CYCLONE TESTING STATION

SCHOOL of ENGINEERING and PHYSICAL SCIENCES

James Cook University

ADDENDUM TO REPORT NO. TS868

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Simulated Windborne Debris Impact Testing of Astroguard Impact Protection Screen Assembly System

By

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For

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1 Introduction

This addendum to the original CTS report No. TS868 is to document the results from additional simulated windborne debris impact testing of *Astroguard* impact protection screen assembly system, provided by *Cyclone Protection Australia.* This addendum is to be used in conjunction with CTS report No. TS868 dated 12 October 2012, but not replace CTS report No. TS868. The test screen assemblies were tested in accordance with the debris impact test criteria specified in *AS/NZS1170.2*:*2011*. The testing was performed with the use of new test materials, supplied by the client.

The impact tests were conducted using the air cannon located in the CTS Building Research Facility at James Cook University.

2 Test Program

As per CTS report No. TS868 dated 12 October 2012.

Four additional windborne debris impact tests were conducted. A summary of the additional test program is provided in Table 3.

Table 3: Additional test Program Summary

Test No.	Overall Screen Size (mm)	Frame Material	Missile	Impact Location	Target Impact Velocity (m/s)
I5	1800 × 2100	Steel	4 kg timber member with 100 × 50 mm cross-section	Geometric Centre	28.0
I6	1200 × 1500				18.0
I7	2100 × 3000	Timber			28.0
I8	1200 × 2100				28.0

3 Astroguard Screen, Clips, Fasteners and Support Frame

3.1 Astroguard Screen

As per CTS report No. TS868 dated 12 October 2012.

3.2 Clips

As per CTS report No. TS868 dated 12 October 2012.

In addition for Trials I5 to I8 the clips were spaced at 300 mm centres around the perimeter of the test specimen.

3.3 Fasteners

3.3.1 Clip Fasteners

As per CTS report No. TS868 dated 12 October 2012.

3.3.2 Frame Fasteners

For all tests excluding Trial I5 description as per CTS report No. TS868 dated 12 October 2012.

For Trial I5 each clip was screwed to the frame with a fastener assembly comprising a M5 × 30 mm screw and 20 mm by 1 mm thick flat washer.

3.4 Support Frames

Support frames used in this testing program were fabricated from either metal or timber and did not contain any internal or external cladding. For Trials I1 to I4 description as per CTS report No. TS868 dated 12 October 2012.

3.4.1 Steel Support Frame for Trial I5

The support frame used for Trial I5 comprised a nominally 1800 × 2100 mm rectangular frame, with a 1200 × 1500 mm inner rectangular section, made from 92 × 34 mm steel C-channels with a total coated thickness (TCT) measuring 0.55 mm. The frame had threaded hollow rivets pre-installed on the outermost rectangular segment with 300 mm centres starting at each corner to allow the clips to be screwed to the frame.

Note that the strength of the support frame itself was not tested in this testing program.

A typical threaded hollow rivet used in the steel frame support for Trial I5 is shown in Figure 11.

Figure 11: Photograph of two threaded hollow rivets used in the steel support frame, one prior to installation and the other installed into the steel support

3.4.2 Steel Support Frame for Trial I6

The support frame used for Trial I6 comprised a nominally 1800 × 2100 mm rectangular frame, with a 1200 × 1500 mm inner rectangular segment, made from 92 × 34 mm steel C-channels with a TCT measuring 0.55 mm. The frame had threaded screw anchors pre-installed on the inner rectangular segment with 300 mm centres starting at each corner to allow the clips to be screwed to the frame.

Note that the strength of the support frame itself was not tested in this testing program.

A typical threaded screw anchor installed in the C-channel of the steel frame support for Trial I6 is shown in Figure 12.

Figure 12: Photograph of a threaded screw anchor installed into the C-channel of the steel support frame for Trial I6

3.4.3 Timber Support Frames for Trials I7 and I8

The support frames used for Trials I7 and I8 comprised 2100 × 3000 mm rectangular frames made from 90 × 45 mm timber. The frames had threaded screw anchors pre-installed with 300 mm centres starting at each corner to allow the clips to be screwed to the frame.

Note that the strength of each of the support frames themselves was not tested in this testing program.

4 Test Criteria

As per CTS report No. TS868 dated 12 October 2012.

5 Target Impact Velocity

As per CTS report No. TS868 dated 12 October 2012.

6 Test Apparatus and Procedure for Impact Tests

As per CTS report No. TS868 dated 12 October 2012.

7 Results

A summary of the additional test results and observations is presented in Table 4. Photographs of damage are provided in Appendix B.

Table 4: Impact Testing Results

Test No.	Date Tested	Impact Location	Measured Impact Velocity (m/s)	Results and Observations
I5	3 Jul 2013	Geometric Centre	28.1	**Pass**. No penetration. Permanent deformation of support frame.
I6			18.9	**Pass**. No penetration. Permanent deformation of support frame.
I7			28.4	**Pass**. No penetration. Permanent deformation of support frame.
I8			28.6	**Pass**. No penetration. Permanent deformation of support frame.

8 Conclusions

A program of simulated windborne debris impact testing was performed on an *Astroguard* impact protection screen assembly system supplied by *Cyclone Protection Australia*.

The methods of testing, in accordance with Clause 2.5.7 of *AS/NZS 1170.2:2011* have been presented.

These results demonstrate the performance of this particular impact protection screen assembly, for the geometry and test assembly details described in this report, when subjected to simulated windborne debris impacts.

Note that the screen assembly when mounted in front of a window may not eliminate the damage that potentially could be caused as the deflections form the screen upon impact have not been assessed.

Prepared by	Checked	
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Appendix A – Photographs of Test Set Up

As per CTS report No. TS868 dated 12 October 2012.

Appendix B – Photographs of Damage

As per CTS report No. TS868 dated 12 October 2012.

Figure 13: General view of deformation to steel support frame after Trial I5

Figure 14: View of deformation to steel support frame after Trial I6

Figure 15: View of deformation to top of timer support frame (left) and side of timber support frame (right) after Trial I7

Figure 16: View of deformation to top of timer support frame (left) and bottom of timber support frame (right) after Trial I8