Balustrade – Glass

AZUMA
Design

Client – CR Laurence Australia P/L

Product – GRS Glass Railing Dry Glaze Taper-loc® System

Tested By

Azuma Design Pty Ltd

AZT0362.18A

Nata Accredited Laboratory No. 15147

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Amendment 1 – 05/03/2021	Added the 1500 N/m result to Section 3, updated requirements on performance at end of table
	Removed C5 rating from conclusion replaced with C1/C2 and C3 rating
	Added note to Section 5.2.1 on performance

1 Aim

To test the sample as per loads specified in `Clause 3.6, Table 3.3 of AS1170.1- 2002' and combination factors as specified in Clause 4.2 of AS/NZS 1170.0:2002 by the test methods specified in `Appendix B & C of AS1657-2018.

2 Referenced Standards

- AS/NZS 1170.0:2002 Structural design actions - General principles (Clause 4.2 and Appendix B - Table B1)
- AS/NZS1170.1:2002 Structural design actions- Permanent, imposed and other actions (Clause 3.6, Table 3.3)
- AS1657-2018 Fixed platforms, walkways, stairways and ladders- Design, construction and installation (Appendix B & C)
- AS1288-2006 Glass in buildings Set - Section 7 Balustrades

3 Result Summary

Load Type	Deflection	Permanent Deflection	Breakage
Concentrated Loads			
Serviceability (600 N) Outwards	7 mm	1 mm	Nil
Serviceability (600 N) Downwards	1 mm	1 mm	Nil
Ultimate (1080 N) Outwards			Nil
Ultimate (1080 N) Downwards			Nil
Uniformly Distributed Loads			
Serviceability Vertical (750 N/m)	0 mm	0 mm	Nil
Serviceability Horizontal (1500 N/m)	28 mm	0 mm	Nil
Serviceability Horizontal (3000 N/m)	97 mm*	5 mm	Nil
Ultimate Vertical (750 N/m)			Nil
Ultimate Horizontal (1500 N/m)			Nil
Ultimate Horizontal (3000 N/m)			2 mm Lift
Infill Loads			
Pressure Load (4500 Pa)			Nil

Serviceability Requirements – Maximum allowable deflection for this test specimen is 30 mm as per AS1288.

Ultimate Requirements – No structural damage to the test specimen. Deflection is measured for reference only.

4 Test Sample Description

4.1 General

Model No./Name	GRS glass railing dry glaze TAPER-LOC® system
Customer	CR Laurence Australia P/L
Address	9 Shale Place, Eastern Creek, NSW 2766
Azuma Testing Number	AZT0362.18A
Date of Test	22/08/2018
Date of Amendment	05/03/2021
Overall Size	1130 mm (H) x 1500 mm (W)
Test Sample Description	Toughened Laminate glass wedged into Aluminium Channel
AS1288 Classification	Cantilevered - Structural

4.2 Barrier

Glass Material	Toughened Laminate
Glass Grade	Not Specified
Glass Thickness	21.52 mm
Glass Panel Size	1100 mm (H) x 1490 mm (W)
Gap between bottom of barrier and ground level	Nil
Complies with AS 2208	See Attached

Azuma Design Pty Ltd
38 Redfern Street Wetherill Park. NSW. 2164 Australia +61(02) 9604 0255
Accreditation Number: 15147
Accredited for compliance with ISO/IEC 17025 - TESTING.

4.3 Base Channel

Product No./Name	Hole Pattern "D"
Material	Aluminium
Overall Dimensions	81 mm (W) x 120 mm (H) x 1500 mm (L)
Base Plate (if applicable)	N/A
Drawing Supplied	See Attached
Fixing Method	EBA335 - Hilti® M12 156 mm Long HSL-3 Expansion Anchor at 300 mm spacing

4.4 Handrail

Handrail	Not part of tested sample

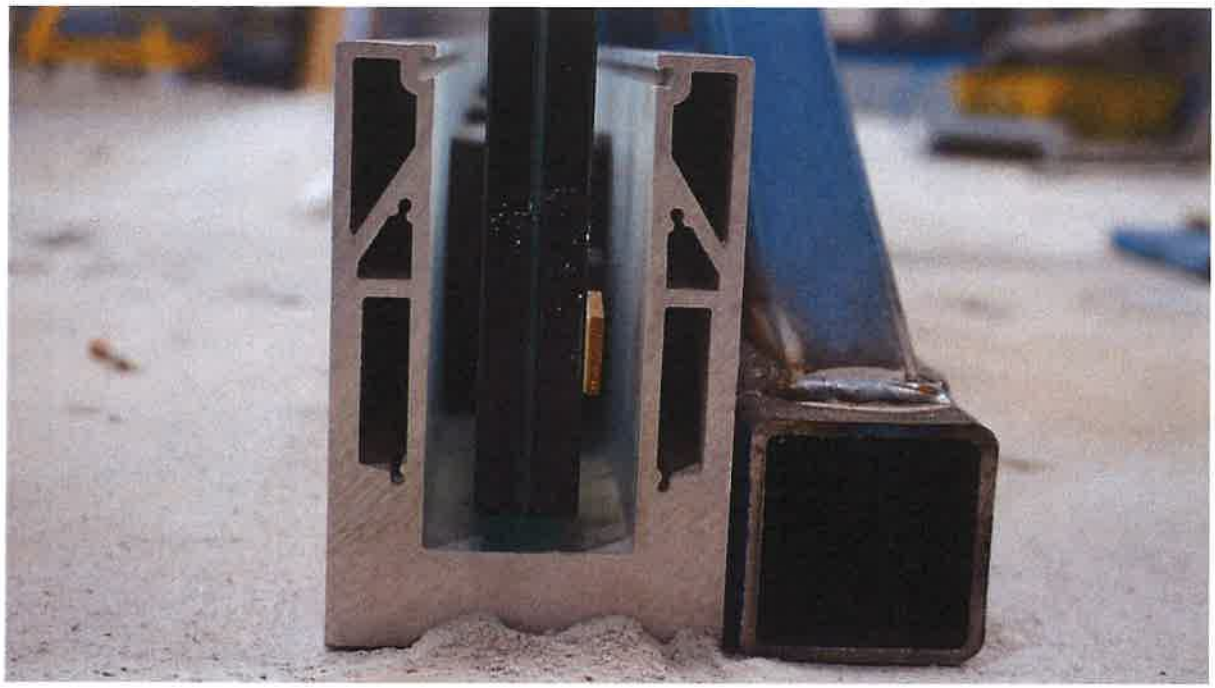


Figure 1: Profile of tested system

Azuma Design Pty Ltd
38 Redfern Street Wetherill Park, NSW, 2164 Australia +61(02) 9604 0255
Accreditation Number: 15147

4 Barrier Loads

4.1 Procedure

From AS1657-2013 Fixed platforms, walkways, stairways and ladders- Design, construction and installation:

1. Set the hydraulic ram to push on the handrail at the centreline between the two fixed points.
2. Record a datum from the centre of the push area to a fixed point.
3. Smoothly increase the force acting on the side of the rail or top edge until the test force is equal to desired load.
4. Hold the test force for 90 seconds.
5. Record the deflection.
6. Remove the test force and after 2 minutes record the permanent deflection reading.

The forces applied to this sample are taken from Table 3.3 from AS 1170.1-2002 - Section 3.6 Barriers, a combination factor for permanent and imposed actions is applied to these figures determined from Table B1 of AS1170.0-2002 as well as a variation factor.

4.2 Testing Parameters for Ultimate Loads

4.2.1 Multipliers

Combination Factor, $\mathbf{E_d}$, (AS/NZS 1170.0 Section 4)	1.5
Variation Factor, $\mathbf{k_t}$, (AS/NZS 1170.0 Appendix B, Table B1)	1.2

4.2.2 Calculations

4.2.2.1 Serviceability Deflection Criteria

The following maximum deflection limits apply to this product:

$$\frac{Height}{30} = \frac{1100}{30} = 36.67mm$$

This value is only applicable while it remains less than 30 mm, otherwise 30 mm is maximum allowable deflection.

4.2.2.2 Concentrated Strength Calculation

The required concentrated load for the glass panel is:

$$Force\ (N) = Imposed\ Action\ (N)\ * Combination\ Factor\ * Variation\ Factor$$

4.2.2.3 Uniform Strength Calculation

The required uniformly distributed load for the glass panel is:

$$Force\ (N) = Imposed\ Action\ (N/m)\ * Width\ (m) * Combination\ Factor\ * Variation\ Factor$$

4.2.2.4 Wind Load Strength Calculation (Infill Barrier Only)

The required wind load for the glass panel is:

$$Force\ (N) = Pressure\ (Pa)\ * Area\ (m^2) * Combination\ Factor\ * Variation\ Factor$$

5 Results

5.1 Concentrated Load

5.1.1 Serviceability

Direction	Load Applied	Datum	Reading During Load	Permanent Deflection
Outwards	600 N	494 mm	501 mm	495 mm
Notes: Nil				
Downwards	600 N	273 mm	274 mm	274 mm
Notes: Nil				

5.1.2 Ultimate

Direction	Load Applied from Section 4.2.2.1	Any damage, signs of breakage or fracture observed
Outwards	1080 N	No Damage
Downwards	1080 N	No Damage

Azuma Design Pty Ltd
38 Redfern Street Wetherill Park, NSW, 2164 Australia +61(02) 9604 0255
Accreditation Number: 15147
Accredited for compliance with ISO/IEC 17025 - TESTING.

5.2 Uniform Load

5.2.1 Serviceability

Direction	Uniformly Distributed Load	Load Applied	Datum	Reading During Load	Permanent Deflection
Vertical	350 N/m	~	~	~	~
	750 N/m	1117.5 N	274 mm	274 mm	274 mm
Notes: Nil					
Horizontal	350 N/m	~	~	~	~
	750 N/m	~	~	~	~
	1500 N/m	2235 N	565 mm	593 mm	565 mm
	3000 N/m	4470 N	565 mm	662 mm	570 mm
Notes: 3000 N/m exceeds allowable deflection of 30 mm					

5.2.2 Ultimate

Direction	Load Applied from Section 4.2.2.1	Any damage, signs of breakage or fracture observed
Outwards	8046 N	2 mm lift of channel, no damage observed
Downwards	2011.5 N	No Damage

Azuma Design Pty Ltd
38 Redfern Street Wetherill Park, NSW, 2164 Australia +61(02) 9604 0255
Accreditation Number: 15147
Accredited for compliance with ISO/IEC 17025 - TESTING.

5.3 Infill Load

5.3.1 Point Load

Testing not required for Structural Balustrade

5.3.2 Pressure Load

Testing completed at customers request using new test sample.

Test Pressure	Test Area	Load Applied	Any damage, signs of breakage or fracture observed
1500 Pa	1.497 m^2	4043 N	Nil
3000 Pa	1.497 m2	8086 N	Nil
4500 Pa	1.497 m2	12129 N	Nil
Ultimate Load			
5201 Pa	1.497 m^2	14020 N	Glass unit collapsed

Azuma Design Pty Ltd
38 Redfern Street Wetherill Park. NSW. 2164 Australia +61(02) 9604 0255

6 Pictures

Figure 2: Concentrated Load Stability

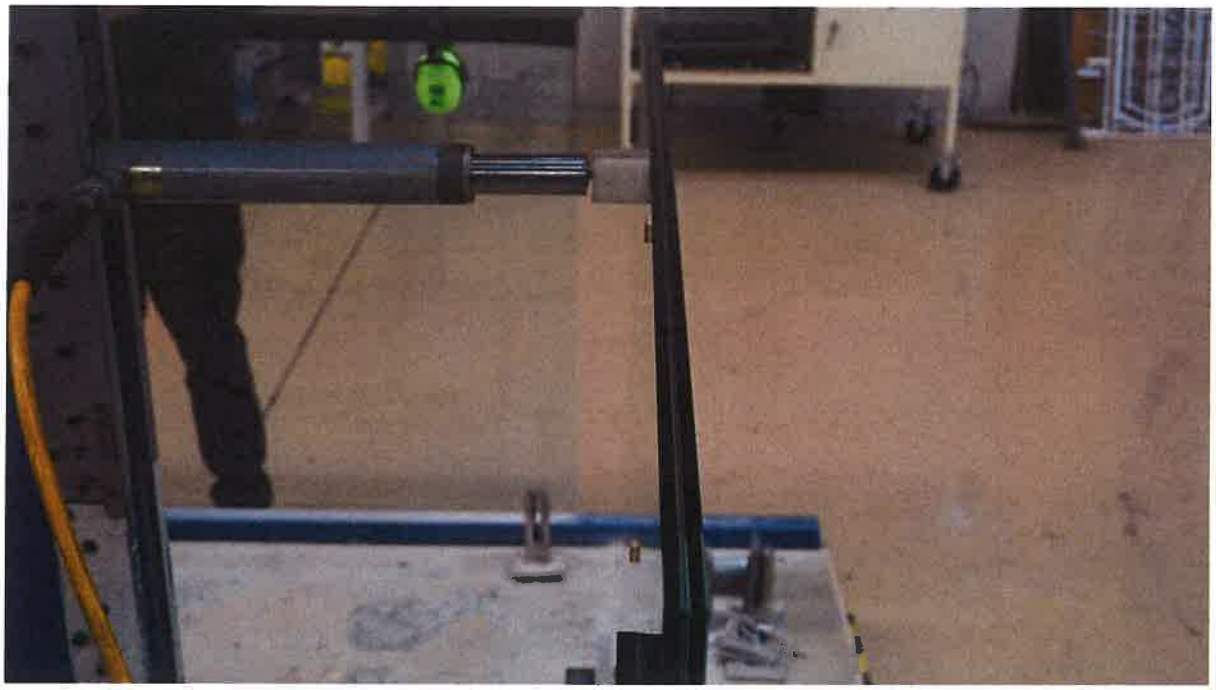


Figure 3: Concentrated Load Strength

Figure 4: Concentrated Load Stability/Strength

Figure 5: Uniform Load - Stability

Azuma Design Pty Ltd
38 Redfern Street Wetherill Park. NSW. 2164 Australia +61(02) 9604 0255
Accreditation Number: 15147
Accredited for compliance with ISO/IEC 17025 - TESTING.

Figure 6: Uniform Load - Strength

Figure 7: Uniform Load - Stability

Figure 8: Uniform Load - Strength 1500 N/m

Figure 9: Uniform Load - Strength 3000 N/m

Figure 10: Wind Load

Figure 11: Wind Load - 1500 Pa

Figure 12: Wind Load - 3000 Pa

Figure 13: Wind Load - 4500 Pa

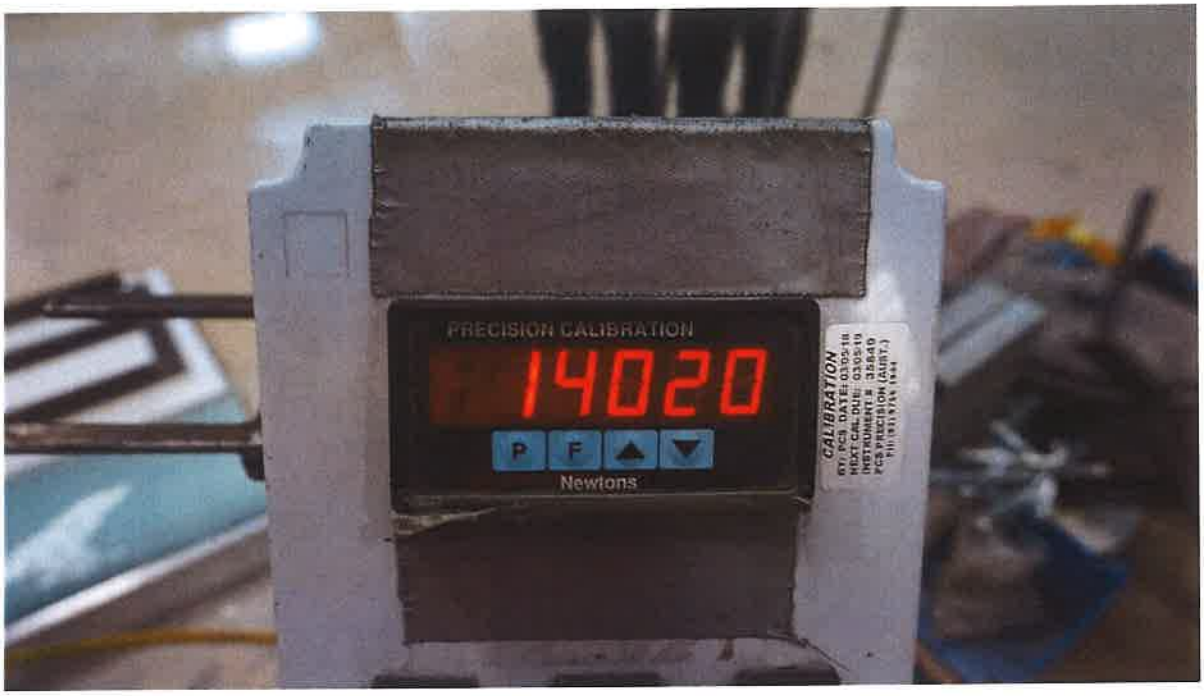


Figure 14: Ultimate Load - Load Reading

Figure 15: Ultimate Load - Sample

Azuma Design Pty Ltd
38 Redfern Street Wetherill Park, NSW, 2164 Australia +61(02) 9604 0255
Accreditation Number: 15147
Accredited for compliance with ISO/IEC 17025 - TESTING.

7 Conclusion and Signatories

7.1 Conclusion

From the results achieved the sample is deemed to satisfy the loading requirements as per table 3.3 of AS1170.1- 2002 for the following classification(s):

- for a Category 'A' Domestic and residential activities - Other Residential (See C3);
- for a Category 'B, E' Offices and work areas not included elsewhere including storage areas - Fixed platforms, walkways, stairways and ladders for access (see NOTE 2).
- for a Category 'C1/C2' Areas with tables or fixed seating – Areas with fixed seating adjacent to a balustrade, restaurants, bars, etc.
- for a Category 'C3' Areas without obstacles for moving people and not susceptible to over-crowding – Stairs, landings, external balconies, edges of roofs, etc.
- for a Category 'D' Retail Areas – All retail areas including public areas of banks/building societies, (see C5 for areas where overcrowding may occur).
- for a Category 'F/G' Vehicular – Pedestrian areas in car parks including stairs, landings, ramps, edges of internal floors, footways, edges of roofs.

NOTE: All classifications with equal or lower load specifications may be applied to this sample. For more information as to their specific use please see table 3.3 of AS1170.1 - 2002.

NOTE 2: This usage (under B,E) is for access to and safe working places normally used by operating, inspection, maintenance and servicing personnel.

7.2 Signatories

Tested By: Ash Horne

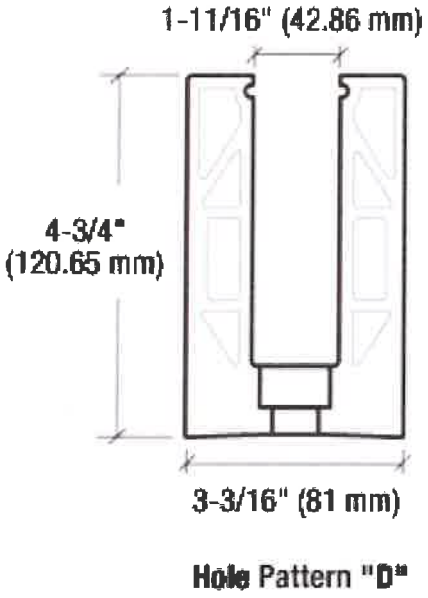
Signature: AHorne

Date: 05/03/2021

Azuma Design Pty Ltd
38 Redfern Street Wetherill Park. NSW. 2164 Australia +61(02) 9604 0255
Accreditation Number: 15147
Accredited for compliance with ISO/IEC 17025 - TESTING.

8 Drawing

Supplied by Customer



Hole Pattern "D"

Azuma Design Pty Ltd
38 Redfern Street Wetherill Park, NSW, 2164 Australia +61(02) 9604 0255
Accreditation Number: 15147
Accredited for compliance with ISO/IEC 17025 - TESTING.

9 Glass Compliance Statement

G.JAMES

Glass
Operations NSW

G.James Safety Glass Pty Ltd
ABN 86 001 230 039
gjamesglass.com

Office & Factory
26 Long Street
Smithfield NSW 2164
Telephone: 02 9732 2111
Facsimile: 02 9732 2199

Postal Address
PO Box 6967
Wetherill Park NSW 2164

CERTIFICATE OF COMPLIANCE

CR Laurence Aust PTY Ltd

9 Shale Place

Eastern Creek, NSW 2766

2nd August 2018

Attention The Manager

Dear Sir;

We hereby certify that the 2 pieces of 21.52mm thick Clear Toughened Laminated glass we supplied to you on our invoice number 100194147 have been supplied as specified in the Australian Standards 1288 and 2208

This glass has been manufactured under Quality Assurance Systems based on the Australian Standard 3902. As requested there have been no stamps placed on the any of the panels, although there are no visible stamps the glass does comply with the above standards.

We will be pleased to provide any further information you may require and look forward to assisting you with future projects.

per

Michael Pascoe

General Manager (NSW)

Defining
Spaces.