Insurance Council of Australia

Climate Change Impact Series: Tropical Cyclones and Future Risks

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Contents

Acknowledgements

This summary report is made possible by the detailed analysis of the James Cook University Cyclone Testing Station in association with Risk Frontiers. The Insurance Council of Australia would also like to acknowledge the work of both the ICA's Climate Change Action Committee and Data and Knowledge Committee whose guidance and data analysis helped to make this report possible.

Top takeaways

1

The total cost of tropical cyclones in Australia since 1967 has been $23 billion.

This risk of damage attributed to tropical cyclones is expected to rise in Australia as they will likely become more severe and are expected to track southward driven by a changing climate.

2

Australia's modern houses are not resilient to the tropical cyclone hazard of today.

Unless significant changes are made to both the design method and criteria for new houses, the impact (and losses) from these events in Australian communities will remain high and will increase with a changing climate.

3

The report examines houses built post 2000; older houses built prior to the 1980s may need to be retrofitted to better protect the lives and finances of Australians.

Older homes were built before the introduction of current design and construction standards which may not only leave them more vulnerable but when damaged, these homes can produce debris which creates further damage to surrounding homes. Federal and state governments must establish long term funding mechanisms to support the development and expansion of household resilience schemes, such as the North Queensland Household Resilience Program.

4

Australia's National Construction Code (NCC) must consider the principle of resilience for all new property construction.

Homes should be built to a standard that protects property and minimises the damage, loss and disruption caused by worsening extreme weather events. This report provides examples of pathways to address key gaps in the current Australian construction code and associated standards which will be critical in bolstering the resilience of new homes in the face of more severe cyclones (*see Table One)*. While this report focuses on addressing gaps for new builds, some of these recommended changes will be relevant for retrofitting existing homes.

Introduction

The total cost of cyclones since ICA records began in 1967 is $23 billion. Cyclone Tracy in 1974 was the most destructive event, incurring insured losses of $5.5 billion (normalised to 2017 values).

Queensland, Western Australia and the Northern Territory currently bear the brunt of cyclone damage costs. Tropical cyclones cause devastating damage to property, communities, and livelihoods. The risk of damage attributed to tropical cyclones is on the rise in Australia as tropical cyclones will likely become more severe, driven by a changing climate.[1] While the frequency of tropical cyclones may decline or stay constant as the climate warms, the number of severe tropical cyclones is expected to increase. The impact of tropical cyclones are likely to move southwards as the oceans warm.

At present no region in Australia is uninsurable. However, as the frequency and severity of extreme weather events increase it is possible some regions may become difficult to insure in the future unless governments invest in appropriate physical mitigation and adaptation strategies.

Community resilience to tropical cyclones can be strengthened by improving building codes and construction quality, this will also play a critical role in keeping Australia insurable. This study focuses on modern homes built post-2000, however it's important to note older houses may also need to be retrofitted to better protect Australians. The vulnerability of older construction to tropical cyclones is already well documented[2] and understanding the resilience of modern housing stock, built to existing standards and national construction codes, will help to inform the improvement of current standards and codes. For example, embedding resilience into the National Construction Code (NCC) will be an essential step to ensure we have resilient houses in a climate changed future.

To explore the solution to this growing challenge, the Insurance Council of Australia (ICA) commissioned James Cook University Cyclone Testing Station in association with Risk Frontiers, to identify key issues affecting modern housing during tropical cyclone events, and to make recommendations that would improve Australia's resilience against tropical cyclones now and in a changing climate.

This study focused on the performance of modern (post-2000) residential construction impacted by a tropical cyclone. The study leveraged industry-wide policy and claim data from recent impacts in North Queensland (including Tropical Cyclones Yasi, Marcia and Debbie that had a combined total claims cost of $3.83 billion, normalised to 2017 values).

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[1] Bruyere et al. (2019) Severe weather in a changing climate. IAG & NCAR. Accessed at: Severe Weather in a Changing Climate (iag.com.au); Climate Measurement Standards Initiative (CMSI) Scenario analysis of climate-related physical risk for buildings and infrastructure: climate science guidance. Accessed at 5f5c2f4cb000cab9c03025d8_CMSI - Climate Science Technical Summary.pdf (webflow.com)

[2] James Cook University Australia. Cyclone Testing Station; Technical Reports and Damage surveys. Accessed at Technical Reports - JCU Australia

Modern houses in North Queensland coastal areas are required to be designed to the wind loading provisions in the Australian standard AS4055 “wind loads for houses” and should therefore be expected to withstand Category 4 winds (wind region C). It should be noted that the analysed cyclones did not produce winds that exceed the design limits for the areas studied and therefore, widespread structural damage should not be expected.

In addition to the Cyclone Testing Station and Risk Frontiers study, this report also draws on additional insights from a damage report prepared by the Cyclone Testing Station following Tropical Cyclone Seroja that impacted Western Australia and provides critical data on the performance of modern construction in wind region B. This data is particularly relevant for the coastal areas of South East Queensland and North East New South Wales that fall under the same wind region but is a significantly larger and growing population.

This report draws on both of these studies to develop a set of recommendations that highlight both the specific gaps in relevant Australian Standards and an approach to address these gaps (see **Table 1**).

Outcomes from the investigation

The key issues from both the Cyclone Testing Station and Risk Frontiers study, CTS Cyclone Seroja damage report and additional ICA analysis can be summarised into four issue areas:

- **Issue 1: The Australian Building Code and Standards focus on life safety but do not provide adequate protection against loss of building functionality. Resilience against non-structural damage should also be incorporated.**
- **Issue 2: Building standards require strengthening in wind region B**
- **Issue 3: Older Housing**
- **Issue 4: Data and Risk Assessment Gaps**

Issue 1: The Australian building standards do not provide adequate protection against building damage

The report detailed that modern homes experienced significant damage at wind speeds below the minimum design standard defined in Australian National Construction Code (NCC) and Standards, during recent tropical cyclones. Unless significant changes are made to design method and criteria, the impact (and losses) from these events in Australian communities will remain high and will increase with a changing climate.

Despite winds being less than the minimum wind load design level in the events investigated, approximately 1 in 5 homes made claims. Most claims were for non-structural damage: interior linings, water ingress, debris damage, ancillary items (e.g. carports, sheds, etc.). For properties which experienced close to design wind speeds of 70 m/s within Region C, over 50% of modern properties filed some form of insurance claim. The study noted:

- This non-structural damage can still render properties uninhabitable and the wider community dysfunctional for a long period of time.
- Some structural failures were apparent at wind speeds estimated as low as 40 m/s. These structural failures were a key driver of overall losses.

- Lack of compliance with the NCC and relevant standards was sometimes identified as a driver of structural failure.

Recommendations:

- **That the federal and state governments prioritise resilience as a principle underpinning design standards within the Australian building code.** The National Construction Code should be uplifted to consider resilience in addition to life safety. This would require performance criteria and objectives with a focus on the building's functionality post-event. In addition to strengthening standards, it is also essential that governments ensure that building design and work meets minimum standards and requirements.

- **Update the building code to address the issue of water ingress.** Water ingress was found to be a key driver of damage and common for homes with zero or minimal envelope damage. At least 1 in 5 (20%) of modern homes affected by a tropical cyclone were found to have some form of water ingress damage regardless of wind speed. Once wind speeds exceed 35 m/s, at least 40% of homes will have water ingress. These findings demonstrate the value of insurance data in this study, as interior damage from water ingress is often difficult to detect from outside the building during damage surveys and the cost and extent of disruption data is primarily available via the insurance industry.

- **A public awareness campaign promoting regular maintenance regimes** on important features (e.g. roof condition, effective flashing, restraint of aerials, etc.).

- **Expanding "rated" (testing initiatives, rating against a resilience standard, and potentially certified) components of buildings.** As a positive finding, the Cyclone Testing Station found that the strength rated components of the building (windows, garage doors, cladding) when installed correctly performed well. This reinforces how effective the building code can be when the appropriate performance criteria are used and correctly applied and constructed. The recommendation is to extend the rated components to other aspects of the building, for instance, guttering, doors and water penetration resistance for windows.

Issue 2: Building standards require strengthening in wind region B

While the report focused on Wind Region C in North Queensland, Wind Region B is also exposed to tropical cyclone impacts. Severe Tropical Cyclone Seroja impacted the town of Kalbarri in Wind Region B in Western Australia in May 2021. Despite not generating wind gusts above the design levels in the building code, this event caused devastating damage with latest industry claims totals of $306M. Damage surveys by CTS and the Western Australian government found that the high degree of damage was attributable to structural failures associated within internal pressures, for which houses in Region B are typically not designed. In simple terms if a house experiences damage to an external opening such as a window, door or garage door in a tropical cyclone, it experiences a sudden positive internal pressure, which combined with the large uplift pressures on the roof overload the minimal tie down components resulting in roof failure. Region C has more stringent roof tie downs than those required in Region B.[3]

[3] James Cook University Australia (June 2021). Tropical Cyclone Seroja Damage to buildings in the Mid-West Coastal Region of Western Australia. Cyclone Testing Station. Accessed at Microsoft Word - 210603 Draft TC Seroja Report.docx (jcu.edu.au)

Recommendations:

- That internal pressure considerations be included in the Australian standard for Region B.
- That household resilience programs be extended into Region B. (e.g. STC Seroja Recovery and Resilience Grant and Queensland Government's Household Resilience Program).[4]

[4] Government of Western Australia. Cyclone Seroja Recovery Grant. Accessed at STC Seroja Recovery and Resilience Grant - Department of Fire and Emergency Services, Western Australia (smartygrants.com.au); Queensland Government. Household resilience program. Accessed at: Household Resilience Program | Homes and housing | Queensland Government (www.qld.gov.au)

Table 1: The following table has been produced as an outcome of both the above ICA-led analysis and other published studies from JCU Cyclone Testing Station. It identifies some pathways to address identified damage drivers, the specific sections of the NCC and associated standards as well as the industry bodies where engagement and solutions can be developed. As such, this table provides examples of collaborative works to investigate address gaps in current standards to achieve greater resilience to cyclones going forward. While the table is focussing on addressing gaps for new builds, some of these changes will be relevant for retrofitting schemes of existing building stock.

Resilient building issue	Relevant to	Mechanism	Damage (loss)	Relevant Standards	Engage with
Wind Driven Rain Water Ingress	Home, strata, commercial	Rain via windows, doors, skylights, etc from low design requirements and implementation	Damage to wall linings, floors, electrical, etc	NCC Vol 1 and 2, AS2047, etc (Wind regions C and D)	AGWA (Aust Glass and Window Assoc), MBA, HIA, MRCAA (Metal Roofing and Cladding Association of Australia)
	Home, strata, commercial	Rain via drainage, roof, flashings from low design requirements and implementation	Ceiling collapse, damage to electrics, wall linings, floors, cabinetry	NCC Vol 1 and 2, HB39, etc (Wind regions C and D)	MRCAA, MBA, HIA,
	Home, strata, commercial	Rain via no secondary line of defence	Loss of ceilings, internal fixtures and contents	NCC Vol 1 and 2, AS2049, AS2050 (Wind region B)	ARTA (Aust Roof Tile Assoc)
Structural integrity for Region B	Home, strata, commercial	For buildings not designed for a sudden dominant opening	Major damage to roof structure	NCC Vol 1 and 2, AS/NZS1170.2, AS4055 (Wind region B)	ABCB, SAA
Stronger sheds	Home, strata, commercial	Minimum criteria applied in design	Damage to structure from failure of doors, etc	NCC Vol 1 and 2, AS/NZS1170.2, AS4055	ASI, ShedSafe

Issue 3: Housing built prior to the 1980s

While the technical report commissioned by the ICA focused on modern housing, properties built before this time have an elevated risk to structural damage from tropical cyclones. The effective mitigation measures for older properties (particularly buildings built prior to 1980s), include retrofitting their roof structural components closer to the modern standard.[5] In addition, all homes, as they age, require ongoing maintenance to ensure that all the components (cladding, windows, tie downs etc.) are up to the task of providing shelter during severe storms.

Recommendations:

- **That federal and state governments establish long term funding mechanisms for tropical cyclone household resilience priorities.** The insurance industry recommends that household resilience schemes such as the North Queensland Household Resilience Program should be continued, and that future schemes should be further refined and targeted to specific periods of construction (e.g. post 1980, 1980-2000, 2000 onwards). The value of targeted resilience retrofitting (e.g. rated glazing for water ingress) can be evidenced by insurers as this area of research evolves, thus ensuring optimal outcomes for public expenditure. Resilience programs can also help to reduce premiums, for example the North Queensland household resilience program contributed to a 7.8% average insurance company premium saving.[6]

Issue 4: Data and Risk Assessment

Throughout the course of the project key data issues were identified which need to be addressed in order to improve both the national picture of cyclone risk and how we can strengthen building codes and standards accordingly.

The first challenge is that a lack of wind observation records impeded analyses of the performance of buildings in tropical cyclones. The sparseness of the wind observational network means that very few automatic weather stations measure the peak gust in our communities or measure winds at regular spatial intervals to enable an appropriate reconstruction of the wind footprint. While the JCU Cyclone Testing Station has a small mobile anemometer program (Swirlnet), longer term funding is required to establish a more complete observational network.

Secondly, as the National Construction Code and wind loading standards have been refined over time, there are important regional and site classification requirements that need to be understood (“as built” conditions) when analysing the performance of buildings. However, these fundamental step changes in engineering design and codes, together with site classifications are not readily available for either the building owner, insurer, or emergency services. Instead, Insurers rely on the building owner to provide these details which can be unknown, incomplete, or inaccurate. It is therefore recommended that these details are captured in an asset register to allow for easy access by key stakeholders.

Recommendations:

- **Investment in Observation Networks for Event Monitoring:** More fixed and mobile weather stations should be funded on an ongoing basis to ensure key data is gathered.

- **Post-event hazard footprints:** establish and maintain an Australian Historical Tropical Cyclone Footprint database that represents the wind speeds experienced on land.

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[5] James Cook University (2015). Suncorp Group Limited: Cyclone Resilience Research- Phase II. Cyclone Testing Station. Accessed at JCU Cyclone Research Phase Report (suncorp.com.au); James Cook University Australia. Cyclone Testing Station; Technical Reports and Damage surveys. Accessed at Technical Reports - JCU Australia

[6] Queensland Government (17 June 2019). Queensland Household Resilience Program Supporting Queensland Strategy for Disaster Resilience.

- **Asset Register:** A nationally consistent asset register could assist in improving data quality regarding housing construction type, wall construction, roof type, year of construction, renovations and retrofitting works. This asset register needs to record “as built” conditions that provide valuable information on the vulnerability and resilience of a building. This could include data such as the wind modifier assumptions that are factored into the design, the year the building was constructed, when renovation occurred and details of any retrofitting or risk reduction including building beyond minimum standards. This information is essential for the owner of the home or future buyers as well as emergency services, insurers and banks.

The role of the insurance industry in building resilience

The general insurance industry has a key role to play in helping strengthen community resilience as extreme weather events become more frequent and severe.

Firstly, industry is uniquely placed to build a picture of the exposure and vulnerability of property and assets around the country by processing and aggregating insurance data in order to improve the risk awareness and risk intelligence of the community.

Secondly, working collaboratively to identify the drivers of risk and the solutions that will enable the creation of resilient homes will ultimately help to reduce the cost of damage and the volume of insurance claims in high-risk regions that are exposed to worsening extreme events. Both measures offer benefits for industry and communities, contributing to building a stronger and insurable Australia.

Finally, this work supports a series of government enquires over the last four years, from the Building Confidence Report and Royal Commission into National Disaster Arrangements to the Northern Australia Insurance Inquiry, all of which have made recommendations about funding projects and initiatives to create more resilient homes, including insurer-recognised retrofitting, build back better initiatives and hazard reduction.

Insurers recognise the importance of supporting these types of initiatives with industry data and knowledge and have demonstrated ability to collaborate.

To develop resilient homes, industry and government must consider and act across the whole housing supply chain, from land release through the development and build, to the whole of life operating costs of a home. Current and future natural hazard risk must be assessed and managed at each stage of the housing life cycle, including:

- Land use planning
- Development
- Planning, Design and Approval
- Construction (Upfront building costs)
- Expected costs of damage and loss of amenity over the life of the home
- Maintenance and durability
- Emergency response
- Local, regional, national economic costs

The Insurance Council of Australia (ICA) has worked with a range of stakeholders including the Master Builders Association (MBA), Queensland Fire and Emergency Services (QFES), the Australian Building Codes Board (ABCB), and The Green Building Council of Australia (GBCA) to support resilient homes initiatives.

In addition, the ABCB is aligned with global building code bodies through the CANZUS[7], to develop codes that take account of future risk. Each has its own definition and interpretation of resilient homes; there is a need to land on a national definition so that it can be measured and monitored over time, insurers measure resilient homes in terms of cost of damage.

This study makes clear that modern houses are not resilient to the tropical cyclone hazard of today. Whilst modern houses conform to the life safety aspects of the National Construction Code, they are not resilient to the damaging impacts of tropical cyclones. The National Construction Code needs to consider future risk. As the climate changes and severe weather events become more frequent and intense the NCC should drive a built environment that is fit for facing up to the weather of the future.

Future building codes and standards need to include a principle of resilience; a principle of property protection and give due regard for strength and durability of buildings. There is also a latent issue with legacy housing stock as older houses will need to be retrofitted to protect Australians and avoid the damage, loss and disruption that will inevitably be caused by brittle buildings in the path of extreme weather events.

Claims that parts of Australia will inevitably become uninsurable or unaffordable due to climate change fail to recognise that mitigation and adaptation can prevent some of the worst impacts of extreme weather.

At present no region in Australia is uninsurable. However, it is possible some regions may become difficult to insure in the future unless governments invest in appropriate physical mitigation and adaptation strategies. Implementation of stronger building codes, improved land-use planning and permanent physical mitigation measures, where necessary, will be key to ensuring an 'Insurable Australia'. Australian communities should be encouraged to lower risks and take practical action.

[7] CANZUS, Global Resiliency Dialogue. Accessed at https://www.iccsafe.org/advocacy/global-resiliency/

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We believe an insurable Australia is a resilient Australia – and it's our purpose to be the voice for a resilient Australia.

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