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Our ref: HG1018_TC1_Rev 1
Date: Thursday, 4 May 2023

RE: TESTING CERTIFICATE – ASSESSMENT OF CHANNEL TLTC1217

STRUCTURAL DESCRIPTION:	Structural glass and aluminium balustrade.
CLIENT:	[redacted] **Drawings:**
REFERENCE DOCUMENTS:	None provided – refer to test report referenced below: **LMATS Test Report:** Report No. MTS-40128 GLASS Rev 1**,** Reference No. LP23-0568 Rev 1**,** Issue Date 14/04/2023**,** Test Date 23/03/2023 (included below) Prototype
PROTOTYPE OR PROOF TESTING ASSEMBLY:	Cantilevered balustrade Assembly with a '1200mm(W) x 1000mm(H) x **12.00mm(T) Toughened Glass panel'** fixed at the bottom to a **TLTC1217** aluminium channel at four locations using curve plates and bolt/nut tightening system. The aluminium channel was fixed at the side to the concrete using **M12 screw anchors at 300mm centres**. **No handrail.**

We, DCO Consulting Engineers, hereby certify that we, being registered Structural Engineers, have assessed the testing of the system outlined above, as described in the referenced testing report, and have found it to be adequate in accordance with AS1170.0 and AS1288 and based on the following site conditions:

1. Live loading for usage type C3 (0.75kN/m crowd loading) in accordance with AS1170.1
2. Maximum design wind load of 2500Pa (Ultimate) in accordance with AS1170.2 or the wind loading expected in a typical urban setting, up to 7 storeys:
    a. Structural Importance Factor 2, Region B, Terrain Category 3.0, 20m max height, full shielding.

This assessment is a guide only. Each proposed installation must be reviewed and assessed by a qualified person prior to loading. This assessment is based on the assumptions and limitations outlined below. We, DCO Consulting Engineers, hereby certify that we, being registered Structural Engineers, have made this assessment in accordance with accepted engineering principles and in particular with the following provisions of the Standard Building Regulations and Australian Standards:

- AS1170 - STRUCTURAL DESIGN ACTIONS
    - AS/NZS 1170.0: 2002 STRUCTURAL DESIGN ACTIONS—GENERAL PRINCIPLES
    - AS/NZS 1170.1: 2002 STRUCTURAL DESIGN ACTIONS—PERMANENT,
    - IMPOSED AND OTHER ACTIONS
    - AS/NZS 1170.2: 2002 STRUCTURAL DESIGN ACTIONS—WIND ACTIONS
- AS1288:2021 – GLASS IN BUILDINGS – SELECTION AND INSTALLATION

- AS/NZS 1664.1: 1997 ALUMINIUM STRUCTURES—LIMIT STATE DESIGN

This certificate is limited to the compliance of the structural design with the provisions of the above identified Australian Standards and relevant sections of the Building Regulations. This certificate is only valid for the above project and can only be relied upon by the addressee. DCO Consulting Engineers accepts no responsibility for information that has not been expressly identified as part of this certification.

Signed

Date

4th of May, 2023

Damien O'Mara

Director - DCO Consulting Engineer

RPEQ 9199, CPEng, NPER, MIEAust (3474754)

ADDITIONAL SPECIFICATION:

1. If suitable for the type of channel used, thicker glass of the same grade and specification can be used in lieu of the 12mm monolithic toughened used in the testing, without a reduction in capacity. That's is:
    a. 2x6mm toughened laminated glass (or thicker) with a 1.52 min SGP or PVB can be used in lieu of 12mm monolithic toughened used in the testing.
    b. 15mm (or thicker) monolithic toughened glass can be used in lieu of the 12mm monolithic toughened used in the testing.

DESIGN CONDITIONS AND LIMITATIONS:

- **THIS IS NOT A SITE SPECIFIC ENGINEERING CERTIFICATE.** This is a statement of capacity. All jobs will required site specific engineering certification.
- Post breakage test does not validate installation of the product in higher temperatures than tested.
- **No assessment of an interlinking handrail, under a failed panel condition**, in accordance with AS1288 – 7.3.1 has been included. This must be assessed on a site-by-site basis.
- All testing to be completed in accordance with the latest versions on AS1170.0 and AS1288 by a NATA accredited tester.
- The use is limited to the loading assumptions, regarding wind load and live load, stated above.
- The handrail to be connected to glass panel in a suitable manner.
- All connections between the product and any supporting structure must be independently verified as capable of providing the necessary structural support. Our analysis assumed connections are fully fixed.
- Product installation shall only be carried out to supporting structures independently verified as capable of providing the necessary structural support.
- This certification does not consider materials safety, site safety or safe work practices in any form.
- This certification does not consider the quality assurance and safe work practice aspects of the manufacturing, transportation and installation processes.
- No representation or warranty is given that your particular application of these products complies with relevant building codes or that the fasteners provided or used are appropriate for your application. Therefore consult with professionals and local building officials before beginning work:
    - (i) to ensure compliance with relevant building codes for your ap lication and for your proposed use of fasteners;
    - (ii) to ensure the integrity of the structural components in connection with which these products are to be used;
    - to identify appropriate safety gear that is to be used during installation such as a safety harness when working above ground;
    - to ensure that the work area is free from utilities, services and hazards; and,
    - to clarify any instructions or warnings that may not be clear.
- Work in a safe manner wearing protective gear such as gloves, eyewear, headwear, footwear and clothing.
- When using tools always comply with operation manuals and instructions.
- Metal and glass may have sharp edges and could fragment or splinter during or as a result of handling or cutting.
- Do not use these products in connection with any substance that is or may be harmful or corrosive to the products.
- Inspect and maintain these products and the structural components that they are used in connection with on a regular basis using professionals when appropriate.
- This report has been prepared for certain standard residential applications. Obtain professional advice for any non-standard or non-residential application.

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Test Report

To [redacted]

Order No. PO0013

Report No. **MTS-40128 GLASS Rev 1**
Reference No. **LP23-0568 Rev 1**
Issue Date 14/04/2023
Test Date 23/03/2023

Introduction

A visit was made to the premises of [redacted] for the purpose of testing five (5) TLTC1217 channel with a glass panel (12.00mm Toughened Glass) balustrade assemblies and one (1) **TLTC1217** channel with a glass panel (14.28 SGP Glass) balustrade assembly to the requirements of AS/NZS 1170.1-2002, AS1288, and DCO Consulting Engineers' specifications.

Test Item(s)

Test Assembly 01, 02, 03, 04 and 05
The test panel consisted of a Balustrade Assembly with a '1200mm(W) x 1000mm(H) x 12.00mm(T) Toughened Glass panel' fixed at the bottom to a TLTC1217 aluminium channel at four locations using curve plates and bolt/nut tightening system. The aluminium channel was fixed to the concrete using M12 screw anchors at 300mm centres.

Test Assembly 06:
The test panel consisted of a Balustrade Assembly with a '1200mm(W) x 1100mm(H) x 14.28mm(T) SGP Glass panel' fixed at the bottom to a TLTC1217 aluminium channel at four locations using curve plates and bolt/nut tightening system. The aluminium channel was fixed to the concrete using M12 screw anchors at 300mm centres.

For details of the structure, refer to the design diagrams in report.

(All details provided by the client).

Details

ID	Item/Heat No.	Dimensions/Type/Details
LP23-0568/01	Test Assembly 1	TLTC1217 with 12.00mm Glass - Top Fixed
LP23-0568/02	Test Assembly 2	TLTC1217 with 12.00mm Glass - Top Fixed
LP23-0568/03	Test Assembly 3	TLTC1217 with 12.00mm Glass - Top Fixed
LP23-0568/04	Test Assembly 4	TLTC1217 with 12.00mm Glass - Top Fixed
LP23-0568/05	Test Assembly 5	TLTC1217 with 12.00mm Glass - Top Fixed
LP23-0568/06	Test Assembly 6	TLTC1217 with 14.28mm SGP Glass - Top Fixed

Examinations & Tests

Test 1: Concentrated Load Test - Test Assemblies 01, 02, 03, 04, 05, and 06.
As per Client's Requirements, AS/NZS 1170.1-2002 Clause 3.6 Occupancy-C3, and AS/NZS 1170.0-2002 Table B1 (Kt-1.13).

The load is applied at a height of 1000mm at the top corner of the glass balustrade assembly.
- Initial measurement was taken. An SLS of 0.6kN with Kt factor of 1.13, (0.6kN x 1.13 = 0.678kN), was then applied and held for 10 minutes and then deflection under load was measured. The load was removed and permanent deformation was measured.
- Initial measurement was taken. A ULS load of 0.6kN with Kt factor of 1.13, (0.6kN x 1.13 x 1.5 = 1.017kN), was then applied and held for 10 minutes and then deflection under load was measured. The load was removed and permanent deformation was measured.

Test 2: Uniform Load Test - Test Assemblies 01, 02, 03, 04, 05 and 06.
As per Client's Requirements, AS/NZS 1170.1-2002 Clause 3.6 Occupancy-C3, and AS/NZS 1170.0-2002 Table B1 (Kt-1.13).

The load is applied on a beam attached at a height of 1000mm on the glass balustrade assembly to uniformly distribute the load across the length.
- Initial measurement was taken. An SLS of 0.75kN/m with Kt factor of 1.13, (1.2m x 0.75kN/m x 1.13 = 1.017kN), was then applied and held for 10 minutes and then deflection under load was measured. The load was removed and permanent deformation was measured.
- Initial measurement is taken. A ULS load of 0.75kN/m with Kt factor of 1.13, (1.2m x 0.75kN/m x 1.5 x 1.13 = 1.526kN), was then applied

and held for 30 seconds and then deflection under load was measured. The load was removed and permanent deformation was measured.

Test 3: Post Breakage Test - Test Assembly 06.
As per Client's Requirements and AS 1288-2021 Appendix I.

Both sides of the laminated glass panel were broken. A load of 0.20kN was applied to the top corner of the glass balustrade and the deflection under the load was recorded.

Note: The ambient temperature during testing was between 24ºC - 26ºC.

Summary

The results of Test 1 - Test Assemblies 01, 02, 03, 04, 05, and 06 reported herein COMPLIED with the requirements of AS/NZS 1170.1-2002 Clause 3.6 for Occupancy-C3

The results of Test 2 - Test Assemblies 01, 02, 03, 04, 05 and 06 reported herein COMPLIED with the requirements of AS/NZS 1170.1-2002 Clause 3.6 for Occupancy-C3.

The results of Test 3 - Test Assemblies 06 reported herein COMPLIED with the requirements of AS1288-2021 Appendix I.

Remarks

AS/NZS 1170.1-2002 Clause 3.6 is NATA Accredited

Mohsen Alvani
Materials Engineer

Accredited for compliance with ISO/IEC 17025 – Testing
Accreditation Number 15840

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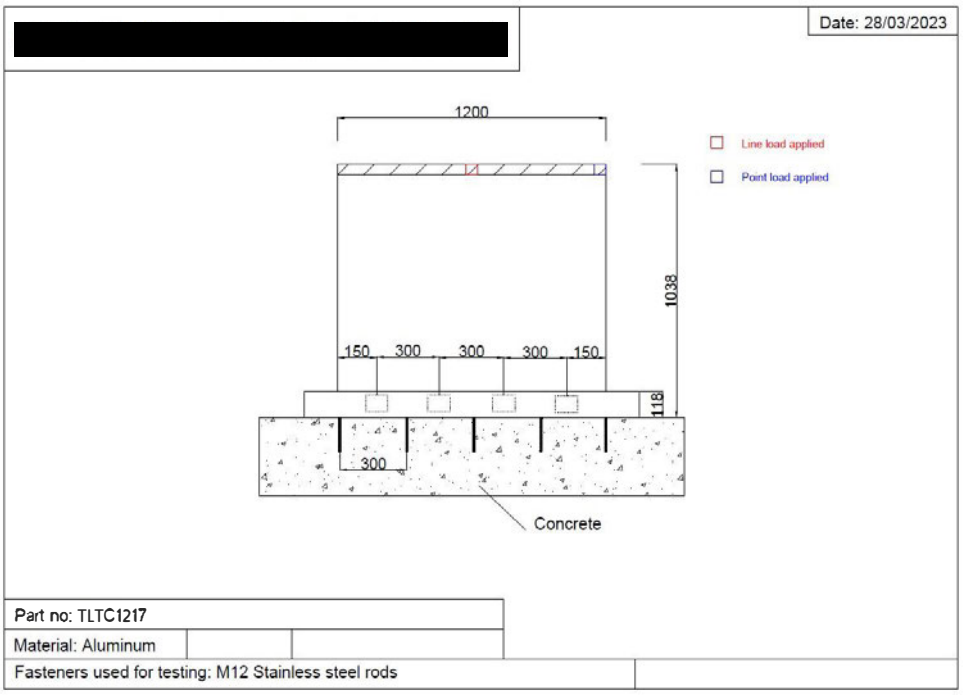
Results

Design Drawing



Design Drawing

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Results

Test 1: Concentrated Load Test

Test Specification AS/NZS 1170.1 - 2002 and Client Specification

Test Procedure MTS-TP3.7 Load Tests of Protective Enclosures, Barriers and Fences

Specimen ID	Test Load (N)	Deflection Under Load (mm)	Permanent Distortion (mm)	Observations	Assessment
LP23-0568/01 - SLS	678	25.3	0.6	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/01 - ULS	1,017	39.5	1.3	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/02 - SLS	678	25.2	0.4	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/02 - ULS	1,017	39.9	1.4	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/03 - SLS	678	25.8	1.0	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/03 - ULS	1,017	40.6	2.5	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/04 - SLS	678	26.2	0.3	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/04 - ULS	1,017	40.4	1.8	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/05 - SLS	678	25.2	0.4	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/05 - ULS	1,017	38.8	1.3	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/06 - SLS	678	18.1	0.6	No breakage, fracture or loosening of any part.	COMPLIES
	Note: 14.28mm Glass Panel				
LP23-0568/06 - ULS	1,017	29.4	2.0	No breakage, fracture or loosening of any part.	COMPLIES
	Note: 14.28mm Glass Panel				

Requirements No breakage, fracture or loosening of any part. Maximum deflection under SLS = 30mm. Maximum permanent displacement after ULS = 10mm.

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Results

Test 2: Uniform Load Test

Test Specification AS/NZS 1170.1 - 2002 and Client Specification

Test Procedure MTS-TP3.7 Load Tests of Protective Enclosures, Barriers and Fences

Specimen ID	Test Load (N)	Deflection Under Load (mm)	Permanent Distortion (mm)	Observations	Assessment
LP23-0568/01 - SLS	1,017	29.1	0.9	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/01 - ULS	1,526	47.7	2.9	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/02 - SLS	1,017	28.7	1.0	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/02 - ULS	1,526	48.8	3.3	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/03 - SLS	1,017	29.3	1.0	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/03 - ULS	1,526	49.3	3.4	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/04 - SLS	1,017	28.3	0.9	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/04 - ULS	1,526	46.6	2.9	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/05 - SLS	1,017	27.7	0.3	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/05 - ULS	1,526	45.7	2.5	No breakage, fracture or loosening of any part.	COMPLIES
LP23-0568/06 - SLS	1,017	21.0	0.0	No breakage, fracture or loosening of any part.	COMPLIES
	Note: 14.28mm Glass Panel				
LP23-0568/06 - ULS	1,526	38.9	3.7	No breakage, fracture or loosening of any part.	COMPLIES
	Note: 14.28mm Glass Panel				

Requirements No breakage, fracture or loosening of any part. Maximum deflection under SLS = 30mm. Maximum permanent displacement after ULS = 20mm.

Test 3: Post Breakage Test

Test Specification AS 1288 -2021 Appendix I

Test Procedure MTS-TP3.7 Load Tests of Protective Enclosures, Barriers and Fences

Specimen ID	Test Load (N)	Deflection Under Load (mm)	Observations	Assessment
LP23-0568/06	200	85.4		COMPLIES
	Note: 14.28mm Glass Panel			

Requirements 250mm maximum deflection at a load of 200N

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Results

Photographs

LP23-0568-01, 02, 03, 04, & 05 - Test Item

LP23-0568-06 - Test Item

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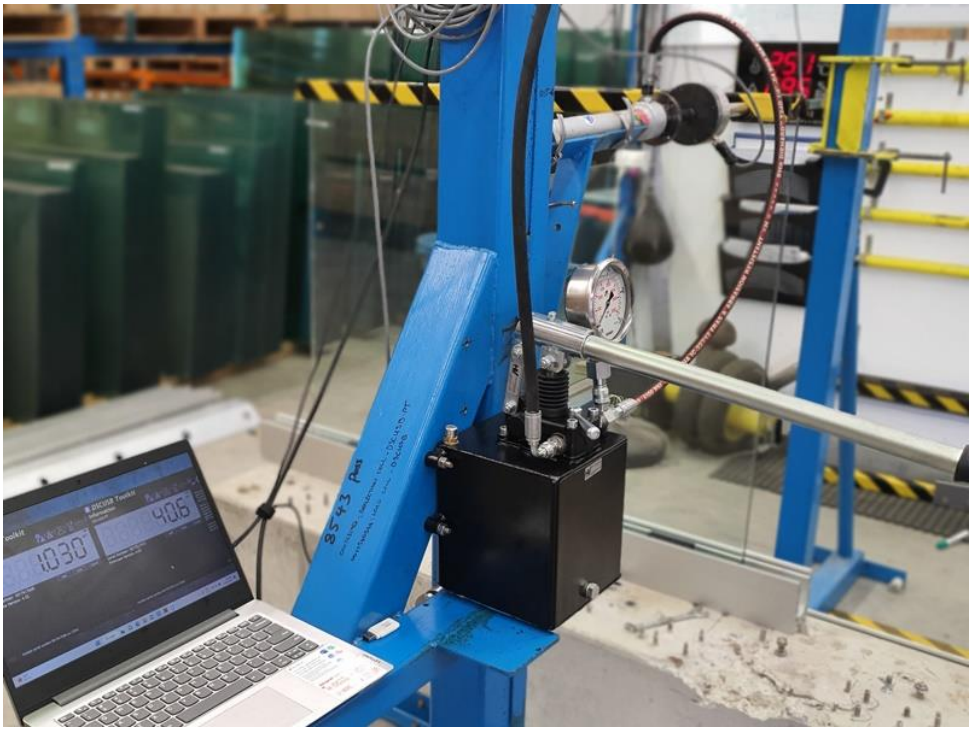
Results

Photographs



LP23-0568-01, 02, 03, 04, & 05 - Test 1 Setup

LP23-0568-01, 02, 03, 04, & 05 - Test 2 Setup

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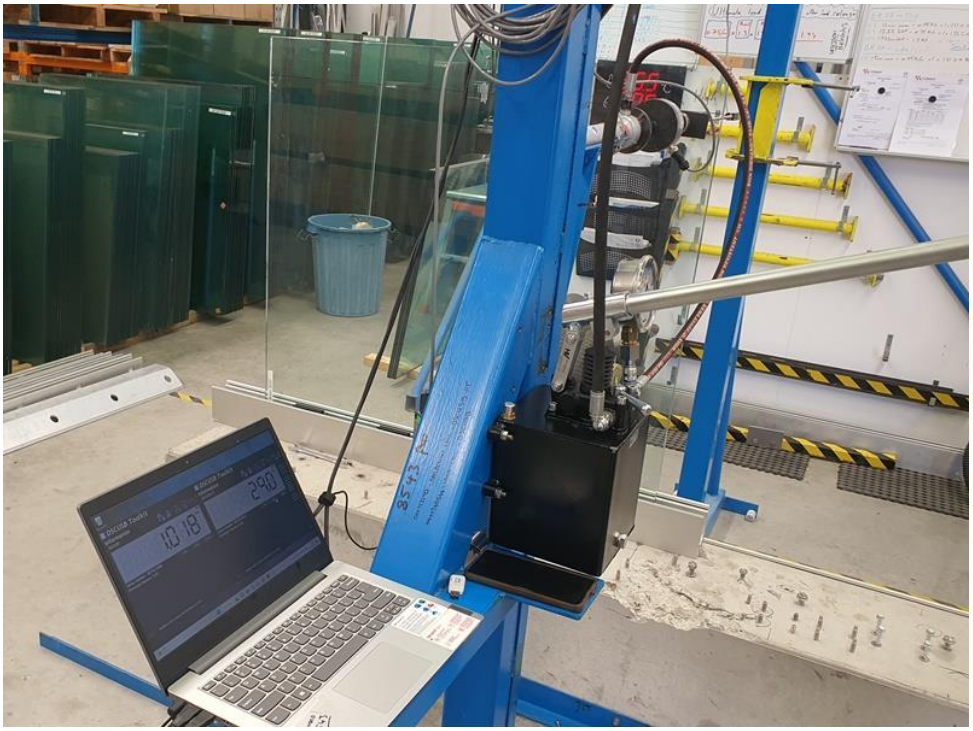
Results

Photographs



LP23-0568-06 - Test 1 Setup

LP23-0568-06 - Test 2 Setup

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Results

Photographs

LP23-0568-06 - Test 3 Setup

Notes

1. All test and inspection items will be discarded after 6 weeks, unless retrieved by the client's representative
2. Samples, identification of samples and all job specific details were supplied by the client.
3. Any stated nominal pipe sizes and nominal thickness of the material were provided by the client.
4. Where applicable, the Measurement Uncertainty (MU) applies to the test results as per LMATS procedure. MU can be obtained by contacting one of the LMATS ISO 17025 accredited laboratory.
5. If this report does not specify acceptance criteria, then the test or inspection results should be referred to a competent authority for further action.
6. Refer to the attached revision notes (if this report is revised). This report shall not be reproduced except in full without approval of the issuing laboratory to ensure that parts of a report are not taken out of context. The client or their representatives shall not edit this report.
7. LMATS or its professional indemnity insurance provider do not indemnify the contents within this report or the conformity of a tested product unless the invoice for the reported work is paid in full within the agreed credit terms. Reports will be revoked if the invoice for the completed work is not paid in full.