Cyclone Testing Station

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Nails almost through the panel – No meat left to resist the loads

Bracing panels

A widespread problem, the overdriving, and incorrect spacing and edge distance of nails or screws into bracing panels reduces the house's capacity to withstand wind storms.

Horizontal wind loads pushing on the house are transferred down to the foundations by the bracing panels. In other words, the bracing panels resist these sideways forces to keep the house standing.

Panel bracing works through diaphragm action, in that the bracing forces are transferred between the house frame and the panel via the nails. In resisting the wind loads, if some thickness of panel has been lost from crushing from overdriving, the panel ruptures with the nails bursting through the edge. Overdriving or not leaving enough edge distance will cause premature failure of the panel as there is not enough 'meat' left in the panel.

The bracing capacities contained within AS1684 and product design guides are all derived from tests where the fixings are installed as per the manufacturer's specifications (eg not overdriven).

An apparent fix for not overdriving using a nail gun involves setting the gun's depth adjustment (or for some guns buying and using the add-on depth adjustment fitting).

Please refer to the manufacturer's product data sheets for information on edge distances and correct fixing. **Remember a house is only as strong as its weakest link. Don't let it be you.**

Overdriven,
Too many and
Too close together.

Cyclone Ingrid

During March 2005, Cyclone Ingrid travelled across parts of Queensland, the Northern Territory and Western Australia before degenerating into a rain depression. The Bureau of Meteorology classified this cyclone as varying in intensity between Category 5 and Category 3 during its erratic path across the 3 states. Fortunately, most of Cyclone Ingrid's track was across sparsely populated areas and so the

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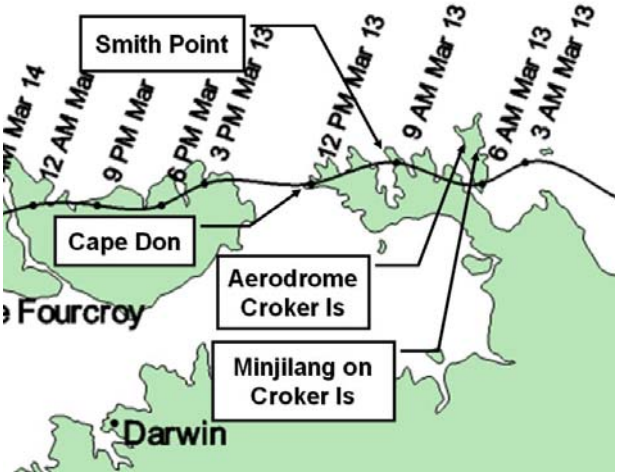
potential for damage to housing and infrastructure was quite limited.



Track of Cyclone Ingrid (from Bureau of Meteorology)

Cyclone Ingrid was classified as an extremely destructive Category 5 cyclone, prior to crossing the coast at Croker Island. The CTS investigation focussed on the small community of Minjilang, located on Croker Island. The CTS team also inspected structures at Coburg Peninsula.

Asbestos cement corrugated cladding scattered

As there was no wind speed measurement facilities near the town, estimates of peak winds need to be determined by calculating wind loads required to fail simple structures such as signs or hoardings. From analysing the few suitable structures available and an overall assessment of the damage, it is estimated that the peak gust wind speed impacting on Croker Island aerodrome was in the order of 65 to 70 m/s (250 km/h) at 10 m height in open terrain. In considering topography and terrain effects it is estimated that the peak wind speeds at 10 m height in Minjilang would have been in the order of 60 m/s (220 km/h).

This estimate of peak winds in open terrain correlates with the Bureau of Meteorology's reanalysis of Cyclone Ingrid at landfall on Croker. From their review of data they suggest that Ingrid was a Cat 4 system with wind gusts to 140 knots (260 km/h) when it impacted Croker Island.

The wind loading standard AS1170.2:1989 gives a strength limit state design wind speed of 70 m/s referenced at 10 m height in open terrain, for the cyclonic regions of the Northern Territory. The damage investigation estimated the peak wind speeds to be approaching this design value. This implies that structures designed to the wind loading standard should be structurally adequate for the wind forces generated from Cyclone Ingrid.

There were approximately 50 houses and buildings at Minjilang with the older houses to the North and the newer houses to the South. Of the 40 houses observed, only 25 % had sustained damage with partial loss of roof cladding through to loss of roof structure. The majority of the buildings performed well structurally. However all houses were subjected to water ingress, although the lack of linings such as plasterboard and carpets in the majority of the housing reduced the water ingress impact on those linings.

Majority of housing resisted wind loads

Typically housing that was constructed in the past several years survived with minimal structural damage from wind loads observed. Impact from wind driven debris, fallen trees, flashing loss and soffit loss was noted. One exception was a reinforced masonry block house that was built within the last couple of years.

Part of the roof had peeled back from the windward edge where there was incorrect rafter tie down.

Many of the failures observed were initiated from elements suffering severe corrosion. Correct specification and installation of materials along with ongoing maintenance is required for structures in cyclonic regions as it maybe many years until a severe cyclone impacts the building.

A highset fibro clad rectangular plan house suffered loss of roof cladding and battens. The battens to truss connections were; corroded, missing or inadequate (nailed). There was severe corrosion of the straps along the exposed eaves. A 3m x 3m section of the house's roofing with battens attached was found 200 m to the SE.

Even though observed damage levels were far lower than that from Cyclone Tracy, wind driven debris still posed a threat.

Roller door failures were noted. Along with damage to houses from attachments such as large awnings failing and smashing the house.

Overall, the buildings performed well for the wind speeds endured. This reflects achievements since Cyclone Tracy. However it should be expected that the houses should are structurally adequate as the impact wind speeds were estimated to be less than the design wind speed. Where failures from wind forces (not falling trees) were observed they were associated with older buildings that had not been upgraded, or

corrosion of fixings, or incorrect construction practice on newer structures. Therefore we need to keep an eye on the detail to ensure that our houses and buildings can provide us shelter.

Recommendations:

- Specify and use appropriate materials suitable for the site exposure conditions.
- Undertake regular inspection and maintenance of housing, especially the structural components.
- Ensure strength upgrades are completed on all structural components of the wind load resistance system. This includes the batten to truss/rafter connection.
- Use water resilient internal linings, if practical.
- Review (& upgrade strength if needed) storm resistance of Automatic Weather Stations.

The authors gratefully acknowledge the support given by the NT Department of Infrastructure Planning and Environment and for arranging access and providing transport to the Coburg Peninsular and Croker Island. The authors are extremely grateful to all the residents who generously assisted this study by volunteering information, answering questions and inviting the authors into their houses to inspect damage.

The CTS report TS50 'Damage of buildings at Minjilang, Cape Don and Smith Point in NT following Cyclone Ingrid' can be ordered from our website.

Wind Workshop – 2 day short course

The CTS is planning a two day short course on wind engineering, 24-25 August 2006. Leading experts Dr. John Holmes, Prof Geoff Boughton and Dr John Ginger will provide intensive sessions on wind engineering theory and background to the Wind Load Standard, AS/NZS 1170.2 to give participants the tools to fully utilise the Standard. Hands on tutorial sessions on low rise and high rise building geometries will be run to highlight the conservative and sometimes unconservative areas of the Standard. The course will be directed toward structural engineers, designers and other professionals involved with wind loads and windstorm resilience. Talks will also focus on wind induced fatigue, internal pressures and findings from damage investigations. Demonstrations of wind tunnel testing, wind driven debris impact and fatigue loading of cladding in the airbox facility will be run.

Please register your interest by sending an email to john.ginger@jcu.edu.au

Help set CTS Research directions

In order to identify future research, the Cyclone Testing Station is keenly interested in understanding the current issues associated with BCA approvals, possible non-conformance both on site and in relation to proprietary product testing and supporting data.

A short questionnaire has been placed on the CTS web site. There is the opportunity on the electronic form for you to raise other issues you would like the CTS to explore (eg ongoing concerns on existing or new products or construction techniques, etc)

Your assistance would be greatly appreciated in filling out this short questionnaire.

Display at ABCB conference

The CTS had a well attended display at the National ABCB conference at the Gold Coast in Sept 05. By having many different samples of tested building materials, we were able to demonstrate and inform the attendees of the importance of testing, specification and correct installation.

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