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Investigation of housing and sheds in Proserpine, Midge Point and Airlie Beach, following Tropical Cyclone Ului

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Cyclone Testing Station
School of Engineering and Physical Sciences
James Cook University
Queensland, 4811, Australia

www. jcu.edu.au/cts

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TECHNICAL REPORT NO. 56

Investigation of housing and sheds in Proserpine, Midge Point and Airlie Beach, following Tropical Cyclone Ului

By

D. Henderson, C. Leitch, U. Frye, J. Ginger, P. Kim and N. Jayasinghe

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Summary

Tropical Cyclone Ului crossed the coast in the early hours of 21 March 2010 with its eye passing over Proserpine. The cyclone path was across the islands of the Whitsunday group,

2. Wind speeds

The intensity of cyclones is usually expressed in terms of the strongest gusts likely to be experienced, which is related to the central pressure, and structure of the storm system. The Bureau of Meteorology uses the five-category system shown in Table 2.1 for classifying tropical cyclone intensity in Australia.

Table 2.1: Australian tropical cyclone category scale

Cyclone Category	Gust Wind Speed at 10 m height in flat open terrain			Central Pressure
	km/h	knots	m/s	hPa
1	90 - 125	49 - 68	25 - 35	990
2	125 - 164	68 - 89	35 - 46	970 - 985
3	165 - 224	89 - 121	46 - 62	950 - 965
4	225 - 279	121 - 151	62 - 78	930 - 945
5	> 280	> 151	> 78	< 925

Residents in Proserpine reported that the eye of the cyclone passed over their homes, lasted about an hour and there was a complete change of wind direction.

A first hand detailed account from a Proserpine resident about the timeline for passage of the eye (he was in his home in Fuller St), is as follows;

- Before the eye, wind coming from the South (hand held anemometer with reading of 115 km/hour).
- Sunday 21 Mar, at 2:10AM, no wind at all.
- At 3:15AM, the wind came back, “very gusty”, blowing from the North.
- About 4:15AM wind even stronger and “more steady”
- About 6:30AM, very quiet, “No wind”

Cantilevered road signs provide a means of obtaining a measure of the spatial variation of gust wind speeds in the surveyed areas. These signs are generally flat plates that are attached to one or two cantilevered posts and located in exposed flat terrain adjacent to the road. The wind loads acting on these plates can be calculated and upper (U) and lower (L) bound wind speeds from signs that were bent-over, shown in Figure 2.3, and those that remained upright, as described in the CTS report on TC Larry (Henderson et al 2006, Ginger et al 2007).

Basic analysis of cantilevered road signs and qualitative assessment of damage, suggest gust wind speeds in the order of 140 k/hr in Proserpine and Airlie Beach to approximately 160 k/hr (45 m/s at 10m height in open terrain), in the vicinity of Midge Point, as shown in Figure 2.4. The Bureau of Meteorology states that the larger gust wind speeds measured at Hamilton Island resulted from the enhanced exposure of the site.

Figure 2.3: Bent road signs and measurement of pipe dimensions

Figure 2.4: Estimate of wind speeds and direction

2.2 Design wind speeds

The Australian Building Codes Board (ABCB) publishes the Building Code of Australia (BCA 2009) which stipulates design parameters for the majority of buildings in Australia. These requirements are met by compliance with a range of Standards relating to building construction (e.g. AS/NZS1170.2 (Standards-Australia 2002)). Codes and standards have been used in the design and construction of en which was in widespread use by the mid 1980s. This required homes to be categorised by site design wind speed at eaves height, and it contained deemed to satisfy detailing for the different categories.

There were many reports of water ingress via undamaged doors, sliding door/window tracks,

Figure 3.2: roller door failure

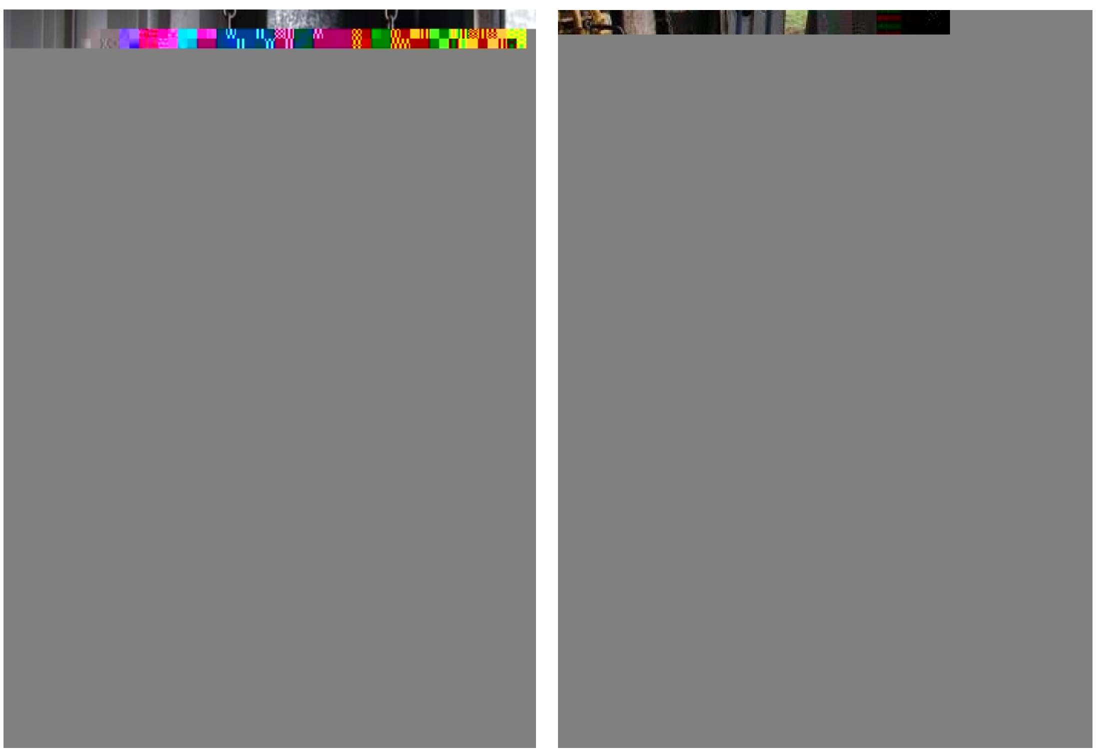

Figure 3.3: Steel wire rope and turnbuckle used to support roller doors

3.3 Older construction

Less than 10% of the surveyed older houses, that were built at least 40 years ago, suffered significant structural damage, due to the wind loads, typically the loss of roof cladding and roof structure.

In these few instances the failure typically originated at the batten to rafter connection with the nailed connections not having sufficient load carrying capacity. Figure 3.4 and Figure 3.5 show loss of roof structure (cladding and battens) caused by failure of batten to rafter nail connections. The battens were nailed to the trusses or rafters, with only one nail at some batten to rafter joints. Examples are shown in Figure 3.6 and Figure 3.7.

The current timber framing standard AS1684.3 (2006) details batten screws or galvanised straps for the batten to rafter connections for the edge zones of a metal clad roof. In some

Figure 3.6: Roofing screwed to battens but insufficient strength at batten to rafter connections

Figure 3.7: Insufficient capacity at batten to rafter joint

Figure 3.8: Loss of cladding, battens and rafters showing skew nails and strap at top plate

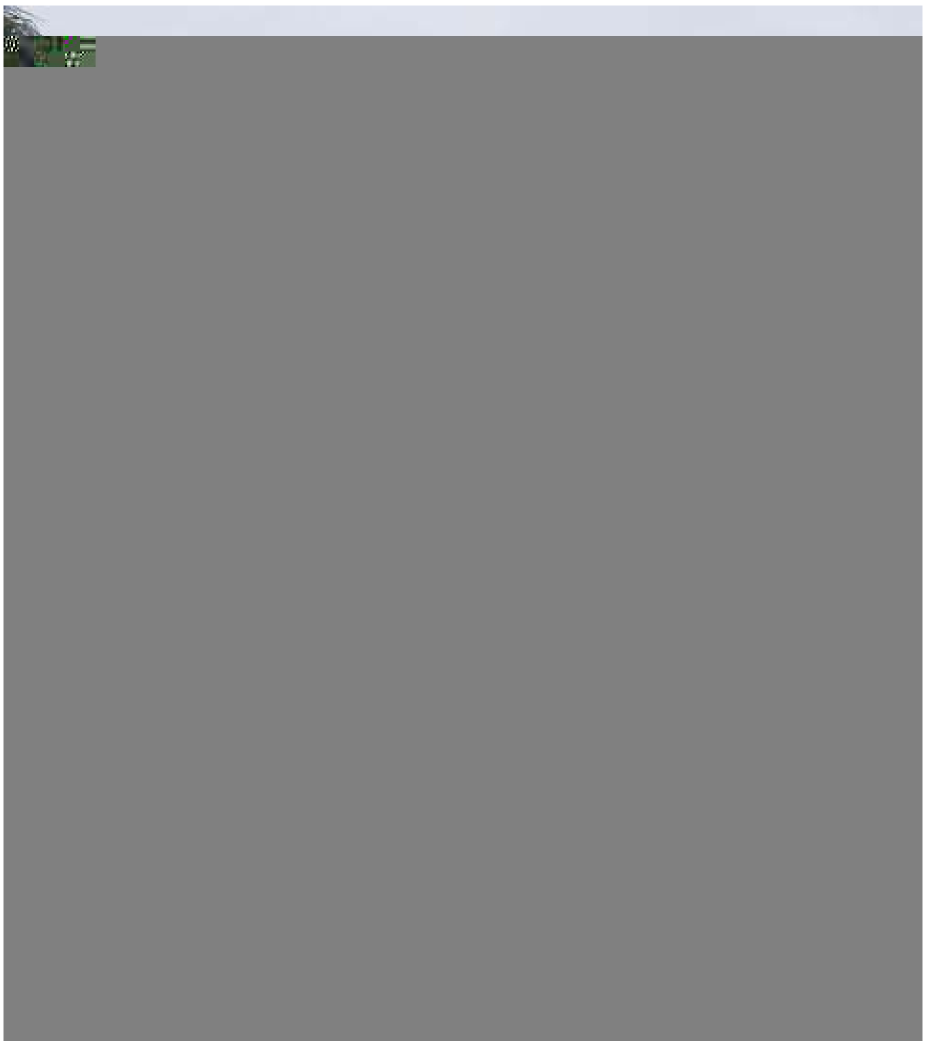

Figure 3.9: Failure of under strength batten connection followed by tearing of cladding

4. Damage to commercial/industrial properties

The Proserpine Sugar Mill lost a significant portion of the roof to one of its older mill buildings, as shown in Figure 4.3. CTS inspectors spoke to staff from the mill, on the day after the cyclone struck and were allowed to take photographs of the failure from outside the building but not able to conduct a closer insp

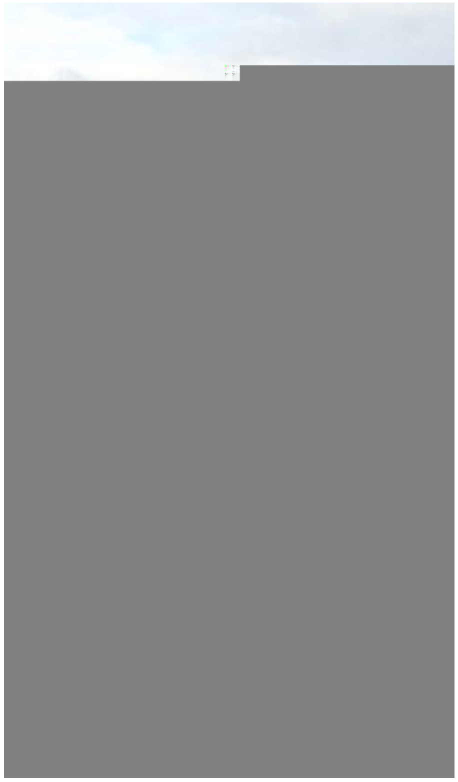

Figure 4.10: Examples of failure of signage elements

5. Other types of damage

5.1 Attachments and ancillary elements

Inadequate design and attachment of elements such as fascias, guttering and awnings can lead to damage to structure, increased water ingress and contribute to wind borne debris. Loss of gutters and down pipes was observed, as shown in Figure 5.1 and Figure 5.2. Figure 5.3 shows a failed solar hot water panel.

Figure 5.1: Loss of guttering and downpipes

Figure 5.6: Failed roof cladding 60m downwind of shed

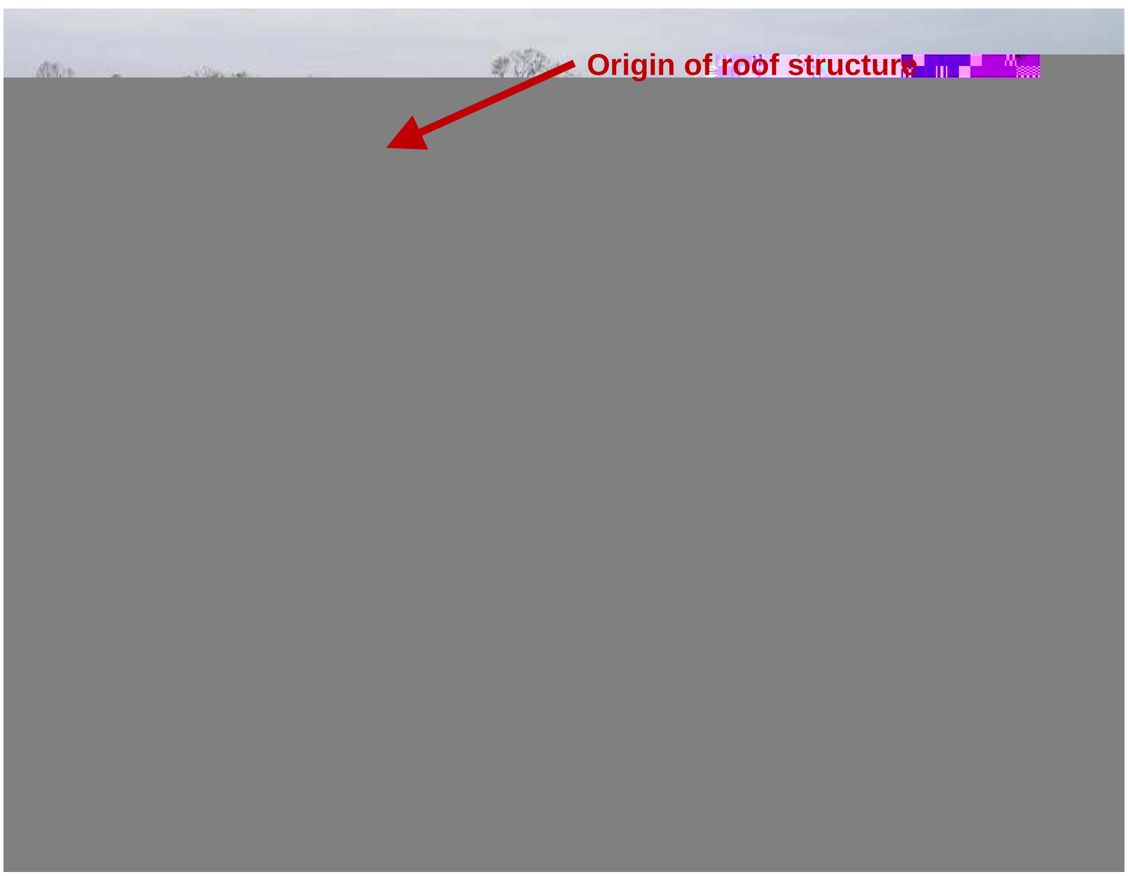

Figure 5.7: Loss of majority of roof blown over 200m downwind (From the house shown by arrow)

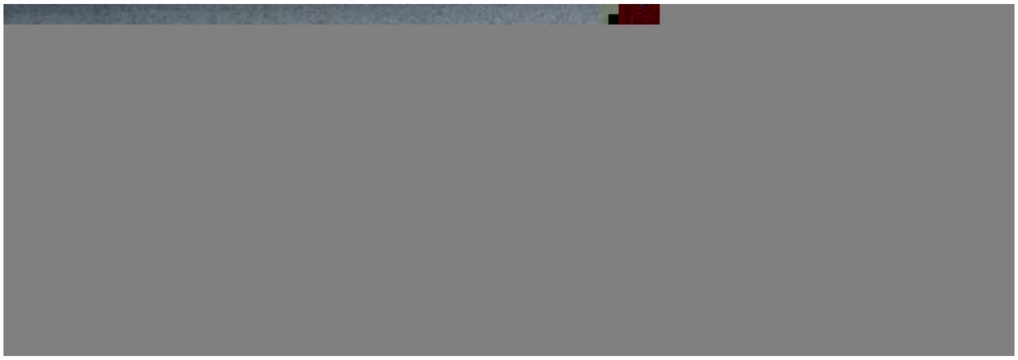

Figure 5.9: Corrosion in cladding adjacent to screw

Figure 5.10: Severe corrosion of cladding

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