Global Resiliency Dialogue Second Survey of Building Code Stakeholders - Australia

Delivering Climate Responsive Resilient Building Codes and Standards

October 2021

The Australian Building Codes Board

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

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Enquiries about this publication can be sent to:

Australian Building Codes Board

GPO Box 2013 CANBERRA ACT 2601

Phone: 1300 134 631

Email: ncc@abcb.gov.au

Web: abcb.gov.au

Attribution

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Executive Summary

Close to thirty Australian building code stakeholders were invited to share their views and opinions on both the climate science and technical challenges and opportunities for enhancing resilience outcomes within the context of building codes and standards. This report provides a high-level analysis and discussion of the subsequent responses.

The overarching finding was that all the stakeholders who responded to the CANZUS survey support and appreciate the diverse impacts, barriers and drivers when it comes to climate adaptation and resilience for new buildings. The urgent need to investigate how building codes and standards can best reduce vulnerability risks to Australia's current and future building stock from changing climate and natural hazards was one of the key messages.

The challenges posed by climate change have been seriously debated in Australia for over two decades. The continent is vulnerable to a range of natural hazards including bushfires, storms, hail, tropical cyclones, floods, coastal inundation and extreme heat. It is estimated that natural disasters influenced by the climate cost the Australian economy $38 billion per year on average. A high emissions scenario could see annual costs rise to $94 billion by 2060 (Deloitte Access Economics, 2021).

Governments at all levels have responded to the significantly higher costs from climate related natural disasters by looking to integrate natural disaster resilience into the future planning for Australia's cities and regions. Many have established agencies to coordinate responses to natural disasters and target investment efforts at improving resilience. Examples include the National Recovery and Resilience Agency (NRRA), Resilience NSW, and Queensland Reconstruction Agency (QRA).

Most of Australia's building stock –constructed since 1996 (if properly maintained) complies with the National Construction Code (NCC). By default, these buildings are reasonably prepared for the impacts of extreme weather events and various hazard risks based on past events (BRANZ 2007). Nevertheless, stakeholders agreed that given impending climate change projections, it is legitimate and necessary for building regulators and standards developers to investigate what, if any changes need to be made to existing building codes and standards to reduce the vulnerability of buildings to Australia's already changing climate.

The majority of survey responses showed stakeholders are highly engaged in this area, and their views are generally consistent. The survey findings reinforce that more progress needs to be made in generating useful climate projections and technical information on how best to make future buildings more resilient to changing climate conditions and hazard risks.

The survey findings also outline several areas that remain to be addressed in order to better inform important policy discussions on the role of the codes in addressing climate resilience, establishing the performance targets and acceptable levels of risk, and having the strong evidence to support regulatory impact assessments. Climate models, scenarios and time lines for projections are all important in this regard.

Stakeholders agreed building codes remain only part of the solution to achieving climate resilience in the built environment and outlined some of their limitations. Respondents highlighted the need for a variety of policy instruments to address adaptation and suggested a few examples of the kind of initiatives governments should be encouraging more of. Better land-use planning and green infrastructure were both seen as complementary actions needing to contribute to desirable changes.

The quality, reliability and scale of climate data information is seen as one of the areas requiring urgent attention. Educating building codes developers and decisions makers to interpret climate projections and what this means for technical building standards was identified as a key action, as was the need to improve and update climatic design data/maps.

Whilst reviewing and updating building codes and standards to changing climatic risk profiles was acknowledged, so was the opinion that climate adaptation is not a standalone solution. Respondents accepted climate mitigation actions to reduce greenhouse gases (GHG) are needed if Australia is to reduce the degree of adaptation interventions and levels of investment required over the longer-term. Delivering on net-zero housing and greater levels of renewable energy was noted.

Finally, the involvement of decision makers at all levels of government, industry, finance/insurance and the community in a coordinated manner was seen as a critical success factor in enhancing building resilience.

Introduction

The Australian Building Codes Board (ABCB) Office invited 29 diverse and important stakeholders to respond to the CANZUS second survey in early January 2021 (see Appendix A). The invited stakeholder agencies are listed in Appendix B.

Given stakeholders agreed to participate on the basis of confidentiality, neither the names of responders or the specific agency/organisation are identified. It should be noted that whilst the ABCB received 28 responses to the survey, this does not represent close to a 100% response rate. A number of respondents belonged to the same agency or organisation and therefore this simply reflects that a number of stakeholders are peak bodies and re-circulated the survey to their members. More importantly, it reinforces the appreciation and understanding of implementing resilience in a building context is not uniform.

Given the nature of how the survey was circulated to stakeholders, the analysis presented in this report is in the form of a qualitative interpretation of what the current thinking is when it comes to expanding the opportunities for incorporating resilience in building regulations. This includes the related but separate corresponding challenges of incorporating climate science and ways of implementing future change.

The expertise and experience of those responding to the survey was as diverse as the responses received. Some respondents were very detailed in their responses with others leaving some questions unanswered or indicating they could not answer given questions because they lacked the expertise or knowledge of the subject matter.

Background

The Global Resiliency Dialogue was launched in July 2019 by building code development and research organisations, along with interested government and non-governmental stakeholders, based in Canada, Australia, New Zealand and the USA (CANZUS). The joint goal of this international collaboration is one of seeking to collectively identify solutions to help address the global challenge posed by the impact of increasingly frequent and extreme weather events and hazard risks (including heatwaves), on building occupants and buildings.

The Global Resiliency Dialogue has two overarching objectives. Firstly, to share leading practice and help inform the ongoing development of building codes that draw on the latest technical building practices and climate science to improve the resilience of buildings and structures. Secondly, it is about enhancing the utility of existing building codes, which have largely been designed in response to past climate and weather events, to respond proportionately to rapidly changing and predicted extreme weather events such as flooding, storms, cyclones/hurricanes and wildfires/bushfires and heatwaves.

The founding members of the Global Resiliency Dialogue, together with supporting stakeholders, recognise that current building codes around the world may not provide the same level of safety and resilience for future extreme weather events as they have in past.

CANZUS and dialogue partners agree in principle that it is desirable and increasingly necessary for codes and standards to respond to the latest research and data from the perspective of both building/technical science and climate/environment science if they are to maintain not only an expected level of safety and amenity, but also an appropriate level of resilience. By working together, the participating organizations can pool their collective resources, experience and knowledge to create guidelines and research that will be of both national value and global benefit.[1]

The first report[2] developed through the collective engagement of the Global Resiliency Dialogue partnership, investigated how climate-based risks are currently treated in national building codes and standards. In addition to input from the four founding Global Resiliency Dialogue participants – the Australian Building Codes Board (ABCB), the National Research Council of Canada, the New Zealand Ministry of Business, Innovation and Employment, and the International Code Council (based in the United States) - responses to the first survey were received by counterpart organisations in Europe (Germany, the Netherlands and Norway) and Asia (Japan). This broadening of international interest offered a more contemporary snapshot of the current status and

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[1] See https://www.iccsafe.org/wp-content/uploads/Findings_ChangingRisk_BldgCodes.pdf.

[2] The Use of Climate Data and Assessment of Extreme Weather Event Risks in Building Codes Around the World, Global Resiliency Dialogue, January 2021.

approaches to integrating climate science in existing building codes around the world. A copy of the report is available here.

The second phase of the Global Resiliency Dialogue's research has been underway since late 2020. The international survey was distributed to selected stakeholders based in Canada, Australia, New Zealand, and the USA. The survey sought input from climate scientists, design professionals, standards developers and peak industry, emergency management and professional bodies on a range of opportunities and challenges to better address resilience needs in the built environment.

The second survey also sought to better understand and determine what possibilities and different types of climate modelling exists or are under development to enable building codes to be more predictive and forward-looking in anticipation of extreme weather events and hazards that are likely to impact the built environment.

The findings from both reports will provide the foundation for the development of an International Building Resilience Guideline. This third piece of work is anticipated to be released in 2022.

Update on Australia's National Climate Change and Resilience based Initiatives

Australia has been seriously debating the challenges of climate change for over two decades. The continent is vulnerable to a range of natural hazards including bushfires, storms, hail, tropical cyclones, floods, coastal inundation and extreme heat. It is estimated that natural disasters cost the Australian economy $38 billion per year on average. A high emissions scenario could see annual costs rise to $94 billion by 2060 (Deloitte Access Economics, 2021).

Given the above, the Australian Government is now actively in the process of drafting a National Climate Resilience and Adaptation Strategy (NCRAS). The strategy will provide a roadmap for Australia to understand, monitor and respond to its changing climate, based on the best available science. The NCRAS will also showcase Australia's current adaptation and resilience actions and look to future needs. Other levels of government within Australia are also pursuing their own strategies to mitigate the causes of global warming and adapting to the effects already hardwired into the natural ecosystem.

Climate scenario modelling is being led by the Commonwealth Department of Agriculture, Water and the Environment (DAWE). The Department is working with the newly established Australian Climate Services (ACS) to develop future national climate scenarios.

Also at the national level, the recommendations arising from the Royal Commission into National Natural Disaster Arrangements (November 2020), Northern Australia Insurance inquiry (ACCC December 2020) and the creation of the new National Recovery and Resilience Agency - NRRA (July 2021) are specific initiatives to further encourage and promote more collaborative engagement between governments and industry sectors when it comes to building greater levels of national resilience.

Research and policy development arising from organisations such as the former Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC), the newly established Natural Hazards Research Australia, the Australian Institute for Disaster Resilience (AIDR), Geoscience Australia (GA), various universities and private research agencies including Risk Frontiers and James Cook University Cyclone Testing Centre is an acknowledged source of rich information.

Other key entities are acknowledged as currently leading the discussion and move towards enhancing built environment resilience in Australia including: the Australian

Sustainable Built Environment Council (ASBEC); the National Emergency Management Ministers and various industry groups, peak professional bodies, local governments and the national standards body -Standards Australia (SA). The latter specifically proposing to examine opportunities to how best to tackle the legacy challenge of trying to encourage greater levels of resilience take-up in the existing building stock.

Governments at all levels have responded to the significantly higher costs from natural disasters by looking to integrate natural disaster resilience into the future planning for Australia's cities and regions.

The national building regulator – the Australian Building Codes Board (ABCB) has been examining the implications of extreme weather and hazard risks on buildings and structures for the past several years. The ABCB has engaged the national science agency – Commonwealth Science and Industrial Research Organisation (CSIRO) to undertake a "climate scan" that will advise on a draft work plan to investigate which areas of the National Construction Code (NCC) would benefit from further study in 2022 and beyond, to enhance the level of overall resilience in future buildings and structures.

Most of the Australia's building stock (built post -1996 and if properly maintained) complies with the National Construction Code (NCC). By default, these buildings are reasonably prepared for the impacts of extreme weather events and various hazard risks based on past events. Nevertheless, stakeholders agreed that given impending climate change projections, it is legitimate and necessary for building regulators and standards developers to investigate what if any changes need to be made to existing building codes and standards to reduce the vulnerability of buildings to Australia's already rapidly changing climate.

As a performance-based code, the NCC sets the minimum required level for the safety, health, amenity, accessibility and sustainability of certain buildings. The ABCB, on behalf of the Australian Government and each State and Territory government, produces and maintains the National Construction Code.

The NCC is updated on a three-yearly cycle and implemented through state and territory government legislation and regulations. It is worth noting the Code only influences the construction standards for new buildings and structures, or those projects involving major redevelopment or renovations.

Introducing Building Resilience into Building Codes

Impacts and Barriers to Achieving More Resilient Codes

When asked to comment on the broader issues relating to increasing the levels of resilience in the national building codes, the responses received were largely supportive of the need for action in this space.

In an extensive survey distributed to nearly thirty different stakeholders (government, infrastructure agencies, professional built environment institutes, science based agencies, industry associations, disaster risk consultants, local government, emergency managers, NGOs) in Australia in early January 2021, respondents were first asked to share their views on ‘what impacts and outcomes can potentially be achieved by designing building codes to ensure both life safety and greater levels of durability in the context of future climate change and differing hazard risks’.

The majority of respondents argued benefits would be generated for multiple stakeholders. Many believed greater levels of building resilience would contribute to improvements in health and safety outcomes experienced by building occupants. Amenity, comfort and safety improvements would result largely through the delivery of greater robustness to the changing risk profiles of various weather-related natural hazards, especially heat stress in Australia's largely urban centres.

Others identified broader benefits for the community through redesigning building codes to be more future climate orientated. By reducing the impacts arising from a range of natural hazards, the pain felt during extreme weather events, and post disaster recovery arrangements, may well be lessened if building structures are generally more robust, durable and resilient when compared to what is largely happening today and in the past. In extreme cases it was felt by many that the ability for quicker re-build and recovery times will reduce the burden on individual households, business operators and community groups by significantly reducing stress and the corresponding disruption to the broader community.

"Disasters impact the community through not only physical injury, costs of disability but also disrupting economic and everyday social activities, as well as longer term costs of mental health issues associated with emotional trauma".

Related to this, respondents stated there are several other related benefits, including: less waste generation through reduced need for 'knock-down rebuilds'; extending the overall building life span; reducing the lifetime costs of buildings; and financial benefits to the nation with less investment required to support recovery efforts after natural hazards. A few respondents also identified the enhanced 'insurability of properties' and lowering the carbon impact from regular post disaster rebuilding as likely benefits.

Some respondents raised the complementary need for better land use planning and the need to ensure resilience is directed to critical infrastructure (some of which is outside the scope of the NCC). Key state infrastructure needs to be able to withstand a natural event with minimal, preferably no impact. “Water, power, roads, medical, aged care, schools are all critical to the functioning of society and a quick return to normality” was how one respondent put it.

The corresponding need to ensure ‘good enforcement’ of building codes was identified by some. The message being that any regulation is only as good as its implementation. Others went further and identified the need for greater community education and awareness about climate change risks and adaptation opportunities.

Interestingly, one respondent argued that changes to building codes to this end are also likely to *”create a trickledown effect establishing a higher agreed standard to mitigate these risks”*, as can be considered for existing assets in the case of retrofit. Higher resilience of assets, as provided by codes, will support long-term investment through increasing certainty about the integrity of assets in the face of increasing climate uncertainty. Increasing standards were also seen to lower the cost of more resilient building products/services over time as they support the creation of new markets and supply chains to meet increasing demand.

Given the global nature of the climate change challenge, one respondent specifically flagged the value of framing the potential impacts and benefits through the World Bank’s Triple Dividend of resilience framework lens. This approach sees all types of disaster risk management strategies (of which strengthening building regulations is one) delivering three different types of benefits/dividends.

The first being an ’avoided losses’ dividend. Investing in disaster risk management (DRM) strategies takes the form of reduced losses and damages in the event of a disaster. These losses and damages can be direct and indirect, leading to both immediate and long-term effects. Most notably, the first dividend includes saved lives along with prevented or reduced damage to assets. This corresponds to the conventional ex-post, loss-centric view, and is likely to underestimate the benefits of DRM measures.

The second dividend is about unlocking economic potential. Even the mere possibility of a future disaster has real impacts on present-day economic growth, particularly in regions or localities where disaster risks are perceived to be high. DRM measures help to manage this ever-present background risk of potential future disasters. This helps to unlock economic development potential by enabling forward-looking planning and investment. Increased resilience can catalyse innovation, entrepreneurship and investment in productive assets – even if disasters do not occur for a long time.

The third dividend is about generating development co-benefits. DRM investments are typically associated with economic, social and environmental uses, or ‘co-benefits’. Co-benefits can play an important role in motivating DRM measures and determining their design (e.g., shelters doubling as community spaces or flood protection infrastructure doubling as roads). While the nature of co-benefits varies significantly, they all materialise even in the absence of a disaster.

Some viewed expanding the explicit objectives of the ABCB to included resilience as important. Whilst the majority of respondents acknowledged the significant positive impacts that may arise by having greater levels of resilience in building codes, they also understood the barriers to generate much needed change were significant.

A few of the more significant barriers mentioned include the appetite of governments to fund greater levels of effort in prevention and preparedness activities. This apprehension arising from political ideology associated with climate change, lack of evidence to support action, the need for multiple levels of government to agree or simply the political risk associated with any change of contemporary ways of operating.

Some respondents flagged that achieving true resilience in the built environment can only be fully effective when the building regulation and planning systems are better integrated. *"When the 'entire system' works then debates about capacity for change becomes an advantage and not a deterrent".*

Others raised the existing evidence base or essentially the perverse ramifications on how we allocate ownership of risk when it comes to climate change impacts on buildings. It was felt by some that economic impact modelling tends to focus on short term 'affordability' considerations rather than the broader criteria and medium to long term benefits arising from stronger building codes. As one respondent put it, "*planning decision makers and developers are rarely held accountable for allowing (urban) development in high natural hazard risk areas where communities are put at risk"*.

Other perceived barriers mentioned included:

- the need for improved extreme values in climate science and modelling;
- improved hazard mapping;
- lack of appropriate collection of data on assessing the effectiveness of past regulations;
- the effectiveness of newer resilience proposals;
- absence of national planning and development principles for natural hazards;
- inconsistency in assumptions to potential exposure and how this impacts the design life of buildings and infrastructure;
- conflicting legislative arrangements between the building and land use planning; and
- industry reticence to introduce more change in an environment that is already quite dynamic when dealing with other equally important matters, be this accessible housing provisions, structural, energy efficiency and quality building system arrangements.

Whilst there is currently wide acceptance that future climatic conditions will be very different in decades to come, the science and evidence base remains open to conjecture and uncertainty. What is missing is the fundamental need to translate climate model outcomes to local hazard likelihood. The need to have climate science in a form that is understandable is crucial to help move the debate from thinking something needs to be done to what actually can and must be done.

From a regulatory perspective, others argued there is a need to develop an understanding of how regulatory options will translate into future climate conditions and urban growth patterns. One respondent believed that land use planning objectives often have negative effects on building regulatory objectives, such as creating conditions that lead to heat island impacts.

Competing with a market that is price/cost sensitive is yet another barrier that must be overcome. The building, development and real estate markets are generally united on *"building and selling on price rather than delivering resilient buildings that will deliver long term energy savings and comfort to the occupants".*

From a governance perspective, there is also the reality of needing to deal with potentially conflicting policy priorities. In an era of housing stress, high housing prices, community health issues, economic trade challenges, infrastructure investment demands and rapid technological change, it is hardly surprising that the public policy space is congested and competing with numerous *"lobby groups, community demands and other vested interests".*

Others saw the building and construction lobby as being hugely influential, often arguing that proposed changes are too costly or that builders need more time to introduce the needed change processes.

When specifically focusing on the operation of the NCC, a few respondents raised concerns over the absence of standards for the construction of buildings in coastal hazard zones (includes storm surge, sea level rise and coastal erosion)' however, where buildings are located is clearly a land use planning, rather than building issue.

Whilst not a barrier in the strict sense of the word, some respondents acknowledged that the goal of resilience takes a long time. In short, they argued it is a very slow progression from research conclusion to inclusion into standards or the NCC. This reality is due to all regulations being seen as 'red tape' and the 'horse trading' that needs to be undertaken when dealing with national frameworks or codes that essentially require multiple government endorsement, implementation and enforcement. One respondent thought the biggest barrier is simply that long term resilient investment is not incentivised.

Main Drivers for Achieving Resilient Codes

Given these perceived barriers, respondents were asked to identify what drivers or interventions were required for achieving more 'resilient codes'?

Several respondents argued the 'true driver' for achieving resilient codes are repeated natural disasters (bushfires, floods, cyclones), which will continue to deliver unacceptable impacts on the community. This will be seen as totally inappropriate given the increasing realisation that these events are not unforeseen and building codes should be proactive. *"A system that is seen as broken will generate attention for intervention and change"*.

On a similar line, the community's commitment to sustainability and minimising the societal costs associated with recovery will drive commitment to both better planning and construction, and ways of supporting rapid recovery from disruptions, be they natural or human-made.

Others were adamant the key driver is "*having authoritative and robust scientific evidence to inform decision-making*". This, they argued includes an understanding of the associated costs and benefits of different climate adaptation actions and an assessment of regulatory impacts.

Others went further and proposed a raft of additional drivers including the: demographic changes (where people live and the capabilities), technological changes (risk assessments, early warning), response to the traditional building industry attitude to price/cost and political inertia due to lobbying and policy challenges over-drive.

The education of end consumers was raised several times as an intervention worth pursuing. The education program would essentially be aimed to increase the understanding of the value of resilient measures, particularly in a recovering community and what is actually meant by 'building back better' principles. In short, "*the key current gap is the ability to consistently assess financially the holistic cost of natural hazard risks as an offset to greater upfront investment*".

An identified need in the Australian context was a suggestion that Australia needs to establish a building research agency like BRANZ, or Building America to undertake assessment and implementation of modern building technology into an Australian built environment.

A number argued there is a need to work more with insurance companies to promote a common view of risk and building performance, and where possible, advance incentives for more resilient building construction through insurance pricing.

Others reinforced that climate science needs to be translated into the tools and knowledge products required to support the robust evaluation of current building codes and standards. 'Knowledge and information' were not seen as the problem. What is required is more the need to adopt a process of capacity building with relevant organisations to understand climate change and assess the variety of real potential impacts.

When it came to identifying the advocates that are leading the debate on the importance of being more resilient in how we construct buildings ‘fit for the future’, the insurance sector and local government were singled out. Insurers in their quest to ensure insurance remains available and affordable, and local councils in their growing interest in building resilient communities and protecting life safety around managing the growing threat associated with heat stress, particularly those municipalities in larger urban centres.

At a national level, the recommendations arising from the Royal Commission into National Natural Disaster Arrangements (November 2020) and the creation of new the National Recovery and Resilience Agency (July 2021) were two specific initiatives that one respondent thought would encourage and promote more collaborative engagement between governments and industry sectors when it comes to building greater levels of resilience.

Whilst Royal Commissions established following natural disasters have, over the years, been big drivers for introducing change to the NCC, such as in the case of bushfires, consistent implementation remains a protracted process.

Others who were considered to be leading the discussion and move towards building resilience included: Australian Sustainable Built Environment Council (ASBEC); National Emergency Management Ministers, industry groups, peak bodies, insurance companies, Standards Australia and World Green Building Council.

Some of the Australian media were also acknowledged playing an important role in keeping the public attention on climate science and related research.

A few respondents thought it necessary to reinforce that ‘current codes and standards on this matter are constantly under review and where evidence from any post disaster analysis indicates areas of improvement these are analysed and result in enhancements to our (Australian) codes'. The latter point reinforcing for some respondents that they believe the ABCB is already doing its bit for building resilience in the work it undertakes.

Communication

Stakeholders to Engage

When asked which stakeholders need to be engaged to ensure successful integration of resiliency into building codes, the following were identified:

- CSIRO, Geoscience Australia, National Fire and Emergency Services Council (AFAC), Australian Institute of Disaster Resilience (AIDR), and Australian Sustainable Built Environment Council (ASBEC);
- Heads of Planning (state planning leaders), planning agencies, infrastructure bodies, the ultimate regulators and monitoring and enforcement agencies that operate at state government and local government levels;
- Insurance companies (including Insurance Council of Australia), finance and legal sectors;
- Building surveyors, builders, architects, building designers, building and construction sector, and engineers;
- NGOs and key service providers (especially health and community based),
- industry associations (Property Council of Australia, HIA, MBA);
- Universities and research bodies;

- On a governance level it was also considered critical that the national Building Ministers and the ABCB be fully engaged and committed to championing this initiative.
- The key government agencies at the national level being DISER, the National Recovery and Resilience Agency and the Department of Agriculture and Water.

A few identified the critical need for the general public, including indigenous communities, to be engaged to both raise awareness and accept the need for integration.

One interesting perspective provided was the need to consider the future occupants of the building yet to be constructed. Hence the reason why it is important to undertake a detailed assessment of current climate related natural hazards and the potential impact on building occupants.

As one respondent flagged, the answer to this question "*depends on the definition of resilience*" that is adopted for building resilience. But it is usually considered a multi-level concept that would benefit from a multi-sectoral approach. That is the resilience of a building is influenced by the resilience of the place in which it is located.

What information and in what format is needed for engaging these Stakeholders?

Responses to this question were interesting. The question looks rather simple at first, but is rather complex when you give it some closer consideration.

Only a few answered the question. Those that did, suggested the following:

- Fact sheets with further expansion in detailed reports, 'evidence, facts and truth', roundtables (online), webinars, newsletters, dedicated websites, clear guidelines and communication material that will help advocate for 'fit for future' codes.

Best Practice Examples of Communication and Engagement

The responses received to this question were not unexpected. Suggestions offered included:

- Insightful and convincing data, having expert communicators to help stakeholders understand the concepts and issues, use of social media, face to face consultation, webinars, adopt the International Association of Public Participation engagement process, lever off the work undertaken to date by ASBEC, use of demonstration housing and model resilient housing estates.
- Others expressed confidence in CSIRO's ability to work with diverse stakeholders and communities on issues relating to climate resilience. One respondent believed that QRRRF's co-funded "Severe Wind Hazard Assessment for South East Queensland' project is worthy of closer examination.

Policy Advancement

Current Policy Discussions

Question 26 asked what policy discussions are needed to introduce resilience in codes, whether any have occurred in the past or are already underway?

Not surprisingly, a number of respondents argued building code policy is clearly a debate for the ABCB to have in an informed manner with key stakeholders, which includes jurisdictional members at the state and territory levels. As previously acknowledged it was noted by some the NCC already provides a level of coverage for buildings in response to past natural hazard events.

Several respondents believed a key driver is "*having authoritative and robust scientific evidence to inform decision-making*". This includes an extensive understanding of the associated costs and benefits of different climate adaptation actions and a thorough and transparent assessment of regulatory impacts.

Overall, however, the view was that as the frequency, severity and costs (financial and human) of weather-related natural hazards increases in Australia, the community will become a key voice and driver for change.

What Complementary tools can achieve building resilience?

When asked in addition to Codes, what complementary tools or activities are needed to achieve a culture of resilience in the building sector, responses tended to fall into the broad camp of monitoring and enforcement.

Some argued that if one is to be serious about strengthening resilience, there needs to be ongoing monitoring and compliance with development/building approval conditions. That is ensuring regulations are adhered to as intended. The effectiveness of codes and standards are reduced where these are not complied with.

In keeping with this line of thinking, others went further and argued that penalties for failing to meet building requirements need to be strengthened.

A number of respondents raised clarity of communication as a worthy focus of attention. In particular, "*clear, plain English web content and fact sheets that are easily accessible*".

In tandem with the need to improve communication, some others argued for the need to include improvements to professional development. This included the value of education for 'champions' that helps them understand the codes to a level where they can be easily communicated to laypeople. Champions may include builders, department of fire and emergency services staff, local government staff, architects, designers, building consultants, etc.

The need for some sort of mandatory disclosure of risk levels for existing and new properties was also suggested. In short, the respondent mentioned in their experience, too many builders/developers are seeking to build a low-cost product. "*A rating system for new homes that includes heating and cooling costs, bushfire safety, cyclone ratings in expanded cyclone risk areas, decentralised energy and water options (rainwater tanks and batteries) would in the opinion of some, provide home buyers with a better understanding of the 'costs' of a low-cost home*".

An interesting perspective was the need to encourage "*scenario planning with a broad group of stakeholders*". Scenarios can assist with identifying likely events, outcomes and lead indicators that demonstrate what risks have increased. If undertaken correctly, community-based scenario planning could be a useful tool to build understanding and community capacity to build and value resilience.

Others proposed actions including developing 'resilience strategies' at the regional level, landscape scale hazard information, strategic planning guidance relevant to land use planning, clarity in assessment and conditions for carbon mitigation and adaptation, transition away from 'approve and forget' planning processes, and wider use and support for so-called 'adaptive management plans'.

Dealing with equity Issues

Question 29 asked stakeholders on how to potentially deal with the existing building legacy and social equity challenges?

One respondent thought a starting point is simply more education for home-owners/purchasers on adapting their homes for future climate. More R&D on simple measures to improve resilience of existing buildings would be worthwhile. Examples including insulation, building siting and orientation, basic house maintenance and use of more appropriate building materials.

Others believed all levels of governments need to give more consideration to introducing incentives and subsidies. "*A safer and more resilient Australia will not come for free and will need governments to foot some of the bill*". This included specific initiatives designed to support retrofitting and many of those living in the rental housing market.

In line with the above, the insurance sector and local councils were seen as two that could play significant roles in incentivising higher levels of resilience in various building types. Specific examples offered included phased grant schemes for home improvements on existing buildings to meet (or aspire to) the codes (e.g., subsidised purchasing of gutter guards, air con mesh, roof insulation, etc.).

Education campaigns to encourage voluntary uptake from the community and business sectors was also recommended. Others argued the need for financial incentives for upgrades to rental properties/ minimum standards for rental properties.

One respondent argued a proper response to this valid question requires a systems-based response engaging multiple sectors.

Data/Research

Gaps

Question 7 posed the challenge of what data and supporting research is needed to enable codes to consider future climate states and extreme weather events?

The majority of respondents believed that much of the data and research needed is already available and it is more important the ABCB start to apply this to improve the building codes and standards. Comments were made like: ”*Please don't get tied down in adding new research to the point of never achieving change” and ”all the data is already available in Australia. We have an excellent national Bureau of Meteorology (BOM), CSIRO and Geoscience Australia and state agencies*”.

Others agree in principle with this view, but also thought the data and supporting evidence should be better informed by stakeholder consultation determined by the specific risks being mitigated and against what assets/sectors.

Those who believed further research was required also raised the need to seek ongoing and proactive advice from those in practice. Some specific suggestions for further research included: ongoing post disaster/incident analysis studies, improved worst case scenario hazard mapping and standardised climate impact scenario framework used to generate information at a sufficiently local scale to inform decisions.

Others thought there is a need to define the current built environment and be able to forecast its exposure based on growth and risk informed (or ill-informed) land use planning. This would involve translating climate science projections into local scale hazard vulnerabilities so as to assess the change in future risk (this covers the range of weather influenced hazards.

A few respondents also raised the need to understand the vulnerability of buildings built to current regulations (including the limitations of construction practices) and how this changes with raised standards. This could include hazards not presently regulated such as hail.

A shift from climate projection information that presents typical or average climate in the future, to research that develops an understanding of how the frequency and severity of extreme events might change. Some respondents also believed it is important to develop an understanding about how the spatial (geographic) distribution of risk profiles is likely to change.

"*Base planning parameters on consistent assumptions for potential exposure with regard to acceptable risk for bushfire, sea level rise, flood and urban heat and design life of housing, buildings and key infrastructure*" was yet another suggestion made.

Partially answered in previous questions was the argument that there is a need to appreciate the social dimension and apply social sciences - not just hazard information and climate projections to the challenge of building greater levels of resilience in the built environment.

Others argued more research is needed to be conducted to determine the current typical life of buildings in different classes and what impact a short life-span has on contributing to the problems caused by extreme weather events through construction.

A number of respondents believed that long term disaster impacts need to be better analysed in order to be able to enhance cost benefit analyses. This is especially so if the benefits are to be largely accrued well into the future.

One respondent was adamant that further evolution of climate data needs to be supported by the re-establishment of a building research agency like NZ's (BRANZ).

There were quite a few respondents who directly or indirectly inferred all further research should apply the principles of risk management. The data only needs to show that there is a risk and the potential damage is sufficient to justify reviews and possible amendments to the building code. This needs to be carefully considered in the context of applying a precautionary approach, which is inconsistent with minimum regulation.

One respondent provided a supporting example with the cyclone zone now appearing to extend much further south in the southern hemisphere. As such, there would appear to be benefits of requiring a broader geographic area to meet cyclone design requirements of the code, even if cyclones may not strike for another decade. In such cases, peer reviewed academic papers may be a sufficient data source to justify such a change.

Studies or planned research to address these gaps?

When asked to describe what studies have been undertaken or are planned to be produced to fill the identified research gaps, many reinforced the multiple pieces of research that have been produced over the years by Australia's leading science and emergency management agencies. These included: CSIRO, Geoscience Australia, BOM, Bushfire CRC, Bushfire and Natural Hazards CRC (BNHCRC), universities and multiple state and territory research agencies.

Some argued the recent National Natural Disasters Royal Commission contained a wealth of information, as was the case with the research produced thanks to the work of the previous National Climate Change Adaptation Research Facility (NCCARF) and the more recent Climate Change Authority's March 2020 'Prospering in a low emissions world' report.

Others reinforced that many local governments have a long standing and ongoing program of climate science research to inform policy and planning, building response in a changing climate.

Risk Frontiers has completed research into natural hazard fatalities including relationships with buildings and also continues to maintain a database of natural hazard fatalities.

Again, there was a sense that research, data and information is not the real concern of many stakeholders. As one respondent put it "*We don't have any significant gaps. We have a lack of focus and political will*".

Advances Needed

The responses to question 12, which sought to investigate what advances in climate modelling are needed to support buildings codes were not extensive. Many respondents failed to answer this question or referred to the responses they had previously given on research gaps and challenges.

Risk Frontiers has incorporated climate projections in catastrophe loss models allowing the financial costs of climate change on property damage to be estimated. These, it was argued, ”*are ideal tools to assess cost benefits associated with code changes*”.

Many of the respondents also referenced the work that has been undertaken by the Bushfire and Natural Hazards CRC, CSIRO, Geoscience Australia and the university sector.

In short, one was left with the impression there is an ensemble of climate models in place and that getting agreement on appropriate amendments to codes and standards is more of a challenge than having access to supporting technical reports and modelling.

Current Scenarios

When asked what scenario is currently being used by practitioners and what needs to be considered in selecting a future climate scenario (RCP) for climate modelling, the responses were fairly consistent.

The majority of those who answered this question believed the climate scenario should be focused on 'worst case'. However even if one uses the ’best case’ scenario model, respondents thought this will also drive improvements in the development of more resilient building codes to address resilience.

It is worth noting the majority of respondents failed to answer this question. In the current situation, this can be interpreted as a sign that respondents are not aware of what climate scenario is being used.

One respondent reinforced that all adopted RCP scenarios need to be based on best available science and developed by/with institutions such as BoM and CSIRO. This is critical to ensure widespread acceptance and credibility. They also argued that all scenarios should incorporate and be subjected to a sensitivity analysis.

Predicting and Dealing with Risk

When it comes to predicting the risk associated with extreme weather events and natural hazards, the challenges identified are numerous.

Respondents mentioned that exposure can be difficult to assess. For example, with respect to flooding knowing the floor height of properties.

Others mentioned the following in relation to estimation of extremes in climate models:

- Fusion of data from a range of government and non-government sources;
- Choosing a suitable timeframe to compare previous history;
- Climate change introduces an increased unpredictability to weather;
- We have data on projected trends, but specific effects of these trends on emergency response and community safety are required;
- Multiple and cascading events, and people's capacity to manage and withstand multiple events;
- The effects of climate change on storm severity are unclear as is with south east lows;
- There is not enough consideration of social and economic vulnerability; and

- There is also a probability of extreme events increasing in a non-linear fashion. This may mean that extreme events are much more likely than many of us have previously considered.

Question 21 asked respondents how risk from extreme weather events should be considered in the design of buildings. Not surprisingly, many commented on the need for future building codes to be regularly updated and include criteria for monitoring change. The rationale being those mandatory changes to building design is introduced when the criteria is triggered.

It would appear that respondents generally agreed buildings should be designed to adapt to future risk and adapt to climatic conditions that are appropriate to the likely future and not the past.

One respondent made the point that this is where the building code and the planning system intersect most. "*The planning system should prevent buildings being constructed in non-stationary climate/hazard areas*". This of course may be very limited in scope.

Others commented that, 'how' we build also needs to take into consideration 'where' we build. The two are complementary and address the desire to build higher levels of resilience in the built environment.

Given the importance of climate science in assessing the appropriateness of current building codes, few saw this as a reason why it would not be possible to design for extreme weather events. Many argued that climate science is robust enough to drive change of buildings codes.

Code Content

Several questions sought to better appreciate how future codes should function on the subject of resilience. For instance, should the goal of resilience be achieved through regulations or other means?

The majority of respondents were supportive of using regulation to enhance resilience. An example quoted by one respondent was that "*clear regulations are paramount to the ability to push through change, particularly when it may not be immediately popular*". The conclusion being, for those who responded, that short term costs may be incurred, but for clear and substantial medium to longer term benefits.

Having said this, the majority of those in favour of introducing higher levels of regulation, also agreed that such action needs to be supported by robust science and be subject to a comprehensive impact assessment. In short, the benefits of adopting regulatory change must be clearly demonstrated.

Land use planning received a lot of attention. There was a strong argument to acknowledge that it is at the land use planning stage where plans are being considered in relation to establishing new communities and associated buildings and infrastructure. Given this fact, land use planning can have a substantial impact on the level of resilience that can be achieved when it comes to the built environment. This is particularly the case when dealing with urban heat stress or coastal storm surges.

Early in the design of new and expanding communities there is an opportunity to consider many factors including natural hazards and extreme events. These considerations can be used to inform where development should occur and if a natural hazard cannot be avoided, how buildings and infrastructure can be made more resilient. Another example is powerlines in bushfire/wildfire prone areas can be placed underground, which will minimise the impact that a fire may have on the infrastructure.

Cases where increasing a building's resilience should not be mandated by regulation include the retrofitting of existing buildings. However, respondents did again highlight that introducing incentive schemes can create an environment where incremental improvements are made to improving overall community and building resilience (e.g., insurance incentive, co-payment/subsidy between government and property owners).

Other alternative interventions proposed included development of codes/guidelines for voluntary adoption and implementation.

Question 6 asked whether thresholds be established to help inform when a code may need to change. The majority of respondents agreed there should be some sort of threshold to trigger if regulatory change is required. Essentially there was a belief that capturing and understanding emerging risk data is essential to mounting an argument for change. Those supporting the introduction of thresholds also acknowledged the climate situation is changing rapidly and that building codes need to be flexible and adaptable to meet these changes. Having some sort of trigger to do this was thought not only reasonable but desirable.

Alternatively, others argued establishing thresholds are problematic as they can be difficult to quantify and depend on a risk appetite of governments. As an example, one respondent flagged that "*the community largely does not accept the current levels of life and house loss from bushfires, however, the majority of the planning and development industry does*".

Another concern with adopting some sort of threshold is that desired improvements may not be implemented until a natural disaster occurs.

Whilst thresholds have been used in the past and can be used as an informing tool, others thought adopting an approach of continuous improvement would be more beneficial. Continuous improvement, some argued, "*is less threatening and accommodates a differing pace of implementation of change*". Others went further and argued that continuous improvement was preferable given it is ”incremental, sustainable and reflects a natural evolvement of knowledge and expertise”.

One respondent argued that ”*too often good initiatives cease or are not fully implemented due to excessive targets, which seemed achievable at the time and conversely improvement may cease once a target (that didn't stretch enough) has been achieved*”.

This was also expressed by one respondent when they thought a more fluid arrangement be adopted, whereby changes in the threat context prompt an assessment of the range of response options that may include adjustments in the code/regulatory regime.

Another respondent made the point that fundamentally there is a need to understand whether current regulation actually meets societal expectations. This would inform when intervention is necessary in the context of building life and future climate.

Question 11 asked how often the climate data referenced in codes be update to achieve resilience goals? Answers to this question were varied. Many respondents failed to provide a response. Others nominated time periods of 3 to 5 years, 5 to 7 years, others thought every 5 years is about right. One respondent thought this should happen every second review of the NCC. That is every 6 years. A smaller number of respondents argued the time scale should be on an annual basis or at least every two years.

Others thought this would depend on update information, which would be provided by BOM or when new information and data becomes widely available in the market that warrants attention. Others simply thought regulatory change should be subject to annual reviews and/or respond to specific events and/or new and significant climate science.

By way of example, the IPCC has prepared regular assessments since 1990, of the available information about climate change based on peer-reviewed published sources. The IPCC has recently published its Sixth Assessment Report (AR6). As such, one respondent proposed that alignment with this process and consideration of any new information relating to Australia, when an assessment report is released, may be an appropriate timescale for a review of climate data being used.

A few respondents thought the timing should be guided by adopting a robust risk-based approach. Others suggested the relevant code committees should consider each major update and determine whether amendments to the design standard is required. However, they noted that in doing this, "*the major update would need to be translated into meaningful hazard likelihood metrics and not be qualitative*".

Question 14 asked how uncertainty should be addressed and communicated in codes for future climate states and climate modelling? Most stakeholders didn't answer this question. Those that did respond answered in a non-uniform way. This tends to indicate many people are challenged on how best to reflect and communicate climate modelling in building codes.

Those few who did respond argued there should be a continual review process to ensure the climate uncertainty is constantly managed. Others argued it might be best to adopt some ensemble of climate models – using the most likely or worse case scenarios. In essence, taking an average view of what scientists believe will occur.

One respondent argued the degree of uncertainty is secondary to the knowledge we already have. That is "*in eastern Australia – it is highly likely there will be more frequent heat waves, extreme heat days, stronger wind gusts*". This tends to indicate for some the answer is not more science but rather more and better education and advice.

‘Uncertainty is a given’, they argued. The ‘assessment needs to be based on probability and consequences’. An uncertain, unlikely event with severe consequences still needs to be managed. This is where further debate is required.

It would appear the level of uncertainty in climate projections varies across sectors and decision contexts, depending on the particular climate driver and time period being considered. For example, in Australia over the next 50 years, one respondent argued that ”*rises in average and maximum temperatures and increased sea levels are virtually a certainty. Whereas there is greater uncertainty associated with changes in rainfall and the number of cyclones*”.

Buildings have a long asset life (50-80 years) and climate will be one of many sources of uncertainty over these timescales. Nonetheless, there are many well-known techniques for decision-making under uncertainty that could be relevant to the building context. One respondent thought it ”*is critical that experts be commissioned to manage this uncertainty and how best to communicate this in future codes*”.

Question 15 asked in what ways can or should non-stationary climate be addressed in Codes and to describe any efforts or discussions that were underway to do this?

There was wide agreement that codes should design for the end of life for a building that is constructed. That is, be forward looking when it comes to the climate and hazard risks that are likely to occur in the decades ahead.

Respondents argued that climate change should be addressed in codes through taking an extra precautionary approach rather than the absolute minimum standard currently adopted. This should be achieved through a culture of continuous improvement and the close tracking of scientific advances.

One respondent supported their position by saying that from their perspective ”*if a building is expected to last 50 years, the building should be designed to withstand the climate modelling for 49 years- time. Notwithstanding maintenance of the building, the* *design and materials at the time of construction should survive the environment it is situated both now and in 50 years*".

Others argued that "*in a period of change, codes need to be forward looking, not backward looking. We need to understand that the costs of poor design and inadequate standards will be borne by the building occupants and the community, not the builders*."

Many of the respondents argued a risk assessment model based on probability, vulnerability and consequences is therefore warranted.

Question 27 asked how do or can cultural, environmental and heritage issues be balanced when considering resilience in land use planning and building codes?

Many respondents didn't answer this question.

Some of those who did, agreed that cultural, environmental and heritage issues need to be considered and that there may well be a tension here. Regardless, driving any change will come with some political risk. The case for change needs to therefore be supported by defensible data and convincing individuals they will be better off from the proposed changes.

Others acknowledged it is very likely that stricter land use planning controls will need to be in place for new construction and be introduced in collaboration between state and local governments. Developments with sensitivities (be they cultural, environmental and heritage) should be somehow supported/provided with assistance if the updated codes trigger the need for retrofit upgrades. What kind of support however, was not offered.

From a mitigation perspective, a few argued that environmental issues should, by and large, be prioritised to ensure actions don't further exacerbate climate change.

Question 17 asked what is the ideal expected service life of different buildings?

The majority who answered this question thought the minimum expected service life of a building should be 50 years. Having said this, there was a view the answer is going to be largely driven by economic and social/demographic influences and individual considerations.

The main issue is that most buildings under construction have a life expectancy of greater than 40 years and the impact of climate change over this period will be immense. If buildings are constructed for less than 50 years, there is increase in waste and a huge burden on society to replace buildings prematurely.

Those who answered the question put forward the following perspectives: industrial buildings for at least 40 years, homes 50 years; commercial 75 years, and public/government buildings up to and possibly longer than 100 years.

One respondent thought this question can only be answered through some specific empirical research. Regardless of a building's design and service life, how long buildings are actually being used for is a question worth asking. Further research being warranted to answer such a question.

Another made the point there would appear to be obvious market failure when it comes to questions about what is the service life of different types of buildings.

Following on from building life spans, Question 18 asked what is the ideal expected service life of different building systems and materials (e.g., windows, roofing, cladding)?

Many respondents made the point this largely depends on the individual element and costs associated with construction. The greater the cost and the more difficult it is to repair/replace needs to equate to the greater life expectancy of that building envelope (i.e. a roof vs a pane of glass).

One respondent thought that ideally this should be some 30 years. However, they also argued they don't believe legislation should be considered to require such a desirable service life.

Others simply thought building materials/ components should last almost as long as the building itself - so 40-50 years is not an unreasonable expectation. One respondent made the point that "*given our older building stock has lasted 100 years or more why would we consider shorter timeframes going forward?*"

One respondent thought all exposed materials should be expected to last 50+ years with proper maintenance.

For building materials that are not easily accessible or replaceable like insulation, it must be equivalent to the life of the building. No compaction sagging or deterioration during building life is a minimum requirement. From a sustainability perspective, it was considered preferable that the insulation could be removed and reused in another building at end of building life.

Question 19 asked should occupancy type/building significance factor into design considerations?

Again, there were mixed responses to this question.

Some argued an emphatic no. All codes should be adjusted to make buildings more resilient to climate change and more energy efficient, from materials through to occupation performance, regardless of occupancy type or importance level. Buildings, others argued, "need to be 'fit-for-purpose' well past the date at which one can expect to have paid for its construction, irrespective of the building's level of importance".

Others responded by arguing increased vulnerability and hazard exposure should require increased design considerations. As a case in point, bushfire design measures in Australia only apply to specific building classifications, which should be broadened to apply to more building classifications. The inference being not just residential properties but commercial and public buildings as well.

Interestingly some thought there may be more value in establishing agreed principles regarding the robustness and survivability of buildings rather than defined importance or type of building structure.

Others agreed that considering the type of building or structure was important, but not to an excessive degree. Having said this, all buildings should deliver reasonable 'shelter in place' outcomes.

Those who did think it was reasonable to allocate higher resilience standards, put forward a number of suggestions of circumstance where this would be warranted. For instance, "*a higher level of design safety required for accommodation and public assembly buildings; places where people sleep or are looked after should have the highest level of safety*".

Yet others strongly believed it is important to factor occupancy type into resilient design. Assessment of occupant vulnerability and other important considerations such as mobility are critical to ensure design is fit for occupant use and safety.

To show the wide range of opinions, one respondent was of the view that people living in apartments are less likely to be prepared than those living in houses, as a result of their transitory living arrangements. Unfortunately, this opinion wasn't supported with examples or clarification.

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Appendix A – Survey Questions

1. Ideal State
1a. What impacts and outcomes can potentially be achieved from the design of Codes to ensure life safety and building durability in the context of future natural hazards influenced by changes in climate? (i.e., social, financial, design goals)
1b. What barriers (e.g., understanding the science and how to integrate it, organization learning, capacity for change, political will, cost, etc.) exist to achieving this ideal end state?
1c. What are the main drivers for achieving resilient codes? What entities are leading the discussion/movement?
1d. In which cases should regulation be considered for achieving resiliency goals? In which cases should it not? What alternatives exist to achieving the same goals?
1e. Should entities be established/assigned to monitor and evaluate changing conditions to inform code changes? If yes, should those entities be governmental or non-governmental?

1f. Should thresholds be established to help inform when a code may need to change?
2. Data and Research Requirements
2a. What data and supporting research is needed to enable codes to consider future climate states and extreme weather events? (Examples: measured data, maps, material properties, pilot studies, etc.)
2b. Describe any studies that were undertaken or are planned to identify these gaps
2c. Describe any ongoing research or planned research/programs to address these gaps
2d. What is the ideal source and format of future climate data for Codes?
2e. How often should the climate data referenced in the Codes be updated to achieve resiliency goals?
3. Climate Science
3a. What advancements in current climate modelling are needed to support Codes?
3b. Describe any efforts underway or planned to advance climate science in support of codes.
3c. How can (or should) the uncertainty in future climate states and climate modelling be addressed and communicated in codes?
4. Choice of Future Climate Scenario

4a. In what ways can/should non-stationary climate (climate change) be addressed in Codes? Describe any efforts or discussions currently underway (e.g., design for end of service life, design to adapt, etc.).
4b. What needs to be/is being considered in selecting a future climate scenario (RCP) for design? What scenario is currently being used or considered by practitioners?
4c. What is the ideal expected service life of different types of buildings?
4d. What is the ideal expected service life of different types of building systems and materials? (e.g., windows, roofing, cladding)
4e. How does or should differences in occupancy type or importance of buildings factor into design considerations?
5. Extreme Events
5a. What are the current challenges in predicting future risk of extreme weather events?
5b. How should risk from extreme weather events ideally be considered in the design of buildings in a non-stationary climate? (For example: uniform risk vs uniform hazard - should the facility be designed to adapt to changing conditions or should the code include criteria for monitoring change, etc.?)
5c. Is the current solution for designing for extreme events limited by the state of climate science? Will a different solution be possible in the future?
6. Stakeholder Engagement
6a. What stakeholders need to be engaged to ensure the successful integration of resiliency into codes?

6b. What information, and in what format, is needed to successfully engage stakeholders?
6c. Describe any best practices for engaging stakeholders and communicating climate change related information.
6d. What policy discussions are needed to introduce resiliency in codes? Have any occurred in the past or are already underway?
7. Achieving a Culture of Resilience
7a. In addition to Codes, what complementary tools or activities are needed to achieve a culture of resilience in the building sector?
7b. What can be done to ensure equal access to resilient buildings? (Codes generally apply to new buildings, and only the population who can afford new homes will be initially impacted by codes changes)
7c. How can/should cost, mitigation and resilience considerations be considered and balanced in the design of buildings?
7d. What could happen to buildings that are impacted by an extreme weather event? (e.g., rebuilt, rezoned, loss of insurance)
7e. How is land use regulation and attitudes towards land use adapting to changes in climate? (e.g., managed retreat)

Appendix B – Stakeholders Invited to Respond to Second Survey

Department of Prime Minister and Cabinet (PMC)

Department of Industry, Science, Energy and Resources (DISER)

Department of Home Affairs

Department of Agriculture, Water and Energy (DAWE)

Geoscience Australia (GA)

Bureau of Meteorology (BOM)

Australian Institute for Disaster Resilience (AIDR)

Bushfire and Natural Hazard Cooperative Research Centre (BNHCRC)

Insurance Council of Australia (ICA)

Risk Frontiers

Planning Institute of Australia (PIA)

Australia Institute of Architects (AIA)

Engineers Australia (EA)

Australian Institute of Landscape Architects (AILA)

Australian Sustainable Built Environment (ASBEC)

Housing Industry Association (HIA)

Master Builders Association (MBA)

Property Council of Australia (PCA)

National Bushfire Recovery Agency

Australian Strategic Policy Institute

Australasian Fire and Emergency Services Council Ltd (AFAC)

Standards Australia (SA)

James Cook University Cyclone Testing Centre (JCU)

Australian Local Government Association (ALGA)

Red Cross

Climate Change Authority

Infrastructure Australia (IA)

Flood Mitigation Association (FMA)

International Council for Local Environmental Initiatives – Local Governments for Sustainability (ICLEI)