for continued Government intervention. These market failures are further explored in the following sections.

2.5.2 Imperfect individual responses

Building owners, especially owner-occupiers, clearly have a strong self-interest in protecting themselves from slips, trips and falls. While owners can choose to implement protection measures to mitigate these risks, they require accurate and readily available information to ensure an appropriate level of mitigation is provided.

Given this information, owners are able to balance the risk of loss against the cost of risk mitigation measures, and thus choose the level of exposure they are willing to accept. However in practice, this may not occur because of the market failures summarised below.

Insufficient information

To determine the risks associated with a particular building and the appropriate approach to mitigating those risks, building owners require information about the following:

- how risks are influenced by specific building, property and occupant characteristics; and
- how different modifications made to the design of various building components can effectively mitigate the risks of slips, trips and falls.

This information is highly technical, extensive and difficult to comprehend. In practical terms, it may not be realistic to assume that individuals would, as a matter of course, have the capacity to assemble, analyse and assess the range of information necessary to form a fully informed view of the building risks and the appropriate mitigation measures.

In addition, where the users of a particular building are not aware of the level or appropriateness of the various preventative measures in operation, an information asymmetry exists. That is, users may assume that they already have adequate protection from slips, trips and falls for the level of risk exposure. They may not necessarily have the capability to understand the information or even be able to access the required information to assess its appropriateness.

2.5.3 Imperfect industry response – split incentives

The benefits of preventing slips, trips and falls in buildings normally do not accrue to the party that designs or constructs the building. Designers and builders have incentives to minimise building costs in order to attract purchasers and remain competitive in the building industry, yet decisions made during the building design and construction phases can significantly impact on the probability of fall injuries and fatalities. Without intervention, builders do not have incentives to voluntarily incorporate additional preventative measures in the design and construction of buildings, where owners are price driven and unable to verify the benefits arising from an increase in building costs.

2.6 Summary of rationale for proposed amendments and continued Government intervention

The rationale for a review of the current arrangements is based on the following:

- inadequacies related to the current BCA requirements that relate to the slips, trips and falls preventative measures as identified by the Monash Report. Modifications to those measures have the potential to reduce the number and costs of falls injuries and deaths; and

- COAG support for the periodic review of regulation to reflect current knowledge and technology.

Continued Government intervention is based on the following market failures:

- individuals are unlikely to make appropriate decisions due to insufficient information (i.e. sufficient information is difficult to obtain and analyse); and

- the building industry is unlikely to voluntarily incorporate adequate protection measures in the design and construction of new buildings as they can involve an increase in building costs, and because purchasers are unable to verify the long term benefits associated with those measures.

In light of these considerations, there is a strong case for continued Government intervention, and a review of the current regulatory arrangements, to assess whether the risk of slips, trips and falls in buildings and its impact and costs on the community can be addressed more effectively and efficiently than the status quo.

3 Objectives of Government intervention

Government intervention would be implemented principally by the ABCB amending the BCA. The ABCB's mission is to address issues relating to health, safety, amenity and sustainability in buildings through the creation of nationally consistent building codes, standards, regulatory requirements and regulatory systems.

ABCB objectives

The objectives of the ABCB are to:

- develop building codes and standards that accord with strategic priorities established by Ministers from time to time, having regard to societal needs and expectations;
- establish building codes and standards that are the minimum necessary to achieve relevant health, safety, amenity and sustainability objectives efficiently; and
- ensure that, in determining the area of regulation and the level of the requirements:
  - there is a rigorously tested rationale for the regulation;
  - the regulation would generate benefits to society greater than the costs (that is, net benefits);
  - there is no regulatory or non-regulatory alternative (whether under the responsibility of the Board or not) that would generate higher net benefits; and
  - the competitive effects of the regulation have been considered and the regulation is no more restrictive than necessary in the public interest.

Objectives of the draft revisions to the BCA

The proposed amendments to the BCA are designed to support the objectives of both the ABCB and COAG's principles for best practice regulation, which support the periodic review of regulation to ensure it remains suitable for its purpose. They also seek to provide an efficient response to reduce the incidence of slips, trips and falls in buildings and the associated costs due to fall related injuries and fatalities. In particular, the proposed revisions and the alternative options being considered seek to achieve the following:

- provide people with safe, equitable and dignified access to a building and the service and facilities within a building, and safeguard occupants from illness or injury while evacuating in an emergency;

- address the identified market failures in relation to the provision of preventative features of slips, trips and falls; and

- ensure that the regulatory requirements are cost effective and transparent.

4 Identification of feasible policy options

4.1 Introduction

This section identifies and considers the merits of alternative means of achieving the Government objectives of reducing the incidence of slips, trips and falls through revisions to the BCA. This discussion of feasible alternatives is divided into three sections:

- a description of the regulatory proposal (i.e. the proposed BCA amendments being the central case) and how it differs from the status quo (i.e. continuing with the current requirements in the BCA);
- a discussion of other forms of regulation and non-regulatory options; and
- a shortlist of feasible policy options for detailed assessment.

The shortlisted options are then assessed in further detail in the subsequent analysis.

4.2 Description of the regulatory proposal

The proposed BCA amendments are based primarily on the recommendations from the Monash Report. The preparation of a Consultation RIS for the proposed BCA amendments was recommended by the Building Codes Committee to the Board, which subsequently agreed to move forward with the project and have it included in the ABCB 2009/10 work program.

4.2.1 Summary of proposed BCA amendments and key changes from current arrangements

The proposed BCA amendments make changes to the DTS requirements that apply to the design and construction of stair risers and goings (including single steps), handrails, non-climbable zones and barriers for openable windows. The five proposed revisions and key changes from current arrangements are summarised in the table below.

The proposed BCA amendments are a result of the review process explained in section 1.3. This RIS explores the costs and benefits associated with the proposed amendments, but do not assess the cost effectiveness of existing arrangements or other potential cost-effective changes to the BCA.

Table 4-1: Summary of the proposed BCA amendments and current arrangements

	Building component	Proposed revisions	Current arrangement
1.	Handrails	• Handrails to be installed on all private stairways to at least one side, however they need not be continuous. • Applicable to Class 1 buildings and private stairways in Class 2, 3, and 4 buildings.	• Current BCA requirements do not apply to private stairways.
2.	Stair riser and going dimensions	• Reducing the spread between the maximum and minimum going and riser dimensions for both private and public stairways. • Riser dimensions to be between 150mm to 180mm (range of 30mm) and going dimensions to be between 280mm to 355mm (range of 75mm). • No requirement for riser and going dimensions to satisfy the equation '2R+G'. • Applicable across all building classes. Spiral stairways are excluded.	• Current allowable spread in riser dimensions is between 115mm to 190mm, a range of 75mm. • Current allowable spread in going dimensions is between 250mm to 355mm, a range of 115mm. • Current riser and going relationship to satisfy the equation '2R+G'.
3.	Barrier for openable windows	• Requirement to have an 865mm high barrier for openable windows where the distance from the floor level to the surface below is greater than one metre. • Applicable across all building classes.	• Current trigger for BCA balustrade or barrier requirements for openable windows is when the difference between the floor level and the surface below is greater than four metres.
4.	Non-climbable zone	• Requirement to have a non-climbable zone in a balustrade or barrier where the distance from the floor level to the surface below is greater than one metre. • The non-climbable zone within a balustrade or barrier sits between 150mm and 760mm above the floor and must not have any horizontal elements that facilitate climbing. • Applicable across all building classes.	• Currently a balustrade or barrier is not required to have a non-climbable zone unless the floor level is greater than four metres above the surface below.
5.	Single step	• Single steps are not to be more than 180mm high, including door thresholds. • Applicable across all building classes.	• Current provisions in the BCA do not regulate the height of single steps. • Current provisions in the BCA for riser minimum and maximum dimensions only apply to two or more risers.

4.2.2 Stakeholder alternative proposal to barriers for openable windows

A stakeholder concerned with preventing injuries to children commented that the proposed BCA amendment: barriers for openable windows would be ineffective. The placement of furniture near windows and children's play behaviour involving climbing or jumping on furniture were significant risk factors causing falls of children from windows, that would continue under the proposed BCA amendment. Instead, the stakeholder proposed that screens be placed in front of openable windows.

It should be noted that the risks mainly relate to behaviour rather than structural building elements. Changing behaviour, both in the placement of furniture and supervising children's play, would have most impact in reducing these risks. Hence it would seem that an education campaign, targeting families in all existing multistorey buildings (rather than just new buildings) could be the most effective option to reduce the risks of children falling from windows.

The stakeholder's comment on effectiveness is considered further in the impact analysis chapter, below.

4.3 Alternative policy approaches

4.3.1 Other forms of regulation

The regulatory proposal involves making changes to the provisions in the BCA that govern the design and construction of various building components. These revisions being subject to explicit government regulation, are one form of regulation. The COAG *Best Practice Regulation* guide identifies a spectrum of regulatory approaches with explicit government regulation at one end of the spectrum and self-regulation at the other. Intermediate forms of regulation (quasi-regulation and co-regulation) are also identified.

Self-regulation

Self-regulation involves industry formulating rules and codes of conduct, and being solely responsible for their enforcement. It generally requires a viable industry association with broad coverage and members that will voluntarily adhere to a code of conduct devised by other members. Minimal sanctions such as loss of membership or peer disapproval are required to ensure broad compliance, and the Government role is reduced to facilitation and advice.

Self-regulation should be considered where:

- there is no strong public concern, in particular, no major health and safety concern;

- the problem is a low risk event and of low impact or significance; and
- the problem can be fixed by the market itself, for example, there may be an incentive for individuals or groups to develop and comply with self-regulatory arrangements (industry survival or market advantage).[34]

This matter appears unlikely to meet these criteria. Self-regulation is unlikely to provide an adequate incentive for the reduction in the occurrence of slips, trips and falls in buildings. Slips, trips and falls are high risk occurring events (particularly with an ageing population and increase in construction activity) and their potential impacts are substantial, particularly in the areas of public health costs and safety concerns for vulnerable populations.

Further, because the benefits of enhanced preventative measures of slips, trips and falls in buildings do not accrue to the building industry (i.e. there are split incentives), it is unlikely that self-regulation would result in an appropriate level of protection being incorporated in the design and construction of such building components in new or refurbished buildings.

Quasi-regulation

Quasi-regulation is similar to self-regulation, but is distinguished by a stronger role for Governments in endorsing industry codes, providing technical guidance, or entering into Government-industry agreements.

One option could be for Government to encourage and assist the building industry to formulate appropriate standards but leave the compliance as a voluntary matter or subject to professional sanction. Possible sanctions range from information sanctions to exclusions from professional bodies.

Similar to self-regulation, it is unlikely that quasi-regulation would deliver an efficient outcome for construction of new or refurbished buildings. Given compliance is voluntary, there is a risk of non-compliance that will not result in a reduction in the incidence of slips, trips and falls.

Co-regulation

Co-regulation involves Governments providing some form of legislative underpinning for industry codes and standards. This may involve delegating regulatory powers to industry, enforcement of undertakings to comply with codes, or providing a fall-back position of explicit regulation in the event that industry fails to self-regulate.

Co-regulation is also unlikely to achieve Government policy objectives for revisions that govern the design and construction of the building components that could reduce the incidence of slips, trips and falls in buildings. This is

[34] Office of Best Practice Regulation *Best Practice Regulation Handbook 2010, p. 34.*

because without Government and legislative backing, there is considerable risk that a co-regulatory approach would result in higher levels of non-compliance, with a potential consequence of a continuing rise in the incidence of slips, trips and falls.

Conclusions

The lack of alignment between those with responsibility for incorporating better preventative measures to reduce the incidence of slips, trips and falls in buildings and those who realise their benefits, mean it is unlikely that an intermediate form of regulation would achieve Government objectives. The risks associated with non-compliance include substantial risks to public health and safety, and economic impacts.

4.3.2 Non-regulatory intervention

A range of alternative instruments that might be used as alternatives to regulatory intervention, include:

- information and education campaigns;
- standards including voluntary, non-regulatory, performance-based or prescriptive; and
- market-based instruments such as taxes and subsidies.

Information and education campaigns

Information and education campaigns regarding improvements to the design and construction of building components that could reduce the incidence of slips, trips and falls in buildings can potentially improve the performance of buildings. However, as outlined in Section 2.5, even with complete information, individuals are unlikely to be able to design, construct and incorporate the appropriate preventative measures due to the technical aspects of risk assessment and product knowledge combined with the assumed limited technical and analytical ability of lay-people. This limits the effectiveness of any information or education campaigns.

Standards

While voluntary Standards could provide flexibility, it is unlikely that, without legislative backing, e.g. through State and Territory based legislation, the building industry would voluntarily comply with the Standards. This relates to the issue of split incentives, where the benefits associated with the increased levels of protection do not accrue to the building industry.

The current arrangement incorporates some characteristics of a non-regulatory approach such as using a performance-based framework and providing builders with flexibility to satisfy the BCA Performance Requirements through the DTS provisions or allowing builders to formulate an alternative solution that demonstrates compliance. That is, the Standards facilitate the process of compliance but the BCA does not mandate compulsory compliance with the Standards if a building practitioner is able to demonstrate compliance via an alternative manner.

Taxes and subsidies

Taxes and subsidies are unlikely to provide sufficient incentive to encourage the adoption of improved preventative measures to reduce the incidence of slips, trips and falls in buildings as they would still require individuals to bear substantial up-front costs. Although these additional costs are likely to be outweighed by longer term benefits, the lack of readily available information around the risk of slipping, tripping and falling and the likely difficulties individuals would face in comprehending and acting rationally on that information, mean that there could be a significant risk that individuals would have insufficient incentive to incur the costs of implementing effective new measures for slips, trips and falls.

Conclusions

Non-regulatory interventions, on their own, appear to be inappropriate responses to ensure implementation of appropriate preventative measures of slips, trips and falls because they would not provide the level of assurance of protection and minimisation of damages required by the public and Governments.

4.4 Options for detailed consideration

Given the above assessments of voluntary and information based approaches and the imperfections in the individual and market responses to this problem, these approaches are likely to have limited effectiveness in isolation. There is however, a strong rationale for a continuing regulatory approach. This RIS provides a comparative assessment of alternative regulatory measures.

The proposed amendments to the BCA are not mutually exclusive. More than one proposal may be selected if supported by the impact analysis. Alternatively, if any proposal cannot be supported by the impact analysis then this report will recommend the status quo with respect to that proposal. The options for detailed consideration are:

- The status quo – no changes to the BCA.
- Proposals, as described in detail in Table 4.1 above:

1. **Handrails**: to be required in all private stairways.

2. **Riser and going dimensions**: to be subject to a narrower range.

3. **Barrier for openable windows**: 865mm barrier to be required for all openable windows where the floor is more than one metre above the ground below.

4. **Non-climbable Zone**: to be required for balustrades where the floor is more than one metre above the ground below.

5. **Single steps**: to be no more than 180mm.

The costs and benefits associated with each proposal will be assessed in terms of the incremental difference to the status quo.

5 Costing the impact of the proposals

5.1 Introduction

This section provides an assessment of the impact of the proposed BCA amendments in different types of buildings. It involves quantification of the incremental change in costs for a representative sample of buildings. The estimated cost impacts are extended to the State and national level in the following section, together with an assessment of the other costs and benefits associated with the proposal.

This section will perform the analysis for each of the proposed BCA amendments as follows:

- identify the expected design implications for each of the five proposals for different types of building (i.e. by BCA classification); and
- calculate the likely cost impact of each proposal for each different class of building.

The remainder of this section details the analysis in each of these areas.

5.2 Proposals and the BCA building classifications

The five proposals do not apply to all building classes in the BCA. The proposed change to the requirement for handrails to be installed only applies to Class 1 buildings and private stairways in Class 2, 3 and 4 buildings. The other four proposals apply to all building classifications. Table ***5-1*** provides a brief overview of the building classes defined by the BCA. For the purpose of this RIS (unless otherwise stated), Classes 1 and 2 are considered residential buildings while Classes 3 to 10 are considered commercial buildings.

Table 5-1: Applicability of proposed revision to the BCA building classes

Class	Description	Type
1	Single dwelling, including terrace or townhouse	Residential buildings
2	Building containing two or more dwellings	
3	Guest house, motel, backpacker accommodation etc	Commercial buildings
4	Single dwelling in a Class 5, 6, 7, 8, or 9 building	
5	Office building	
6	Shop, café or restaurant etc	
7	Carpark or wholesale type warehouse	
8	Laboratory or factory	
9a	Health-care building, hospitals etc	

Class	Description	Type
9b	Assembly building	
9c	Aged care building	
10	Non-habitable building or structure such as private garage or swimming pool etc	

5.3 Handrails on private stairways

The costs of supplying and installing handrails to buildings in Classes 1 to 4 are provided by a cost analysis report by Turner and Townsend[35] as shown in Table 5-2. Note that the Turner and Townsend report provided cost estimates for handrails of lengths four, five and six metres based on three different types of materials. Cost estimates provided by Turner and Townsend are exclusive of GST. These cost estimates represent the incremental cost of implementing the proposed change as there are no current BCA requirements for private stairways.

Table 5-2: Cost estimates for proposed handrail requirement (2009/10 dollars)

Type	4 metres	5 metres	6 metres
Hardwood timber	$264	$330	$400
	$396*	$495*	$600*
Anodised Aluminium	$1,000	$1,250	$1,500
Steel with PVC sheathing	$670	$840	$1,000

*One submission by a stakeholder that specialises in stair manufacturing suggested that the Consultation RIS cost estimates for handrails should be at least 50% more

The analysis has assumed that, for a representative building in each building class impacted by the revision, the average length of a handrail constructed is eight metres. It was reasonable to assume that private stairways would already have a balustrade along half the length of the stairway, therefore only the remaining four metres along a stairway would require the construction of a handrail in order to comply with the proposed amendment. Cost impacts of the proposed revision for a building in Classes 1 to 4 ranges from $264 to $1,000 depending on the material used.

5.4 Stair riser and going dimensions

The reduction in the spread between the maximum and minimum stair riser and going dimensions applies across all building classes. Turner and Townsend estimated the incremental cost implication of the revision for each building class using two different types of materials (in-situ concrete and timber) as shown in Table 5-3. When estimating the incremental costs, Turner and Townsend have also assumed a slab to slab height for each class. Further, to estimate the incremental cost, Turner and Townsend assumed that

[35] Turner and Townsend, _Cost Analysis Report_, 2010, report commissioned by the ABCB, p. 2.

the typical riser and going dimension under the current code is 180mm (riser) and 250mm (going), and that under the proposed code it would change to 180mm (riser) and 280mm (going).[36]

Further assumptions were used in relation to the average number of storeys for a representative building in each BCA class as well as the type of material to be used for residential (timber) versus commercial (in-situ concrete) buildings. Buildings in Classes 2 and 3 will incorporate both private and public stairways. Further, it was assumed that there is an average of 10 single occupancy units (SOUs) on each storey of the building and that around 5 per cent of these units are double storey and would require the construction of one flight of timber residential stairs. All buildings within Classes 2 and 3 were also assumed to incorporate concrete public stairways.

Table 5-3 and Table 5-4 show the cost estimates for residential stairs and commercial stairs respectively, calculated using the information provided by Turner and Townsend and taking into account the assumptions used in the Consultation RIS.

During public comment, one submission from a stair manufacturer provided a very detailed costing and estimated a figure of $404.30 per timber stair. This figure factors in the increased length of the stringers required to accommodate a longer stairway, the difficulty in sourcing longer length timber for the longer stringers, the requirement for solid timber treads to be laminated/glued in order to achieve a 280mm going due to it being a non-standard timber dimension, the extra labour involved in machining and installing the stairway, sanding, laminating and staining the stairway.

Table 5.4a shows the alternative cost estimates for residential stairs (timber), calculated using information provided by this detailed stakeholder submission.

Table _5-3_: Cost estimates for proposed change to stair riser and going dimensions for (private) residential stairs

Building Class	No. of storeys	No. of SOUs affected	No. flights of stairs per SOU	Assumed slab to slab height (m)	Incremental cost per flight ($)		Cost estimates ($)
					In-situ concrete	Timber	
1	2	NA	1	3	--	66	66
2	5	2.5	1	3	--	66	165
	10	5	1	3	--	66	330
3	5	2.5	1	3.5	--	77	193
	10	5	1	3.5	--	77	385

Source: 1. Incremental cost estimates from Turner and Townsend. 2. Assumptions regarding number of flights of steps from Consultation RIS. 3. Calculations performed by KPMG.

[36] Turner and Townsend, _Cost Analysis Report_, 2010, report commissioned by the ABCB, p. 3.

Table 5-4: Cost estimates for proposed change to stair riser and going dimensions for (public) commercial stairs

Building Class	No. of storeys	No. of stairwells per building	Total no. flights of stairs	Assumed slab to slab height (m)	Incremental cost per flight ($)		Cost estimates ($)
					In-situ concrete	Timber	
2	5	1	4	3	83	--	332
	10	2	18	3	83	--	1,494
3	5	1	4	3.5	97	--	388
	10	2	18	3.5	97	--	1,746
4	2	1	1	3	83	--	83
5	5	1	4	4	111	--	444
	10	2	18	4	111	--	1,998
	20	2	38	4	111	--	4,218
6	2	1	1	4	111	--	111
7	3	1	2	5	138	--	276
	5	1	4	5	138	--	552
	10	2	18	5	138	--	2,484
8	2	1	1	5	138	--	138
9	2	1	1	4	111	--	111
	5	2	8	4	111	--	888
10	N/A	NA	N/A	N/A	97	--	N/A

Source: 1. Incremental cost estimates from Turner and Townsend. 2. Assumptions regarding number of flights of steps from Consultation RIS. 3. Calculations performed by KPMG.

Table 5-4a: Alternative cost estimates for proposed change to stair riser and going dimensions for (private) residential stairs

Building Class	No. of storeys	No. of SOUs affected	No. flights of stairs per SOU	Assumed slab to slab height (m)	Incremental cost per flight ($)		Cost estimates ($)
					In-situ concrete	Timber	
1	2	NA	1	3	--	404.3	400
2	5	2.5	1	3	--	404.3	1000
	10	5	1	3	--	404.3	2000
3	5	2.5	1	3.5	--	404.3	1000
	10	5	1	3.5	--	404.3	2000

Source: 1. Stakeholder feedback 2. Assumptions regarding number of flights of steps from Consultation RIS.

For Class 2 and 3 buildings, there is a combination of residential and commercial stairs. Using cost figures provided by Turner and Townsend the data indicates that for a:

- Class 2:
  - five storey building, there is an estimated net cost of $497;
  - ten storey building, there is an estimated net cost of $1,824;
- Class 3:
  - five storey building, there is an estimated net cost of $581; and
  - ten storey building, there is an estimated net cost of $2,131.

Across all building classes, the cost increase of the proposed amendments ranges from $66 (Class 1) to $4,218 (Class 5 – 20 storey building).

Calculations' using alternative cost figures provided by stakeholder feedback indicates that for a:

- Class 2:
  - five storey building, there is an estimated net cost of $1,332;
  - ten storey building, there is an estimated net cost of $3,494;
- Class 3:
  - five storey building, there is an estimated net cost of $1,388; and
  - ten storey building, there is an estimated net cost of $3,746.

5.5 Barrier for openable windows

The proposed requirement to have an 865mm high barrier for openable windows where the distance from the floor to the surface below is greater than one metre applies across all building classifications. The cost estimates provided by Turner and Townsend relate to the unit rates for the supply of Juliet balconies and the cost of infilling the risk zone with different construction materials as shown in Table 5-5.[37] Turner and Townsend reported that in the scenario of an opening full height window or sliding door, the bottom 865mm would need to be fixed. As there are a range of possible design variations,

[37] ibid , p. 5.

Turner and Townsend were unable to provide the cost impacts under this scenario.

Table 5-5: Cost estimates for proposed barrier for openable windows

Infill material	Cost ($)
Powder coated aluminium balcony with safety glass infill	550
Powder coated aluminium framework balcony with vertical balusters	410
Plasterboard on metal frame, insulation, brick outer skin wall construction	265
Plasterboard on metal frame, insulation, brick/render/paint outer skin wall	265
6.38 laminated safety glass in lieu of 4mm float glass	50

In practice however, the proposed requirement is more likely to result in a design change for new buildings rather than the construction of Juliet balconies, e.g. an increase in the height of window sills. Hypothetically, even where there is a design change resulting from a full height window to the use of a smaller window at an increased sill height, the substitution cost of roughly $265 per square metre for a typical compliant wall system (see Table 5-5) would be offset by the saving of roughly $285 per square metre for a typical window[38]. Hence it is assumed that no significant incremental construction cost would be incurred for a representative building in each building class as a design change would not incur any significant costs and is sufficient to address the proposed requirement.

5.6 Non-climbable zone

The proposed requirement to have a non-climbable zone in a balustrade or barrier where the distance from the floor to the surface level below is greater than one metre applies across all building classifications.

Due to the existing requirement where no part of the balustrade above the nosing allows a 125mm sphere to pass through, and that the spacing between support rails for vertical wire balustrades must not exceed 900mm, Turner and Townsend assumed a minimal difference between the actual cost of the "barrier wire/rod" in either a vertical or horizontal system.

However, Turner and Townsend commented that in the vertical system, there would be a need to provide an additional support bar at the bottom of the balustrade. In the horizontal system, there is no need as the lowest wire/bar is supported by vertical bars which are a requirement in both circumstances. Hence, Turner and Townsend concluded that the cost impact would only apply to a vertical system at an incremental cost of approximately $50 per metre for a representative building in each building class.[39] Feedback provided in public comment submissions however, suggested that the $50 incremental cost was underestimated. A range of submissions from stainless steel wire manufacturers and wire balustrade installers highlighted a number

[38] Rawlinsons - Australian Construction Handbook 2009 p. 358
[39] Turner and Townsend, *Cost Analysis Report*, 2010, report commissioned by the ABCB, p. 7

of construction element differences between horizontal and vertical wire systems which should also be accounted for. These construction elements include the extra fixings required in vertical systems, the extra labour involved to install the fittings, the need to strengthen the top and bottom rails and the additional fabrication process. Members of the Australian Stainless Steel Development Association (ASSDA) estimated additional costs of $120 per metre.

The current BCA requirement states that a non-climbable zone is to apply to a balustrade or barrier where the surface beneath is greater than four metres in height. In practice, it is unlikely that designers and builders for high rise buildings (Classes 2 to 9) will apply different design requirements for balustrades and barriers above the four metre threshold when the non-climbable zone provisions would apply. It is assumed that, in order to maintain a consistent design and look, all balustrades and barriers on high-rise buildings will use the one design that will comply with the non-climbable zone provisions regardless of whether it is below the four metre threshold. On this basis, the new requirement is unlikely to result in an incremental cost for Class 2 to 9 buildings. Therefore, from the perspective of this RIS, the new requirement is only applicable to multi-storey buildings in Class 1 buildings. The cost impacts for Class 1 buildings are shown in Table 5-6. Both Turner and Townsend costings in the Consultation RIS and stakeholder costings by ASSDA from public comment are presented.

Table 5-6: Cost estimate for proposed requirement for a non-climbable zone

Building Class 1	Cost ($)		
	10 metres	20 metres	30 metres
Consultation RIS costings	500	1000	1500
Stakeholder costings	1200	2400	3600

5.7 Single steps

The requirement for single steps to be not more than 180mm high applies across all building classes. The Turner and Townsend report stated that the new requirement is unlikely to have any impact as building owners will build new buildings within the Code.

However the report noted that in existing buildings undergoing major refurbishments, where there is need to introduce a change in level, there are “dead” zones which cannot be supported by typical construction techniques that would enable the new requirement to be met most cost efficiently. The first “dead” zone is a change in level between 180 – 300mm. If the two levels differ within this range (180mm - 300mm), it is not possible to construct stairs that comply with the proposed riser dimensions with the existing requirement to have constant risers throughout a flight. It is also not possible to construct a single step to comply with the proposed single step height requirement. For major refurbishments, the potential remedial options can be onerous and would include:

- increasing the lower floor or decreasing the higher floor level to maintain a change in level outside of the "dead" zone. This would provide a single step; and
- decreasing the lower floor or increasing the higher floor level to maintain a change in level outside the "dead" zone. This would provide a flight with two steps and an associated handrail.

It should also be noted that there are other "dead" zones between 360mm to 450mm, 540mm to 600mm and 720mm to 750mm. In each of these circumstances, staircases cannot be built with consistent riser heights to the proposed minimum and maximum riser dimensions. Where these dead zones occur, the floors of the properties will either need to be raised or lowered by the appropriate amount. Depending on the site conditions, the remedial treatments to existing premises could be extremely difficult and expensive. In some circumstances, they may not be possible without altering the foundations.

While the encounter of "dead" zones in major refurbishments would translate to onerous construction, this can be mitigated to some extent with careful planning during the design phase of the building project and would be no different to other design considerations necessary for a BCA compliant building. There may also be a level of flexibility and discretion with regards to the application of this requirement on existing buildings undergoing renovations/refurbishment, by councils and building certifiers[40].

5.8 Estimated impact of total construction costs

The range of cost impacts of the proposed revisions on affected buildings are summarised in the tables below.

Table 5-7: Summary of building cost impact of the proposed revisions

Proposed revision	Cost range ($)
Handrail	264 – 1000
Stair riser and going dimensions	66 – 4218
Barrier for openable windows	n/a
Non-climbable zone	500 – 3600
Single steps	n/a

[40] The application of the BCA to existing buildings being altered extended or undergoing a change of use or classification is controlled by the relevant building legislation of each State and Territory. As such, individual jurisdictions or approval authorities (usually the local council or private certifier) can apply the BCA to existing buildings undergoing refurbishment as rigorously as their legislation allows.

The handrail amendment affects only private stairways in Class 1, 2 and 3 buildings; the low end of the range represents the use of a timber handrail, while the high end of the range represents the use of steel with PVC sheathing. The stair riser and going amendment affects all stairways in all building classes, the low end of the range represents the cost difference of timber stairways the amendment will have in Class 1 buildings using Turner & Townsend cost estimates and the high end of the range represents the cost difference of in-situ concrete stairways the amendment will have in Class 5 buildings (20 storeys) with two fire isolated stairways. For the purposes of the quantitative analysis the non-climbable zone amendment affects only Class 1 buildings, the low end of the range represents the cost difference between horizontal and vertical balustrade wire systems for a 10 metre balustrade and the high end of the range represents a 30 metre balustrade length.

Table 5-8: Summary of average cost impact of the proposed revisions per representative building by building class

Building Class	Average cost impact per proposed revision ($)		
	Handrails	Stair riser and going dimensions	Non-climbable zone
1	378	66	1,000
		400*	2400*
2	378	1,161	0
		2413*	
3	378	1,356	0
		2567*	
4	378	83	0
5	0	2,220	0
6	0	111	0
7	0	1,104	0
8	0	138	0
9	0	500	0
10	0	0	0

*Note – Calculations using alternative costs as provided in public comment.

The handrail amendment affects only private stairways in Class 1, 2 and 3 buildings; the low end of the range represents the use of a timber handrail, while the high end of the range represents the use of steel with PVC sheathing. The stair riser and going amendment affects all stairways in all building classes, the low end of the range represents the cost difference of timber stairways the amendment will have in Class 1 buildings using Turner & Townsend cost estimates and the high end of the range represents the cost difference of in-situ concrete stairways the amendment will have in Class 5 buildings (20 storeys) with two fire isolated stairways. For the purposes of the quantitative analysis the non-climbable zone amendment affects only Class 1 buildings, the low end of the range represents the cost difference between

horizontal and vertical balustrade wire systems for a 10 metre balustrade and the high end of the range represents a 30 metre balustrade length.

Table 5-8 above shows the overall costings of the proposed amendments with cost impacts (handrails, stair riser and going dimensions, non-climbable zones) per representative building in each BCA building class. The most significant cost impact in terms of building class is estimated to be borne by Class 1, 2, 3 and 5 buildings. Class 6 buildings – shops, cafes etc – are expected to incur the least cost impact.

6 Impact Analysis

6.1 Introduction

This section assesses the impact of each proposal to address the risks of slips, trips and falls in buildings. Rigorous methodologies are presented to quantify the costs and benefits of each proposal, although these methodologies should be understood to deliver estimates that are indicative of the broad magnitude of the impacts. Information from stakeholders is also incorporated into the impact analysis, including new data that in some cases substantively alters the estimates and comments which enhance the qualitative analysis.

6.2 Groups impacted by the proposed revisions to the BCA

This RIS expects the proposed BCA amendments to impact the following stakeholder groups:

- individuals, e.g. building owners;
- businesses, e.g. building practitioners, manufacturers, etc; and
- Government, e.g. regulators.

The section below outlines the nature of the expected impacts of each option for each stakeholder group.

6.2.1 Individuals

The proposed BCA amendments involve a range of different impacts on the owners and occupants of buildings, namely:

- potential changes to the costs associated with the design and construction of the building components impacted by the revisions; and
- potential implications for the safety and well-being of building occupants through a reduction in the occurrence of slips, trips and falls in buildings.

Each of these impacts are described and assessed in further detail below.

6.2.2 Businesses

The proposed BCA amendments are likely to impact businesses operating in the design and building industry. This may include potential variations in demand for the design and construction of building components that meet the new requirements as a result of the proposed arrangements, and a requirement for building practitioners to become familiar with and implement the proposed revisions.

The proposed revisions could also potentially provide benefits for businesses occupying new Class 3 to 10 buildings by reducing productivity losses that would otherwise result from employees suffering slips, trips and falls.

6.2.3 Government

The provision of additional preventative measures should enable Governments to more effectively and efficiently meet their regulatory objectives of addressing market failures and reducing the incidence of slips, trips and falls in buildings.

6.3 Assessment of costs

The quantitative assessment of costs associated with the proposed BCA amendments is focussed on the change in construction costs at a State and national level. The cost estimates provided are based on the estimated impact on the representative sample of building types (refer to Section 5) and projections of future construction activity across Australia for Class 1 to 10 buildings.

The cost estimates take into account a flat trend in construction activity over the five years to 2009-10, for both the residential and non-residential series (excluding outliers in non-residential construction). Hence the level of construction activity, as a scale factor underpinning the level of costs, is higher than reported in the previous Consultation RIS. Some stakeholders had expressed concern that the Consultation RIS projected a decline in residential construction. With the benefit of up-to-date data it is now possible to clearly determine robust trends.

6.3.1 Estimating construction activity for BCA Class 1 to 10 buildings

The estimated construction activity for Class 1 to 10 buildings in each State and Territory was based on a combination of a specific data requested from the Victorian Building Commission and ABS Building Approvals Data for all jurisdictions.[41] Victorian Building Commission data relating to the number of building permits across each BCA Class was used to obtain a similar breakdown from ABS figures for other jurisdictions (refer Table 6-1 below). It is important to note that while the Building Commission of Victoria does not collect building approval data, which directly corresponds to the approval data reported by ABS, the data it collects on building permit volumes are essentially gathered from the same source. The key difference being that the

[41] ABS Catalogue number 8731.0, “Building approvals, Australia”

ABS applies a cost threshold of $10,000 for residential buildings and $50,000 for commercial buildings when collating the data for approvals, while the permit volume data from the Building Commission of Victoria does not impose this restriction.[42] Therefore, the building approval data from the ABS is effectively a subset of the permit volume data from the Building Commission of Victoria, and so is comparable for the purposes of this analysis.

Table 6-1: Estimate of building approvals for each BCA class (Volume, year average over the five years to 2009-10)

Jurisdictions	BCA Building Class										
	1	2	3	4	5	6	7	8	9	10	Total
VIC	42,429	800	70	15	658	790	285	159	553	5464	51,222
NSW	30,249	570	62	13	584	701	253	141	491	4852	37,916
QLD	36,765	693	50	11	474	568	205	115	398	3933	43,212
SA	23,487	443	26	6	247	296	107	60	207	2049	26,927
WA	11,833	223	15	3	146	176	63	35	123	1217	13,836
TAS	2,927	55	6	1	58	70	25	14	49	484	3,690
NT / ACT	3,964	75	8	2	76	91	33	18	64	630	4,960
AUS	**151,655**	**2,858**	**237**	**52**	**2,243**	**2,692**	**970**	**542**	**1,886**	**18,628**	**181,763**

As the above figures rely on an assumed proportional breakdown of aggregate ABS data, they should be considered only as an indicative estimate of annual building activity within each BCA class. The development of robust estimates for all jurisdictions would require a census of councils and State and Territory Governments, which is beyond the scope of this RIS. It is also important to note that not all of the approvals outlined above will result in actual construction in the year of approval. However, for the purpose of this exercise, any timing difference between approvals that were granted prior to 2009/10 and construction started in 2009/10, and 2009/10 approvals where construction is delayed to later years, is assumed to be immaterial.

6.3.2 Cost impacts

The impact of the estimated increase in design and construction costs for each of the five proposed revisions in the proposed BCA amendment option is calculated based on annual average building activity and the estimated cost impacts for a representative sample of affected buildings (refer Section 5).

6.3.2.1 Handrails on private stairways

Table **6-2** shows the cost impact for the handrail proposal and is calculated taking into account:

[42] This explanation was provided by the Building Commission of Victoria's Information Analyst.

- the construction activity in the BCA Classes 1 to 4 across all States and Territories;
- the percentage of buildings within each BCA Class that are multi-storey dwellings and are therefore impacted by the proposed handrail provision.
  - It is assumed that for BCA Classes 2 and 3, there are 10 single occupancy units per storey and that 5 per cent of single occupancy units located within each building are double storey and would require a handrail. These percentages are applied to the construction activity in each BCA class.
  - For Class 4, it is assumed that there is minimal activity within this class where the proposed change is likely to apply and hence the overall impact is insignificant[43]; and
- the current level of non-compliance with the proposed handrail requirement[44], which is assumed to be 15 per cent for BCA Classes 1 to 3.[45]

Table 6-2: Cost of proposed handrail requirement (2009/10 dollars)

State	BCA Building Class				
	1	2	3	4	Total ($)
VIC	465,516	170,134	14,794	--	650,444
NSW	331,878	121,293	13,135	--	466,306
QLD	403,371	147,421	10,650	--	561,441
WA	257,693	94,180	5,547	--	357,420
SA	129,826	47,448	3,294	--	180,569
TAS	32,112	11,736	1,310	--	45,158
NT and ACT	43,494	15,896	1,705	--	61,095
AUS	**1,663,890**	**608,108**	**50,435**	--	**2,322,433**

Feedback from one stair manufacturer commented that the typical market rate for a 5m length timber handrail is probably 50% more than the $330 Turner and Townsend used in their cost estimates. Applying this increase to a 4m timber handrail increases costs to $396. Table 6-3 shows the cost of the proposed handrail amendment using revised costs from stakeholder input.

[43] Assumption provided by the ABCB. Refer to Appendix A for more information.
[44] For the purposes of this RIS, the level of non compliance reflects the percentage of existing buildings that would not voluntarily install handrails on stairways. This percentage is used to calculate the level of new buildings that would be affected by the proposed handrail amendment.
[45] Di Marzio Research Pty Ltd, _Trips Slips and Falls Project_, prepared for the ABCB, 2010.

Table 6-3: Stakeholder cost of proposed handrail requirement (2009/10 dollars)

State	BCA Building Class				
	1	2	3	4	Total ($)
VIC	595,496	217,638	18,924	--	832,059
NSW	424,544	155,160	16,803	--	596,506
QLD	515,999	188,584	13,623	--	718,206
WA	329,645	120,477	7,096	--	457,217
SA	166,076	60,696	4,214	--	230,987
TAS	41,078	15,013	1,676	--	57,767
NT and ACT	55,639	20,335	2,181	--	78,154
AUS	**2,128,477**	**777,902**	**64,517**	**--**	**2,970,896**

The total annual cost related to the proposed handrail requirements is estimated to be in the order of $2.3 million using Consultation RIS cost figures and $3 million using stakeholder cost figures (2009/10 dollars) across all new BCA Class 1 to 4 buildings, with Class 1 and 2 (residential) buildings incurring nearly all the cost impact. The majority, if not all, of the cost would be borne by individuals as any additional design and construction costs incurred by builders are likely to be passed on to consumers.

6.3.2.2 Stair riser and going dimensions

The aggregate cost impact for the proposed reduction in the spread between the maximum and minimum of stair riser and going dimensions, as shown in Table 6-4, was calculated taking into account:

- the construction activity in the BCA Classes 1 to 10 across all States and Territories;
- Turner Townsend cost estimates;
- the likely percentage use of the two types of materials listed in the Turner and Townsend report (timber and in-situ concrete) for the construction of stairs[46]; and
- the current level of non-compliance with the proposed stair riser and going dimensions[47], is assumed to be 89 per cent for residential stairways in BCA Class 1 to 3 buildings, and 83 per cent for commercial stairways in BCA Class 2 to 10 buildings.[48]

[46] Assumption provided by the ABCB. Refer to Appendix A for more information.
[47] For the purposes of this RIS, the level of non compliance reflects the percentage of existing buildings that do not typically construct stairways within the proposed riser and going dimensions. This percentage is used to calculate the level of new buildings that would be affected by the proposed stair riser and going dimension amendment.
[48] Di Marzio Research Pty Ltd, *Trips Slips and Falls Project*, prepared for the ABCB, 2010.

Table 6-4: Aggregate cost (2009/10 dollars) for proposed change to stair riser and going dimensions

Jurisdiction	BCA building class		Total ($)
	Residential (Classes 1 to 3)	Commercial (Classes 2 to 10)	
VIC	676,042	2,724,906	3,400,948
NSW	485,094	2,313,407	2,798,501
QLD	583,172	2,050,462	2,633,634
WA	371,041	1,129,956	1,500,996
SA	187,535	640,877	828,412
TAS	46,985	229,490	276,474
ACT/NT	63,554	300,772	364,326
AUS	**2,413,422**	**9,389,869**	**11,803,291**

Cost estimates in this table are derived from Turner and Townsend costings.

In aggregate, the proposed requirement to narrow the range of stair dimensions will result in a net annual cost of approximately $12 million, which although incurred by builder / developers are largely expected to be passed on to individuals or businesses purchasing new buildings. Similar figures were presented in the Consultation RIS.

A number of stakeholders commented that the costs of this proposal were much higher than presented in the Consultation RIS. One stair manufacturer highlighted that they have spent over 3 million dollars in stair manufacturing technology based on current building codes and that any change to the riser and going heights would require updating their manufacturing capabilities at a cost that is not insignificant.

Another stakeholder provided estimates of cost impacts based on very detailed costings, which are presented in Table 6-4a below. The calculations relate to timber stairs, hence only residential buildings are affected. The main cost figure used in the revised calculations is the additional construction cost increase of $404.30 per stair.

Table 6-4a: Aggregate cost (2009/10 dollars) for proposed change to stair riser and going dimensions using cost estimates from stakeholder feedback

Jurisdiction	BCA building class		Total ($)
	Residential (Classes 1 to 3)	Commercial (Classes 2 to 10)	
VIC	4,125,634	2,724,906	6,850,539
NSW	2,957,683	2,313,407	5,271,089
QLD	3,561,110	2,050,462	5,611,573
WA	2,267,041	1,129,956	3,396,996
SA	1,145,312	640,877	1,786,189
TAS	286,431	229,490	515,921

Jurisdiction	BCA building class		Total ($)
	Residential (Classes 1 to 3)	Commercial (Classes 2 to 10)	
ACT/NT	387,514	300,772	688,286
AUS	**14,730,725**	**9,389,869**	**24,120,593**

Cost estimates in this table are derived from detailed costings and costs provided by a stakeholder.

This table indicates that the cost impact on residential buildings, as informed by stakeholder costings, could be much higher than reported in the Consultation RIS. The proposal to narrow the range of stair dimensions using these revised costs would result in a net annual cost of approximately $24 million, which although incurred initially by builder / developers are largely expected to be passed on to individuals or businesses purchasing new buildings.

Decrease in net rentable floor space

The Consultation RIS noted that the proposed riser and going dimensions could decrease net rentable floor space in commercial buildings. For the assumed riser and going dimensions used in the calculations for the stair riser and going dimension amendment[49], Turner and Townsend reported that there was a decrease in the net rentable floor space due to an increase in the stairway footprint. The decrease in available floor area ranges between 2.75 per cent to 4.58 per cent for a 20m^2 room and 1.83 per cent to 3.06 per cent for a 30m^2 room. The actual decrease in rentable space range from 0.5m^2 to 1m^2, depending on the BCA building class. It should be noted that the effect on the net rentable floor space is also dependant on which riser and going dimension is used in the calculations.

A number of public comment submissions suggested that an attempt be made to quantify the costs imposed as a result of a decrease in rentable space. One submission from a volume builder indicated the price of rent forgone at $1000/m2/year for a typical CBD office building. A review of commercial market rentals determined that rental rates per square metre of commercial floor space per annum typically range from $150 to $700. The large spread is due to the fact that rental rates are highly dependent on location (e.g. city, industrial or regional areas), class of building, intended purpose, available amenities and age of building amongst other factors. The loss of floor area was estimated by Turner and Townsend to be 0.5 to 1.0 square metres, and by stakeholders to be 0.5 to 1.7 square metres. Conservative assumptions were used to estimate the impact of the decrease of rentable space: a market rental of $150 per square metre with a loss of 0.5 square metres per flight of stairs per storey. A figure of $150 was used as the minimum rental for multi-storey commercial buildings across regional and urban Australia, and hence

[49] Under the existing code, the assumed typical dimensions of 180mm riser and 250mm going were costed to the proposed amendment, where the assumed typical dimensions of 180mm riser and 280mm going were used.

the costs presented should be regarded as minimum cost impacts. It was observed that rentals were in the range of $500 to $700 in inner city areas of Australia's capitals, but these high rentals could not be applied to outer city or regional areas. The methodology to calculate the loss of net rentable floor space is similar to that used to calculate the additional construction costs for the stair riser and going amendment and is further explained in Appendix A.

At a loss of 0.5 m2 of floor space per flight of stairs per storey and at a rental rate of $150/m2/yr, the loss of net rentable floor area for non-residential commercial buildings at a national level adds a further $7.8 million to the net cost of the stair riser and going amendment.

The loss of rentable space for residential buildings is difficult to quantify. Where rentals of commercial buildings are cited in terms of dollars per square metre, rentals of residential buildings are cited typically in terms of dollars per apartment or dollars per house, and hence it is difficult or impossible to determine floor space for these properties. However it should be noted that for residential buildings (with private stairways) the loss of floor area is a loss of utility the floor area provides. This disutility from private stairways in residential buildings is recognised in this analysis as an unquantified cost.

Table 6-4b: total aggregate costs including the cost of rentable floor space forgone for the stair riser and going amendment.

Proposal	Consultation RIS Costing ($m)	Stakeholder Costing ($m)
Riser & Going dimensions	**19,672,827**	**32,990,229**

Adding the cost of rentable floor space forgone to the additional construction costs imposed by the stair riser and going amendment under Consultation RIS costings results in the aggregate cost of approximately $20 million. Under stakeholder costings the aggregate cost would come to approximately $33 million.

6.3.2.3 Barrier for openable windows

This proposal would more likely result in design changes than additional construction activity (see detailed costing discussion in the previous chapter). Hence no significant incremental construction costs would be incurred.

In response to the Consultation RIS some stakeholders commented that this proposal would impose a non-zero cost impact, although they were unable to provide data to support new cost estimates. For the purpose of illustrating these concerns, a modest figure of $500,000 per annum was incorporated into the quantitative analysis of costs as a stakeholder scenario.

6.3.2.4 Non-climbable zone

The cost impact of this proposal to have a non-climbable zone in a balustrade or barrier where the distance from the floor to the surface below is greater than one metre is calculated using the cost estimate from Section 5 for a representative building in a Class 1 building and taking into account the construction activity in the BCA Class 1 building across all States and Territories.

A number of submissions from the balustrade industry noted that with the non climbable zone amendment the shift to vertical wire balustrade systems would require making changes to their fabrication processes, however no specific details was provided nor the cost of making these changes.

Table 6-5: Aggregate cost (2009/10 dollars) for proposed requirement for a non-climbable zone ($)

Jurisdiction	Consultation RIS Costing ($)	Stakeholder costing ($)
VIC	3,762,251	9,029,402
NSW	2,682,200	6,437,279
QLD	3,259,997	7,823,992
WA	2,082,645	4,998,348
SA	1,049,242	2,518,182
TAS	259,526	622,861
ACT/NT	351,517	843,641
AUS	**13,447,377**	**32,273,705**

The total annual cost of incorporating a non-climbable zone in Class 1 buildings is estimated to be approximately $13.5 million using Consultation RIS costings and $32 million using stakeholder costings, which again will be primarily borne by individuals purchasing new buildings.

6.3.2.5 Single step

Any concerns of additional construction activity arising under this proposal could be mitigated with careful planning during the design phase of a building project, no different to other design considerations necessary for a BCA compliant building (see detailed costing discussion in the previous chapter). Hence no significant incremental construction costs would be incurred.

In response to the Consultation RIS some stakeholders commented that this proposal would impose a non-zero cost impact, although they were unable to provide data to support new cost estimates. For the purpose of illustrating these concerns, a modest figure of $500,000 per annum was incorporated into the quantitative analysis of costs as a stakeholder scenario.

6.3.2.6 Summary of cost impacts

The cost impacts of the proposed amendments to the BCA are summarised in the table below, on the basis of the Consultation RIS costings of the proposals and also on the basis of stakeholder costing information.

Table 6-6: Cost impact of each proposal, per annum (2009-10 dollars)

Proposal	Consultation RIS Costing ($)	Stakeholder Costing ($)
Handrail	2,322,433	2,970,896
Riser & Going dimensions	19,672,927	31,990,229
Barrier for openable windows	0	500,000*
Non-climbable zones	13,447,377	32,273,705
Single step	0	500,000*

*Illustrative stakeholder scenario

6.3.2.7 Present value of costs

The present value calculation of costs assumes the foreseeable life of the regulations will be 10 years. Costs incurred in future years are discounted at an annual rate of 7 per cent as advised by the Office of Best Practice Regulation. The results are presented in the following table, on the basis of the Consultation RIS costing of the proposals and also on the basis of stakeholder costing information.

Table 6-7: Present Value of Costs (2009-10 dollars)

Proposal	Consultation RIS Costing ($m)	Stakeholder Costing ($m)
Handrail	17.5	22.3
Riser & Going dimensions	147.8	240.4
Barrier for openable windows	0	3.8*
Non-climbable zones	101.1	242.5
Single step	0	3.8*

*Illustrative stakeholder scenario

6.4 Assessment of benefits

To perform a quantitative assessment of benefits, the following information is required:

- the contribution of building components to the incidence of slips, trips and falls, given that the occurrences of slips, trips and falls are also influenced by biological and medical, behavioural and socio-economic factors;

- the contribution of the proposed changes to each building component to the incidence of slips, trips and falls in buildings;

- the reduction in the number of injuries and deaths from slips, trips and falls that can be attributed to the proposed changes to each building component;

- the reduction in hospitalisation and fatality costs that result from the reduction in injuries and deaths; and

- the reduction in other types of costs (e.g. production losses, legal and compensation costs) that result from the reduction in injuries and deaths.

No research has been conducted to identify the contribution that individual building components make to the incidence of slips, trips and falls relative to other contributing factors or how specific changes to some building components can reduce the incidence of slips, trips and falls. While the Monash Report makes recommendations for changes to specific building components that could reduce the incidence of slips, trips and falls, it does not identify the extent of reduction that can be attributed to each proposed change.

With limited data, a range of assumptions (refer to Appendix B) were required to quantify the potential benefits of the proposed revisions. Assumptions made include the current number and cost of injuries and fatalities that could be attributed to the proposed building component subject to amendment, and the effectiveness of the proposed amendments in preventing injuries and fatalities in new buildings. The quantified potential benefits only takes into account the reduction in the costs of hospital separations due to injuries and the cost of fatalities. In addition, the benefits quantification can only be presented at an aggregate level (whole of Australia) as data on injuries and fatalities are not available at the State and Territory level.

A break-even analysis is also performed in Section 6.6. The breakeven analysis should be considered alongside the benefits quantified in this section, and provides an estimate of the reduction in the number of deaths or injuries that would need to occur in order to justify the costs imposed by the proposed BCA amendments. The analysis allows the assessment of the likelihood that the proposed BCA amendments are likely to represent a net benefit to the community.

6.4.1 Benefits calculation

The following steps were taken to calculate the potential avoided costs (i.e. benefits) related to each proposed revision:

- Step 1 – Estimate the current annual number of injuries and fatalities that can be attributed to the building components subject to amendment using data from a range of resources including the Monash Report, the Australian Institute of Heath and Welfare and the Victorian Injury Surveillance and Applied Research (VISAR) Hazard report;

- Step 2 – Calculate the costs of injuries and fatalities that can be attributed to the building components subject to amendment by making assumptions regarding the average cost of a hospital separation that results from a fall injury and the economic value of life. The average cost of a hospital separation that results from a fall is assumed to be $4,660[50] while the economic value of life is assumed to be $3.8 million[51];

- Step 3 – Calculate the proportion of new buildings impacted by each proposed amendment over the life of the regulations, compared to existing building stock taking into consideration the applicability of each amendment across the BCA classes;

- Step 4 – Assume an effectiveness rate for each proposed amendment in preventing injuries and fatalities from slips, trips and falls; and

- Step 5 – Calculate the potential costs that could be avoided under each proposed amendment by combining the results of Steps 1, 2, 3, and 4.

Table 6-8 shows the numbers and costs of injuries and fatalities that can be attributed to each of the building components subject to amendment based on the assumptions outlined above. Detailed assumptions and calculations are included in Appendix B.

Table 6-8: Estimated annual cost (2009-10 dollars)* of injuries and fatalities related to building components subject to amendment

Proposed amendments	Number		Costs ($m)		Total cost ($m)
	Injuries	Fatalities	Injuries	Fatalities	
Handrail	3,620	36	16.9	136.8	153.7
Stair riser and going dimensions	7,501	46	35.0	174.8	209.8
Barrier for openable windows	290	1.5	1.4	5.7	7.1
Non-climbable zone	190	1.5	0.9	5.7	6.6
Single steps	1,072	0.0	5.0	0.0	5.0

* Costs updated from the Consultation RIS: injury costs increased 26.1% over 2005-06 to 2009-10 as measured by the hospitals and medical services sub-group of the CPI; value of a statistical life increased from $3.5m to $3.8m over

[50] Monash University Accident Research Centre, *The relationship between slips, trips and falls and the design and construction of buildings*, funded by the ABCB, 2008, p. xiii, based on AIHW *Hospital Statistics 2005-06*, updated to 2009-10 prices by the hospital and medical services sub-group of the CPI.
[51] The value of a statistical life is assumed to be $3.8 million according to guidance material provided by the Office of Best Practice Regulation (http://www.finance.gov.au/obpr/docs/ValuingStatisticalLife.pdf).

the period June 2007 to June 2010, in accordance with methodology published by the Office of Best Practice Regulation.

The extent to which the costs attributed to these building components could be prevented depends on the percentage of the total building stock that comprises new buildings subject to the amendments, and the effectiveness of each proposed amendment in preventing injuries and fatalities from slips, trips and falls in buildings.

Some stakeholders concerned with preventing injury to children commented on two proposals: barriers for openable windows and non-climbable zone. Their information on the number of fatalities was consistent with the data presented above. However higher injury numbers were given by one stakeholder: "current estimates from surveillance data are that there are 2 children (5 years old and under) falling from windows and 4 children falling from balconies every week" in one State. These figures are higher than data previously supplied to the ABCB by an injury surveillance unit. On the basis of this stakeholder's data, the cost of injuries from falls from windows would increase to $2.4 million, and the cost of falls from balconies would increase to $4.8 million.

The stakeholders concerned with preventing injury to children also provided comments on the barrier for openable windows and non-climbable zones proposals. They suggested that the placement of furniture near windows and balconies, and children's play behaviour of climbing or jumping on furniture, were significant risk factors that could cause falls from windows and balustrades that would continue to be risk factors under both proposals. These comments imply that the two proposals would be limited in their capacity to reduce the risk of falls.

The assumptions applied for each building component subject to amendment are presented in Table 6-9 and are described in further detail in Appendix B.

Table 6-9: Benefits attributed to the proposed amendments in Year 1

Proposed amendment	% of new buildings compared to the stock of existing buildings ^	Effectiveness rate (%)	Support for assumption on effectiveness rate	Total cost of injuries / fatalities ($m)	Benefits in one year ($m)^^
Handrail	1.8	30	Academic article	153.7	0.83
Stair riser and going dimensions	1.8	30	Assumption	209.8	1.13
Barrier for openable windows	1.8	30*	Assumption	7.1	0.04
Non-climbable	1.8	30*	Assumption	6.6	0.04

zone					
Single steps	1.8	5	Assumption	5.0	0.005

^ Derivation of this parameter explained in Appendix B.

^^ The benefits are derived by multiplying together the three figures to the left. See detailed calculations presented in Table B-1 of Appendix B.

* Specific comments by stakeholder imply that the effectiveness rates could be much lower.

The effectiveness rate assumed for the handrail proposal is supported by two academic articles cited in the Monash Report. First, Ishihara *et al* (2002)[52] found that of the 2,800 elderly respondents to a questionnaire concerning stair use, 34.2% reported being saved by a handrail when they nearly fell. The same investigation also found that handrails were particularly effective at preventing falls in the context of sub-standard illumination of stairwells, the effects of which are often exacerbated in the elderly by vision deterioration. Second, Maki and Fernie *et al* (1998)[53] conducted 192 trials of falls down stairs and recorded 54% of falls when a handrail was absent, and 8% of falls when a handrail was in place. This improvement in safety by a factor of 6 times indicates that an assumed effectiveness rate of 30% for handrails would be conservative.

For the other proposals, the Monash Report was able to identify buildings as one of a number of factors contributing to personal injury and death, although the literature appears to have been silent on the question of specific attribution. In this situation explicit assumptions are made about the effectiveness of these proposals in reducing injury and death, linked to what is known about the effectiveness of handrails. Estimates generated under these assumptions should be understood to be indicative of the broad magnitude of possible benefits.

The present value calculation of benefits assumes the life of the regulations will be 10 years and that the lifespan of buildings will be 30 years. The benefits associated with buildings in each year will accrue over a period of 30 years; with benefits in future years discounted in accordance with standard cost benefit analysis practice. The flow of discounted benefits in each year is then summed over the 10 years of the regulations to yield a present value for each proposal. The calculation incorporates an annual discount rate of 7 per cent as advised by the OBPR. The results are presented in Table 6-10 below.

Table 6-10: Present value of benefits (2009-10 dollars)

Proposal	Present value ($m)
Handrail	82.8

[52] Ishihara, K., Nagamachi M., Komatsu K., et al. (2002) Handrails for the elderly: A survey of the need for handrails and experiments to determine the optimal size of staircase handrails, *Gerontechnology* ; 1(3):175-189, cited in the Monash Report page 25.
[53] Maki and Fernie, B.E., Perry S.D., McIlroy W.E., (1998) "Efficacy of Handrails in preventing stairway falls: A new experimental approach." *Safety Science*; 28(3): 189-206, cited in the Monash Report p 25.

Stair riser and going dimensions	113.1
Barrier for openable windows	3.8
Non-climbable zone	3.6
Single steps	0.5

This table shows that substantial benefits would be generated by the first two proposals: handrail and stair riser and going dimensions.

The benefits of the remaining proposals – barrier for openable windows, non-climbable zone and single steps – are small. Given the caveat on the estimating methodology, above, these small benefits may be interpreted as close to zero.

This conclusion is reinforced by comments by the children's injury prevention groups about other risk factors affecting the barriers for openable windows and non-climbable zones proposals, implying limits to the effectiveness of both proposals, which supports the conclusion of likely zero present values of benefits for these proposals.

6.5 Evaluation of the costs and benefits – net present value

This section summarises the present value information about the costs and benefits of each proposal to amend the BCA. The proposals are not considered to be mutually exclusive and more than one proposal can be recommended if it would provide a net benefit to the community. However if any proposal would result in a net cost to the community, then the status quo would be recommended with no change to the BCA with respect to that proposal.

The present value of costs and benefits of each proposal, and the overall net present value, is presented below. Note that stakeholder costings of each proposal are presented in addition to Consultation RIS costings.

Table 6-11: Net Present Value of the Proposals

Proposal				Stakeholder Costings ($m)		
	PV Costs	PV Benefits	Net Present Value	PV Costs	PV Benefits	Net Present Value
Handrail	17.5	82.8	**65.4**	22.3	82.8	**60.5**
Stair riser and going dimensions	147.8	113.1	**(34.8)**	240.4	113.1	**(127.4)**
Barrier for openable windows	0	3.8	**3.8**	3.8*	3.8	**(0.0)**
Non-climbable zone	101.1	3.6	**(97.5)**	242.5	3.6	**(239.0)**
Single steps	0	0.5	**0.5**	3.8*	0.5	**(3.3)**

* Illustrative stakeholder scenario

The net present value results clearly identify the proposal for handrails in residential buildings as providing a substantive net benefit to the community.

All other proposals involve net costs overall.

- The stair riser and going dimension proposal would deliver a high level of benefits, but it would also involve higher costs. The detailed costings by a stakeholder indicate that the overall net cost could become very large.

- The non-climbable zone proposal would provide small or zero benefits, but very substantial costs under either Consultation RIS or stakeholder costings. Overall a substantial net cost to the community.

- The two proposals (i) barrier for openable windows and (ii) single steps would each deliver small or possibly zero benefits acknowledging the caveat on the benefit calculations. Stakeholder comments around the effectiveness of the barrier for openable windows proposal reinforce the view that its benefits would be close to zero. Under Consultation RIS costings assigning both proposals a zero cost, their net benefits would be questionable. However stakeholders argued that costs would be incurred. Allowing for a very modest cost impact of $500,000 per annum, nation-wide, as a scenario for consideration, combined with the likely possibility of zero benefits, gives a net cost for each proposal. On balance there would be a discernible risk that these proposals would result in a net cost to the community.

6.6 Break-even analysis

In addition to the direct quantification of benefits, a break-even analysis is also performed. The effectiveness rate of each proposal is adjusted so that the present value of the benefits just equals the present value of the costs. The lower the effectiveness rate can be for a proposal to break even, the easier it is for that proposal to deliver benefits. The more a break even rate is lower than the current effectiveness rate, the more confidence one can have that the proposal will deliver net benefits. Conversely, where the break even rate is higher than the current effectiveness rate, the proposal appears unlikely to be capable of delivering net benefits.

For example, in Table 6-12, below, the handrail proposal would deliver a present value of benefits of $82.8 million under the current effectiveness rate of 30 per cent. To break even these benefits would be reduced to the present value of costs, of $17.5 million, by reducing the effectiveness rate. Hence the break even rate, where the present value of benefits has been reduced to equal the present value of the costs, is 6.34% (82.8/0.3x0.0634 = 17.498).

The break even analysis facilitates comparison between proposals, and is presented in the table below.

Table 6-12: Breakeven analysis

Proposed amendments	PV Costs) ($m)	PV Benefits ($m)	Effectiveness Rate	
			Current	Break-even
Handrail	17.5	82.8	30%	6%
Stair riser and going dimensions	147.8	113.1	30%	39%
Barrier for openable windows	3.8*	3.8	30%	30%
Non-climbable zone	101.1	3.6	30%	842%
Single steps	3.8*	.5	5%	38%

* Illustrative stakeholder costing scenario

The break-even analysis identifies the handrail amendment as the only proposal where the break even rate is much lower than the current effectiveness rate, and so provides a degree of assurance that it will deliver net benefits.

6.7 Sensitivity analysis

This section tests the sensitivity of particular assumptions used in the impact analysis, and reports the consequences for the net present value of each proposal. The aim is to determine whether any assumption had a disproportionate affect on the cost benefit analysis, and to provide information to decision makers about how changes in different assumptions affect the overall net benefits of the regulatory proposals. The sensitivity analysis was performed on Consultation RIS costings of the proposals.

The assumptions tested are:

- Construction costs
- Injury costs
- Value of a statistical life
- Effectiveness of the proposals in reducing injury and death in buildings
- Discount rate

The sensitivity analysis is presented in the table below.

Table 6-13: Sensitivity Analysis

	Net Present Value ($m)				
	Handrail	**Riser and going dimensions**	**Barrier for openable windows**	**Non climbable zones**	**Single steps**
Construction Costs					
Low (-10%)	65.6	-32.8	3.8	-96.1	0.5
Base case	65.4	-34.8	3.8	-97.5	0.5
High (+10%)	65.1	-36.8	3.8	-98.8	0.5
Injury Costs					
Low (-10%)	64.5	-36.7	3.8	-96.7	0.4
Base case	65.4	-34.8	3.8	-97.5	0.5
High (+10%)	66.3	-32.9	3.9	-96.6	0.5
Value of a statistical life					
Low (adjusted for aged persons)	49.8	-54.6	3.2	-97.3	0.5
Base case	65.4	-34.8	3.8	-97.5	0.5
Effectiveness					
Low (20%)	37.8	-72.5	2.6	-98.7	0.3
Base case (30%)	65.4	-34.8	3.8	-97.5	0.5
High (40%)	93.0	2.9	5.1	-96.3	0.6
Discount Rate					
Low - 3%	126.8	28.1	6.8	-111.8	0.8
Base Case - 7%	65.4	-34.8	3.8	-97.5	0.5
High - 11%	37.2	-57.1	2.4	-85.6	0.3

Sensitivity to variation in construction costs

The riser and going dimensions proposal shows some sensitivity to changes in construction costs, with its net present value changing by $2 million for a 10% change in costs. However the net present value remains clearly negative.

The non-climbable zone proposal also changes by around $2 ½ million for a 10% change in costs, but this variation around a net cost of $97 ½ million does not alter the very large net cost of this proposal.

The other proposals are little changed by variation in construction costs.

Sensitivity to variation in injury costs

Variation in injury costs mostly affects the riser and going dimensions proposal, although only by $2 million for a 10% change in costs. Its net present value remains clearly negative.

The other proposals are little changed by variation in injury costs.

Sensitivity to variation in the value of a statistical life

Guidance from the Office of Best Practice Regulation states that the estimates of the value of a statistical life (VOSL) "represent an average based on a healthy person living for another 40 years". However 75% of fall fatalities occur to people aged 65 years and over[54], who would not expect to live another 40 years. This sensitivity analysis presents an indication of the effect of allowing for fewer years of expected life. A very simple calculation, taking 80 years as life expectancy for persons, with 75% of persons with a 15 year life expectancy and 25% with an average 40 year life expectancy, yields a weighted average expectancy, broadly, of another 20 years of life of people subject to falls. Allowing for discounting over future years, the low case reduces the VOSL from $3.8 million to $3.0 million.

The effect is to reduce the net present value of the handrail proposal from $65 million to $50 million, still a substantial net benefit to society. The net present value of the riser and going dimensions proposal would decrease from -$35 million to -$55 million, always a substantial net cost to the community.

The other proposals are little changed by variation in the value of a statistical life.

Sensitivity to variation in effectiveness

Variation in effectiveness has a marked effect on the handrail proposal, with its net present value ranging from $39 million to $93 million. In all cases the proposal delivers a substantial net benefit to society.

Variation in effectiveness also has a marked effect on the riser and going dimensions proposal, with its net present value ranging from -$73 million to +$3 million. The +$3 million figure is interpreted as close to zero, given the caveat in the benefit calculations, and taking account of higher stakeholder costings would not, on the basis of this sensitivity analysis, consider this proposal to be cost-effective.

The other proposals are little changed by variation in the value of effectiveness.

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[54] Monash Report page ix.

Sensitivity to variation in the discount rate

All proposals showed marked changes in their net present value to variation in the discount rate.

The handrail proposal would deliver a net benefit to society over the full range of variation in the discount rate, from around $126 million in the low case to around $37 million in the high case.

The riser and going dimensions proposal was also significantly affected by of variation of the discount rate, with its net present value ranging from +$28 million in the low case to -$57 million in the high case. If the low case discount rate was considered feasible then the proposal could be considered further. That would require justification supporting a low discount rate of 3% and further consideration of the stakeholder costing of this proposal.

7 Business Compliance Costs

7.1 Introduction

The COAG *Best Practice Regulation* guide requires consideration of the compliance burden imposed on businesses. This is the additional (incremental) cost incurred by businesses when complying with regulations. Quantification of compliance costs using the Business Costs Calculator (BCC) is required for proposals that are likely to impose medium or significant compliance costs on business.

Compliance costs include:

1 Notification costs – requirement to report certain events;

2 Education costs – keeping abreast with regulatory requirements;

3 Cost of gaining permission – to conduct certain activities;

4 Purchase costs – requirement to purchase materials or equipment;

5 Record keeping costs – keeping up-to-date records;

6 Enforcement costs – cooperating with audits or inspections;

7 Publication and documentation costs – producing documents for third parties; and

8 Procedural costs – costs incurred that are of a non-administrative nature (e.g. requirement to conduct fire drills).[55]

Business, particularly the building industry, already incurs compliance costs under existing arrangements. We consider below the potential extent of any additional compliance costs under the proposed the proposed BCA amendments.

7.2 Assessment of additional compliance costs

The cost impacts of the proposed BCA amendments on business are thoroughly documented in the impact analysis, above, and in the preceding chapter “Costing the impact of the proposals”.

Other, more general compliance costs were also identified: education and familiarisation of industry to the new changes; and publication and

[55] COAG Best Practice Regulation, A Guide for Ministerial Councils and National Standard Setting Bodies, October 2007, p. 27.

documentation costs. As assessed below, these compliance activities are considered to result in a minimal change in business costs.

Education and familiarisation

The proposed BCA amendments could impose additional compliance costs on industry practitioners, businesses and building owners in the short term as they undergo a process of familiarisation and education with the changed requirements. Whilst it is envisaged that this process may take some time and effort, it is not likely that this would involve significant compliance costs to a business. Further, it is likely that the additional costs could be partially absorbed within ongoing costs associated with staff and professional development.

Publication and documentation costs

Stakeholder feedback from peak housing bodies and home builders pointed out that the proposals in aggregate would require changes to their marketing materials and home plans. It should be noted that the extent of the required changes will be fewer to the extent that some proposals do not proceed, and the level of compliance cost can be reduced further through appropriate implementation.

7.3 Conclusion

Based on this assessment, the proposed BCA amendments would not have significant compliance costs on businesses, in addition to those costs previously identified in this RIS.

8 Assessment of competition impacts

The COAG *Best Practice Regulation* guide requires that the competition impacts of proposed regulation be considered, when undertaking a RIS. A preliminary analysis can be conducted by working through the questions in the *Competition Assessment Checklist* set out in the guide. Where this preliminary analysis indicates there could be an impact on competition, a competition assessment should be undertaken as part of the RIS.

The checklist questions are:

- Would the regulatory proposal restrict or reduce the number and range of suppliers?
- Would the regulatory proposal restrict or reduce the ability of suppliers to compete?
- Would the regulatory proposal alter suppliers' incentives to compete vigorously?[56]

These questions are discussed below.

Do the options being considered restrict or reduce the number and range of suppliers?

It is unlikely that the proposed BCA amendments will affect or restrict the number and range of suppliers of the materials for the proposed changes or restrict or reduce the number of businesses operating in the design and construction industry.

The options do not restrict the use of any particular material for the construction of the building components that are affected. While the proposed arrangements may increase demand for handrails, it is unlikely to have a significant impact given that the proposed change applies only to private stairways.

Further, any additional costs for the construction of the new preventative measures would most likely be passed on to the building purchaser and not incurred by the builder or developer.

[56] COAG Best Practice Regulation, A Guide for Ministerial Councils and National Standard Setting Bodies, October 2007, p. 29.

Do the options being considered restrict or reduce the ability of suppliers to compete?

The proposed BCA amendments would not restrict the use of any particular building material. The options only influence the design of the building components affected by the revisions. This is unlikely to have any adverse competitive impact on the ability of suppliers of design and construction services to compete.

Do the options being considered impact incentives to compete vigorously?

The proposed BCA amendments do not impact or alter suppliers' nor builders' incentives to compete vigorously. There remains an incentive for practitioners to design the most cost effective solution to comply with the BCA Performance Requirements for the relevant building components.

Conclusion

Overall, it is unlikely that there will be any competition impacts associated with either the proposed BCA amendments. Furthermore, because the amendments constitute performance-based regulation, they provide flexibility to builders to meet the BCA Performance Requirements by proposing alternative building solutions.

9 Consultation

Principle 7 in the COAG *Best Practice Regulations* guide requires effective consultation with affected stakeholders at all stages of the regulatory cycle. Public consultation is an important part of any regulatory development process.

The ABCB Consultation Protocol

The ABCB is committed to regular review of the BCA and to amend and update the BCA to ensure that it meets changing community standards. To facilitate this, the ABCB maintains regular and extensive consultative relationships with a wide range of stakeholders. In particular, a continuous feedback mechanism exists and is maintained through State and Territory building control administrations, industry and the senior national technical advisory group, the Building Codes Committee. These mechanisms ensure that opportunities for regulatory reform are identified and assessed for implementation in a timely manner.

All ABCB regulatory proposals are developed in a consultative framework in accordance with the Inter-Government Agreement. Key stakeholders are identified and approached for inclusion in relevant project specific committees and working groups. Thus, all proposals have widespread industry and Government involvement.

The ABCB has also developed a Consultation Protocol[57], which includes provisions for a consultation process and consultation forums. The Protocol explains the ABCB's philosophy of engaging constructively with the community and industry in key issues affecting buildings and describes the various consultation mechanisms available to ABCB stakeholders.

Public comment informing this RIS has come from two consultation periods. In the first consultation period the proposed BCA amendments were made available in the normal amendment cycle of the BCA. In the second consultation period the Consultation RIS was made available for comment. Submissions from both consultation periods are summarised below.

Use of Stakeholder Comments in this Report

The ABCB welcomes stakeholder comments, feedback, information and data. This report draws extensively on stakeholder information to refine costings and expand and enhance the analysis of costs and benefits contained in the impact analysis chapter.

[57] Available on http://tinyurl.com/ABCBconsultationprotocol

This chapter is a stand alone, factual record of stakeholder comments to the ABCB. A number of comments will be recognisable from their use in earlier chapters.

9.1 Handrails

The handrail amendment received relatively few comments, there was however general support for the handrail amendment to be included in the BCA, though noting concerns.

In one submission, a large volume builder drew attention to the fact that although handrails were not a requirement on private stairways, it was nevertheless installed on all of their housing developments and that for them it was not an issue.

Submissions from a number of building certifiers questioned the intent of the proposed handrail amendment, noting that the way the provision is written and structured would mean that a handrail would be required to be installed on a flight with only 2 steps. It would also mean in some situations that a handrail is required on a stairway even though a balustrade is not. It was suggested that if this is not the intent, provisions should be changed to suit.

A number of submissions from stair manufacturers including one from a peak housing body questioned the merit of handrails having to be continuous due to the high cost of manufacturing handrails around corners. It was pointed out that in common stairway designs for private stairways, a balustrade on the inside of the stair cannot be continuous as the top rail is usually broken midway by a newel post. These submissions requested that the proposed provisions be changed to reflect this.

9.2 Stair Going and Riser Dimensions

The stair going and riser dimension amendment received a significant number of comments. The majority of which came from stair manufacturers and building design practitioners arguing that the changes have not been accurately factored in the analysis and that the 'dead zones' are simply too onerous and inflexible in design to be practical, particularly in new refurbishments and extensions where building levels are already set. One submission did not think the amendment was reasonable or appropriate as it can in some situations leave for no margin of error and noting that "*…slab heights above ground line will be dictated by riser heights and not normal building considerations.*"

Some submissions felt that the loss of net lettable area and hence rent forgone is not an insignificant figure and an attempt should be made to include it in the quantitative analysis. Others, in particular stair manufacturers, provided detailed quotes highlighting the difference in price and a number of building components the RIS should consider, such as the increased length of the stringers required to accommodate a longer stairway, the difficulty in sourcing longer length timber for the longer stringers, the requirement for solid timber treads to be laminated in order to achieve a 280mm going as it was a non-standard timber dimension, the extra labour involved not just in machining and installing the stairway but in sanding, laminating and staining the stairway. Revised costs provided in one detailed submission calculated an extra $311 as compared to the $66 used in the Consultation RIS.

Another change not included in the RIS was an increase in the upper storey cut out in order to accommodate a 2m head height as required by the BCA. The increase in stairway footprint in Class 1 buildings should be accounted for and was suggested by a number of submissions.

The wider goings also caused some to question whether this would affect how fast or slow people would use stairs and whether this would have adverse effects on stair use ergonomics.

It was pointed out that on stairways where a requirement for 19 steps is required due to the amendment, a landing would need to be provided at extra cost.

One stair manufacturer noted that they have spent over 3 million dollars in stair manufacturing technology based on current building codes and any change to the riser and going heights would require updating their manufacturing capabilities at a cost that is not insignificant.

There was criticism levelled at the lack of evidence showing fall injury directly attributable to stair design and that the effectiveness assumption used in the quantitative analysis for this amendment was an unsubstantiated assumption. The submitter indicated inconsistencies from the Monash Report noting that –

> "…the Monash Report misrepresents the basis for the proposed changes to risers and goings, based on the standards applied in the United States of America. The Monash Report states that:
>
> > *"As a result of much lobbying, as reported by Pauls (2002), the committees responsible for the new United States NFPA Building Code accepted the widely agreed minimum standard described above, the so-called "7-11" stair step geometry in the autumn of 2001 and the standard was mainstreamed and applied to new one and two family dwellings in the U.S. This standard, which has been the U.S. national standard for building usability and accessibility (ANSI A117.1) for decades, now limits risers to a maximum height of 7 inches (178mm) and tread depths to a minimum of 11 inches (280mm), with each measured nosing to nosing (Pauls 2002)"*

> However this is completely incorrect for residential buildings in the USA. For residential buildings, the actual maximum riser height is 7 ¾ inches or 196 mm, with a maximum[58] tread of 10 inches or 254 mm. The quoted standard only applies to commercial buildings. These figures have been confirmed by several sources in both the USA and Canada."

A study undertaken by the National Association of Home Builders (NAHB) – a US association, cited in one submission discounted the various studies by Pauls and others used in the Monash Report. One of the findings from the NAHB report showed no quantitative relationship between riser height and tread depth and accident rate on stairs. This report was not picked up by the Monash Report.

The statement that "*the design, construction and regulation of stairs are based heavily on tradition rather principals or ergonomics and universal design. Reliance on tradition does not necessarily mean that the current design of stairs is adequate*" from the Consultation RIS and based on the Monash Report was called into question, a number of submissions argued that the use of the 2R+G dimensions provided a safe slope of the staircase and was developed to replace complicated, trigonometric calculations that can be used on site.

9.3 Openable Barrier for Windows

The majority of comments regarding the openable barrier for windows amendment have come from injury prevention bodies. Criticism was directed at the injury data that was used in the Consultation RIS to calculate the benefits in avoided injury and avoided deaths, pointing out that the use of *Victorian Injury Surveillance and Applied Research System* (VISAR) and *Australian Institute of Health and Welfare* (AIHW) data was too out of date. More current statistics collected and maintained by QISU indicate that the number of toddlers falling from windows averages 2 per week in Queensland.

A number of comments from building certifiers and councils have made suggestions that the 865mm barrier for openable windows should be raised to 1m for consistency with the balustrade provisions. Doing so would also resolve the potential risk posed by large windows that can be fully opened along its width. Some windows can be 2 metres or more wide and when fully open would present the same hazard as a balcony.

On the other side of the argument however, the fact that the current barrier for openable window provisions was only introduced as recently as BCA 2008 begs the question whether there has been enough time allowed since, to review the current provisions effectiveness on fall incidences. Adding weight to this argument is the decrease in deaths due to falls, according to the AIHW

[58] Although 'maximum' is used, it is believed the authors actually meant 'minimum'

report, and the increases in stock of both houses and population according to ABS data.

Furthermore, while some submissions in particular those from the injury prevention bodies would welcome this amendment, they were also clear that this amendment would do little to prevent toddler falls from windows. In their view the mechanism for toddlers falling from windows occur when a toddler accesses the window via fixed or moveable furniture.

In a submission by the window industry, education was highlighted as the major issue and area of need to prevent falls from windows, in particular regarding the inadequate capabilities of fly screens and the placement of furniture. This observation echoes a number of research reports and submissions from injury prevention bodies that show a significant proponent of child falls from windows and balconies have come from climbing on adjacent furniture. The window industry has made clear that they would show support for the BCA to require the installation of window guards at second storey height in all domestic buildings, irrespective of whether they exceed four metres in height above the surface beneath. There was also support for this requirement by other injury prevention bodies. On the flip side however, some submissions highlighted the potential impact on egress if window restricting mechanisms were required on all windows. It should be noted that the BCA does not recognise windows as an egress point; nevertheless, there may be homeowners who have incorporated in home evacuation plans, the ability to egress through a window.

9.4 Non Climbable Zone

This amendment received a significant amount of comment from both industry and injury prevention groups. The stainless steel industry, stair and balustrade manufacturers, and installers emphasised that the amendment to the non-climbable zone was effectively a ban on horizontal wire balustrade systems. A popular product that has been well received in the market by consumers because of its cost effectiveness, simplicity and aesthetics will be taken away – a huge impost on consumer choice. The amendment would also impact on ornate, classical wrought iron balustrade designs, potentially placing a ban on these designs as well. Furthermore, in the situation of extensions and rebuilds, new balustrades would not be able to match with the existing design if the existing made use of horizontal wire balustrades.

A consumer preference favouring vertical systems over other types, e.g. glass, was questioned. While it is not possible to figure out what consumers preferences are ex ante, if consumers next highest preference was for glass balustrades over vertical wire systems the cost impost would potentially be even more significant.

Noting the above point, the cost estimates used in the RIS for vertical wire systems were heavily criticised. A number of submissions including one from the stainless steel association provided revised cost figures starting at $120 for the first metre but increasing exponentially as the length of the balustrade increases, others have quoted $250 extra per metre. This is in contrast to the $50 per metre used in the RIS to quantify the cost going from horizontal to vertical. Furthermore the extra complexity in installing vertical wire systems was not accounted for. Nuances not included between horizontal vs. vertical wire systems include the increase use of fittings in vertical wire format, increasing requirements for strength in top and bottom rails, extra posts, and the additional labour required.

It was noted that the use of horizontal wire barriers in structures lower that 4 metres is widespread in Australia. One of Australia's largest manufacturers of stainless steel rigging products pointed out that there is a large number of businesses and individuals who rely solely on the installation of wire rope barriers with considerable time and resources invested. Any change towards the BCA's 'non-climbable zone' provisions would greatly affect their livelihoods. This was not discussed or considered in the RIS.

There was general consensus amongst the industry to tackle the problem from a different angle. One suggestion wholly and fully supported was to work with relevant stakeholders to produce a code of practice for their products and eventually develop a standard that was able to provide a definable and adequate level of safety for both consumers and users of these structures.

One notable concern common amongst industry submissions drew on the fact that the Monash Report showed that falls from balconies are only a proportion of the reported 5.8% of all falls from heights (this figure includes falls from ladders and openings with no reference to actual falls attributed to 'climbable' barriers). It was contended that injuries and fatalities from this type of accident cannot be concluded.

Submissions from injury prevention bodies drew criticism on the lack of representation in the use of Queensland injury data. It was noted in one submission that QISU data indicated approximately 200 toddlers falling from balconies per year in Queensland alone, if this was extrapolated for the rest of Australia the number would be more than 1000 rather than the estimate of 190 used in the RIS.

The estimated average cost of injury was also perceived to be inadequate as it fails to account for the lifelong cost in diminished cognitive potential following a head injury which is usually greater than 50% in toddler falls.

It has been suggested that increasing the width of the top timber rail would make it more difficult for children to climb over and that perhaps this was overlooked in the RIS as a viable option.

9.5 Single Steps

Single steps received relatively little feedback. Support for and against the amendment was broadly the same. One peak housing body highlighted the fact that the single step provision was not amenable to the current construction practice of sunken floors. Together with the stair going and riser amendment designers would face design constraints deemed too onerous, noting also, that the benefits are negligible and highly uncertain while its constraints on building design are many. The window association highlighted that in some buildings step ups off balconies into living areas average a step of 250-300mm (including the window/door threshold), If the maximum height of the single step is inclusive of both the threshold and step there would be some impacts to their industry.

A number of alternatives/refinements for the single step amendment have been suggested including a minimum requirement for illumination at single steps to help mitigate falls and the inclusion of a minimum height for single steps.

9.6 Other Comments

A number of submissions suggested that slip resistance should be addressed in the BCA, highlighting the fact that a large cohort of falls come from slips trips and stumbles on the same level. It was pointed out that there are a number of available standards and handbooks on slip resistance which could be updated, and referenced in the BCA. Furthermore, the proposed amendments only address 13% of fall hospitalisations. If slip resistance was included this would increase the proportion of fall hospitalisations it could address.

A common theme amongst the submissions was the critical eye that was cast on the Monash Report. For many the Monash Report did not provide conclusive evidence that building design and construction was causing fall injury. Submissions from peak housing bodies called into question the Monash Report's reliance on US research in particular that of Pauls. There was acknowledgement that the data showed correlation but not causation. Other risk factors were also deemed inadequately explored. Was another object involved in the fall? Was it a non-complying staircase or balustrade? Was it intrinsic factors such as old age, poor physical condition and frailty? Was the person under the influence of drugs? Was it poor choice of foot wear? Do we know if the floor was contaminated? Was poor lighting involved? These risk factors which are real, lacked any attribution in the fall injury data provided by the Monash Report, indeed it is the lack of disaggregation of the injury data linking to one of any of these risk factors which as been called into question.

The use of 5.11 percent per annum decline in residential construction was also lambasted as it would mean that by 2050 Australia would be building around 17,000 dwellings per annum. It was also argued that the negative growth rate used has a significant affect on the cost side of the equation more than the benefits side. It was suggested that a rewrite taking into account more realistic activity assumptions would likely increase the net costs.

The majority of the comments addressing the effectiveness assumptions drew attention to the fact that apart from the handrail amendment the effectiveness rate for all others was essentially unsubstantiated arbitrary assumptions. It was suggested that without firstly establishing a causal relationship between fall injury and building design and construction there was no basis for the quantitative analysis. Secondly, even without a casual relationship established 4 out of the 5 effectiveness rates were not backed by any scientific basis, and thirdly there is simply no way of knowing the effectiveness rate of the proposals on an ex-ante basis. Any findings based on such an analysis would need to be fully qualified noting the significant uncertainties in the data.

The Value of a Statistical Life (VSL) used in the RIS was picked up on by a number of submissions who questioned the over generalisation of the demographics that make up the fall injury dataset. The VSL at $3.5 million represents an average value based on a healthy person living for another 40 years, however the demographic most represented in fatalities is skewed to older age groups. As a consequence the quantitative analysis tends to overestimate the benefits attributable to avoided fatalities. One submission highlighted that the OBPR guidance note on VSL is based on a paper prepared by Dr Peter Abelson where he recommends the application of age specific VSL's for older people based on the present value of future life years saved. Using this methodology could provide a more accurate representation of the VSL for the cohort of fatalities represented in the quantitative analysis.

There was also a focus from industry groups on the lack of discussion the amendments will have on compliance costs. Some submissions felt that the RIS was not only lacking in this area but that it was too easily dismissed. A well known volume builder outlined a number of considerations the RIS missed including designs that would need to be reviewed and updated, plans that would need to be redrafted, marketing materials reprinted and display homes retrofitted. For stair and balustrade installers, it was the loss of value in inventory and the re-tooling required on plant and machinery.

One submission queried the Consultation RIS's inclusion of compensation as a cost and not a transfer.

9.7 Consultation Questions

The following questions from the Consultation RIS were asked in the hope of eliciting targeted feedback from the public comment period. Where relevant, feedback responding to the questions is summarized and included –

1. Are there other potential cost-effective measures that could be implemented to reduce slips, trips and falls in buildings?

    - A number of submissions supported the requirement of window restrictors in the BCA, the requirement for slip resistant surfaces, illumination of stairwells, educational campaigns on children falling from windows and balconies and a handbook on safe balustrade design.

2. How cost-effective are current arrangements?

    - The barrier for openable window provision as it currently exists has only recently been introduced with BCA 2008. There has not been enough time since to gauge whether it is having any impact on fall injury data.

    - The window industry was of the opinion that the current arrangements are cost effective and adequate.

3. Is it reasonable to assume for the purposes of this RIS, that there is an average of 10 single occupancy units per floor of a Class 2 or 3 building?

    - No feedback provided

4. Is it reasonable to assume that 5 per cent of single occupancy units located within a Class 2 or 3 building are double storey?

    - No feedback provided

5. Is it reasonable to assume that designers will design buildings using windows with higher sills rather than openable windows that require the use of Juliet balconies where a balustrade/barrier is required for openable windows?

    - The window association was of the opinion that regardless of whether raising window sills or incorporating Juliet balconies, the change to the building design would be significant.

    - Other submissions believed that raising the sill height would be the preferred option due to the lower cost.

6. Is it reasonable to assume that the requirement for a non-climbable zone is unlikely to impose an incremental cost for Class 2 to 9 buildings because it is unlikely that buildings would have different balustrade designs above and below four metres?

- One submission pointed out that while this may be reasonable to assume for exterior balustrades, it fails to account for internal balustrades in commercial type buildings.

- In contrast to the above, a submission by a building surveyor noted that the majority of apartment buildings she has observed use glass balustrade or vertical balustrade designs

7. Is it reasonable to assume 5 per cent of single storey and 25 per cent of double storey Class 1 buildings would be affected by the non-climbable zone proposed changes?

   - A building surveyor reported that in her shire it would be more reasonable to expect less than 5 per cent of single Class 1 buildings would be affected, however almost all double storey Class 1 buildings would be affected.

8. Is it reasonable to assume negligible cost impact on the proposed single step provisions?

   - Several submissions pointed out that the single step provisions would impose onerous costs on sites not amenable to the 180mm height maximum. It was also noted that single step heights should not be the main design consideration for building heights. Existing buildings requiring refurbishment was noted almost unanimously as a cause for concern with this amendment.

9. How often are inherent “dead zones” with regards to the proposed riser and going dimensions encountered on building sites? Is it reasonable to assume building designers will design buildings with this in mind to avoid these “dead zones”?

   - A number of industry bodies and building practitioners including building certifiers and architects pointed out that the proposed stair riser and going dimensions would create problems for short flights of stairs where floor to floor heights between; 180-300mm, 360-450mm, 540-600mm and 720-750mm would not achieve a legal stair. Many pointed out that this constraint would be too onerous in building refurbishments. Others pointed out that slab heights should not be dictated by riser heights rather than normal building considerations. Anecdotally one building surveyor noted that while the amendment will be easy to design in mind, in practice building sites encounter many unseen circumstances that can prevent the proper building height being achieved.

10. Are the cost estimates for the proposed BCA amendments provided by the Turner and Townsend report reflective of the marketplace?

- The general consensus amongst submissions was that the Turner and Townsend figures provided in the RIS appeared to be simplistic; almost all cost figures were underestimated, with some very important considerations altogether unaccounted for. Stair manufacturers pointed out that the Turner and Townsend calculations were based incorrectly on the same number of risers and goings, rather there should always be one more rise than going.

11. What are the likely quantifiable costs associated with a decrease in net rentable floor space?

- While the RIS points out that the net rentable floor space would be hard to account for in the analysis due to the wide ranging spectrum of rents available, a number of submissions have suggested that an attempt should at least be made to include this cost as it would appear to be significant.

12. Are the assumptions regarding effectiveness for each proposed amendment appropriate?

- The general consensus amongst the submissions is that the effectiveness assumptions used in the RIS (with the exception of the handrail amendment) are not supported by any scientific evidence and should not be used.

- Based on the mechanism for toddler falls on a balcony, i.e. toddlers climbing on balustrade components, toddlers climbing balcony furniture, and toddlers falling through gaps, QISU believes that 30% effectiveness is reasonable for the non-climbable zone provision. However when it comes to barriers for openable windows a number of injury prevention bodies agreed that the provisions would not be effective as there is no mechanism to prevent occupants from placing beds and furniture under a window.

13. What other variables should be considered when performing the sensitivity analysis?

- It has been argued that measuring building activity in isolation of dwelling occupant numbers and population growth implies that houses are the risk rather than the occupants. For example, 10 people living in 10 houses have twice the risk of injury or death than the same 10 people living in 5 houses. It would be more appropriate to consider sensitivity to population change.

14. Are there other compliance related costs or issues that require further consideration?

- Submissions cast a critical eye on the lack of consultation involving the businesses that the BCA amendments would impact the most. A number of submissions suggested that industry impacts were too easily dismissed and did not account for the fact that the non-climbable zone amendment was basically a ban on horizontal wire balustrade systems; hence a significant product line would be taken off the market. Home builders noted that the amendments would require updating of marketing materials and plans, and the retrofitting of display homes.

15. Is it reasonable for the cost/benefit analysis to assume the life of the regulation as 10 years such that the associated costs will stop incurring in year 10 while the benefits will continue to accumulate until year 40?

    - Feedback from submissions agreed that this was a reasonable assumption to allow benefits to accrue until year 40.

16. Is it reasonable to assume there will be negligible competition impacts?

    - No feedback provided.

10 Conclusion

The main health and safety risks in buildings were identified in a report to the ABCB (Atech Group, 2003) to be from slips, trips and falls. A subsequent report to the ABCB by the Monash University Accident Research Centre, 2008, *the relationship between slips, trips and falls and the design and construction of buildings* (the Monash Report) examined these risks in detail. The Monash Report showed that these risks disproportionately affected vulnerable pockets of the population: namely young children and the elderly. The report documented the number of injuries and fatalities from slips, trips and falls in buildings, and calculated the cost of these injuries to be $3.1 billion over 2002 to 2005 and fatalities to be $1.2 billion over 2001 to 2005.

Government intervention may be required when an issue or problem imposes social or economic costs to the community but is not adequately addressed by individuals or the market. In this instance, government intervention is required because:

- Inadequate individual response due to insufficient information. The information required to understand the risks of slips, trips and falls, and to formulate appropriate risk mitigation measures, is highly technical. Individuals will be unable to fully comprehend and respond to the risks to which they are exposed.

- Imperfect industry response due to split incentives. Designers and builders do not have incentives to voluntarily incorporate additional preventative measures in buildings, where owners are price driven and unable to verify the benefits of potentially costly preventative measures.

The Monash Report identified four principal risks associated with slips, trips and falls in buildings:

- Biological and medical risks: such as muscle weakness, illness, physical disability or cogitative impairment of a person.

- Behavioural risks: such as excessive alcohol, risk-taking behaviour, inappropriate footwear and a history of previous falls.

- Socio-economic risk factors: such as income, education, housing and social connectedness.

- Environmental risks: including stairs, floor surfaces, lack of grab bars or handrails, bad lighting and inadequate maintenance.

The Monash Report recommended a number of areas where amendments to the BCA could address proven environmental risks and potentially reduce the incidence and costs associated with slips trips and falls. From these recommendations five proposals were identified to address the risks of slips, trips and falls in buildings, through amendments to the BCA. The proposals were:

1. Handrails: to be required in all private dwellings with stairs.

2. Riser and going dimensions: to be subject to a narrower range.

3. Barrier for openable windows: to be required for all windows more than 1 metre above the surface beneath.

4. Non-climbable zones: to be required for balustrades.

5. Single steps: to be no more than 180mm.

These proposals would satisfy a BCA objective to provide people with a safe, equitable and dignified access to a building and safeguard occupants from illness or injury while evacuating in an emergency.

A number of possible non-regulatory approaches were also noted, but were considered to be inappropriate responses to the risks of slips, trips and falls because they would not provide sufficient assurance of protection and reduction in injuries and fatalities in buildings.

It should be noted that the five proposals to amend the BCA are not mutually exclusive; ie more than one proposal could be recommended if it was supported by the cost benefit analysis. Alternatively, if any proposal was not supported by the cost benefit analysis then this report would recommend the status quo, with no change to the BCA with respect to that proposal.

Stakeholder comments and data from public consultation were incorporated into the cost benefit analysis. The present value of costs was calculated on the basis of Consultation RIS costings, and also on the basis of stakeholder comments and data. Stakeholders generally indicated costs to be higher than the Consultation RIS costings, and these higher costs were presented and compared in the impact analysis.

A rigorous methodology was adopted to estimate the present value of benefits, calculating the value of avoiding injury and death from slips, trips and falls. The Monash Report was helpful in identifying the five proposals as feasible means to reduce slips, trips and falls. The report cited academic literature that enabled the determination that handrails in private dwellings with stairs would be 30% effective in reducing slips, trips and falls.

However the literature was silent on the contribution the built environment could make through the other proposals in reducing these risks when compared to other risk factors. Without an evidence base from the literature for the other proposals, explicit assumptions were made about their effectiveness. Hence the calculated estimates of these benefits should be understood to be indicative of the broad magnitudes, rather than precise numbers.

The net present value for the five proposals was calculated on the basis of Consultation RIS costings and also stakeholder costings. One proposal, namely requiring handrails: in all private dwellings with stairs, would clearly deliver substantial net benefits to society, with a net present value of $65 million under Consultation RIS costings or $60 million under stakeholder costings:

The other proposals would involve net costs overall.

- The stair riser and going dimension proposal would deliver a high level of benefits, but would also involve higher costs. Overall a net cost of $35 million. The detailed costings by a stakeholder indicate that the net cost could become very large (a net cost of up to $127 million in present value terms).

- The non-climbable zones proposal may provide a small benefit, as calculated, but given the caveat to the methodology the level of benefit is more likely to be close to zero. Stakeholder comments around the effectiveness of this proposal reinforce the view that its benefits would be close to zero. This proposal would also result in very substantial costs under either Consultation RIS or stakeholder costings and therefore, in net present value terms, it would result in a substantial net cost to the community (a net cost exceeding $97 million).

- The two proposals (i) barrier for openable windows and (ii) regulating single steps would each deliver small benefits, as calculated, but given the caveat to the benefits estimation methodology the level of benefit is more likely to be close to zero. Stakeholder comments around the effectiveness of the barrier for openable windows proposal reinforce the view that its benefits would be close to zero. Under Consultation RIS costings assigning both proposals a zero cost, their net benefits would be questionable. However stakeholders argued that costs would be incurred. Allowing for a very modest cost impact of $500,000 per annum, nation-wide, as a scenario for consideration, and taking the benefits of these proposals as close to zero, gives a net cost for each proposal. Overall it was considered that there would be a discernible risk that these proposals would result in a net cost to the community.

A sensitivity analysis was also undertaken for the important assumptions in the cost benefit analysis: construction costs; injury costs; the value of a statistical life; effectiveness; and the discount rate. The most sensitive assumptions were the discount rate and the rate of effectiveness of BCA amendments to reduce risks of slips, trips and falls. Only one proposal delivered net benefits over the full range of variation of all assumptions: handrails to be required in all private dwellings with stairs.

In conclusion the impact analysis supports one proposal to address the risks of slips, trips and falls in buildings, namely to require handrails in all private dwellings with stairs.

11 Implementation and review

If approved, the measures are currently proposed for introduction in BCA 2012, scheduled for adoption on 1 May 2012. As a matter of policy, proposed changes to the BCA are released in advance of implementation to allow time for familiarisation and education and for industry to modify its practices to accommodate the changes.

It is expected that building control administrations and industry organisations, in association with the ABCB, will conduct information training seminars on the new measures prior to their introduction into the BCA.

There is no fixed schedule for reviewing provisions of the BCA. However, the ABCB maintains regular and extensive consultative relationships with a wide range of stakeholders. It relies on this process to identify emerging concerns.

A Detailed cost assumptions/calculations

This Appendix describes the detailed approach and the assumptions used to estimate the likely cost impacts of the proposed BCA amendments. This analysis estimated the impact of the proposed changes at a State and national level using a combination of a specific data request from the Victorian Building Commission and ABS Building Approvals Data for all jurisdictions.[59]

A description of the specific steps and assumptions involved in estimating the impact of the proposed changes at a State and national level is provided below.

A.1 Victorian Building Commission data

Table A-1 below provides a summary of the total number of residential building permits issued across BCA Classes 1-2 in Victoria for 2008/09.[60]

Table A-1: Number of residential Victorian building permits (2008/09)

Building class	Number of building permits	Percentage of total permits
Class 1	53,958	98.15%
Class 2	1,017	1.85%
Total	**54,975**	**100.00%**

Table A-2 below provides a summary of the total number of non-residential building permits issued across BCA Classes 3-10 in Victoria for 2008/09.[61]

Table A-2: Number of non-residential Victorian building permits (2008/09)

Building class	Number of building permits	Percentage of total permits
Class 3	376	0.87%
Class 4	81	0.19%
Class 5	3,550	8.23%
Class 6	4,260	9.88%
Class 7	1,533	3.56%
Class 8	859	1.99%
Class 9	2,983	6.92%
Class 10	29,474	68.36%
Total	**43,116**	**100.00%**

[59] Australian Bureau of Statistics, _Building Approvals,_ Cat. No 8731.0 (March 2010).
[60] Unpublished data sourced through specific data request to the Building Commission.
[61] Unpublished data sourced through specific data request to the Building Commission.

A.2 Australian Bureau of Statistics data

Tables A-3 and A-4 below outline the average number of building approvals for residential and non-residential buildings in each State/Territory over the period 2005-06 to 2009-10.[62]

Table A-3: Number of residential building approvals (2005-06 to 2009-10)

Jurisdiction	2005-06	2006-07	2007-08	2008-09	2009-10	5 year average	Percentage
Vic	41,642	37,942	42,908	41,633	57,005	43,229	28.00%
NSW	34,160	31,402	31,302	23,861	33,299	30,819	19.90%
Qld	38,033	41,516	45,052	28,954	33,733	37,458	24.20%
WA	26,170	25,087	23,641	19,387	25,366	23,930	15.50%
SA	11,458	10,818	13,380	12,009	12,611	12,056	7.80%
Tas	2,634	2,940	2,938	3,167	3,233	2,982	1.90%
NT	1,363	1,464	1,172	985	1,331	1,263	0.80%
ACT	1,867	2,246	2,339	2,867	4,539	2,776	1.80%
Aust	**157,327**	**153,415**	**162,732**	**132,863**	**171,117**	**154,513**	**100.00%**

Table A-4: Number of non-residential building approvals (2005-06 to 2009-10)

Jurisdiction	2005-06	2006-07	2007-08	2008-09	2009-10	5 year average	Percentage
Vic	7,475	7,841	8,146	7,570	8,925	7,993	29.30%
NSW	71,05	6,837	6,680	5,803	9,057	7,097	26.00%
Qld	5,755	6,343	5,595	5,402	5,673	5,754	21.10%
WA	2,700	2,795	3,028	2,880	3,581	2,997	11.00%
SA	1,701	1,588	1,775	1,826	2,009	1,780	6.50%
Tas	605	643	712	716	865	708	2.60%
ACT/NT*	838	912	911	888	1,058	921	3.40%
Aust	**26,179**	**26,959**	**26,847**	**25,085**	**31,168**	**27,249**	**100.00%**

*Note that data from the NT and ACT was combined due to the small jurisdiction sizes.

As shown above, for the purposes of this analysis it was assumed that residential building approvals related to Class 1-2 buildings, while non-residential building approvals related to Class 3-9 buildings.

The 5 year averages calculated in Table A-3 and A-4 will be an input into the cost levels of the proposed BCA amendments.

[62] Australian Bureau of Statistics, *Building Approvals,* Cat. No 8731.0 (2004-2009).

A.3 Estimating building activity for each BCA class

Note that there is a discrepancy in the number of Victorian Building Approvals granted in 2008-09 (as per ABS data) and the number of Victorian Building Permits (as per Building Commission data). This is due to the fact that while the Building Commission records all building activities of any value as Building Permits, only residential building activities greater than $10,000 in value and non-residential building activities greater than $50,000 in value are recorded as Building Approvals by the ABS. Despite this consideration, it is assumed that the proportion of activities in each building class will remain similar and therefore can be applied throughout this RIS.

For the purposes of this analysis, it was necessary to separately identify the number of building approvals for Class 1-10 buildings. The Victorian Building Commission data reported above in Tables A-1 and A-2 provided a percentage figure indicating the proportion of permits in each class. This was then extrapolated for all other states, which is outlined in Table A-5.

These percentage figures were then applied to ABS data for other jurisdictions to achieve the breakdown outlined below.

Table A-5: Estimated building activity by BCA category (using 5 year average of number of permits from 05/06 to 09/10 figures)

Jurisdiction	Residential (Class 1)	Residential (Class 2)	Non-residential (Classes 3 10)	Total (Classes 1 10)
VIC	30,249	570	7,993	38,812
NSW	42,429	800	7,097	50,326
QLD	36,765	693	5,754	43,212
WA	11,833	223	2,997	15,053
SA	23,487	443	1,780	25,710
TAS	2,927	55	708	3,690
ACT/NT*	3,964	75	921	4,960
Australia	**151,655**	**2,858**	**27,250**	**181,763**

*Note that data from the NT and ACT was combined due to the small jurisdiction sizes

Since the Consultation RIS, 2009/10 building approval figures have been released by the ABS. Using the figures from the 5 year average, there is an increase of 16.3% in building approvals for residential buildings and an increase of 8.6% in building approvals for non-residential buildings from the Consultation RIS.

Estimating aggregate impact of proposed BCA amendments

The next step in the analysis involved extrapolating the construction cost estimates derived for the new safety requirements for handrails, stair risers and goings and non-climbable zones to a State and national level. This required identification of the relevant BCA Class(s) for each of the chosen buildings and applying the relevant percentage of affected buildings in each class to the estimated building numbers for that class of building. This analysis was performed on both a State/Territory level and at a national level, using the same methodology throughout.

A.4 Residential stair handrails

Table A-6 below estimates cost impacts under the proposed BCA handrail amendment using Turner and Townsend costings.

Table A-6: Estimated cost impact for assumed sample of buildings affected by new handrail requirements (Australia) using Consultation RIS costings

Building Class	Total number of buildings 2009-10	Number of storeys (Class 2 & 3 buildings)	Number of Class 1 buildings with two storeys (19.34%)	Number of double storey SOUs in Class 2 & 3 buildings which will be afffected	Hardwood timber handrails		Anodised aluminium handrails		Steel with PVC sheathing handrails		
					Number of handrails	Cost ($)	Number of handrails	Cost ($)	Number of handrails	Cost ($)	Total Cost ($)
1	151655	N/A	4,399.50		3,519.60	$ 929,173.83	439.95	$439,949.73	439.95	$294,766.32	$ 1,663,889.89
2	2858	5 (50%)		535.97	428.77	$ 113,196.22	53.60	$ 53,596.70	53.60	$ 35,909.79	$ 202,702.71
		10 (50%)		1,071.93	857.55	$ 226,392.45	107.19	$107,193.39	107.19	$ 71,819.57	$ 405,405.42
3	237	5 (50%)		44.45	35.56	$ 9,388.17	4.45	$ 4,445.16	4.45	$ 2,978.25	$ 16,811.58
		10 (50%)		88.90	71.12	$ 18,776.34	8.89	$ 8,890.31	8.89	$ 5,956.51	$ 33,623.16
TOTAL	**154,750**				**4,912.60**	**$ 1,296,927.02**	**614.08**	**$614,075.29**	**614.08**	**$411,430.45**	**$ 2,322,432.75**

Table A-6a below estimates cost impacts under the proposed BCA handrail amendment using Stakeholder costings.

Table A-6a: Estimated cost impact for assumed sample of buildings affected by new handrail requirements (Australia) using Stakeholder costings

Building Class	Total number of buildings 2009-10	Number of storeys (Class 2 & 3 buildings)	Number of Class 1 buildings with two storeys (19.34%)	Number of double storey SOUs in Class 2 & 3 buildings which will be afffected	Hardwood timber handrails		Anodised aluminium handrails		Steel with PVC sheathing handrails		
					Number of handrails	Cost ($)	Number of handrails	Cost ($)	Number of handrails	Cost ($)	Total Cost ($)
1	151655	N/A	4,399.50		3,519.60	$ 1,393,760.75	439.95	$439,949.73	439.95	$294,766.32	$ 2,128,476.80
2	2858	5 (50%)		535.97	428.77	$ 169,794.34	53.60	$ 53,596.70	53.60	$ 35,909.79	$ 259,300.82
		10 (50%)		1,071.93	857.55	$ 339,588.67	107.19	$107,193.39	107.19	$ 71,819.57	$ 518,601.64
3	237	5 (50%)		44.45	35.56	$ 14,082.26	4.45	$ 4,445.16	4.45	$ 2,978.25	$ 21,505.67
		10 (50%)		88.90	71.12	$ 28,164.51	8.89	$ 8,890.31	8.89	$ 5,956.51	$ 43,011.33
TOTAL	**154,750**				**4,912.60**	**$ 1,945,390.52**	**614.08**	**$614,075.29**	**614.08**	**$411,430.45**	**$ 2,970,896.26**

Note the following assumptions:

1 Despite this analysis relating to handrail requirements in residential buildings, Class 3 (generally categorised as 'commercial' throughout this report) is incorporated in this section due to the residential nature of the internal apartments/rooms in a guest house, motel, backpacker accommodation, etc.

2 Number of buildings is based on data obtained from the Building Commission and ABS, as outlined previously.

3 The assumed level of buildings that will be affected by the proposed handrail requirements was set at 15% for Classes 1-3, as confirmed by *Research Report: Trips, Slips and Falls Project prepared for Australian Building Codes Board* by Di Marzio Research Pty Ltd.

4 Only buildings with two or more storeys require handrails. Building Commission data indicated that 19.3% of Class 1 buildings were of two or more storeys (as demonstrated below). This proportion was applied to other State and Territory jurisdictions.

Table A-7: Proportion of buildings with one or more storeys (Victoria)

	Number of buildings with one storey	Number of buildings with two or more storeys	Total number of buildings	Proportion of buildings with two or more storeys
Class 1	43,523	10,435	53,958	19.34%

5 The average number of storeys in Class 2 and 3 buildings was assumed on a low and high basis to provide a range of costs associated with amendments to handrail requirements in each building class. No indication of the incidence of number of storeys was provided, so an aggregate average of 50% of buildings in the 'low' category and 50% of buildings in the 'high' category was applied.

6 An assumption of 10 apartments per storey in Class 2 and Class 3 buildings was used.

7 An assumption that 5% of apartments in Class 2 and 3 buildings is double storey was used.

8 Costs involved in using each type of handrail material were derived from information provided by Turner & Townsend.[63] An assumption that all buildings would already be fitted with a 4 metre handrail was used, hence only an additional 4 metre handrail would be required. The cost of each type of handrail material on a 4 metre basis was obtained from the information provided by Turner & Townsend. Table A-8 below outlines this process. An assumption as to the incidence in which each material was also used.

[63] Turner and Townsend, *Cost Analysis Report*, 2010, report commissioned by the ABCB, p. 2.

Table A-8: Costs and incidence of the use hardwood timber, anodised aluminium and steel with PVC sheathing

Type of material	Cost per 4m handrail ($)		Incidence
	Consultation RIS costings	Stakeholder costings	
Hardwood timber	264.00	396.00	80.00%
Anodised aluminium	1000.00	1000.00	10.00%
Steel with PVC sheathing	670.00	670.00	10.00%

A.5 Stair risers and goings (residential and non-residential)

Timber stairs provide a varying range of increased costs per flight depending on building class, as outlined in Table A-9 to Table A10a below. Note also the revised cost estimates as provided by stakeholder feedback.

Table A-9: Costs associated with the use of timber stairs by BCA class (residential)

Construction material	Building class	Cost per flight (18 steps) ($)	
		Consultation RIS costings	Stakeholder costings
Timber	Class 1	$66.00	404.30
	Class 2	$66.00	404.30
	Class 3	$77.00	404.30

Using Turner and Townsend cost estimates from the Consultation RIS, Table A-10 below identifies the aggregate cost impacts of residential buildings according to building class affected by new stair riser and going requirements.

Table A-10: Estimated cost impact of stair riser and going requirements by BCA class (residential buildings) (Australia) – Consultation RIS costings

	Total number of buildings 2009-10	Number of storeys (Class 1, 2 & 3 buildings)	Number of affected Class 1 buildings with two storeys	Number of affected SOUs in Class 2 & 3 buildings with two storeys	Number of flights	Cost ($)
Class 1	151,655	2 (100%)	26,104		1	$ 1,722,843.15
Class 2	2,858	5 (50%)		3,180	1	$ 209,884.66
		10 (50%)		6,360	1	$ 419,769.33
Class 3	237	5 (50%)		264	1	$ 20,308.44
		10 (50%)		527	1	$ 40,616.87
TOTAL						**2,413,422**

Using revised detailed cost estimates from a stakeholder, Table A-10a below identifies the aggregate cost impacts of residential buildings according to building class affected by new stair riser and going requirements.

Table A-10a: Estimated cost impact of stair riser and going requirements by BCA class (residential buildings) (Australia) – Stakeholder costings

	Total number of buildings 2009-10	Number of storeys (Class 1, 2 & 3 buildings)	Number of affected Class 1 buildings with two storeys	Number of affected SOUs in Class 2 & 3 buildings with two storeys	Number of flights	Cost ($)
Class 1	151,655	2 (100%)	26,104		1	$ 10,553,719.48
Class 2	2,858	5 (50%)		3,180	1	$ 1,285,702.58
		10 (50%)		6,360	1	$ 2,571,405.15
Class 3	237	5 (50%)		264	1	$ 106,632.48
		10 (50%)		527	1	$ 213,264.97
TOTAL						**14,730,725**

Note the following assumptions:

1 Despite this analysis relating to stair riser and tread/going requirements in residential buildings, Class 3 (generally categorised as 'commercial' throughout this report) is incorporated in this section due to the residential nature of the internal apartments/rooms in a guest house, motel, backpacker accommodation, etc.

2 The number of buildings is based on the number data obtained from the Victorian Building Commission and ABS, as outlined previously.

3 The assumed level of new buildings that will be affected by the proposed stair riser and going amendments was set at 89% for Classes 1-2, based on findings from the *Research Report: Trips, Slips and Falls Project prepared for Australian Building Codes Board* by Di Marzio Research Pty Ltd. This is the greater of two figures indicating non-compliance against the proposed amendment for stair risers (55%) and stair treads/goings (89%) as it is assumed that both facets of a step require compliance for the step to be deemed suitable.

4 The average number of storeys in each building class was assumed on a low, medium and high basis to provide a range of costs (savings) associated with amendments to stair risers and goings in each building class. No indication of the incidence of number of storeys was provided, so an aggregate average of 33.3% of buildings was applied to each number of storeys in cases where low, medium and high ranges were provided, and an aggregate average of 50% of buildings was applied in cases where only low and high ranges were provided.

5 An assumption of 10 sole occupancy units per storey in Class 2 and Class 3 buildings was used.

6 An assumption that 5% of sole occupancy units in Class 2 and 3 buildings are double storey and therefore would need to comply with new residential stair riser and tread/goings requirements was used.

7 It was assumed that timber stairs are mainly used in residential buildings (i.e. private stairways).

Table A-11 below identifies the assumed BCA class numbers for each type of non-residential building affected by new stair riser and going requirements and the estimated cost impact proposed by the changes.

Table A-11: Estimated cost impact of stair riser and going requirements by BCA Class (non-residential buildings) (Australia) – Consultation RIS costings

Class	Total no. of buildings 2009-10	Number of affected buildings (83%)	No .of Storeys	Weighting	No. stairwells	Number of flights	No. of buildings	Cost ($)
2	2,858	2,373	**5**	**50%**	**1**	4	1,186	$ 393,842.82
			10	**50%**	**2**	18	1,186	$ 1,772,292.69
3	237	197	**5**	**50%**	**1**	4	98	$ 32,664.19
			10	**50%**	**2**	18	98	$ 146,988.87
4	52	43	**2**	**33%**	**1**	1	14	$ 1,388.08
			2	**33%**	**1**	1	14	$ 1,388.08
			2	**33%**	**1**	1	14	$ 1,388.08
5	2,243	1,861	**5**	**33%**	**1**	4	620	$ 275,214.71
			10	**33%**	**2**	18	620	$ 1,238,466.18
			20	**33%**	**2**	38	620	$ 2,614,539.71
6	2,692	2,235	**2**	**33%**	**1**	1	744	$ 82,597.85
			2	**33%**	**1**	1	744	$ 82,597.85
			2	**33%**	**1**	1	744	$ 82,597.85
7	970	805	**3**	**33%**	**1**	2	268	$ 74,002.76
			5	**33%**	**1**	4	268	$ 148,005.52
			10	**33%**	**2**	18	268	$ 666,024.83
8	542	450	**2**	**33%**	**1**	1	150	$ 20,683.36
			2	**33%**	**1**	1	150	$ 20,683.36
			2	**33%**	**1**	1	150	$ 20,683.36
9	1,886	1,565	**5**	**50%**	**1**	4	783	$ 347,459.08
			10	**50%**	**2**	18	783	$ 1,366,359.36
10	18,628	0	-		**-**	**-**	-	-
			-		**-**	**-**	-	-
					-	-	-	
TOTAL	**30,108**	**9,529**					**8,628**	**$ 9,389,868.60**

Note the following assumptions:

1 Despite this analysis relating to stair riser and tread/going requirements in non-residential (commercial) buildings, Class 2 (generally categorised as 'residential' throughout this report) is incorporated in this section due to the commercial nature of the common areas in such buildings, e.g. stairwells, hallways, etc.

2 The number of buildings is based on the number data obtained from the Victorian Building Commission and ABS, as outlined previously.

3 The assumed level of new buildings that are affected by the proposed stair riser and going requirements was set at 83% for Classes 3-10, based on findings from the *Research Report: Trips, Slips and Falls Project prepared for Australian Building Codes Board* by Di Marzio Research Pty Ltd. This is the greater of two figures indicating non-compliance for stair risers (49%) and stair treads/goings (83%) as it is assumed that both facets of a step require compliance for the step to be deemed suitable.

4 The average number of storeys in each building class was assumed on a low, medium and high basis to provide a range of costs (savings) associated with amendments to stair risers and goings in each building class. No indication of the incidence of number of storeys was provided, so an aggregate average of 33.3% of buildings was applied to each number of storeys in cases where low, medium and high ranges were provided, and an aggregate average of 50% of buildings was applied in cases where only low and high ranges were provided.

5 An assumption that in-situ concrete stairs are mainly used in non-residential buildings was used. In-situ concrete stairs provide a varying range of increased costs per flight depending on building class, as outlined in Turner and Townsend and Table A-12 below.[64]

[64] Turner and Townsend, *Cost Analysis Report*, 2010, report commissioned by the ABCB, p. 3.

Table A-12: Costs associated with the use of in-situ concrete by BCA class

Construction material	Building class	Cost per flight (18 steps) ($)
In-situ concrete	Class 1	$83.00
	Class 2	$83.00
	Class 3	$97.00
	Class 4	$83.00
	Class 5	$111.00
	Class 6	$111.00
	Class 7	$138.00
	Class 8	$138.00
	Class 9 (Av)	$111,00
	Class 10	$97.00

Note that an average of the costs associated with stair riser and going requirements in Class 9 has been calculated as an average of Class 9a ($138.00), Class 9b ($83.00) and Class 9c ($97.00).

Loss of rentable floor space

Table A-13 below estimates the cost incurred from the loss of rentable floor space under the stair riser and going amendment in non-residential buildings. One stakeholder indicated the loss of 1m2/yr in a CBD office to be $1000. Internet research on commercial floor space leases showed that a range of $150 to $700 was more prevalent when smaller regional towns were accounted for. Using a conservative figure of $150/m2/yr and at a loss of 0.5m2 of floor space per flight of stairs per storey, the same methodology and assumptions used to calculate the aggregate construction costs can be used to calculate the aggregate cost from the loss of rentable floor space.

Table A-13: Aggregate cost impact of the stair riser and going amendment from the loss of rentable floor space in non-residential buildings

Class	Total no. of buildings 2009-10	Number of affected buildings (83%)	No .of Storeys	Weighting	No. stairwells	Loss of Area per storey (m2)	Total loss of Area (m2)	No. of buildings	Cost/m2 of NLA	Total Cost ($)
2	2,858	2,373	5	50%	1	0.5	2.5	1,186	$ 150.00	$ 444,852.58
			10	50%	2	0.5	10	1,186	$ 150.00	$ 1,779,410.34
3	237	197	5	50%	1	0.5	2.5	98	$ 150.00	$ 36,894.80
			10	50%	2	0.5	10	98	$ 150.00	$ 147,579.19
4	52	43	2	33%	1	0.5	1	14	$ 150.00	$ 2,146.51
			2	33%	1	0.5	1	14	$ 150.00	$ 2,146.51
			2	33%	1	0.5	1	14	$ 150.00	$ 2,146.51
5	2,243	1,861	5	33%	1	0.5	2.5	620	$ 150.00	$ 232,444.85
			10	33%	2	0.5	10	620	$ 150.00	$ 929,779.41
			20	33%	2	0.5	20	620	$ 150.00	$ 1,859,558.83
6	2,692	2,235	2	33%	1	0.5	1	744	$ 150.00	$ 111,618.72
			2	33%	1	0.5	1	744	$ 150.00	$ 111,618.72
			2	33%	1	0.5	1	744	$ 150.00	$ 111,618.72
7	970	805	3	33%	1	0.5	1.5	268	$ 150.00	$ 60,328.34
			5	33%	1	0.5	2.5	268	$ 150.00	$ 100,547.23
			10	33%	2	0.5	10	268	$ 150.00	$ 402,188.91
8	542	450	2	33%	1	0.5	1	150	$ 150.00	$ 22,481.91
			2	33%	1	0.5	1	150	$ 150.00	$ 22,481.91
			2	33%	1	0.5	1	150	$ 150.00	$ 22,481.91
9	1,886	1,565	5	50%	1	0.5	2.5	783	$ 150.00	$ 293,462.06
			10	50%	2	0.5	10	783	$ 150.00	$ 1,173,848.25
10	18,628	0	-		-		-	-		-
			-		-		-	-		-
					-		-	-		
TOTAL	**30,108**	**9,529**						**8,628**		**$ 7,869,636.21**

Non-climbable zones

Table A-13 below shows the estimated cost impact on Class 1 buildings using Consultation RIS costings.

Table A-13: Estimated cost impact of non-climbable zone requirements (Australia) – Consultation RIS costings

	Total number of buildings 2009-10	Number of affected buildings (5% for single storey, 25% for double storey)	Length of balustrade system (metres)	Weighted	Number of affected buildings	Cost ($)
Class 1 (single storey)	122,325	6,116	**10**	**33%**	2,039	$ 1,019,269.12
			20	**33%**	2,039	$ 2,038,538.25
			30	**33%**	2,039	$ 3,057,807.37
Class 1 (double storey)	29,330	7,332	**10**	**33%**	2,444	$ 1,221,960.38
			20	**33%**	2,444	$ 2,443,920.76
			30	**33%**	2,444	$ 3,665,881.14
TOTAL	**151,655**	**13,449**			**13,447**	**13,447,377**

Table A-15 below shows the estimated cost impact proposed by the changes on Class 1 buildings using stakeholder costings.

Table A-15: Estimated cost impact of non-climbable zone requirements (Australia) – Stakeholder costings

	Total number of buildings 2009-10	Number of affected buildings (5% for single storey, 25% for double storey)	Length of balustrade system (metres)	Weighted	Number of affected buildings	Cost ($)
Class 1 (single storey)	122,325	6,116	**10**	**33%**	2,039	$ 2,446,245.90
			20	**33%**	2,039	$ 4,892,491.80
			30	**33%**	2,039	$ 7,338,737.69
Class 1 (double storey)	29,330	7,332	**10**	**33%**	2,444	$ 2,932,704.91
			20	**33%**	2,444	$ 5,865,409.83
			30	**33%**	2,444	$ 8,798,114.74
TOTAL	**151,655**	**13,449**			**13,447**	**32,273,705**

Note the following assumptions:

1 The number of buildings is based on the number data obtained from the Victorian Building Commission and ABS, as outlined previously. While the proposed revisions apply to all building classes, it can be assumed that mainly Class 1 buildings will be affected by this proposed change. This is because it is unlikely in current practice that designers of high rise buildings will have different balustrade/barrier designs above and below the current four metre threshold when the non-climbable provisions kick in.

2 Only Class 1 buildings with two or more storeys are assumed to be affected by the proposed changes to non-climbable zone requirements. An assumption that 5% of Class 1 single storey and 25% of Class 1 double (or more) storey buildings would be affected by the proposed changes to non-climbable zone requirements was used.

3 Victorian Building Commission data indicated that 19.3% of Class 1 buildings were of two or more storeys (and therefore 80.66% of Class 1 buildings were single storey), as outlined previously.

4 A low (10m), medium (20m) and high (30m) range was assumed to require adjustment under the proposed changes. No indication of the incidence of each area was provided, so an aggregate average of 33.3% was applied to each area size.

5 The cost of the proposed change was taken as $120 per metre as provided by stakeholder feedback. The increase in cost is based on a design change from horizontal wire balustrades to vertical wire balustrades. This cost was applied to a range of balustrade lengths (low, medium, high) to calculate a total cost of the proposed change.

B Detailed benefits assumptions/calculations

B.1 Cost of hospital separations and fatalities – assumptions and calculations

Table B-1: Cost of hospital separations and fatalities by proposed amendment

Amendment	Current annual injury/fatality costs attributed to slips, trips and falls occurring under building component
Handrail	Cost of injuries: • Table 9.8.4.1 in the MUARC report p. 94 showed the frequency of falls related hospitalisation separations by cause from 1999/00 to 2004/05. Over the 6-year period, 57,153 hospital separations result from falls on and from stairs and steps. On average, 9,526 of such falls occur per annum. • Table 9.8.5.1 in the MUARC report p. 95 indicated that 38 per cent of fall related hospital separations occur in the home (BCA Class 1). The handrail amendment is only applicable to private handrails in Class 1, 2 and 3 buildings. Furthermore, the MUARC report p. 89 also states that hospital separations over represent the number of actual hospitalised fall injury by 10 per cent. Therefore, the handrail amendment could potentially reduce a maximum of 3,620 falls per annum over the next 10 years. • The cost of an average hospital separation was assumed to be $3,700 (3.7 days at a cost of approximately $1,000 per hospital day) in the MUARC report p. xiii, as reported in the Consultation RIS. Allowing for an increase in hospital costs over the period 2005-06 to 2009-10, since the AIHW _Hospital Statistics_ 2005-06 on which the MURAC report relied increases the average cost of hospital separation to $4,660 or $1,260 per hospital day. The increase in hospital costs was obtained from changes in the hospital and medical services sub-group of the Australian Bureau of Statistics Consumer Price Index, 6401.0. Therefore the total cost of injuries is estimated to be $16.9 million per annum. Cost of fatalities: • Table 10.2.5 in the MUARC report pp. 177-78 showed that from 2001 to 2005, 179 stairs and steps fatalities occur at home or at a residential facility. This translates to 36 deaths per annum. The economic value of life is assumed to be $3.8 million according to guidance provided by the Office of Better Practice Regulation (http://www.finance.gov.au/obpr/docs/ValuingStatisticalLife.pdf) • Therefore the cost of fatalities is estimated to be $136.8 million per annum.

Amendment	Current annual injury/fatality costs attributed to slips, trips and falls occurring under building component

Stair dimensions	Cost of injuries:
	• The number of hospital fall injuries on and from stairs and steps that could be prevented through the implementation of the stair dimension amendment is calculated in a similar manner as for handrails.
	• Taking into account:
	  ◦ that the stair dimension amendment applies to all building classes;
	  ◦ a 10 per cent adjustment for over representation of hospital injuries;
	  ◦ subtracting the number of falls that can be attributed from single steps;
	  ◦ the stair dimension amendment could potentially prevent a maximum of 7,501 falls on and from stairs per annum.
	• The cost of an average hospital separation is assumed to be $4,660. Therefore the total cost of injuries is estimated to be $35.0 million per annum.
	
	Cost of fatalities:
	• Table 10.2.5 in the MUARC report pp. 177-78 showed that 230 stairs and steps fatalities occur across all BCA building classes over a 5-year period from 2001 to 2005, equating to 46 deaths per annum. The economic value of life is assumed to be $3.8 million.
	• Therefore the cost of fatalities is estimated to be $175 million per annum.

Single step	Cost of injuries:
	• The number of hospital fall injuries on and from stairs and steps that could be prevented through the implementation of the single step amendment is calculated in a similar manner as for handrails.
	• Taking into account that:
	  ◦ the single step amendment applies to all building classes;
	  ◦ Jackson and Cohen (1995) stated that 25 per cent of stair and step falls occur on stairs with one or two risers;
	  ◦ it has been assumed that half of the 25 per cent of falls occur on single steps;
	  ◦ making a 10 per cent adjustment for over representation of hospital injuries;
	  ◦ the single step amendment could potentially prevent a maximum of 1,072 falls on and from stairs per annum.
	• The cost of an average hospital separation is assumed to be $4,660. Therefore the total cost of injuries is estimated to be $5 million per annum.

Amendment	Current annual injury/fatality costs attributed to slips, trips and falls occurring under building component
	Cost of fatalities: • There is a lack of data showing deaths attributed to single step falls, as such it has been assumed that single step falls are more likely to result in injuries than deaths, therefore no cost of fatalities has been estimated.
Barrier to openable window	Cost of injuries: • The Victorian Injury Surveillance and Applied Research (VISAR) Hazard (edition no. 59) report indicated that over a 3-year period from 2000 to 2003, Victoria recorded 216 falls from windows. This translates to 72 falls per annum on average. • According to ABS, Victoria makes up 24.8 per cent of the population of Australia. (http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0). Extrapolating the falls data to the whole of Australia using the population data gives 290 window falls per annum. • Assuming that the cost of an average hospital separation is $4,660 the cost of injuries is estimated to be approximately $1.4 million per annum. Cost of fatalities: • The barrier for openable windows amendment is largely to contribute to the prevention of children from falling to their deaths. • The Australian Institute of Heath and Welfare (2001)[65] reported that over a 20-year period from 1979 to 1998, 62 children under the age of 14 died as a result of falls from or out of buildings or other structures. The average number of deaths per annum is 3.1. The report does not differentiate if the deaths are a result of falls from windows or from verandahs/balconies. It has been assumed that there is a 50/50 split. Therefore the number of deaths per annum due to children falling out of windows is estimated to be approximately 1.5. Hence the cost of fatalities is estimated to be $5.7 million.
Non-climbable zone	Cost of injuries: • The Victorian Injury Surveillance and Applied Research (VISAR) Hazard (edition no. 59) report indicated that over a 3-year period from 2000 to 2003, Victoria recorded 140 falls from verandahs and balconies. This translates to 47 falls per annum on average. • According to ABS, Victoria makes up 24.8 per cent of the population of Australia. (http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0). Extrapolating the falls data to the whole of Australia using the population data gives 190 window falls per annum. • Assuming that the cost of an average hospital separation is $4,660 the cost of injuries is estimated to be approximately $0.9 million per annum.

[65] Australian Institute of Heath and Welfare 2001, *Child injuries due to falls*, p. 4.

Amendment	Current annual injury/fatality costs attributed to slips, trips and falls occurring under building component
	Cost of fatalities: • The non-climbable amendment is largely to contribute to the prevention of children from falling to their deaths. • The Australian Institute of Heath and Welfare (2001)[66] reported that over a 20-year period from 1979 to 1998, 62 children under the age of 14 died as a result of falls from or out of buildings or other structures. The average number of deaths per annum is 3.1. The report does not differentiate if the deaths are a result of falls from windows or from verandahs/balconies. It has been assumed that there is a 50/50 split. Therefore the number of deaths per annum due to verandahs/balconies is estimated to be approximately 1.5. Hence the cost of fatalities is estimated to be $5.7 million.

[66] Australian Institute of Heath and Welfare 2001, *Child injuries due to falls*, p. 4.

B.2 Benefits – assumptions and calculations

Table B-2: Benefits from prevented hospital separations due to injuries and fatalities

Amendment	% of new building	Effectiveness of amendment in preventing slips, trips and falls in new buildings	Support for effectiveness assumption	Benefits from prevented injuries and fatalities in one year
Handrail	• The handrail amendment applies to private handrails in private dwellings. • In 2010, there were 8.395 million private dwellings in Australia.[67] • In 2010 total completions of new residential dwellings were 150,000.[68] This figure is close to the average of residential approvals used in the impact analysis, of 154,513 per year.[69] • The percentage of new residential dwellings to the total stock of residential dwellings is 1.8 per cent.	Effectiveness = 30% • The handrail amendment is assumed to prevent up to 30 per cent of falls and fatalities on and from stairs and steps.	Ishihara et al. (2002) found that of the 2,800 elderly respondents to a questionnaire concerning stair use, 34.2% reported being saved by a handrail when they nearly fell. The same investigation also found that handrails were particularly effective at preventing falls due to sub-standard illumination of stairwells, the effects of which are often exacerbated in the elderly by vision deterioration. (MUARC, p. 25)	Injuries prevented: • Cost of injuries $16.9 million • Effectiveness = 0.30 • New building stock = 0.018 • Benefits = $16.9 million x 0.30 x 0.018 = $91,260 Fatalities prevented: • Cost of fatalities = $136.8 million • Effectiveness = 0.30 • New building stock = 0.018 • Benefits = $136.8million x 0.30 x 0.018 =

67 ABS, Australian Social Trends, Data Cube: Housing, Cat. No. 4102.0, Table 1.
68 ABS Building Activity Australia, Cat. No. 8752.0
69 ABS, Building Approvals, Cat. No. 8731.

Amendment	% of new building	Effectiveness of amendment in preventing slips, trips and falls in new buildings	Support for effectiveness assumption	Benefits from prevented injuries and fatalities in one year
				$738,720 <u>Total benefits:</u> • Sum of injuries and deaths prevented = $91,260 + $738,720 = $829,980
Stair dimensions	• The stair dimensions amendment applies across all building classes. However, no data exists on the total building stock in Australia. • The ABS reported that, over the five years to 2009-10, approvals averaged 154,513 (85%) for residential buildings and 27,249 (15%) for non-residential buildings. • In 2010, there were 8.395 million private dwellings in Australia.[70] • Using both sets of data, the percentage of new building stock is 1.8 per cent in 2010.	Effectiveness = 30%	Assumption	<u>Injuries prevented:</u> • Cost of injuries $35.0 million • Effectiveness = 0.30 • New building stock = 0.018 • Benefits = $35.0 million x 0.30 x 0.018 = $189,000 <u>Fatalities prevented:</u> • Cost of fatalities = $175million • Effectiveness = 0.30 • New building

[70] ABS, Australian Social Trends, Data Cube: Housing, Cat. No. 4102.0, Table 1.

Amendment	% of new building	Effectiveness of amendment in preventing slips, trips and falls in new buildings	Support for effectiveness assumption	Benefits from prevented injuries and fatalities in one year
				stock = 0.019 • Benefits = \$175million x 0.30 x 0.018 = \$945,000 Total benefits: Sum of injuries and deaths prevented = \$189,000 + \$948,000 = \$1,134,000
Single step	• The single step amendment applies across all building classes. However, no data exists on the total building stock in Australia. • The percentage of new building in 2010 is 1.8 per cent as shown above.	Effectiveness = 5%	Assumption	Total benefits = injuries prevented: • Cost of injuries \$5 million • Effectiveness = 0.05 • New building stock = 0.018 • Benefits = \$5 million x 0.05 x 0.018 = \$4,500
Barrier for openable window	• The barrier for openable window amendment applies across all building classes. • The percentage of new building in 2010 is 1.8 per cent as shown	Effectiveness = 30%	Assumption	Injuries prevented: • Cost of injuries \$1.4 million • Effectiveness = 0.30

Amendment	% of new building	Effectiveness of amendment in preventing slips, trips and falls in new buildings	Support for effectiveness assumption	Benefits from prevented injuries and fatalities in one year
	above.			• New building stock = 0.018 • Benefits = $1.4 million x 0.30 x 0.018 = $7,560 <u>Fatalities prevented:</u> • Cost of fatalities = $5.7 million • Effectiveness = 0.30 • New building stock = 0.018 • Benefits = $5.25 million x 0.30 x 0.018 = $30,780 <u>Total benefits:</u> Sum of injuries and deaths prevented = $7,560 + $30,780 = $38,340
Non-climbable zone	• Even though the amendment applies across all building classes, it is likely that only Class	Effectiveness = 30%	Assumption	<u>Injuries prevented:</u> • Cost of injuries $0.9 million

Amendment	% of new building	Effectiveness of amendment in preventing slips, trips and falls in new buildings	Support for effectiveness assumption	Benefits from prevented injuries and fatalities in one year
	1 buildings will be impacted. • The percentage of new building in 2010 is 1.8 per cent as shown above.			• Effectiveness = 0.30 • New building stock = 0.018 • Benefits = $0.9 million x 0.30 x 0.018 = $4,860 <u>Fatalities prevented:</u> • Cost of fatalities = $5.7 million • Effectiveness = 0.30 • New building stock = 0.018 • Benefits = $5.7 million x 0.30 x 0.018 = $30,780 <u>Total benefits:</u> Sum of injuries and deaths prevented = $4,860 + $30,780 = $35,640