



ABCBC

RESILIENCE OF BUILDINGS TO EXTREME WEATHER EVENTS

FINAL PAPER

2014

This document is available for download from the ABCBC website at www.abcb.gov.au

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1 Introduction

Effective resilience to extreme weather events (or extreme climate related natural hazards) involves a number of strategies across all levels of government, business and communities. These strategies include consideration of settlements and infrastructure, emergency planning and response, insurance, and human health. For the purpose of this paper, consideration is limited to buildings, structures, and plumbing systems, which come under the domain of the Australian Building Codes Board (ABCB) and the National Construction Code (NCC).

To provide an understanding of what 'resilience' means for the purpose of this paper, the following definition contained in the Intergovernmental Panel on Climate Change (IPCC) 2012 report *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*¹ is useful.

“Resilience: The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.”

Not to be confused with property protection as an outright objective, a critical future challenge facing the ABCB is ensuring that the NCC contains appropriate standards for buildings and plumbing systems to be sufficiently resilient in the face of natural hazards affected by extreme weather events, which may change over time. This is not, however, a new concept for the ABCB.

The ABCB's mission, as outlined in the Intergovernment Agreement (IGA)², references sustainability in the design, construction and performance of buildings. In turn this is reflected in the NCC requirements for new buildings and plumbing systems to be designed and constructed to withstand extreme climate related natural hazard events, including wind and cyclones, rainfall, snow, bushfire and flood, as appropriate to their location.

The ABCB has traditionally relied on historic climate and weather data when setting standards for the resilience of buildings, structures and plumbing systems facing extreme natural hazards and extreme weather events. In addition, the ABCB has promptly investigated natural disasters to determine whether the current NCC provisions are appropriate and has developed new provisions where required.

Changes to the NCC are subject to compliance with Council of Australian Government (COAG) best practice regulatory principles; this includes a cost benefit analysis, regulation impact assessment (RIS) and consideration of available data and research. However, more recently the ABCB is seeking to utilise scientifically based climate projections such as in its review of wind standards for construction in cyclone affected areas.

Further, the COAG National Adaptation Framework, the 2011 COAG National Strategy for Disaster Resilience, as well as the Productivity Commission Report into Barriers to Effective Climate Change Adaptation all recommended that the ABCB should continually

¹ 2012: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

² <http://www.abcb.gov.au/~media/Files/Download%20Documents/ABCB%20docs/ABCB-2012-IGA.pdf>

monitor climate related hazards and review the NCC to ensure the standards are appropriate for the risk environment, taking climate change into account.

2 Background

2.1 ABCB

The ABCB is a COAG standards writing body that is responsible for the NCC, which comprises the Building Code of Australia (BCA) and the Plumbing Code of Australia (PCA) (refer Figure 1 which displays the NCC Code Series). COAG has signalled its intent to combine all onsite building regulation into the NCC provided the benefits outweigh the costs, with gas and telecommunication regulation currently being assessed and electrical likely to be considered in future.

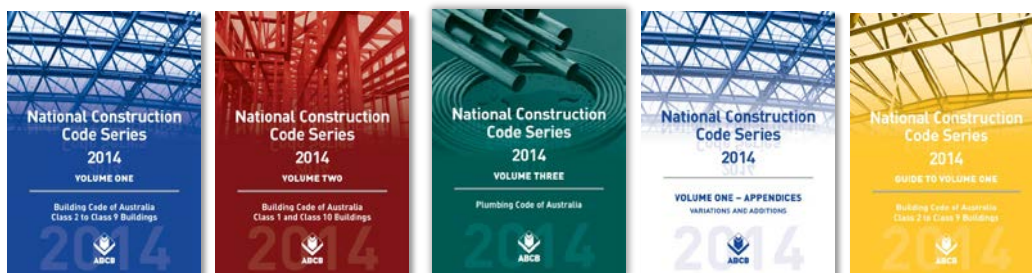


Figure 1: National Construction Code (NCC)

The Board is a joint initiative of the Commonwealth, State and Territory governments and was established by an IGA signed by the Commonwealth, States and Territories on 1 March 1994. A new IGA was signed by Ministers, with effect from 30 April 2012.

The Board's mission is to address issues of safety and health, amenity and sustainability in the design, construction and performance of buildings. It is also a regulatory reform vehicle for COAG.

The Board consists of an independent Chairman, up to five industry representatives, a representative of the Commonwealth Government, senior executives responsible for building regulatory matters from all State and Territory Governments, and a Local Government representative. The ABCB reports directly to the Commonwealth Government, State and Territory Ministers responsible for building regulatory matters, and provides a vital link for the building industry between building practice and Government building regulatory policy (note that reference to building here includes plumbing).

The BCA and PCA are national codes which are developed and maintained by the ABCB on behalf of the Commonwealth and the State and Territory governments, who each have statutory responsibility for building and plumbing control and regulation within their jurisdiction. Both codes contain the minimum necessary requirements for building construction and plumbing in Australia.

2.2 Policy setting

There are a number of policy expectations and boundaries placed upon the ABCB that impact on the way the ABCB is able to deal with these future challenges. At a national level these include:

- The IGA of 30 April 2012³ which provides for the on-going operation of the ABCB and which gives expression to the COAG policies for regulation of the design and construction of new buildings and new building work.
- COAG Principles of Best Practice Regulation⁴ (2007).
- COAG National Climate Change Adaptation Framework⁵ (2007).
- COAG National Strategy for Disaster Resilience⁶ (2011).
- Productivity Commission Report - Reform of Building Regulation (2004)⁷.
- Productivity Commission Report - Barriers to Effective Climate Change Adaptation (2012)⁸.
- Productivity Commission –Natural Disaster Funding Arrangements- Issues Paper (May 2014)⁹
- The policies of different governments.
- Societal expectations.
- Availability of data

One of the main objectives of the ABCB under the IGA is to ensure that the NCC requirements are as far as practicable nationally consistent. This does not mean, however, that 'one size fits all' because different locations can have geographic, climatic or other differences, but the overall risk levels to the community should be reasonably similar.

The IGA and the COAG best practice regulation guidelines require the ABCB to undertake a RIS for every significant change to the NCC, which includes an assessment of net benefits and costs, and justification for the most appropriate option. The RIS must be cleared by the Government's Office of Best Practice Regulation, which also determines the applicable discount rate. The RIS informs the decision making process of the Board.

A 2009 review for the Commonwealth Government¹⁰ found that 'standards for building design and construction do not currently reflect the potential impact of climate change'. The review recommended that 'governments and industry be open to the potential to reflect climate change adaptation risks within the National Construction Code, where such inclusion can be justified in regulation impact statement analysis'.

The COAG National Adaptation Framework recommended that 'the ABCB consider climate change as part of periodic reviews' of the building code. It proposed that 'information used to determine vulnerability of settlements to climate related hazards (such as floods, bushfires, cyclones and coastal inundation)' should be reviewed'¹¹.

³ <http://www.abcb.gov.au/~media/Files/Download%20Documents/ABCB%20docs/ABCB-2012-IGA.pdf>

⁴ http://www.finance.gov.au/obpr/docs/COAG_best_practice_guide_2007.pdf

⁵ COAG 2007, National Climate Change Adaptation Framework, p.18, Canberra

⁶ COAG 2011, National Strategy for Disaster Resilience: Building Our Nation's Resilience to Disasters, p.12, Canberra

⁷ Productivity Commission 2004, Reform of Building Regulation, Research Report, Productivity Commission, November

⁸ Productivity Commission 2012, Barriers to Effective Climate Change Adaptation, Report No. 59, Final Inquiry Report, Canberra

⁹ <http://www.pc.gov.au/projects/inquiry/disaster-funding/issues>

¹⁰ ACG (Allen Consulting Group) 2009, *Review of the Intergovernmental Agreement for the Australian Building Codes Board*, Final Report, p.iv, March, Canberra.

¹¹ COAG 2007, *National Climate Change Adaptation Framework*, p.18, Canberra.

The 2011 COAG National Strategy for Disaster Resilience established a priority outcome that ‘building standards and their implementation are regularly reviewed to ensure they are appropriate for the risk environment’¹².

The Productivity Commission 2012 Report into Barriers to Effective Climate Change Adaptation¹³ (the Productivity Commission Report) identified regulatory and policy barriers to effective climate change adaptation together with high priority reforms to address these barriers.

More recently, on 9 May 2014, the Productivity Commission released an issues paper¹⁴ as part of its inquiry into the effectiveness and sustainability of Australia’s natural disaster funding arrangements. The Commission has been asked to assess the full scope of current Commonwealth, state and territory expenditure on natural disaster mitigation, resilience and recovery and to identify reforms which achieve an effective and sustainable balance between natural disaster recovery and mitigation funding to help communities better prepare for disasters. The issues paper identifies that Deloitte Access Economics (2013) estimated that the annual economic cost of natural disasters would rise from \$6 billion in 2012 to \$12 billion by 2030 and \$23 billion by 2050. It also estimated that increased Australian Government expenditure on pre disaster resilience (of around \$250 million per year) would reduce these costs by more than 50 per cent by 2050. It recommended increased identification and prioritisation of mitigation activities.

The Productivity Commission draft report ‘Inquiry into Natural Disaster Funding Arrangements’ (released September 2014) is generally supportive of how the ABCB and the NCC deal with natural disasters. The draft report states “overall, Australia’s building stock is of a high quality and building regulations are effective in reducing the impacts of natural disasters. They are regularly reviewed and updated to ensure they reflect a current understanding of natural disaster risk. The use of rigorous cost–benefit analysis and review processes provides a strong foundation for natural disaster risk to continue to be appropriately incorporated into building regulations.” A final report to Government is expected in December 2014.

2.3 ABCB Roundtable

The ABCB held a Climate Change Adaptation roundtable in Melbourne on 17 April 2013 to assist the Board further develop a strategy for improving the resilience of buildings and plumbing systems in the face of extreme weather events and a changing climate.

Considerations included natural hazards, energy, water and material use. Fourteen high level external stakeholders from industry, research institutions and government also attended to inform the discussion. The roundtable outcomes (refer Appendix A) have been used to inform the content of this paper.

2.4 Stakeholder Consultation

On 4 April 2014, the ABCB issued a Media Release advising that it had released a discussion paper on Resilience of Buildings to Extreme Weather Events (available on the ABCB website). The purpose of the paper was to inform stakeholders of the ABCB’s preliminary views on resilience to extreme weather events, to seek feedback from stakeholders and obtain responses to a number of questions to help inform the ABCB on

¹² COAG 2011, *National Strategy for Disaster Resilience: Building Our Nation’s Resilience to Disasters*, p.12, Canberra.

¹³ Productivity Commission 2012, *Barriers to Effective Climate Change Adaptation*, Report No. 59, Final Inquiry Report, Canberra.

¹⁴ http://www.pc.gov.au/__data/assets/pdf_file/0007/136429/disaster-funding-issues.pdf

the appropriate way forward. The stakeholder feedback also assisted the development of the final document. The closing date for comment was 1 July 2014, although a number of submissions were received and accepted after that date. The media release was picked up by a number of media outlets and industry organisations.

A total of 31 submissions were received from Government agencies, industry, insurance, education, research and environmental organisations, material suppliers and individuals (refer Appendix B for the list of organisations). A summary of stakeholder responses, together with conclusions and recommendations resulting from the responses are included in this paper.

3 Productivity Commission Recommendation to include Climate Change Adaptation on ABCB Work Program

3.1 Response to Productivity Commission Recommendation regarding transparency/identification of climate change related work on the ABCB work program

The Productivity Commission Report into Barriers to Effective Climate Change Adaptation acknowledged that the 'ABCB has recently undertaken work to consider the implications of climate change for the NCC. This included work on assessing the need to update the NCC to reflect the impacts of increased cyclone intensity and floods. The Commission acknowledged that ABCB has indicated that it intends to consider climate change impacts in its future work.'

The Commission further considered there may be potential to improve the transparency of this process. 'In particular, there is currently no publicly available work plan published by the ABCB explaining how climate change will be incorporated into the NCC, nor is there a formal requirement for the Board to consider climate change in its reviews of the NCC.'

The Commission recommended (Recommendation 10.1):

- 'The Council of Australian Governments' Building Ministers' Forum should provide formal direction to the Australian Building Codes Board to:
 - monitor projections of climate change risks to buildings; and
 - revise the standards in the National Construction Code to take into account these projections where this delivers a net benefit to the community.
- This body of work should be transparently and formally incorporated in the Australian Building Codes Board's annual work programs.'

The Commonwealth Government's response to Recommendation 10.1 was to note the recommendation and agree that managing the risks of climate change to existing settlements is a significant issue that requires cross-jurisdictional cooperation and further investigation. Early planning will reduce future costs, and there is a clear need for community engagement on the acceptable levels of risk for public and private assets. The Commonwealth Government also agreed to consult with State and Territory governments on the best way to address this issue.

Importantly, the Commission did not identify any barriers preventing the ABCB taking climate change into account when amending the NCC. The Commission considered:

- 'The current objectives of the NCC do not restrict building regulators incorporating climate change risks into the code.'

- The current process of regulatory impact analysis for changes to the NCC is appropriate.’

4 ABCB Work Program and Adequacy of NCC

4.1 Climate related natural hazards currently addressed by NCC

Buildings are currently designed and constructed in accordance with the NCC to withstand climate related natural hazards such as cyclones and extreme winds, intense rain, bushfire, snow and flood, as appropriate to their location (refer Figure 2 which displays the ABCB Flood Standard and Handbook available on www.abcb.gov.au). These hazards impose loads and risks to buildings determined mainly by historic records and post event analysis, from which design events with annual probabilities of exceedance are specified.



Figure 2: ABCB Standard and Handbook for Construction of Buildings in Flood Hazard Areas^{15,16}

Building standards have undergone constant review, particularly after major hazard events and via research, to ensure adequate levels of safety and health are maintained for the community. Where the building standards proved to be inadequate, as identified in the wake of Cyclone Althea in 1971 and Cyclone Tracy in 1974, they were subsequently upgraded (refer Figure 3 for example of damage caused by Cyclone Tracy impacting on Darwin).



Figure 3: Example of damage - Cyclone Tracy (Source: BoM)

These improved standards for high wind design were later demonstrated to be satisfactory as evidenced by the small number of building failures resulting from Cyclones Vance,

¹⁵ http://www.abcb.gov.au/education-events-resources/publications/~media/Files/Download%20Documents/Education%20and%20Training/Standards/130214%20Flood%20Standard_Final%20Combined.ashx

¹⁶ <http://www.abcb.gov.au/education-events-resources/publications/~media/Files/Download%20Documents/Education%20and%20Training/Handbooks/2012%20Flood%20handbook%20Third%20Edition.pdf>

which affected northern WA in 1999, and Cyclones Larry and Yasi which affected northern Qld in 2006 and 2011 respectively. However, the largest problem identified by recent cyclone investigations relates to pre-1980 buildings that were designed in the main to lesser standards and which have often been weakened by material degradation and inadequate maintenance (refer Figure 4 for example of damage to older housing caused by Cyclone Yasi).



Figure 4: Example of damage to older house - Cyclone Yasi (Source: JCU CTS)

As noted in the Productivity Commission Report, the ABCB has undertaken a study into the impact of climate change on the BCA¹⁷. The Report finds that by and large, buildings designed and constructed in accordance with the current BCA are likely to be reasonably adequate for climate related hazards anticipated in 50 years- time, associated with a low emissions scenario. If the climate changes in accordance with high emissions scenarios however, the current BCA is likely to be deficient in some areas.

Whatever the emission scenario, potential climate change impacts at both a regional and national level require constant monitoring and review to ensure the NCC's established level of safety is proportional to the likely hazard intensity and resultant risk of damage.

4.2 Financial benefits of climate related natural hazards addressed by the NCC

The fact the NCC currently addresses a number of climate related natural hazards through what have been adjudged to be proportional minimum performance requirements, results in both significant social benefits and financial benefits for the Australian economy.

For example, a report by Risk Frontiers, Macquarie University in December 2007 for the ABCB entitled 'Financial benefits arising from improved wind loading construction standards in Tropical-Cyclone prone areas of Australia',¹⁸ found that '*...the improved building standards have been enormously successful with our calculations suggesting that they have been responsible for reducing annual average cyclone-related losses by nearly two thirds*'. The report estimates that this equates to a present value benefit of future loss reductions equalling AUD14.2 billion. It is anticipated that additional significant financial benefits will also accumulate from the other climate related natural hazards addressed by the NCC.

¹⁷ ABCB (Australian Building Codes Board) 2010, *An Investigation of Possible Building Code of Australia (BCA) Adaptation Measures for Climate Change*, December, Canberra.

¹⁸ McAneney, J., Crompton, R., and L. Coates, 2007. Financial benefits arising from improved wind loading construction standards in Tropical-Cyclone prone areas of Australia. Risk Frontiers, Macquarie University. Report prepared for Australian Building Codes Board.

4.3 Hazards not addressed by NCC

The main objective of the NCC is life safety and not property protection. However, a level of property protection is often achieved as a consequence of addressing life safety. For example, a house should be able to provide reasonably safe shelter for occupants during a cyclone, bushfire or flood. In the process of providing safe shelter, the objective is for the building to remain intact.

While the bulk of the building may as a consequence be protected, this level of protection may not extend to building contents. For example, during a cyclone or flood, water may affect the non-structural elements leading to failure of these elements (e.g. plasterboard ceiling or wall linings), which could cause additional contents damage.

The NCC currently does not cover hail, storm tide or have specific requirements relating to heat stress. However, for heat stress, the NCC energy efficiency requirements would moderate the impacts of extreme heat within buildings that have been built to contemporary energy efficiency standards, resulting in reduced risk of heat stress for building occupants.

Some of the largest insurance property losses result from hail damage (e.g. the 1999 Sydney hailstorm). However, any proposed changes would need to pass regulation impact analysis. It is unlikely it would be cost effective to require all external building materials to resist hail impact, taking into account the localised nature of such storms, the cost of upgrading or restricting certain building materials, and the low risk to life safety.

Storm tide is potentially a very high risk in low lying coastal communities, especially those subject to the risk of cyclones (refer Figure 5 for example of housing impacted by storm surge caused by Cyclone Yasi). However, it would be very costly and restrictive to design and construct buildings to resist storm surge because of the significant water forces involved. Restricting development in high hazard areas via planning controls may provide a more realistic solution.



Figure 5: Example of storm surge damage– Cyclone Yasi (Source: JCU CTS)

Nevertheless, taking into account the Productivity Commission's report on Barriers to Effective Climate Change Adaptation, the ABCB could include hail, heat waves and storm surge in its future work program, undertake investigations of each hazard, develop possible solutions and subject them to the RIS process.

It would be unwise to commit to projects of this nature, however, without consulting more broadly, establishing an evidence base and better understanding the capacity of the NCC to provide meaningful and pragmatic responses. It is also doubtful, given the current data gaps and likely cost implications, that a RIS would provide a net benefit.

Rather than undertake the exercise, it may be more appropriate for the ABCB to monitor these hazards, the data and stakeholder views, to determine if and when an investigation of any new hazards would be appropriate.

Another possible option is for the ABCB to develop information Handbooks on these hazards to provide non-mandatory advice on building solutions to help mitigate these hazards.

As mentioned above, recognising the inter-operability of building and planning controls for natural hazard mitigation is crucial, not only to ensure the correct geographic locations are identified for the application of building standards, but also because the best way to reduce risk to life and property is to determine where buildings should or shouldn't be built in the first place.

It is also important to note that the vast majority of buildings that are highly exposed to natural hazard events already exist. The NCC does not apply retrospectively unless required by State and Territory laws (such as in the case of swimming pool fences). This means it will take a long period of time for the existing stock to be replaced or incrementally improved as owners undertake renovations that require the building to meet the current requirements of the NCC.

The ABCB sought stakeholder feedback on-

- 1. Is the NCC adequate and is the scope reasonable for extreme natural hazard events?***
- 2. The NCC covers most natural hazards affected by climate (i.e. bushfire, flood, cyclone and extreme wind). What about other hazards such as hail and extreme heat?***
- 3. Under the IGA, the NCC must be the minimum necessary to efficiently achieve the objectives of safety and health, amenity and sustainability. Is this scope reasonable and sufficient enough to account for resilience to extreme weather events?***

Examples of stakeholder responses to Q1: Is the NCC adequate and is the scope reasonable for extreme natural hazard events?

- Yes *The ACBC should be limited to preparing technical guides or codes for the appropriate construction in such areas.*
- No *NCC may need to expand its scope beyond the current "design for Safety" provisions though the NCC or other standards and guides.*
- No *Review of the history of cyclones shows that cyclones have crossed the coast line as far south as Byron Bay. It is concerning a significant cyclone could cross the coast in south-east Qld.*
- Yes *But requires constant monitoring of the situation.*
- No *The scope of the ABCB should include a greater appreciation for things that don't come under the title of Life Safety, like economic and productive value of buildings.*
- No *Consideration should be given to extending the scope to include all extreme weather events (e.g. hail, storm surges and heat waves).*
- Yes *NCC should consider the impacts on the broader community's resilience and economic recovery from widespread damage from (non-life threatening) wind driven rain water-ingress.*

- Yes *Examples such as the cyclone events in northern Australia over the last 5 years show that the NCC standards perform significantly better than past standards and are generally adequate.*
- No *The scope of the NCC is not reasonable for extreme natural events.*

Summary of Response	Value	Percentage
Yes	14	70%
No	6	30%
Totals	20	

Conclusion 1:

The current NCC appears adequate and the scope appears reasonable for extreme natural hazard events under current climate conditions.

Recommendation 1:

The ABCB should continue to monitor extreme natural hazard events and trends to ensure the NCC remains adequate.

Summary of stakeholder responses to Q2: The NCC covers most natural hazards affected by climate (i.e. bushfire, flood, cyclone and extreme wind. What about other hazards such as hail and extreme heat?)

Summary of responses	
Hail	7
Heatwaves	9
Storm tide	0
Earthquake	1
Coastal erosion	1
Landslide/ mudslide	1
Total	19

Conclusion 2:

The current NCC adequately covers most natural hazards affected by climate (i.e. bushfire, flood, cyclone and extreme wind).

Recommendation 2:

The ABCB should conduct preliminary investigations on the hazards of heatwaves and hail to enable consideration by the Board and Building Ministers for inclusion as projects on a future ABCB work program.

Examples of stakeholder responses to Q3: Under the IGA, the NCC must be the minimum necessary to efficiently achieve the objectives of safety and health, amenity and sustainability. Is this scope reasonable and sufficient enough to account for resilience to extreme weather events?

- No *Does not appear to consider the benefits of being able to continue to occupy a building following a natural hazard event from a community and financial perspective. Does not appear to consider a full spectrum of natural hazard events sufficiently.*

- Yes *However, their very broad nature creates difficulties in interpreting what is an acceptable and unacceptable “level” of safety, health, amenity and sustainability. The evidence of how much benefit to these objectives can be gained by implementing changes to the NCC, therefore, is critical. There needs to be recognition that both qualitative and quantitative evidence are acceptable in determining benefits.*
- Yes *But clarity over the meanings of 'safety and health', 'amenity' and 'sustainability' should to be provided.*
- Yes *However, the definition of resilience also includes 'recovery in a timely and efficient manner' and recent events such as TC Yasi have shown that rainwater ingress to otherwise undamaged buildings in events smaller than the design event can hinder community recovery.*
- Yes *It is considered the current scope of the NCC is adequate in relation to addressing the range of climate change and resilience matters that can be managed through building design rather than building location.*

Summary of Responses	Value	Percentage
Yes	12	75%
No	4	25%
Totals	16	

Conclusion 3:

The current NCC scope is reasonable and sufficient to account for resilience to extreme weather events.

4.4 Impact of climate changes on these hazards

The weight of scientific analysis tells us that our climate is changing and this may impact on extreme weather events such as storms, floods and heat waves. Data is also informing us that temperatures are rising and that the impact on rainfall appears more variable around the country (refer Figure 6 showing changes in average temperature for Australia from 1910-2010). However, the impact of these changes on extreme natural hazard events is not always apparent.

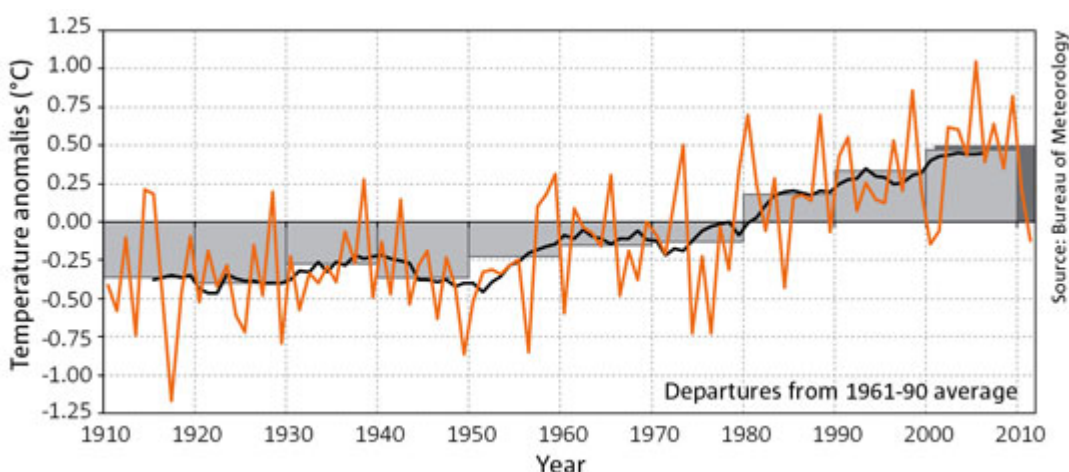


Figure 6: Changes in average temperature for Australia (Source: BoM)

The impact of climate changes on wind and cyclones appears minimal at this stage. An investigation by JDH Consulting in 2011¹⁹ reviewed recent studies of climate change

¹⁹ JDH Consulting, 2008, *Impact of Climate Change on Design Wind Speeds in Cyclonic Regions*.

effects on tropical cyclones. The studies indicate that in the Australian region, the total number of cyclones has diminished. However, there is evidence that the number of more severe events has increased. Simulations of future climate, with projected increases in CO₂ concentrations, also predict fewer cyclones, but further increases in more severe tropical cyclones. One of the more significant scenarios is the possibility of a greater risk of a severe cyclone affecting South-East Queensland.

The IPCC 2012 Report entitled *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*²⁰ found:

- It is likely that there will be increasing temperatures, an increasing proportion of total rainfall from heavy falls, increasing droughts and sea level rises.
- A low confidence in any long-term (i.e. 40 years or more) increase in tropical cyclone activity (in terms of intensity, frequency, or duration); however it is likely that there will be a poleward shift in the tropical storm tracks.

For bushfires, where the models show an increase in temperature combined with lower rainfall as well as longer droughts and lower humidity, an increased risk is likely.

Other implications include:

- Increased flooding and erosion due to more intense rainfall in places.
- Increased soil moisture variation resulting in greater ground movement which will impact on foundations and plumbing services.
- Increased localised hailstorms.
- Increased risk of heat stress and increased energy demand due to longer periods of higher temperatures (refer Figure 7 showing an increase in the number of hottest days in Australia since the mid 1990's).

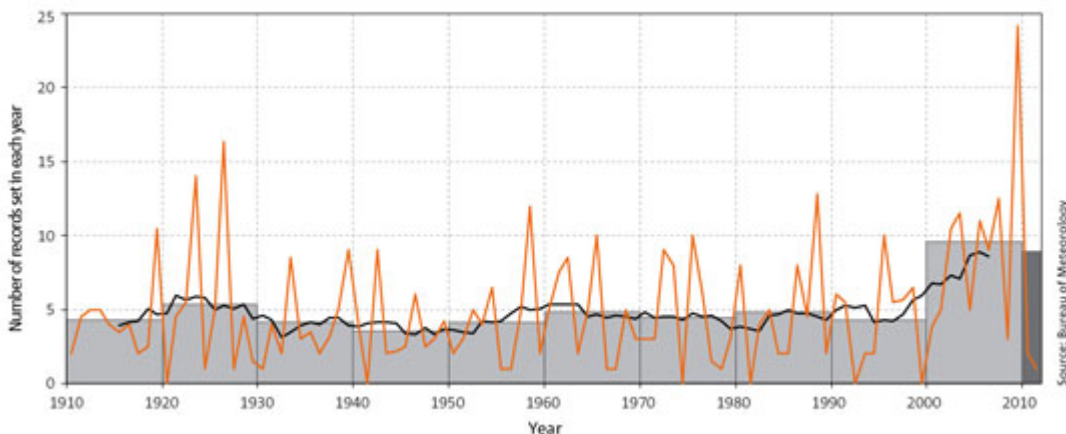


Figure 7: Number of hottest-day-of-the-month (highest maximum) records at 43 Australian climate reference stations (Source: BoM)

4.5 Other impacts on hazard risks

In addition to the climate change implications for weather affected natural hazards impacting on buildings, other significant impacts on potential risk to life and building damage include the increasing density of settlements and the increasing dwelling size and value. In other words, a greater number of buildings of increasing value are being exposed

to extreme weather events. Examples include increased density of settlements on the coastlines and river systems of Australia which are exposing a greater number of people and buildings to cyclones and other extreme winds, flooding and storm surge (refer Figure 8 showing increase in development on the Gold Coast from 1950's to present). Even if the risk of extreme weather events does not increase, the greater density and value of settlements exposed to these risks will mean that losses of life and property will inevitably also increase.



Figure 8: Contrast of Main Beach, Gold Coast, in the 1950's and in more recent times (Source: Gold Coast Tourism Bureau)

4.6 Limitations on the NCC to address resilience to extreme weather events

The ABCB is not a climate expert. The ABCB must rely on climate/weather experts to provide advice, research and evidence to establish whether and to what extent climate changes are impacting on extreme natural hazards and should be taken into account in determining the coverage and appropriate risk levels in the NCC. This must occur in conjunction with policy makers having regard to the science and providing strategic direction for the Board in undertaking its work.

4.7 ABCB Achievements in 2012-13

In 2012-13, the ABCB completed a number of projects concerning the adequacy of the NCC in relation to natural hazard impacts and extreme weather events. The projects include:

- Completion of an assessment of the adequacy of the current cyclonic wind provisions taking climate change into account. The final Cyclone RIS is freely available online.
- ABCB Flood Standard and Information Handbook completed together with an associated RIS. The Flood Standard is referenced in NCC 2013, whilst the Standard, Handbook and RIS are freely available online.
- Natural disasters monitored to determine whether current NCC provisions are appropriate.
- Monitored progress of revised Australian Standards for roller doors; roof tiles; and shed design criteria; resulting from the July 2011 Cyclone Yasi investigation.
- Referenced updated version of AS/NZS 4505 to address structural failures of garage doors and other large access doors in cyclonic wind regions C and D.
- Undertaken research into acceptance criteria for the design and construction of private bushfire shelters.

4.8 ABCB Future Work Program

The ABCB proposes to undertake several activities in 2013-14 including:

- Developing a discussion paper on resilience to extreme weather events for public consideration.
- Finalising an ABCB policy statement outlining the principles to be used by the ABCB to guide its approach to resilience to extreme weather events when considering Proposals for Change to the NCC.
- Reviewing the ABCB's 2010 report on possible NCC adaptation measures to identify priority areas for further investigation.
- Continuing to monitor natural disasters to determine whether the current NCC provisions are appropriate.
- Transparently and formally incorporate the body of work relating to resilience to extreme weather events into the ABCB's annual work programs.
- Investigating ways to improve the interaction between planning and building control.

The ABCB has a number of initiatives underway to address the issue of resilience to extreme weather events. As a number of the measures are climate and location dependant (e.g. cyclones, flood, bushfire), accordingly there are differing requirements in the NCC.

5 ABCB's 2010 Report on Climate Change

5.1 Report Background

In December 2010, the ABCB Office completed a report titled 'An Investigation of Possible Building Code of Australia Adaptation Measures for Climate Change'. The purpose of the report was to identify and review the potential impacts of climate change on the BCA to contribute to strategic policy development by the ABCB.

The report identified there is a reasonable level of confidence that new buildings constructed to the BCA can withstand current climate hazard design events (noting that a building withstanding all types of events can be guaranteed and that maintenance is a critical factor), and will cope reasonably well with future events that are slightly more severe under a low emissions scenario. The largest concern is in relation to existing buildings constructed prior to today's contemporary building standards. These buildings are likely to be vulnerable to current climate hazard events, so would be even more vulnerable when faced with the prospect of more severe future events.

The report further identified that the BCA provisions affected by the different climate change scenarios, such as higher temperatures and greater bushfire risk, highlights relevant areas of the BCA requiring further investigation, and recommended priority areas for consideration.

5.2 Main findings of the Report

The report found that the main impacts of climate change with implications for Australian buildings are:

- Increased energy consumption due to higher temperatures.
- Adverse health effects on building occupants caused by over-heating due to higher temperatures.
- Increased risk of damage from -

- more intense tropical cyclones, storms and stronger winds.
- increased flooding, inundation, and erosion due to more intense rainfall events, sea-level rise and storm surge.
- increased bushfires (refer Figure 9 showing examples of bushfire damage).
- increased hailstorms especially in Sydney.
- increased moisture variation of clay soils resulting in greater ground movement impacting on foundations and services.

Under a high emissions scenario, the need for buildings to be more resilient to the impacts of climate change becomes more critical because climate related events have the potential to be more extreme. For example, heat stress may become a critical factor impacting on public health and wellbeing, which could necessitate significant improvements in building passive design and ventilation.

Also, extreme sea level rise or bushfire risk could result in significant relocation or improvements in either protecting the buildings themselves or in creating protection mechanisms or buffer zones. Therefore, subject to the availability of sufficient data to justify changes, future editions of the BCA would need to consider these possible impacts.



Figure 9: Example of bushfire damage (Source: istockphoto)

5.3 Role of BCA in addressing community resilience to climate change

The report identified that the role of the BCA is critical in addressing community resilience to climate change impacts. However, the report also found that the BCA is but one component of many which need to interact successfully for the community to be more resilient to the effects of severe climate related hazards.

The factors that ultimately determine community resilience include:

- Appropriate land use planning controls to restrict or condition development in areas subject to high risk, such as areas subject to flooding, extreme bushfire and storm surge.
- Appropriate mitigation measures such as flood mitigation works and bushfire risk reduction measures (eg controlled burning).
- Proportional building standards in the BCA so buildings can be appropriately designed and constructed for the likely hazards.
- Community awareness, understanding and preparedness in the face of climate hazards.
- Effective emergency management response when climate related hazard events occur, including recovery planning.
- Insurance to provide a safety net.

5.4 Further investigation and research needs

Whilst acknowledging that changes to the BCA may be required to respond to impacts under a high emissions scenario, the report found that without further investigation and research it is unlikely there would be sufficient justification to enable BCA changes that would be consistent with the COAG Principles and the IGA.

Potential further investigation and research needs identified in the 2010 ABCB Adaptation Report include:

- Review the ability of buildings to cope with increased bushfire risk.
- Review BCA energy efficiency provisions and other measures to reduce risk of heat stress related health impacts on occupants.
- Review the ability of buildings and structures (particularly roof cladding) and associated test methods, to cope with higher winds.
- Investigate the impact of climate change on the design annual probabilities of exceedance for climate related hazards. For example, to maintain the current BCA requirement for housing to resist wind with an annual probability of exceedance of 1:500, do the current standards need to be more stringent?
- Continue to monitor climate change information and research to identify whether the low or high emissions case is likely, and identify any new risks so they can be addressed.
- Develop a RIS covering the proposals relating to the impact of climate change design wind speeds in cyclonic regions.
- Obtain better data more suited to our use i.e. climate scientists to develop probability density functions (PDFs) for all climate related hazards (not just provide estimates of temperature and rainfall, but also cover hazards such as cyclones and other wind events, bushfire, flood, storm surge and hail etc.) for specific regions.
- Develop a Standard and/or Guideline on flooding, including construction options to minimise flood damage.

5.5 What has the ABCB done to date in addressing the investigation and research needs identified in the 2010 report?

Review the ability of buildings to cope with increased bushfire risk.

In NCC 2010, the standards for the construction of buildings in bushfire prone areas were updated to reflect the revised risk levels in the amended Australian Standard AS 3959 – Construction of buildings in bushfire prone areas.

In NCC 2011, new provisions were included for Class 10c private bushfire shelters associated with Class 1 dwellings. In addition, the ABCB developed a new performance standard for private bushfire shelters (refer Figure 10 which displays the ABCB Performance Standard for the design and construction of private bushfire shelters available at www.abcb.gov.au).



Figure 10: ABCB Performance Standard for the design and construction of private bushfire shelters²¹.

Review BCA energy efficiency provisions and other measures to reduce risk of heat stress related health impacts on occupants.

In NCC 2010, the stringency of the energy efficiency provisions for housing was increased to a minimum house energy rating software rating of 6 stars (or equivalent). This change could assist in making houses cooler in summer therefore reducing the risk of heat stress for occupants.

Develop a RIS covering the proposals relating to the impact of climate change design wind speeds in cyclonic regions; and review the ability of buildings and structures (particularly roof cladding) and associated test methods, to cope with higher winds.

In February 2012, the ABCB published a Final RIS on a proposal to revise the NCC requirements for construction in cyclone regions. After full investigation and careful analysis, the ABCB resolved there was insufficient justification to increase stringency or amend the cyclone region boundaries at this stage.

Other initiatives undertaken to improve the resilience of buildings and structures in the face of high winds include revised Australian Standards for wind actions (including new criteria for solar panels on roofs and revised requirements for impact of wind borne debris) and amended standards for roof tiles, garage doors and sheds.

Investigate the impact of climate change on the design annual probabilities of exceedance for climate related hazards. For example, to maintain the current BCA requirement for housing to resist wind with an annual probability of exceedance of 1:500, do the current standards need to be more stringent?

The ABCB commissioned JDH Consulting to revise an earlier 2008 report on the impact of climate change on design wind speeds in cyclonic regions. The revised 2011 report determined there is currently insufficient information and justification to change design wind speeds in cyclonic regions in the Australian Standard for Wind Actions (AS/NZS1170.2) taking into account currently available wind data; recent extreme events, such as Cyclone 'Yasi'; and with particular reference to climate change.

Continue to monitor climate change information and research to identify whether the low or high emissions case is likely, and identify any new risks so they can be addressed.

This work is ongoing.

²¹ http://www.abcb.gov.au/education-events-resources/publications/~media/Files/Download%20Documents/Education%20and%20Training/Handbooks/2010_Performance_Standard_for_PBS.ashx

Obtain better data more suited to our use i.e. climate scientists to develop PDFs for all climate related hazards (not just provide estimates of temp, rainfall, but also cover hazards such as cyclones and other wind events, bushfire, flood, storm surge, hail etc.) for specific regions.

The report identified that modelling techniques can be used to assess the potential range of climate outcomes based on current understanding. This information can be presented in the form of a PDF, where the median has the highest probability of occurring, but where there is also a chance of outcomes that are either much more benign, or much more damaging.

PDFs have been developed for individual elements such as rainfall and temperature. However, it would be of much greater assistance to building regulators if PDFs were available for the entire range of climate related hazards including cyclones, floods, bushfires, hail and intense rainfall in different regions. This information would be of significant assistance to building regulators in ensuring buildings can be sufficiently resilient to the impacts of extreme weather events.

However, the ABCB has limited funds for climate related research so it must rely on work undertaken by others and monitor the outcome of this work. The monitoring is ongoing.

Develop a Standard and/or Guideline on flooding, including construction options to minimise flood damage.

New performance requirements were included in NCC 2013 to require buildings to resist actions associated with a defined flood event if the buildings are located in a flood hazard area. In addition, the ABCB developed a new flood standard which is referenced in NCC 2013 and is deemed-to-satisfy the performance requirements. An information handbook was also published to provide commentary on the standard and provide additional information.

6 Impact of NCC changes in short/medium term

6.1 Identify State/Territory triggers regarding work on existing building/plumbing systems

The NCC has little impact in the short term in regard to existing buildings. One area of work that is already proceeding as part of the ABCB's current study into existing buildings is to investigate the State/Territory triggers as to when the NCC is applied to existing buildings. The study to date has revealed a reasonable level of consistency in the way States and Territories regulate new work on existing buildings or plumbing systems.

In general, where an existing building undergoes a change of use, which would necessitate a change of building classification under the NCC, the new use would be required to comply with the new classification as if it was a new building. Most administrations permit a level of discretion by the approving body.

Where the new work involves an addition or alteration to an existing building or plumbing system the new work would need to comply with the latest NCC provisions. Again, discretion by the approving body may apply.

Most administrations also require existing buildings undergoing alteration or addition to be upgraded and brought into total or partial conformity with the BCA under special circumstances. A circumstance likely to require this is when the proposed building work, together with any other building work completed or authorised within the previous 3 years, represents more than half the total volume of the building.

The consequence of the above State/Territory requirements is that the NCC changes take significant time to impact on existing buildings and the application of the latest NCC relies on the trigger of a change or use, or significant alterations or additions.

This is also an area where information handbooks could have a role.

The ABCB sought stakeholder feedback on-

- 4. What impact would NCC changes have in the short to medium term?***
- 5. New buildings account for around 1.8% of total building stock per annum. It takes a long time for NCC changes to have a meaningful impact on a community. Therefore, is the NCC the most realistic means to transition building stock for resilience to extreme weather events?***
- 6. The NCC also applies to building and plumbing work in existing buildings (subject to State/Territory laws). What effect does this have on improving the resilience of a community?***
- 7. What is the best strategy for upgrading existing buildings to adapt them for more extreme weather events?***

Examples of stakeholder responses to Q4: What impact would NCC changes have in the short to medium term?

- *NCC changes will have a relatively small but cumulative impact in the medium to short term. While they may not have a significant impact on community resilience in the short term, any positive impact is an advantage and over time the building stock will be progressively updated.*
- *It is apparent that NCC changes will have limited effect in the short to medium term. Other options to deal with this residual risk in the short to medium term should be agreed and implemented by Government as a priority to deal with this shortfall.*
- *Changes to the NCC would have limited impact in the short term, more in the medium term and significant impact in the longer term. This is appropriate for climate change adaptation as consequences will be longer term.*
- *If the NCC's BCA made it clear it does not cater for the things that its mandatory provisions currently state they cover, in the short and medium term non-expert users might not have as many misconceptions about the safety of buildings as they currently have.*
- *Governments should provide incentives for retrofitting existing buildings.*

Conclusion 4:

NCC changes will have a relatively small but cumulative impact on building resilience in the medium to short term.

Examples of stakeholder responses to Q5: New buildings account for around 1.8% of total building stock per annum. It takes a long time for NCC changes to have a meaningful impact on a community. Therefore, is the NCC the most realistic means to transition building stock for resilience to extreme weather events?

- *Yes Buildings are designed and built for a useful life of 30-50 years or more. While new buildings account for around 1.8% of total building stock per annum, a change to the NCC now, for instance, would directly influence 18% of the market in 10 years, not to mention the*

influence on upgrades to existing buildings and the flow-on effects to the wider industry as standard practices evolve.

- *Yes The only way to truly create community resilience would be to mandate a requirement for all built structures to be upgraded and certified to the current standard.*
- *Yes The NCC is one part of a multi prong approach to Extreme Weather Events.*
- *Yes Implementing changes to the NCC in conjunction with other factors, such as planning regulations and possible insurance incentives can all play an important role in making building stock resilient to future extreme weather events. Because of small annual increments in total building stock, there is a significant lag between community resilience and the NCC requirements.*
- *No The NCC currently provides an appropriate basis for good building design and construction. Decisions relating to existing building stock sit outside its scope and should continue to do so.*
- *Yes The premise of question 5 might be short sighted, particularly if the BCA has some blame for officials falsely believing that contemporary BCA-compliant houses will resist category 5 cyclones, and “safe guard occupants”.*
- *No As the NCC is not retrospective, it is not the best or most realistic means to increase the resilience of existing building stock in the short-term.*

<i>Summary of Responses</i>	<i>Number</i>	<i>Percentage</i>
<i>Yes</i>	<i>11</i>	<i>69%</i>
<i>No</i>	<i>5</i>	<i>31%</i>
<i>Totals</i>	<i>16</i>	

Conclusion 5:

Taking into account the 30-50 year life of buildings and renovations/upgrades, the NCC is the most realistic means to transition building stock for resilience to extreme weather events. However, insurance also plays a part together with the ability of state/territory governments to introduce retrospective requirements if needs be.

Examples of stakeholder responses to Q6: The NCC also applies to building and plumbing work in existing buildings (subject to State/Territory laws). What effect does this have on improving the resilience of a community?

- *The greatest affect will be in the long-term and will differ across jurisdictions given the different triggers that each jurisdiction uses.*
- *The requirements for additions or amendments to existing buildings will have a long lead time before resilience for entire communities will be realised. The benefits for the individual residents or business owners would be almost immediate if a comprehensive cost-benefit analysis were undertaken. The impact on resilience will be greatly enhanced by commensurate improvements for other measures such as planning controls, community awareness, emergency planning, insurance and mitigation works/risk reduction activities.*
- *Community resilience is improved if upgrades to existing buildings approach or meet the NCC requirements. The performance of total community building stock will improve faster if ‘special circumstances’ requirements for total or partial conformity with the BCA are tightened.*
- *The application of the NCC to ‘new building work’ does have an impact on the resilience of existing building stock, albeit limited.*

Conclusion 6:

Applying the NCC to new building and plumbing work in existing buildings will improve the resilience of the community over time.

Examples of stakeholder responses to Q7: What is the best strategy for upgrading existing buildings to adapt them for more extreme weather events?

- *They don't need to be updated as no statistical problem.*
- *Provide guidance/ framework that offers guidance to buildings practitioners.*
- *Insurance to come on board and offer discounted rates for buildings which comply with current Building Codes. This may necessitate a 'risk survey' of the insured building.*
- *Making people aware of the risks.*
- *By existing controls. i.e. when upgrading.*
- *Guidelines showing risk with cost benefit eg a guide to retrofit your home for better protection from a bushfire (VBC).*
- *A good strategy should be able to provide the building owners with incentives to upgrade old buildings. This may be achieved by offering discounts or rebates on insurance premiums, or some percentage deduction on property tax after upgrade.*
- *The jurisdictions to retain their own upgrading triggers but be able to reference an instrument that provides consistent technical solutions.*
- *See ASBEC Built Environment Adaption Framework.*
- *It may be possible that a combination of pre-disaster retrofitting and post-disaster "betterment" may achieve this outcome.*
- *A combination of financial savings, incentives and funding support.*
- *Encourage States and Territories to require compliance of the entire roof structure with the NCC where any work on the roof is performed, i.e. replacement of sheeting would also require checking and possible upgrading batten to rafter/truss and truss to wall connections.*
- *Encourage insurance/governments to offer incentives for upgrading of individual buildings to achieve improved community resilience.*
- *Provide information/guidelines that include appropriately researched and varying cost level details for differing levels of performance upgrades.*
- *The upgrading of existing building stock is a policy matter. The most appropriate avenue to manage this is through the states and territories determining a clear direction that a problem exists and that action is necessary to either reduce a defined risk to life or potentially to improve property protection.*
- *50% rules will eventuate due to the large regulatory impost on the community and the regulatory climate of red tape reduction and reduction in regulatory burdens. However, it would be self-evidently beneficial for the BCA to have provisions that cater for existing building cases for where existing laws require pre-existing building to be brought into code compliance, such as the current 50% rules.*
- *This depends on the cost benefit of retrofitting existing building stock to meet new, or even some fraction of new, standards. The Bushfire and Natural Hazards CRC is currently undertaking research into cost-effective retrofit techniques for the cyclone, flood and earthquake hazards. Note that the cost-benefit analysis is not simply applied to building stock replacement / repair alone, but also economic impacts. It is hoped that the outcomes of this research will provide guidance to such questions.*
- *In the short term one strategy that could be applied is to require an upgrade in those areas identified as "high risk".*

Conclusion 7:

The most appropriate strategy for upgrading existing buildings to adapt them for more extreme weather events would involve a combination of measures, including insurance and government incentives; awareness and guidelines; making use of existing controls (eg renovations to meet the NCC); research into cost effective retrofitting; and identifying the buildings (location and type) that are most at risk in order to inform the community.

7 Impediments/limitations on amending the NCC for resilience to extreme weather events

7.1 Need for robust consistent data

Any changes to the NCC must be evidence-based and cost-effective. Therefore before the NCC can be amended to improve resilience of buildings to extreme weather events, robust and consistent data must be available, there must be clear government and community support; and evidence available showing the benefits exceed the costs. While these aspects are primarily outside the ABCB's control, it can monitor the information as it becomes available.

The ABCB is not a climate expert. The ABCB must rely on policy makers and climate/weather experts to provide advice and robust, consistent research and evidence as to whether and to what extent climate changes are affecting extreme natural hazards and should be taken into account in determining the coverage and appropriate risk levels in the NCC.

7.2 Government/community support

The ABCB is established by the Commonwealth, State and Territory Governments via an IGA. The Governments, via the BMF, collectively provide policy direction to the ABCB. All major initiatives, such as reviewing the NCC to improve resilience to extreme weather events, must be endorsed by the BMF. The support of industry and the community are also crucial in successfully undertaking significant reforms. The ABCB already has processes in place which ensure high levels of transparency and consultation in developing new NCC proposals.

7.3 Affordability

The cost of new buildings and housing in particular, is a crucial factor in driving affordability. Increasing the NCC stringency to improve building resilience in the face of extreme weather events comes at a cost. The primary goal is to ensure the benefits of any potential change exceed the costs. Where increased cost is unavoidable because of necessary health, safety, amenity or sustainability improvements, the increased costs must still be justified in accordance with the COAG best practice regulation guidelines as described earlier.

7.4 Opportunity to differentiate between residential and non-residential buildings and new and existing buildings

One possible opportunity to keep any construction cost increases resulting from improved resilience to extreme weather events to a minimum would be to differentiate between residential and non-residential buildings to effectively permit different risk levels for these building types. This matter would need to be carefully investigated however, to ensure building occupants were still provided with an adequate level of safety.

Another possibility is to restrict the application of more stringent standards that apply to new buildings from applying to alterations, additions and changes of use for existing buildings. This would however be a matter for individual States and Territories to implement as the ABCB has no jurisdiction in this area.

The ABCB sought stakeholder feedback on-

- 8. Are there opportunities to differentiate requirements for new and existing buildings in order to help lift the resilience of existing buildings in vulnerable areas at a lower cost?**
- 9. Is the IGA too limiting?**
- 10. Is there sufficient data/research available to justify NCC changes in accordance with the IGA and COAG Principles of Best Practice Regulation?**
- 11. What is the appropriate discount rate to use (for cost/benefit analysis) when assessing draft NCC proposals dealing with resilience to extreme weather events?**

Examples of stakeholder responses to Q8: Are there opportunities to differentiate requirements for new and existing buildings in order to help lift the resilience of existing buildings in vulnerable areas at a lower cost?

- Yes See NZ Building Code provisions. Likely to be expensive.
- Yes Non mandatory handbooks.
- Yes The jurisdictions to retain their own upgrading triggers but be able to reference an instrument that provides consistent technical solutions.
- Yes While there may be some potential to specify limited cost-effective upgrade options for existing buildings, this question would require further coordinated research and advice.
- No legacy of poor land use decision making in the past (when information on risk was unavailable and/or unreliable) resulting in a significant proportion of the current risk to our communities from flood, storm and tsunامي.
- No Severe weather does not differentiate between new and existing buildings.
- Yes Requirements for new and existing buildings would be differentiated If retrofitting is covered in an information handbook and new buildings are covered in the NCC.
- Yes there is definitely scope to have different standards for new versus existing buildings and deliver a realistic improvement in the performance of existing buildings. However as also discussed, this is not a matter for the NCC to determine, but a policy issue for states and territories.
- Yes For example, retrofitting wall insulation in houses is not always cost effective, particularly if it would mean removing large amounts of wall linings etc.
- Yes For new buildings, the regulatory approach of the NCC remains appropriate and sound. However, for existing buildings, the issue is more complex and nuanced and a range of options need to be considered to achieve the required degree of differentiation, flexibility and balance of cost and impacts.

Summary of Responses	Value	Percentage
Yes	14	82%
No	3	18%
Totals	17	

Conclusion 8:

There are opportunities to differentiate requirements for new and existing buildings in order to help lift the resilience of existing buildings in vulnerable areas at a lower cost. However, any requirements would need to be assessed on a case by case basis as not all solutions would be cost effective. The use of guidelines would also be an effective strategy.

Examples of stakeholder responses to Q9: Is the IGA too limiting?

- *N/A The IGA limits the functions of the Board to new buildings. Consideration should be given to expanding the IGA to address existing buildings in some manner and maybe in the longer term should better recognise the interface with planning as a means of addressing extreme natural hazard events.*
- *No The primary question to consider under the current IGA is whether there is a proven need for action to be taken to change or add new requirements to the NCC in relation to resilience for all buildings.*
- *Yes the IGA helps shape policy decisions but ultimately is not effective in fettering law making powers, and therefore is probably not too limiting.*
- *Yes the IGA and the manner in which NCC changes are considered, needs to be re considered for all events, not only “Extreme Events”.*
- *N/A It is difficult to determine whether the IGA is too limiting until a clear policy position has been established*

<i>Summary of Responses</i>	<i>Value</i>	<i>Percentage</i>
<i>Yes</i>	<i>2</i>	<i>18%</i>
<i>No</i>	<i>5</i>	<i>45%</i>
<i>N/A</i>	<i>4</i>	<i>36%</i>
<i>Totals</i>	<i>11</i>	

Conclusion 9:

The current IGA does not appear too limiting. If governments decide to apply the NCC to existing buildings, this would need to be through State and Territory legislative provisions.

Examples of stakeholder responses to Q10: Is there sufficient data/research available to justify NCC changes in accordance with the IGA and COAG Principles of Best Practice Regulation?

- *No What % of damage to housing stock total due to extreme weather is occurring annually?*
- *No The ABCB is not the appropriate organisation to undertake research. Research done should be robust, peer reviewed and scientifically supported.*
- *Yes Latest IPCC 2014 report supports the NCC changes.*
- *No some jurisdictions and local governments have undertaken extensive data/research exercises. What efforts have been made to ‘tap into’ these resources?*
- *Yes See research undertaken by Cyclone Testing Centre*
- *No Based on the information put forward in this paper, there is not sufficient justification for any further changes to current NCC provisions in relation to the issues identified.*
- *No Data and good quality research from more than one source is lacking in many areas. There is also a lack information that reviews the performance of “old – non compliant” and “new-compliant” buildings.*
- *N/A At this point in time, there does not appear to be sufficient data and research available to justify NCC changes on the ground of addressing extreme weather events.*

<i>Summary of Responses</i>	<i>Value</i>	<i>Percentage</i>
Yes	4	33%
No	6	50%
N/A	2	17%
<i>Don't know</i>	1	8%
<i>Totals</i>	12	

Conclusion 10:

There is currently insufficient data/research available to justify NCC changes in relation to extreme weather events, having regard to the IGA and COAG Principles of Best Practice Regulation.

Recommendation 3:

The ABCB should monitor any new information/data/research on changing climate and impacts on extreme weather events to determine whether the NCC remains appropriate.

Examples of stakeholder responses to Q11: What is the appropriate discount rate to use (for cost/benefit analysis) when assessing draft NCC proposals dealing with resilience to extreme weather events?

- Varies for state to state.
- An economist may be better placed to provide this advice. However it should be based on the expected life of the relevant building. A sensitivity analysis should also be included as part of any cost/benefit analysis.
- The paper has not put forward any discussion on this issue and therefore the question is out of context. It is not considered that a response can be provided at this time and any response must be based on actual proposals.
- 5%.
- 7% - based on NSW Treasury Guidelines for Economic Appraisal (2007).

Conclusion 11:

There appears to be support for the current 7% discount rate for cost/benefit analysis when assessing draft NCC proposals dealing with resilience to extreme weather events. There is also support for sensitivity analysis, which the ABCB currently uses in regulation impact assessment (i.e. includes 3%, 5%, and 11% discount rates).

8 Alternatives to NCC dealing with resilience to extreme weather events

8.1 Identify alternatives

Most of the alternatives to the NCC (e.g. planning, incentives, market mechanisms, insurance) are outside the scope of the ABCB. In discussion with building regulators from other countries, it is apparent that where there are obvious risks that can have a quantifiable measure developed for a building to respond to, provisions will be prepared. However, they may not be uniformly adopted as they are in Australia given the different nature of systems in other countries.

8.2 Investigate international responses

The ABCB proposes to investigate and monitor international responses to resilience to extreme weather events in relation to buildings and structures. The ABCB is a member of the Intergovernmental Regulatory Collaboration Committee (IRCC) established to harmonise as far as practicable building regulatory structures and processes, and to share regulation and standards information. Many of the IRCC members have measures for natural hazards, including extreme weather events, however, the approach to the potential for change is varied.

The ABCB sought stakeholder feedback on-

- 12. Are there more appropriate alternatives to the NCC dealing with resilience of buildings and structures for extreme weather events?**
- 13. Can planning controls effectively address all extreme weather events?**
- 14. Is the insurance market more efficient at dealing with extreme weather events?**
- 15. Is it likely insurance always be available for building owners in high hazard areas?**
- 16. Is there a role for governments to offer incentives for owners of existing buildings to bring them up to a higher standard of resilience?**

Examples of stakeholder responses to Q12: Are there more appropriate alternatives to the NCC dealing with resilience of buildings and structures for extreme weather events?

- Yes *The NCC can't do it alone. Introduce resilience standards similar to energy star ratings.*
- Yes *The NCC fits into a suite of required measures.*
- Yes *Non mandatory building codes.*
- Yes *Australian Standards.*
- Yes *Benchmarks, information and tools, education.*
- No *For the most part, there are no current alternatives to the NCC, but complimentary measures to be delivered as part of a 'package' to enhance community resilience*
- Yes *The NCC is an important tool in a much larger management framework for responding to extreme weather events and managing building resilience.*
- No *Not for those matters that are the purview of the NCC, but they can be complimented by planning regulations etc for matters beyond BCA scope.*
- Yes *In the longer term, the NCC should address building resilience to extreme (yet to be defined) events and without an assumption that the Emergency Services will facilitate rescue during and for sometime (yet to be defined) after the passing of the emergency event.*

Summary of Responses	Value	Percentage
Yes	12	80%
No	2	13%
Don't know	1	7%
Totals	15	

Conclusion 12:

The NCC is an important tool in a much larger framework for responding to extreme weather events and managing building resilience. For matters that are within the scope of the NCC, there should not be duplication or alternatives in other parts of the framework to deal with resilience (design and construction) of buildings and structures for extreme weather events. However, the NCC can be supplemented by guidelines, information and education.

Examples of stakeholder responses to Q13: Can planning controls effectively address all extreme weather events?

- *No A combined approach is needed between planning and building regulations.*
- *Yes NCC to supplement planning controls.*
- *No Planning controls are most effective in mitigating the impacts of extreme weather events where the extent of those impacts can clearly be determined spatially.*
- *Yes Building controls are only as good as the protection afforded by local development and other community planning controls.*
- *Yes Planning controls can address many extreme weather events but building codes are likely to be more relevant when there is less certainty in knowing the impact of a hazard on the community or across a geographical area.*
- *Yes Not all events but it would create better awareness and help drive the industry in the right direction.*
- *No Planning controls alone can't effectively address changes in extreme weather events. Planning is only part of the solution, and may limit the extent of the hazard but the NCC must define requirements for the building given the hazard.*
- *Yes in that planning controls are generally not fettered by legal obligations to only produce net benefits or to not cross into BCA territory. So planning laws could theoretically regulate all the matters regulated by the BCA and more. In practice though, planners would be unlikely to go that far without sufficient impetus.*
- *No Planning controls are tools to reduce the impact and likelihood of death. They can play an important part in reducing the replication of legacy issues arising from poor planning decisions in the past, so that large cohorts of foreseeable risks are avoided and minimised.*
- *No Planning controls cannot effectively address all extreme weather events in the built environment. A holistic approach is required.*

Summary of Responses	Value	Percentage
Yes	8	47%
No	9	53%
Totals	17	

Conclusion 13:

Planning controls alone can't effectively address extreme weather events. Planning is only part of the solution and may limit the extent of the hazard but the NCC must define requirements for the building given the hazard.

Examples of stakeholder responses to Q14: Is the insurance market more efficient at dealing with extreme weather events?

- *No Insurance offers no input other than not offering insurance for a building if deemed too high a risk.*
- *No To date the insurance market in Australia has had very little influence over the immediate consequences of extreme weather events.*

No the insurance market is not more efficient at dealing with this issue. While they may dictate that certain standards be achieved before they will insure, they also use exclusions as a way of avoiding situations.

No Only involved in individual properties and does not cover communities.

No The insurance industry is market driven and prices are based on risk at a particular locality and on an ability to pay. In relation to flooding, insurance companies have unilaterally withdrawn from offering flood insurance in some flood prone areas.

No It is unlikely to be a case of the insurance industry being “more efficient” – again a multifaceted approach is expected to be most effective. The insurance industry certainly has a key role, however recent events have seen insurance cover being withdrawn for certain events/types of damage.

Yes The insurance industry has the advantage of being able to offer financial incentives/disincentives for adopting risk averse measures.

Yes There are good international examples to show what can be achieved where the insurance industry and governments work together to encourage the upgrading of existing buildings to improve resilience.

No as some people will continue to build where they want despite high insurance premiums or an inability to obtain insurance due to extreme weather event risks.

No The insurance market is fundamentally a system to redistribute the financial impacts of certain events.

Summary of Responses	Value	Percentage
Yes	5	29%
No	11	65%
Don't know	1	6%
Totals	17	

Conclusion 14:

The insurance market in isolation would not be more efficient at dealing with extreme weather events. Insurance has a key role in community resilience and in enabling a community to rapidly recover after an event. However, recent events have also resulted in insurance cover being withdrawn for certain events/types of damage.

Examples of stakeholder responses to Q15: Is it likely insurance always be available for building owners in high hazard areas?

- No Past events have resulted in areas that insurance companies wont touch.
- No Only if you modify your building to reduce the risks.
- No Insurance companies will either continue to charge higher premiums for such areas, or exclude those hazards from policies.
- No The Insurance Council of Australia has already advised of locations in Australia where insurance has not been offered to home owners seeking to rebuild due to higher than acceptable risk.
- No In that in extreme cases either the insurance industry will not provide the insurance or it will be priced so as it is not reasonably available.
- No insurance coverage is not likely to always be available. There are likely to be a range of locations and circumstances where insurance policies are either not offered or are offered with premiums too high to be a cost effective option.

Summary of Responses	Value	Percentage
Yes	1	6%
No	11	69%
Don't know	4	25%
Totals	16	

Conclusion 15:

It is likely that insurance will not always be available or premiums could be very expensive for building owners in high hazard areas. Insurance would not therefore be a realistic alternative to the NCC requirements for buildings in these high hazard areas, but may discourage building in the first instance.

Examples of stakeholder responses to Q16: Is there a role for governments to offer incentives for owners of existing buildings to bring them up to a higher standard of resilience?

- Yes *If they think that a problem really exists.*
- Yes *If the insurance companies wont insure them, the government will have to meet the shortfall in disaster relief.*
- No *not in the current financial climate.*
- Yes *All governments have a role to play.*
- Yes *The Building Upgrade Finance framework adopted recently, whilst aimed at providing financial support for owners to upgrade sustainability aspects of buildings, has been implemented with the view to broadening the finance to cover the upgrading of other aspects of a building.*
- Yes *Incentives (financial and non-financial) could potentially be a coordinated effort between a number of stakeholders in disaster management and the resilience of buildings (i.e. all levels of government, the insurance industry, product manufacturers and suppliers, building and construction industry).*
- Yes *The protection of lives from flood, storm and tsunami, the primary focus and responsibility of the SES, does not appear to be a consideration in the process for costing such housing in areas at risk from natural hazards.*
- Yes *Research points to a potential \$14.2B saving.*
- Yes *The upgrading of existing buildings to improve resilience offers benefits to governments (through faster community recovery, less damage to government infrastructure and lower payments to those without insurance).*
- Yes *Governments have a role in assisting or guiding building owners who have in good faith, based on the planning and building laws of the day, purchased buildings that may now be identified as being at high risk.*

Summary of Responses	Value	Percentage
Yes	15	94%
No	1	6%
Don't know	0	0%
Totals	16	

Conclusion 16:

There would be a benefit to governments if buildings and infrastructure were more resilient, in terms of reduced funding for disaster relief, less damage to infrastructure,

faster recovery for industry and the community, etc. This benefit would need to be measured against the cost of any incentive funding.

Recommendation 4:

The ABCB should monitor the findings of the current Productivity Commission Inquiry into national disaster funding arrangements.

9 Building and Planning working cooperatively

9.1 Planning and Building - Background

Planning control systems determine whether a building can be constructed in an area subject to natural hazards or risks and often operate in conjunction with the NCC. Examples of these interactions include regulation relating to flooding and bushfires where the planning system identifies the extent of the hazard which then triggers the appropriate NCC standard.

As the coverage of the NCC moves from the traditional safety and health issues associated with building design and construction to sustainability/societal issues such as energy, water and access for people with disabilities, the distinction between building and planning control systems and other areas of administrative responsibility becomes increasingly blurred. The overlap of local government regulations and the NCC has been recognised as an issue by several bodies.

The 2004 PC Report 'Reform of Building Regulation' recommended that the future agenda for building regulation reform should include examining ways to reduce the scope for the inappropriate erosion of national consistency of building regulation by Local Governments through their planning approval processes. The report further recommended that the ABCB, in consultation with key stakeholders, should examine the possibility of defining a clear delineation between those issues to be addressed by planning regulation and those issues to be addressed by building regulation.

Some States (e.g. Victoria and Queensland) already have regulations in place (the 'gateway-model'), which restricts the ability of local governments to impose requirements already regulated through the BCA. The gateway model was agreed to in-principle by the Building Ministers Forum in 2008 and is now reflected in the 2012 IGA.

The 2012 Productivity Commission Report *Barriers to Effective Climate Change Adaptation*²² states that 'in some cases, the vulnerability of people and buildings to climate change impacts will depend on how well building standards (which generally control **how** to build) and planning regulations (which generally control **where** to build) are integrated. For example, where planning schemes can identify areas that are bushfire prone and the level of bushfire hazard, building regulation can then specify a construction standard for a building in a given area to better manage bushfire risk'.

The importance of this crossover is recognised in the National Strategy for Disaster Resilience which states that:

"... the predicted impact of climate change on sea level and the frequency and intensity of extreme weather events must be considered in an integrated approach to natural hazards

²² Productivity Commission 2012, *Barriers to Effective Climate Change Adaptation*, Report No. 59, Final Inquiry Report, p. 204, Canberra

in land-use planning schemes, building code standards, and state and territory based regulations²³..” (Refer Figure 11 showing past and projected global average sea level rise).

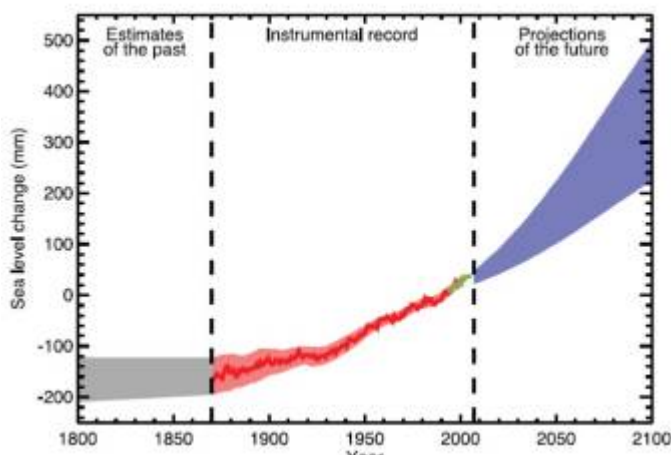


Figure 11: Past and projected global average sea level (Source: IPCC (2007))

The Productivity Commission Report also states: *“it is appropriate that the NCC does not contain standards to manage some natural hazards which would be better managed by the planning system (for example, the current NCC does not contain standards for storm surge)”*.

9.2 Possible improvements

Although building and planning delineation is now embraced by the IGA there is still a need to further refine the building and planning regulatory relationship. A robust system of delineation will reduce regulatory duplication and costs to the community.

Unfortunately there is no longer a central body to coordinate national planning matters and to provide advice on building/planning delineation resulting in a greater potential for regulatory overlap and duplication. Nevertheless, the ABCB will need to engage effectively with those State and Territory agencies responsible for land use planning controls to improve the current relationship between the two.

The ABCB sought stakeholder feedback on-

- 17. Are Building and Planning working effectively on this matter?**
- 18. How can planning and building controls work better together?**
- 19. Are planning agencies able to adequately identify and map hazard areas where building standards can then be applied?**
- 20. More and more development is occurring in high hazard areas. Should such development be discouraged? If so, how?**

²³ COAG 2011, *National Strategy for Disaster Resilience: Building Our Nation’s Resilience to Disasters*, p.11, Canberra.

Examples of stakeholder responses to Q17: Are Building and Planning working effectively on this matter?

- No From a State perspective, tensions have emerged overtime as a result of planning and building frameworks being developed in isolation.
- No Clear contradictions between the two that need to be aligned.
- Yes But it doesn't always work.
- Yes There needs to be a strong focus on existing property in higher hazard areas, which may not be encompassed by effective planning controls but which NCC/building codes may be able to be applied, especially if incentives were offered. The NCC can only begin to remediate some of the problem but without comprehensive changes across government, the NCC in isolation will fail to deliver significant improvements to community resilience.
- No The effective roles of planning and building are not blurred. Any confusion around the distinction between the two parts of the land use management framework only exist due to lack of awareness by stakeholders of the very clear responsibilities and more importantly the actual ability of each element to effect change.
- No It is sometimes the case that planning forges ahead, intruding into the building realm, but with constraints and parameters unlike those of the ABCB IGA, potentially imposing compliance burdens that do not produce net societal benefits.
- Yes There is room to improve Building and Planning controls and liaison between both.
- No It is likely that there are currently some gaps and inconsistencies at a national level between building and planning controls. In many cases, it is difficult to know the full extent of a problem. As a further complication, the quality and extent of local government data can be highly variable.

Summary of Responses	Value	Percentage
Yes	4	29%
No	9	64%
Don't know	1	7%
Totals	14	

Conclusion 17:

In some jurisdictions, building and planning are working more effectively than in others. However, in general, there is room for improvement and a reduction in the gaps and inconsistencies.

Examples of stakeholder responses to Q18: How can planning and building controls work better together?

- Identifying common issues and working together to resolve differences via better liaison/communication.
- Consistencies across all of Australia.
- Planning and building controls need to be clearly demarcated in legislation such as via the Gateway model.
- Closer collaboration in the development of local plans and through mapped hazard areas and ongoing development of industry awareness of mitigation options.
- There should also be a better understanding between building and planning policy makers about their roles and a coordinated approach taken to initiatives being undertaken in each area. A coordinated approach should also be taken to any education or consultation strategy to ensure both aspects are discussed.
- A detailed cost-benefit analysis of risks and options to reduce risk/enhance resilience would be the first step.
- Create a matrix of risk and allowing additional safety factors in design regulation.

- *In general, the planning and building system are working effectively together. However there may be room for improvement in the operation of zoning and subdivision processes to ensure that only land with acceptable risk is released for development.*
- *Legislate the ABCB's gateway model in each jurisdiction, and educate the planning policy folks, in particular, on implementation. An approach for achieving that could be via a COAG agreement followed by the ABCB helping develop wording for the necessary legislative amendments for each jurisdiction.*
- *Formalise an arrangement with the ABCB where planning areas can refer their proposed policies and regulation for ABCB comment. This could be extended further by making the ABCB office a referral entity for jurisdiction's proposed policies and regulations that could impact on building design or construction.*
- *Planning controls need to have consideration to the limitation of the building controls. That is, building provisions can only be provided to certain hazard levels and locations.*
- *To improve national consistency with respect to the planning and building interface, it would be beneficial to establish a national planning forum which could engage formally with the ABCB on matters which have a planning and building focus or component.*
- *The Australia-New Zealand Emergency Management Committee (ANZEMC) reports to the Law, Crime and Community Safety Council, which is responsible for implementing the COAG National Strategy for Disaster Resilience. ANZEMC formed the Land Use Planning and Building Codes Taskforce to develop a vision and a blueprint for improving disaster resilience in Australia through land use planning and building codes. A subsequent Roadmap was published in 2012 and all jurisdictions committed to delivering capability and investment plans to achieve the Roadmap objectives. The Roadmap advocates the establishment of an appropriate senior officials land use planning and building body within the COAG framework. This would facilitate land use planning expertise being part of ongoing disaster resilience decision making.*

Conclusion 18:

In jurisdictions where the principles of the 'Gateway' model has been adopted, it appears it is an effective mechanism in improving the interaction between planning and building controls. There is room for a better relationship between jurisdictions, the planning profession and the ABCB to develop an effective strategy to deal with the issues.

Recommendation 5:

That the ABCB monitors the establishment of any senior officials land use planning and building body within the COAG framework in accordance with the Land Use Planning and Building Codes Taskforce Roadmap, and where appropriate, participates on that body once established.

Examples of stakeholder responses to Q19: Are planning agencies able to adequately identify and map hazard areas where building standards can then be applied?

- Yes *Always room for improvement and far more hazard mapping should be done.*
- Yes *In Queensland.*
- Yes *In NSW with the SES.*
- Yes *In Victoria for bushfire zones.*
- Yes *By risk assessment mapping and creating associated safety factors.*
- Yes *Queensland Reconstruction Guidelines for rebuilding in Storm Tide prone areas.*
- Yes *In general, the planning system is able to map many of the hazards that affect the capability of land to sustain urban settlements. However, the adhoc approaches taken by local government rather than being directed by state governments, for example approaches to inundation levels from sea level rise, does create confusion.*

- No *A premise of question 19 is that building standards are an appropriate way of mitigating risks arising from extreme natural hazards. However, building standards that meet the NCC's DtS provisions do not necessarily mitigate risks to community resilience or personal safety in extreme hazard events.*
- Yes *With the appropriate resources and controls, planning agencies are capable of identifying and mapping hazard areas.*
- No *For some hazards, such as hail storms and extreme heat events, mapping may not be an appropriate approach. Further, it should be noted that the frequency of an extreme weather event can be as significant as its severity.*

Summary of Responses	Value	Percentage
Yes	12	71%
No	5	29%
Don't know	0	0%
Totals	17	

Conclusion 19:

In most jurisdictions, planning agencies can adequately identify and map hazard areas so that building standards can then be applied.

Examples of stakeholder responses to Q20: More and more development is occurring in high hazard areas. Should such development be discouraged? If so, how?

- No *From an engineering perspective, there's always a positive engineering solution.*
- Yes *Local government should look at risk reduction planning.*
- Yes *No go zones for development.*
- Yes *Point out dangers and high cost of insurance.*
- Yes *Discourage via planning regulations and much higher building standards in high hazard areas.*
- Yes *But it brings with it significant issues of compensation.*
- Yes *Avoidance is the best form of mitigation.*
- Yes *Government can also play a role by not allowing/encouraging high risk development through the placement of new government infrastructure, e.g. schools, in high risk areas.*
- Yes *investigation and implementation of strategies that reduce development that creates new or exacerbates existing risk from natural hazards.*
- Yes *It may be unrealistic to restrict building in all areas that could potentially be exposed to high hazards. However, if the requirements in the NCC satisfactorily address hazards in all areas, then commercial and societal decisions can be made about the location of buildings.*
- No *Existing land, approved in good faith based on knowledge at that time, should not be categorised as a failure of the current planning and building framework.*
- No *Not directly "out of the blue" where development was previously permitted, but yes through indirect means such as higher regulatory structure that helps mitigate risk.*
- Yes *Development in high hazard areas should be discouraged. Undertaking this strategy will increase building affordability, as extreme hazard events will not need to be factored into design, i.e. cyclone or bushfire or flood mitigation is not required in areas where these events are unlikely to occur.*
- Yes *Planning restrictions and zoning are the most effective way to prevent development in high hazard areas. Some restrictive zonings and hazard overlays are available for use by councils within the NSW local plan making process at present.*

Summary of Responses	Value	Percentage
Yes	13	87%
No	2	13%
Don't know	0	0%
Totals	15	

Conclusion 20:

It is technically possible to design and construct 'safe' buildings in high hazard areas; however, it may not be economically feasible to do so. Planning restrictions and zoning are an effective way to prevent development in extremely high hazard areas, or alternatively, sufficient information about the risks and consequences should be provided by authorities to allow the public to make informed choices.

Additional Comments

- *We are incapable of addressing even the simplest disaster scenarios. NZ shows the way we should move forward via national disaster insurance etc. In the case of our biggest national threat to housing, bushfire, we fail to successfully address the problem. \$100 million spent on the Royal Commission, gov buy back go sites, yet the simplest way to make a house safe, is to cut down trees. Government fails to address or allow this, apart for the first 10 metres.*
- *This is generally a good paper. Need to analyse what % of housing is impacted each year.*
- *Quantification of the NCC performance requirements should help to further standardise risk across different events and jurisdictions. The continued use of COAG best practice guidelines will ensure that future building regulation offers the community value for money along with an appropriately low level of risk. The provision of relevant guidelines for retrofitting buildings will allow building owners to make informed decisions when upgrading or renovating their property for improved resilience.*
- *HIA supports the current objectives of the NCC to achieve a level of life safety and amenity for building occupants. It is apparent that part of the confusion over the roles between planning and building is derived from those who consider the NCC's objective should also be property protection. Those debating this issue from such a position will ultimately disagree with the views put forward about the performance of current NCC standards. This does not make the standards wrong or inadequate. However it does highlight that to move forward in the longer term consideration of extreme weather events, the ABCB must make it clear to all stakeholders what is considered life safety and amenity, versus property protection. Should governments wish to change the objectives of the NCC to address property protection then a separate debate is required that takes into consideration much more than extreme weather events.*
- *Any foreseeable hazard resulting from climate change must be considered where it impacts on the built environment. There are three key aspects to hazard treatment options; they are inherently difficult to predict and so must be treated probabilistically, they have a specific geographical character and a very specific impact on buildings. The NCC already has an appropriate architecture for dealing with these kinds of problems. There needs to be zonings attributable individually to each hazard. There then needs to be an assigned annual probability of exceedance. This hazard mapping is then applied to individual buildings. The key aspects of a building for resilience are its location and function. The appropriately identified combination of zoning deals with location but the function of a building should be assigned an importance level. Code requirements are then set by zoning and importance level with the most stringent requirements being applicable where there is overlap of requirements from different hazard zones. In setting code requirements, they will vary for importance level dependent on the extent to which the building's function and general habitability contributes to the overall performance of the built environment system in meeting community expectations for restoring the community to normal function after an event.*

10. Key messages

10.1 Summary of key messages relating to ABCB's position and activities on resilience to extreme weather events

The ABCB is committed to comprehensively reviewing and considering the impacts of extreme weather events in relation to all relevant new regulatory initiatives as outlined below in Table 1: *ABCB Principles – Catering for Extreme Weather Events*.

The ABCB has robust processes in place to ensure the NCC adequately addresses future extreme weather events, and that they are continually refined and improved. All changes to the NCC must be evidence based with the problem clearly articulated and the response proportional to the issue being addressed. This is consistent with the ABCB's 2012 IGA obligations and COAG best practice regulatory principles.

The challenges resulting from the potential for increased extreme weather events will in all likelihood change the way that many new buildings and plumbing systems are designed and constructed to withstand the requirements associated with different locations and to meet changing societal demands.

The challenges will also stretch the capacity of the ABCB to maintain national consistency and minimum performance standards for new building and plumbing work, whilst ensuring the NCC continues to meet its objectives of minimum performance standards for safety and health, amenity and sustainability.

In order to better assess the future impacts of extreme weather events on buildings and plumbing systems, ongoing access to contemporary climate information including research and data is imperative. Additional research and more reliable data is required on specific climate impacts, such as cyclonic events, bushfires and intense rainfall, to ensure that standards can be adequately reviewed to take account of longer term trends.

The ABCB is not the appropriate organisation to undertake research and collect data of a nature that predicts future weather events. Any research used as a basis for future regulation needs to be robust, peer-reviewed and have the support of the scientific community.

Finally, the ABCB needs to continually engage with its stakeholders to ensure there are ample opportunities for input and to ensure that all potential impacts of proposed changes are fully identified and analysed before final decisions are made by the ABCB. However, judging by the ABCB's past achievements in areas including disability access, energy efficiency, natural hazard mitigation, health and safety, it is highly likely that the ABCB will also deal effectively with the challenges resulting from potential increases in extreme weather events.

Table 1: ABCB Principles – Catering for Extreme Weather Events

The ABCB commits to the following principles to guide its approach in amending the NCC to cater for extreme weather events:

The ABCB will:

- *Comprehensively review and consider the impacts of extreme weather events in relation to all relevant new regulatory initiatives.*
- *When considering work in relation to extreme weather events for the NCC, ensure that the ABCB's objectives, as outlined in its IGA, are satisfied;*
- *Ensure compliance with the COAG Best Practice Regulation Guidelines and have regard to other relevant COAG initiatives, such as the National Strategy for Disaster Resilience, and the National Climate Change Adaptation Framework;*
- *Investigate climate related natural hazard events as they occur to determine whether the NCC scope and provisions are adequate;*
- *Monitor projections of extreme weather event risks to buildings and revise the standards in the NCC to take into account these projections where this delivers a net benefit to the community;*
- *Liaise with the planning, building, industry and insurance sectors, to improve the relationship between building and planning and to explore ways of better defining responsibilities, especially in high hazard areas;*
- *Recognise that it is appropriate that the NCC does not contain requirements to manage climate related natural hazards where these would be better managed by the planning system. In these cases the ABCB will strive to liaise with the planning sector to ensure that the risks are appropriately managed by the planning system; and*
- *Identify any consequential improvements to relevant Australian Standards and promote consistency with NCC objectives.*

11. Summary of Conclusions resulting from Stakeholder responses

Conclusion 1:

The current NCC appears adequate and the scope appears reasonable for extreme natural hazard events under current climate conditions.

Conclusion 2:

The current NCC adequately covers most natural hazards affected by climate (i.e. bushfire, flood, cyclone and extreme wind).

Conclusion 3:

The current NCC scope is reasonable and sufficient to account for resilience to extreme weather events.

Conclusion 4:

NCC changes will have a relatively small but cumulative impact on building resilience in the medium to short term.

Conclusion 5:

Taking into account the 30-50 year life of buildings and renovations/upgrades, the NCC is the most realistic means to transition building stock for resilience to extreme weather events. However, insurance also plays a part together with the ability of state/territory governments to introduce retrospective requirements if needs be.

Conclusion 6:

Applying the NCC to new building and plumbing work in existing buildings will improve the resilience of the community over time.

Conclusion 7:

The most appropriate strategy for upgrading existing buildings to adapt them for more extreme weather events would involve a combination of measures, including insurance and government incentives; awareness and guidelines; making use of existing controls (eg renovations to meet the NCC); research into cost effective retrofitting; and identifying the buildings (location and type) that are most at risk in order to inform the community.

Conclusion 8:

There are opportunities to differentiate requirements for new and existing buildings in order to help lift the resilience of existing buildings in vulnerable areas at a lower cost. However, any requirements would need to be assessed on a case by case basis as not all solutions would be cost effective. The use of guidelines would also be an effective strategy.

Conclusion 9:

The current IGA does not appear too limiting. If governments decide to apply the NCC to existing buildings, this would need to be through State and Territory legislative provisions.

Conclusion 10:

There is currently insufficient data/research available to justify NCC changes in relation to extreme weather events, having regard to the IGA and COAG Principles of Best Practice Regulation.

Conclusion 11:

There appears to be support for the current 7% discount rate for cost/benefit analysis when assessing draft NCC proposals dealing with resilience to extreme weather events.

There is also support for sensitivity analysis, which the ABCB currently uses in regulation impact assessment (i.e. includes 3%, 5%, and 11% discount rates).

Conclusion 12:

The NCC is an important tool in a much larger framework for responding to extreme weather events and managing building resilience. For matters that are within the scope of the NCC, there should not be duplication or alternatives in other parts of the framework to deal with resilience (design and construction) of buildings and structures for extreme weather events. However, the NCC can be supplemented by guidelines, information and education.

Conclusion 13:

Planning controls alone can't effectively address extreme weather events. Planning is only part of the solution and may limit the extent of the hazard but the NCC must define requirements for the building given the hazard.

Conclusion 14:

The insurance market in isolation would not be more efficient at dealing with extreme weather events. Insurance has a key role in community resilience and in enabling a community to rapidly recover after an event. However, recent events have also resulted in insurance cover being withdrawn for certain events/types of damage.

Conclusion 15:

It is likely that insurance will not always be available or premiums could be very expensive for building owners in high hazard areas. Insurance would not therefore be a realistic alternative to the NCC requirements for buildings in these high hazard areas, but may discourage building in the first instance.

Conclusion 16:

There would be a benefit to governments if buildings and infrastructure were more resilient, in terms of reduced funding for disaster relief, less damage to infrastructure, faster recovery for industry and the community, etc. This benefit would need to be measured against the cost of any incentive funding.

Conclusion 17:

In some jurisdictions, building and planning are working more effectively than in others. However, in general, there is room for improvement and a reduction in the gaps and inconsistencies.

Conclusion 18:

In jurisdictions where the principles of the 'Gateway' model has been adopted, it appears it is an effective mechanism in improving the interaction between planning and building controls. There is room for a better relationship between jurisdictions, the planning profession and the ABCB to develop an effective strategy to deal with the issues.

Conclusion 19:

In most jurisdictions, planning agencies can adequately identify and map hazard areas so that building standards can then be applied.

Conclusion 20:

It is technically possible to design and construct 'safe' buildings in high hazard areas; however, it may not be economically feasible to do so. Planning restrictions and zoning are an effective way to prevent development in extremely high hazard areas, or alternatively, sufficient information about the risks and consequences should be provided by authorities to allow the public to make informed choices.

12. Summary of Recommendations resulting from Stakeholder responses

The following recommendations resulting from the stakeholder responses to the draft discussion paper are provided for consideration and possible inclusion on the ABCB future work program.

Recommendation 1:

The ABCB should continue to monitor extreme natural hazard events and trends to ensure the NCC remains adequate.

Recommendation 2:

The ABCB should conduct preliminary investigations on the hazards of heatwaves and hail to enable consideration by the Board and Building Ministers for inclusion as projects on a future ABCB work program.

Recommendation 3:

The ABCB should monitor any new information/data/research on changing climate and impacts on extreme weather events to determine whether the NCC remains appropriate.

Recommendation 4:

The ABCB should monitor the findings of the current Productivity Commission Inquiry into national disaster funding arrangements.

Recommendation 5:

That the ABCB monitors the establishment of any senior officials land use planning and building body within the COAG framework in accordance with the Land Use Planning and Building Codes Taskforce Roadmap, and where appropriate, participates on that body once established.

13. References

ABCB (Australian Building Codes Board) 2010, *An Investigation of Possible Building Code of Australia (BCA) Adaptation Measures for Climate Change*, December, Canberra.

ACG (Allen Consulting Group) 2009, *Review of the Intergovernmental Agreement for the Australian Building Codes Board*, Final Report, March, Canberra.

COAG 2007, National Climate Change Adaptation Framework, Canberra.

COAG 2011, National Strategy for Disaster Resilience: Building Our Nation's Resilience to Disasters, Canberra.

JDH Consulting, 2008, *Impact of Climate Change on Design Wind Speeds in Cyclonic Regions*.

McAneney, J., Crompton, R., and L. Coates, 2007. Financial benefits arising from improved wind loading construction standards in Tropical-Cyclone prone areas of Australia. Risk Frontiers, Macquarie University. Report prepared for Australian Building Codes Board.

Productivity Commission 2004, Reform of Building Regulation, Research Report, Productivity Commission, November.

Productivity Commission 2012, Barriers to Effective Climate Change Adaptation, Report No. 59, Final Inquiry Report, Canberra.

The International Energy Agency (IEA), REDRAWING THE ENERGY-CLIMATE MAP, World Energy Outlook Special Report 10 June 2013.

2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

ABCB CLIMATE CHANGE ADAPTATION ROUNDTABLE - CONCLUSIONS

Held in Melbourne on 17 April 2013

Adequacy of the NCC

Half of the roundtable participants considered the National Construction Code (NCC) is not adequate, taking into account the Productivity Commission report on Barriers to Climate Change Adaptation. Potential areas of investigation include consideration of addressing hail, heat waves and storm surge in particular.

The ABCB could include the issues in its work program, undertake investigations of each new hazard, develop possible solutions and subject them to the Regulation Impact Statement (RIS) process. However, it would be unwise to commit to projects of this nature without consulting more broadly, establishing an evidence base and better understanding the capacity of the NCC to provide meaningful responses. It is also doubtful, given the current data gaps and likely cost implications, that a RIS would currently provide a net benefit.

Rather than undertake the exercise, it is recommended the ABCB monitor the hazards, the data as it becomes available and stakeholder views, to determine if and when an investigation of any new hazards would be appropriate.

Another possible option is for the ABCB to develop information handbooks on the hazards to provide non-mandatory advice on building solutions to mitigate these hazards. This would be consistent with the ABCB's strategy to promote good industry practice through the development of voluntary tools.

Impact of NCC changes in the short to medium term

The roundtable acknowledged that the NCC has little impact in the short term and in regard to existing buildings. One area of investigation that is already proceeding as part of another ABCB project on existing buildings is to look at the State/Territory triggers as to when the NCC is applied to existing buildings.

This is also an area where information handbooks can have a role.

Impediments to amending the NCC for climate change adaptation

The principal impediments to amending the NCC for climate change adaptation are lack of robust data, lack of government and community support and affordability. While these are primarily outside the ABCB's control, it can monitor the information as it becomes available.

Alternatives to the NCC dealing with climate change risks

Most of the NCC alternatives (eg planning, incentives, market mechanisms, insurance) are outside the scope of the ABCB. In discussion with International building regulators, it is apparent that where there are obvious risks that can have a quantifiable measure developed for a building to respond to, provisions could be prepared. However, in other countries the measures may not be uniformly adopted as they are in Australia given the different nature of their systems. It is also clear that up until now the primary focus has been on mitigation rather than adaptation, and in this respect Australia could consider itself pioneering in the area. Many other countries have measures for natural hazards, but not necessarily related to the risk of climate change impacts (eg. seismic).

Building and Planning working cooperatively

The roundtable identified an opportunity to re-establish the Building/Planning Working Group or a similar forum with industry and insurance also invited to participate, to improve the relationship between building and planning and to reduce the risk of inappropriate development in high hazard areas.

List of stakeholders who responded to the draft Discussion Paper

Organisation

City of Greater Bendigo
University of Newcastle CAEx Research Cluster
Master Builders Association
SA Dept of Planning, Transport and Infrastructure
Australian Sustainable Built Environment Council
Churches Housing Inc.
ICPS Australia Pty Ltd
Vic Department of Environment and Primary Industries
Individual Building Certifier
BlueScope Steel Research
CSIRO
SA Building Advisory Committee
Master Plumbers
Suncorp Group - general insurance
Standards Australia
Australian Institute of Architects
QLD Dept of State Development, Infrastructure and Planning
Green Building Council
Building Codes Queensland - Department of Housing and Public Works (HPW)
Department of Communities, Child Safety and Disabilities (DCCSDS)
NSW SES
DWP Suters
Cyclone Testing Station - James Cook University
Housing Industry Association
Magnesium Oxide Board Corporation
ACT Government, Environment and Sustainable Development
Australasian Fire and Emergency Service Authorities Council
NSW Department of Planning & Environment
Attorney-General's Department, National Resilience Policy Division
Griffith Business School
Master Plumbers & Gasfitters Association of WA