Cyclone damage in Queensland, 2009

Key Topics:

- cyclone [2]
- engineering [3]
- mitigation [4]

Improving the resilience of existing housing to severe wind events [5]

This study identified vulnerable legacy house types across Australia and developed cost-effective retrofits for mitigation damage during windstorms. These evidence-based strategies will aid policy formation and decision making by Government and industry, and provide guidelines detailing various options and benefits to homeowners and the industry for retrofitting typical at-risk houses in Australia. The final report presents an overview of the research approach used for this project including the selection of house types, the development of the Vulnerability and Adaptation to Wind Simulation software and the Internet-based guidelines, Weather the Storm.

## Project: detail Notabs

## Research team

## Research leader

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## Description

The primary objective of this study was to identify vulnerable legacy house types across Australia and develop cost-effective retrofits for mitigating damage during windstorms. These evidence-based strategies will (a) aid policy formulation and decision making by Government and industry, and (b) provide guidelines detailing various options and benefits to homeowners and the industry for retrofitting typical at-risk houses in Australia.

The final report presents an overview of the research approach used for this project including the selection of house types, the development of the VAWS software and the Internet-based guidelines. A case study is presented of the vulnerability and benefit cost assessment of one of the selected house types, with the complete set of results presented in the Appendices. These results show that tile roofed houses in cyclonic regions of Australia benefit the most from retrofitting for severe wind events. The benefit-cost ratios for these tile roof houses and other house types are expected to improve when accounting for intangible costs, which are currently not included in the analyses presented in this report. In addition, examples of the impacts and utilisation of this project including the Queensland Government Housing Resilience Program are also presented.

Read the final report here. [33]

## Related News

22 APR 2021

New online – April 2021

MULTI-HAZARD, RESILIENCE

[34]


25 JAN 2021

New website to keep the roof over your head

CYCLONE, ENGINEERING

[35]


25 SEP 2020

New online - September 2020

EMERGENCY MANAGEMENT, FIRE

[36]


11 DEC 2019

Special edition Monographs share AFAC19 science

EMERGENCY MANAGEMENT, LAND MANAGEMENT

[37]

09 DEC 2019

Homes can be better prepared for cyclones. But first we must convince the owners

COMMUNICATION, CYCLONE

[38]


09 OCT 2019

New online - October 2019

EMERGENCY MANAGEMENT, ENGINEERING

[39]


08 OCT 2019

CRC backed program receives state award

CYCLONE, EMERGENCY MANAGEMENT

[40]


09 AUG 2019

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COINCIDENT EVENTS, FORECASTING

[41]


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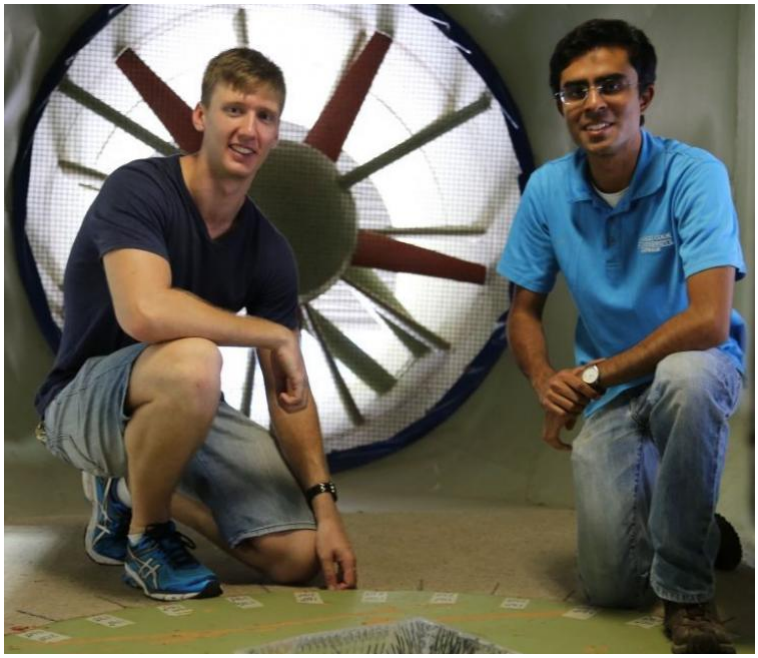
New online - April 2019

CYCLONE, EARTHQUAKE

[42]



11 JAN 2019

Student cyclone interest up north

CYCLONE, MITIGATION

[43]


18 DEC 2018

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EMERGENCY MANAGEMENT, MODELLING

[44]

12 DEC 2018

Strength in the face of high winds

CYCLONE, ENGINEERING

[45]

07 DEC 2018

Preparing for the future focus of magazine

CYCLONE, EMERGENCY MANAGEMENT

[46]

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CYCLONE, MITIGATION

[47]

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[48]

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CYCLONE, MITIGATION

[49]


20 JUL 2018

Multi-disciplinary approaches to natural hazards science unpacked

CYCLONE, RESILIENCE

[50]

01 JUN 2018

Making a difference

FIRE, RISK MANAGEMENT

[51]


31 MAY 2018

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COMMUNITIES, DECISION MAKING

[52]

18 DEC 2017

Strength in the face of high winds

CYCLONE, ENGINEERING

[53]

20 NOV 2017

Cyclone research briefings underway

COMMUNICATION, CYCLONE

[54]


17 NOV 2017

New online - November 2017

[55]


08 NOV 2017

Research featured in Journal

EMERGENCY MANAGEMENT, MULTI-HAZARD

[56]

19 OCT 2017

Harvey damage assessed by team

CYCLONE, ENGINEERING

[57]

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CYCLONE, ENGINEERING

[58]


31 AUG 2017

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CYCLONE, ENGINEERING

[59]

19 APR 2017

Science to show impact of Cyclone Debbie

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[60]


29 MAR 2017

Measuring Debbie

CYCLONE, ENGINEERING

[61]

07 DEC 2016

Researchers test tropical cyclone deployment strategies

CYCLONE, ENGINEERING

[62]


26 OCT 2016

Journal publishes important research

[63]


13 OCT 2016

New online - October 2016

[64]


16 AUG 2016

New online - August 2016

[65]

20 JUL 2016

Failures on re-roofed houses

CYCLONE, EXPOSURE

[66]

17 MAY 2016

Videos highlight research benefits

COASTAL, INDIGENOUS COMMUNITIES

[67]

25 JAN 2016

Earthquake and wind testing in Adelaide

CYCLONE, EARTHQUAKE

[68]


24 APR 2015

House Upgrades in the Wind

CYCLONE, INFRASTRUCTURE

[69]


24 APR 2015

CRC magazine details research

ENGINEERING, FIRE WEATHER

[70]


15 APR 2015

Cyclones provide important data

COASTAL, CYCLONE

[71]

11 DEC 2014

You can help wind research

CYCLONE, SEVERE WEATHER

[72]

## Publications

| Year | Type | Citation |
|---|---|---|
| 2021 | Report | Ginger, J. [6] *et al.* **Improving the resilience of existing housing to severe wind events - final project report** [33]. (Bushfire and Natural Hazards CRC, 2021). Google Scholar [73] BibTeX [74] EndN |
| 2020 | Report | Parackal, K. [15] *et al.* **Improving the resilience of existing housing to severe wind events: annual report 2019-2020** [76]. (Bushfire and Natural Hazards CRC, 2020). Google Scholar [77] BibTeX [7 |
| 2019 | Book Chapter | Krupar, III, R. [80] & Smith, D. J. [81] *Hurricane Risk* **1,** 199-214 (Springer, 2019). DOI [82] Google Scholar [83] BibTeX [84] EndNote XML [85] |
| 2019 | Conference Paper | Parackal, K. [15] *et al.* **Modelling the vulnerability of a high-set house roof structure to windstorms using VAWS** [86]. *Bushfire and Natural Hazards CRC Research Day AFAC19* (2019). at <https:/ |
| 2019 | Report | Ginger, J. [6] *et al.* **Improving the resilience of existing housing to severe wind events - annual report 2018-19** [91]. (Bushfire and Natural Hazards CRC, 2019). Google Scholar [92] BibTeX [93] E |
| 2019 | Report | Parackal, K. [15], Ginger, J. [6], Leblais, A. [95] & Henderson, D. [8] **Rainwater ingress through residential sliding doors** [96]. (Bushfire and Natural Hazards CRC, 2019). Google Scholar [97] BibTeX |
| 2019 | Report | Parackal, K. [15], Ginger, J. [6], Wehner, M. [11] & Henderson, D. [8] **Retrofitting of a high-set Queensland house for wind loading** [100]. (Bushfire & Natural Hazards CRC, 2019). Google Scholar [1 |
| 2019 | Report | Henderson, D. [8], Smith, D. [13], Parackal, K. [15] & Ginger, J. [6] **Analysis of damage surveys of houses and preliminary input of VAWs** [104]. (Bushfire and Natural Hazards CRC, 2019). Google |
| 2019 | Report | Henderson, D. [8] *et al.* **Improving the resilience of existing housing to severe wind events in Australia Annual Report 2017-2018** [108]. (Bushfire and Natural Hazards CRC, 2019). Google Schola |
| 2019 | Report | Parackal, K. [15] *et al.* **Model for assessing the vulnerability of Australian housing to windstorms - VAWS** [112]. (Bushfire and Natural Hazards CRC, 2019). Google Scholar [113] BibTeX [114] En |
| 2019 | Report | Parackal, K. [15], Ginger, J. [6], Henderson, D. [8] & Wehner, M. [11] **Community benefits of roof upgrades** [116]. (Bushfire and Natural Hazards CRC, 2019). Google Scholar [117] BibTeX [118] Endl |
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| 2018 | Conference Paper | Henderson, D. [8], Smith, D. [13] & Ginger, J. [6] **Large damage bills to buildings from cyclones can be reduced by small actions** [125]. *AFAC18* (Bushfire and Natural Hazards CRC, 2018). Google |
| 2018 | Journal Article | Stewart, M. [129], Ginger, J. [6], Henderson, D. [8] & Ryan, P. [130] **Fragility and climate impact assessment of contemporary housing roof sheeting failure due to extreme wind** [131]. *Engineeri* |
| 2018 | Journal Article | Parackal, K. [15], Ginger, J. [6] & Henderson, D. [8] **Wind load fluctuations on roof batten to rafter/truss connections** [136]. *Journal of Wind Engineering & Industrial Aerodynamics* **175,** (2018). DOI |
| 2018 | Journal Article | Jayasinghe, N. [141], Ginger, J. [6], Henderson, D. [8] & Walker, G. [142] **Distribution of wind loads in metal-clad roofing structures** [143]. *Journal of Structural Engineering* **144,** (2018). DOI [144] G |
| 2018 | Report | Leblais, A. [95] & Henderson, D. [8] **Simulated wind load strength testing of soffits** [148]. (Bushfire and Natural Hazards CRC, 2018). Google Scholar [149] BibTeX [150] EndNote XML [151] |
| 2018 | Report | Leblais, A. [95] & Henderson, D. [8] **Simulated wind load strength testing of entrance doors** [152]. (Bushfire and Natural Hazards CRC, 2018). Google Scholar [153] BibTeX [154] EndNote XML [155 |
| 2017 | Journal Article | Smith, D. [13], Krupar, III, R. [80], Henderson, D. [8] & Mason, M. S. [156] **Analysis of rapid damage assessment data following severe windstorm events** [157]. *Australian Journal of Emergency M* |
| 2017 | Report | Kloetzke, T. [161] *et al.* **Severe wind hazard preliminary assessment: Tropical Cyclone Debbie, Whitsunday Coast, Queensland, Australia** [162]. (James Cook University, 2017). at <https://www.j |
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| 2016 | Conference Paper | Rumsewicz, M. [177] **Research proceedings from the 2016 Bushfire and Natural Hazards CRC and AFAC conference** [178]. *Bushfire and Natural Hazards CRC & AFAC annual conference 2016* (E |
| 2016 | Conference Paper | Harwood, J. [182], Smith, D. J. [81] & Henderson, D. [8] **Building community cyclone resilience through academic and community partnership** [183]. *AFAC16* (Bushfire and Natural Hazards CRC |
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| 2016 | Journal Article | Satheeskumar, N. [193], Henderson, D. [8], Ginger, J. [6] & Wang, C. H. [194] **Wind uplift strength capacity variation in roof-to-wall connections of timber-framed houses** [195]. *Journal of Architec* |
| 2016 | Journal Article | Leitch, C. J. [200], Ginger, J. [6] & Holmes, J. D. [201] **Wind loads on solar panels mounted parallel to pitched roofs, and acting on the underlying roof** [202]. *Wind and Structures* **22,** 307-328 (20 |
| 2016 | Journal Article | Smith, D. [13], Masters, F. J. [207] & Chowdhury, A. G. [208] **Investigating a wind tunnel method for determining wind-induced loads on roofing tiles** [209]. *Journal of Wind Engineering and Indus* |
| 2016 | Report | Smith, D. [13] *et al.* **Improving the resilience of existing housing to severe wind events: Annual project report 2015-2016** [214]. (Bushfire and Natural Hazards CRC, 2016). Google Scholar [215] E |
| 2015 | Conference Paper | Henderson, D. [8] & Ginger, J. [6] **Improving the Resilience of Existing Housing to Severe Wind Events Conference Paper 2014** [218]. *Bushfire and Natural Hazards CRC and AFAC Wellington Co* |
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| 2015 | Journal Article | Smith, D. [13], Henderson, D. [8] & Terza, L. M. [226] **Modelling cyclone loss mitigation using claims analysis** [227]. (2015). Google Scholar [228] BibTeX [229] EndNote XML [230] |
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| 2014 | Journal Article | Smith, D. [13], Masters, F. J. [207] & Gurley, K. R. [246] **An historical perspective on the wind resistance of clay and concrete roofing tiles** [247]. *RCI Interface* **32,** 22-35 (2014). Google Scholar [2 |

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| 19 Jun 2015 | Tropical Cyclone Olwyn Rapid Damage Assessment [268] | 790.15 KB | [269] (790.15 KB), engineering [3] |
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| 31 Aug 2017 | Fire Australia Issue Three 2017 [293] | 5.22 MB | [294] (5.22 MB), [295], prescribed burning [296], severe weather [263] |
| 07 Sep 2017 | Analysis of rapid damage assessment data following severe windstorm events [297] | 3.31 MB | [298] (3.31 MB), engineering [3], severe weather [263] |
| 31 Oct 2017 | Built environment cluster [299] | 713.22 KB | [300] (713.22 KB), mitigation [4], multi-hazard [273] |
| 01 Jun 2018 | Fire Australia Issue Two 2018 [301] | 6.73 MB | [302] (6.73 MB), [303], decision making [304], emergency management [30 |
| 19 Sep 2018 | Large damage bills (to buildings) from cyclones can be reduced by small actions [306] | 6.95 MB | [307] (6.95 MB), resilience [280] |
| 23 Nov 2018 | Improving the resilience of existing housing to severe wind events [308] | 3.32 MB | [309] (3.32 MB), modelling [262], resilience [280] |
| 05 Dec 2018 | Fire Australia Issue Four 2018 [310] | 4.99 MB | [311] (4.99 MB) |
| 30 Jul 2019 | Improving the Resilience of Existing Housing to Severe Wind Events [312] | 3.37 MB | [313] (3.37 MB), modelling [262], resilience [280] |
| 27 Aug 2019 | Improving the Resilience of Existing Housing to Severe Wind Events [314] | 3.51 MB | [315] (3.51 MB), severe weather [263] |
| 25 Nov 2020 | Strength in the face of high winds [316] | | cyclone [2], engineering [3], mitigation [4] |
| 17 May 2021 | Fire Australia Issue Two 2021 [317] | 11.74 MB | [318] (11.74 MB), emergency management [305], Northern Australia [320 |

# Posters


[321]

Improving the resilience of existing housing to severe wind events

[321]

Typically, older houses do not offer the same level of performance and protection during windstorms as houses...


[322]

Improving the Resilience of Existing Housing to Severe Wind Events

[322]

MITIGATION [4], RESILIENCE [280]

Many of us live in homes with vulnerabilities that contribute to community wind risk. This project aims to...


[323]

Improving the resilience of existing housing to severe wind events

[323]

INFRASTRUCTURE [272], RESILIENCE [280]

Many of us live in homes with vulnerabilities that contribute to community wind risk.


[324]

Internal pressure fluctuations in industrial buildings

[324]

INFRASTRUCTURE [272], RESILIENCE [280]

Internal pressures can contribute to a large portion of the net wind load on a building.


[325]

Improving the resilience of existing housing to severe wind events

[325]

CYCLONE [2], ENGINEERING [3]

This project aims to investigate windstorm risk mitigation by: (a) developing vulnerability models for...

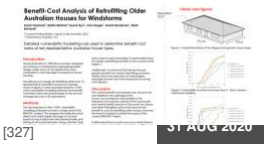

[326]

Improving the resilience of existing housing to severe wind events

[326]

CYCLONE [2], ENGINEERING [3]

This project aims to investigate and reduce damage from windstorms by developing vulnerability models for...




[327]

Benefit-Cost Analysis of Retrofitting Older Australian Houses for Windstorms

[327]

RESILIENCE [280], SEVERE WEATHER [263]

Key findings: Certain house types can benefit from retrofitting for severe wind events

# Linked Projects

**Cost-effective mitigation strategy for building related earthquake risk [328]**

BUILT ENVIRONMENT [329]

Prof Michael Griffith
University of Adelaide [330]

[330]

**Cost-effective mitigation strategy for flood prone buildings [331]**

BUILT ENVIRONMENT [329]

Dr Ken Dale
Geoscience Australia [10]

[10]

**Enhancing resilience of critical road infrastructure [332]**

BUILT ENVIRONMENT [329]

Prof Sujeeva Setunge
RMIT University [333]

[333]

**Natural hazard exposure information modelling framework [334]**

BUILT ENVIRONMENT [329]

Dr Krishna Nadimpalli
Geoscience Australia [10]



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