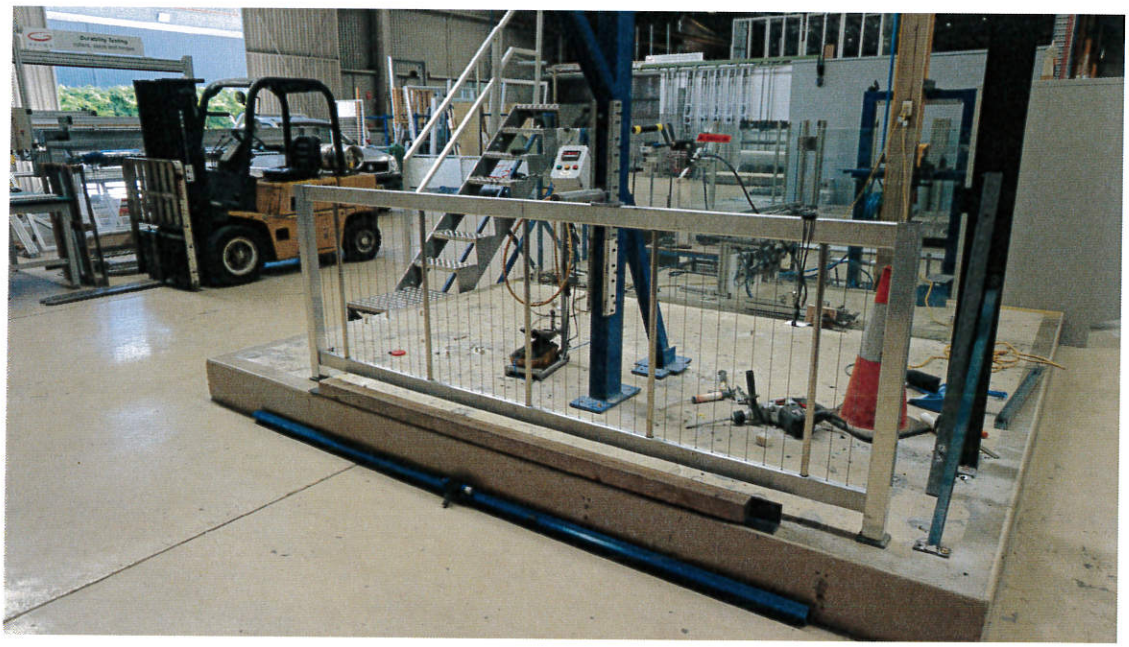
Balustrade

AZUMA Design



Sentrel

Wire Balustrade

Tested By
AZUMA DESIGN Pty Ltd

AZT0444.17

Nata Accredited Laboratory No. 15147

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

1 Aim

To test the sample as per loads specified in 'Clause 3.6, Table 3.3 of AS1170.1- 2002' by the test methods specified in 'Appendix B & C of AS1657-2013.

2 Reference Standards

- AS1170.1:2002 Structural design actions- Permanent, imposed and other actions (Clause 3.6, Table 3.3)
- AS1657-2013 Fixed platforms, walkways, stairways and ladders- Design, construction and installation (Appendix 'B' & 'C')

3 Test Sample Description

3.1 General

Model No./Name	Wire Balustrade
Customer	Sentrel
Address	PO BOX 122 Bellingen NSW 2454
Azuma Testing Number	AZT 0444.17
Date of Test	02/11/2017
Overall Size	Height = 1015 mm Width = 2880 mm

3.2 Spigot & Post

Number of Posts	2
Material	Aluminium
Overall Size	1000 mm (H) mm x 65 mm (W) x 65 mm (L) x 3 mm (T)
Fixing Method	Per Post - 1 x 140 mm Dia 16 mm Booker Rod fixed with CRL Qwikset 100 mm engagement Chemtools - 8680 - Retaining compound anaerobic adhesive for post to Spigot
Spacing between Fixings	2810 mm

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3.3 Barrier

Material	Aluminium, Stainless Steel Wire and Tube
Thickness	3 mm for Aluminium Extrusion
Panel Size	Height = 925 mm Width = 2770 mm
Gap between bottom of barrier and ground level	87 mm
Handrail Used	Top Rail of Panel Considered a Handrail
Spacing Between Post Centers	2810 mm
Wire Detail	316 Stainless Steel, 2.5 mm 7 x 7 lay
Wire Tension	1700 Nm
Spacing between Wire	64 mm
Vertical Tube Material	316 Stainless Steel
Vertical Tube Spacing	190 mm , 588.5 mm and 576 mm (See Drawing)
Vertical Tube Diameter	25.4 mm at 1.2 mm thickness

Figure 1: Spigot and Post

4 Minimum Imposed Actions for Barriers

4.1 Concentrated Load

4.1.1 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 centerline between the two fixed points.
2. Record a datum from the center of the push area to a fixed point.
3. Smoothly increase the force acting on the side of the rail until the test force is equal to 600 N.
4. Hold the test force for 1 minute.
5. Record the deflection.
6. Remove the test force and after 2 minutes record the permanent deflection reading.

4.1.2 Results

Direction	Load Applied	Datum (mm)	Reading after load removed (mm)	Permanent Deflection (mm)
Outwards	600 N	507 mm	508 mm	1 mm
Downwards	600 N	501 mm	502 mm	1 mm

4.1.3 Pass/Fail Criteria

The following maximum deflection limits apply to this product:

$$\frac{Span}{60} = \frac{2880}{60} = 48mm \tag{1}$$

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

Criteria	Observation	Result
Outwards		
Deflection no more than 30 mm after load is removed	1 mm	Pass
Any damage, signs of breakage or fracture observed	Nil	Pass
Notes: Nil		
Downwards		
Deflection no more than 30 mm after load is removed	1 mm	Pass
Any damage, signs of breakage or fracture observed	Nil	Pass
Notes: Nil		

4.1.4 Pictures

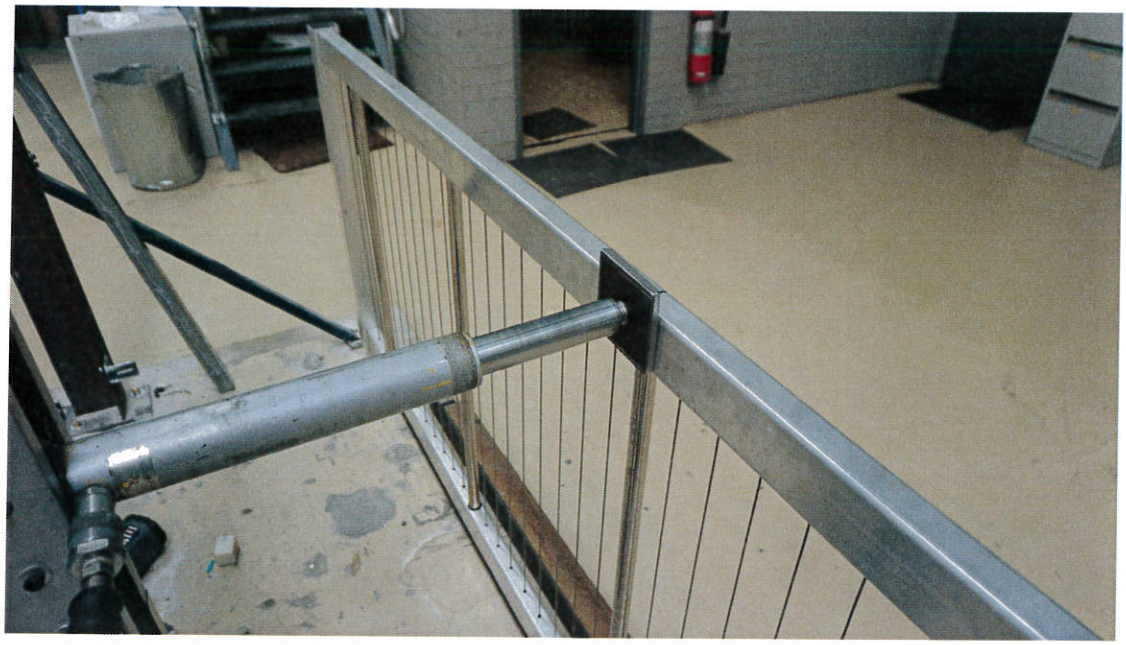

Figure 2: Outwards Push

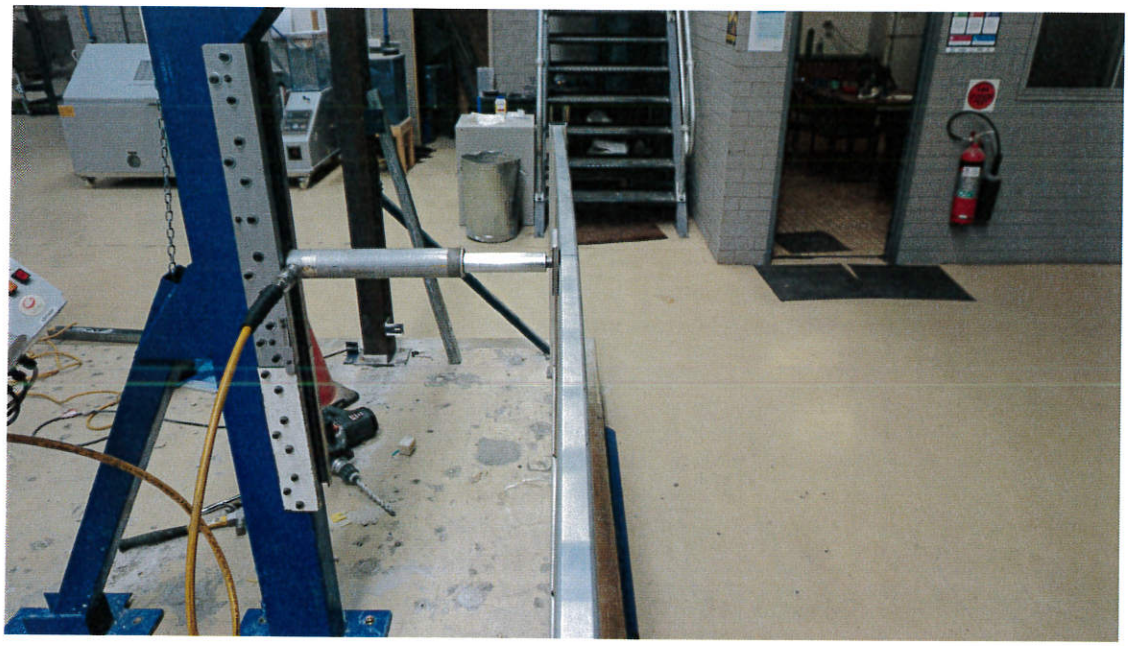

Figure 3: Outwards Push - Bend

Figure 4: Downwards Push

4.2 Uniformly Distributed Load - VERTICAL

4.2.1 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 centerline between the two fixed points.
2. Record a datum from the center of the push area to a fixed point.
3. Smoothly increase the force acting on the side of the rail until the test force is equal to the desired force.
4. Hold the test force for 1 minute.
5. Record the deflection.
6. Remove the test force and after 2 minutes record the permanent deflection reading.

4.2.2 Calculation

The required uniformly distributed load for the glass panel is the imposed action multiplied by the width of the product:

$$RequiredForce(N) = ImposedAction(N/m) * WidthoftthePanel(m) \quad (2)$$

Note: Width used is the above equation was 2400 mm.

4.2.3 Results

Uniformly Distributed Load	Load Applied	Datum (mm)	Reading after load removed (mm)	Permanent Deflection (mm)
350 N/m	840 N	Not Tested	-	-
750 N/m	1800 N	502 mm	504 mm	2 mm

4.2.4 Pass/Fail Criteria

The following maximum deflection limits apply to this product:

$$\frac{Span}{60} = \frac{2400}{60} = 40mm \tag{3}$$

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

Criteria	Result	Pass/Fail
350 N/m (840 N)		
Deflection no more than 30 mm after load is removed	-	Not Tested
Any damage, signs of breakage or fracture observed	Nil	Not Tested
Notes: Nil		
750 N/m (1800 N)		
Deflection no more than 30 mm after load is removed	2 mm	Pass
Any damage, signs of breakage or fracture observed	Nil	Pass
Notes: Nil		
Total Deflection	2 mm	Pass

Figure 5: Vertical Uniform Distributed Load

4.3 Uniformly Distributed Load - HORIZONTAL

4.3.1 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 centerline between the two fixed points.
2. Record a datum from the center of the push area to a fixed point.
3. Smoothly increase the force acting on the side of the rail until the test force is equal to the desired force.
4. Hold the test force for 1 minute.
5. Record the deflection.
6. Remove the test force and after 2 minutes record the permanent deflection reading.

4.3.2 Calculation

The required uniformly distributed load for the glass panel is the imposed action multiplied by the width of the product:

$$RequiredForce(N) = ImposedAction(N/m) * WidthoftthePanel(m) \quad (4)$$

Note: Width used is the above equation was 2400 mm.

4.3.3 Results

Uniformly Distributed Load	Load Applied	Datum (mm)	Reading after load removed (mm)	Permanent Deflection (mm)
350 N/m	840 N	506 mm	508 mm	2 mm
750 N/m	1800 N	508 mm	510 mm	2 mm

4.3.4 Pass/Fail Criteria

The following maximum deflection limits apply to this product:

$$\frac{Span}{60} = \frac{2400}{60} = 40mm \tag{5}$$

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

Criteria	Result	Pass/Fail
350 N/m (840 N)		
Deflection no more than 30 mm after load is removed	2 mm	Pass
Any damage, signs of breakage or fracture observed	Nil	Pass
Notes: Nil		
750 N/m (1800 N)		
Deflection no more than 30 mm after load is removed	2 mm	Pass
Any damage, signs of breakage or fracture observed	Nil	Pass
Notes: Nil		
Total Deflection at 750 N/m Rating	4 mm	Pass

4.3.5 Pictures

Figure 6: Horizontal Uniform Load - 350 N/m

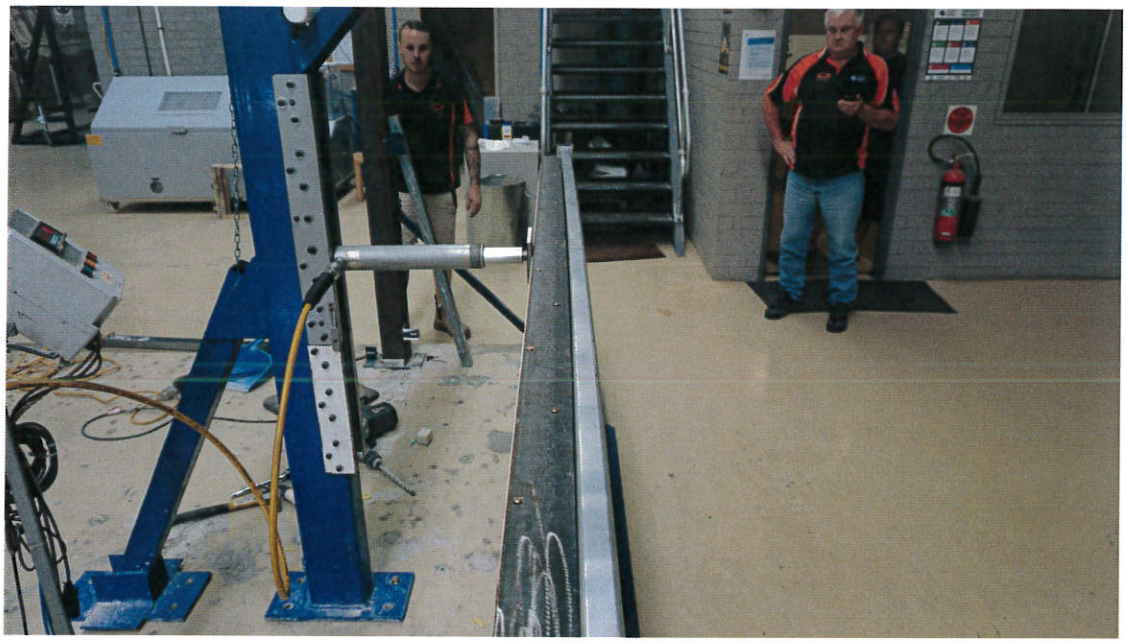

Figure 7: Horizontal Uniform Load - 750 N/m

5 Post Test Methods

5.1 Procedure

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

1. Preload the test sample to the point load of 300 N (50% of imposed action) for a period of 1 minute. Known as settling in or taking up period.
2. Remove the preload force and set the deflection-measuring device to zero.
3. Smoothly increase the force acting on the side of the rail until the test force is equal to 600 N. Hold the test force for 1 minute.
4. Record the deflection at the top of the post
5. Remove the test force and after 2 minutes record the permanent deflection reading.

5.2 Results

Load Applied	Datum (mm)	Reading after load removed (mm)	Permanent Deflection (mm)
600 N	511 mm	511 mm	0 mm

5.3 Pass/Fail Criteria

The following maximum deflection limits apply to this product:

$$\frac{Height}{30} = \frac{985}{30} = 32.833mm \tag{6}$$

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

Criteria	Result	Pass/Fail
Post		
Deflection no more than 30 mm after load is removed	0 mm	Pass

6 Minimum Imposed Actions for Barriers

6.1 Infill Pressure Load and Point Load

6.1.1 Procedure

From AS 1170.1 - 2002 - Subsection 3.6 Barriers - Table 3.3 Minimum imposed actions for Barriers.

1. Set the hydraulic ram to push on the infill at the center point of the sample infill.
2. Record a datum from the center of the push area to a fixed point.
3. Smoothly increase the force acting on the side of the infill until the test force is equal to the desired load.
4. Hold the test force for 1 minute.
5. State the condition of the infill.

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. The factor which is used is a 1.5 times multiplier determined from AS1170.0-2002. In the 'Load Applied' Column the base load is in brackets and the actual load applied to the sample is unbracketed.

6.1.2 Results - Infill Pressure

The force is applied across a steel plate with reinforced bars with a total square area of 0.5 m^2. All pressures described in Table 3.3 of AS1170.1 - 2002 have been adjusted to achieve the correct N/m^2.

Uniformly Distributed Pressure	Load Applied	Infill Condition	Result
1000 N/m^2	500 N	No Change	Pass

6.1.3 Results - Point Load

Load applied to single wire strand.

Load Applied	Infill Condition	Result
500 N	No Change	Pass

7 Ultimate Load

At the clients request the test specimen was subject to an ultimate uniformly distributed load, following the procedure from Section 4.3 of this document, with the peak value taken when the posts suffered failure.

7.1 Results

Load Reached	Datum (mm)	Reading after load removed (mm)	Permanent Deflection (mm)
2400 N	510 mm	523 mm	13 mm
Adhesive between the spigot and the post gave way on the left side			

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8 Conclusion and Signatories

8.1 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:

- 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 'C3' Areas without obstacles for moving people and not susceptible to over-crowding - Stairs, landings, external balconies, edges of roofs, etc.

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.

8.2 Signatories

Tested By: Ash Horne

Signature: Horne

Date: 14/12/17

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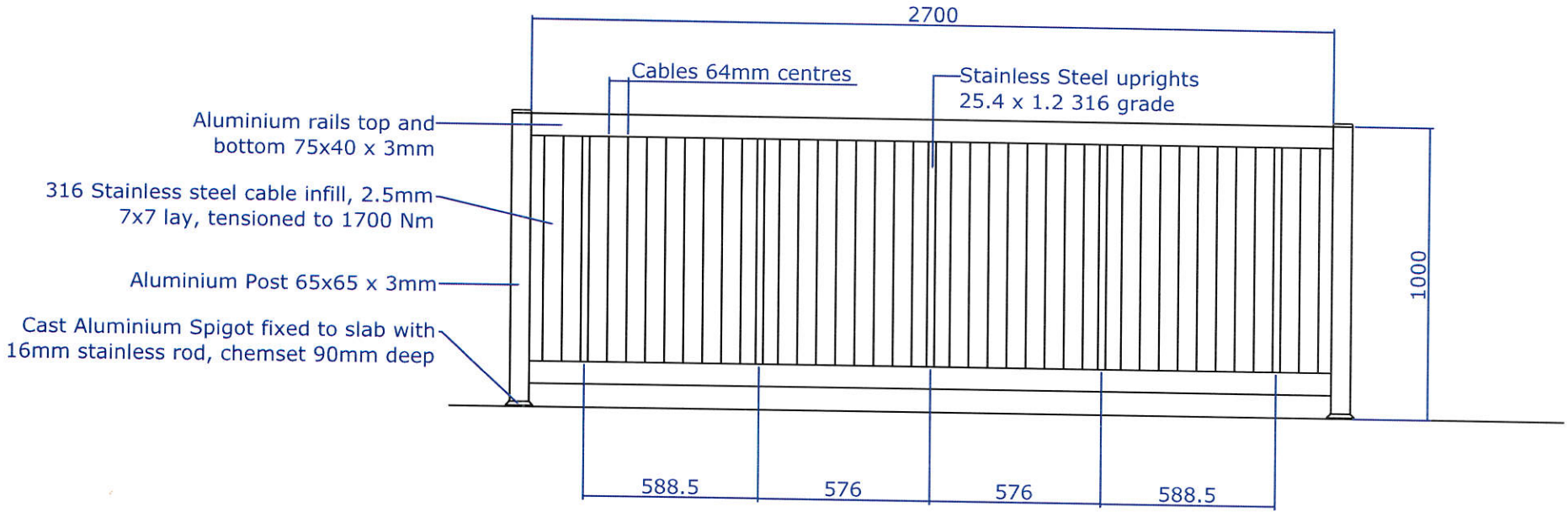

Sentrel Aluminium Balustrade Panel