TECHNICAL REPORT
No. IR5166

BALUSTRADE LOAD TESTING (IN-HOUSE TESTING)

Job No. J5039

PREPARED BY TESTCONSULT FOR

PANIDIS SA

October 2017

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1. INTRODUCTION

Testconsult was instructed by PANIDIS SA (client) to carry out in-house balustrade load testing to one glass Infill balustrade system MS6030 with a panel thickness 11.5mm.

Testing was carried out on Thursday 5th October 2017.

2. METHODOLOGY

2.1 Setup

As instructed by the client, 1 No. balustrade was tested; 3 respective tests were carried out on the system:

1. Uniformly distributed Line Load
2. Uniform Distributed Load
3. Point Load

The Load was applied by using a hydraulic system and a displacement gauge was used to measure the deflection at the point where maximum deflection was anticipated.

The posts provided by the client, were installed and secured to the concrete floor, using M10 projecting bolt anchors and fastened to the flange of the posts with an appropriate M10 washer and nut. The glass infill panels were then clamped into place using the incumbent fittings and infill rubbers, connected to the Allen key fittings.

2.1.1 Horizontal Uniformly Distributed Line Load Test

For the horizontal uniformly distributed line load test a stiff square section beam was used to apply the load uniformly. The load was applied incrementally with the use of a hydraulic jack that pushed the beam thus applying a line load to the infill panel. The jack was attached to 1100mm tall bracket that was anchored to the floor.

2.1.2 Uniformly Distributed Area Load Test

In order to apply the load uniformly on the infill a wooden panel of $1m^2$ of area was used.

2.1.3 Point Load Test

For the point load test the end of the jack was used to apply a load at the centre of the glass infill.

2.2 LOAD ASSESSMENTS

The barrier should be of adequate strength and stiffness to sustain the applied loads and have a maximum deflection that does not exceed the specification defined in BS 6180:2011.

Section 6.4 of the standard specifies the maximum allowable horizontal deflection and the deflection on the load to the infill. In each instance the following loading conditions are applicable:

- Horizontal uniformly distributed line load (applied at 1.1m from the finished floor)
- Uniformly distributed load applied to the infill
- Point load applied to the infill

Furthermore in the BS 6180:2011 it is stated that for the horizontal uniformly distributed line load the maximum allowable deflection at any point of the system is 25mm. Also for the load tests to the infill the maximum allowable deflection at any point of the system is 25mm or L/65, whichever is smaller (where L is the distance between the supports).

2.3 TEST PROCEDURE

2.3.1 Horizontal Uniformly Distributed Line Load Test

Load was applied to the infill panel in increments until the full load of 0.74kN/m was reached. During the load process, deflection was measured at the centre of the rail.

2.3.2 Uniformly Distributed Area Load Test

Load was applied to the infill panel in increments until the full load of 1.0kN/m^2 was reached. During the process the deflection was measured in the centre of the infill.

2.3.3 Point Load Test

The load was applied to the infill panel in increments until the full load of 0.5kN was reached. Deflection was measured in the centre of the infill.

3. RESULTS & FINDINGS

The results of balustrade tests are presented on test certificates along with a plot. The table below indicates the location and size of each balustrade tested.

Table 1- Results

Balustrade ID	Size (width)	Maximum deflection		
		UDLL	UDL to Infill	PL to Infill
Glass Infill 11.5mm Thickness	1000 mm	19.66 mm	3.24 mm	0.23 mm

In conclusion to the results the balustrade system MS-6030 tested is of adequate strength and stiffness and can be used at:

1. Domestic and residential activities:
    a. All areas within or serving exclusive one single family dwelling including stairs, landings, etc. but excluding external balconies and edges or roofs
    b. Other residential, i.e. houses of multiple occupancy and balconies, including Juliette balconies and edges of roofs in single family dwellings.

2. Offices and work areas not included elsewhere, including storage areas:
    a. Light access stairs and gangways not more than 600 mm wide.
    b. Light pedestrian traffic routes in industrial and storage buildings except designated escape routes.
    c. Areas not susceptible to overcrowding in office and institutional buildings, also industrial and storage buildings except as given above

3. Areas without obstacles for moving people and not susceptible to overcrowding:
    a. Stairs, landings, corridors, ramps
    b. External balconies including Juliette balconies and edges of roofs. Footways and pavements within building curtilage adjacent to basement/sunken areas

The balustrade system is therefore considered to be satisfactory and meet the conditions stated in the aforementioned British Standard for the above usages.

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ADRIAN BROWN **IWAN JONES**

Product Test Engineer **Technical Authority**

For and on behalf of TESTCONSULT

APPENDIX A

TEST PHOTOGRAPHS – GENERAL ARRANGEMENT & SETUP

Figure 1a: M10 Projecting Bolt Anchors with M10 washer and M10 nut.

Figure 1b: M10 Projecting Bolt Anchor.

Figure 2: Uniform Distributed Line Load Test

Figure 3: Uniform Distributed Load Test

Figure 4: Point Load Test

APPENDIX B

TEST CERTIFICATE

TESTCONSULT - JAMES FISHER TESTING SERVICES LIMITED
Ruby House, 40A Hardwick Grange, Warrington WA1 4RF
Tel. (01925) 286880 Fax. 01925) 286881

LABORATORY TEST REPORT

In-situ Balustrade Test - BS 6180:2011 Barriers in and about buildings

Project :	Panidis In-House testing	**Job No.:**	J5039
Client :	Panidis	**Date Tested:**	05/10/2017
		Date Reported:	05/10/2017
		Material:	11.5mm Laminate Glass Infill Panel
		Specification:	BS 6180:2011
Originator:	**Adrian Brown**		

Test Reference Panidis 11.5mm LAMINATE

Intended Use 0.74 kN/m Domestic and residential activities (ii)

Imposed Loads

Horizontal Uniformly Distributed Line Load	0.74	kN/m
Uniformly Distributed Load Applied To Infill	1.0	kN/m^2
Point Load Applied To Infill	0.5	kN

Balustrade component dimensions

Overall Height	**1.1**	m
Overall Width	1.1	m
Centre to Centre	1.1	m

Glass panel dimensions

Height	1	m
Width	1	m
Thickness	11.5	mm

Test Details

Overall Test Length (centre to centre)	1100	mm
Line Load Height	1100	mm
Pressure Plate Height	1000	mm
Pressure Plate Width	1000	mm
Pressure Plate Area	**1**	**m^2**
Number of Hydraulic Rams	1	
Effective hydraulic area	0.00065	m^2
L/65	16.92	mm

Test Summary

Allowable deflection line load	25.00	mm	
Measured deflection	19.66	mm	Pass
Allowable deflection uniformly distributed	16.92	mm	
Measured deflection	3.24	mm	Pass
Allowable deflection point load	16.92	mm	
Measured deflection	0.23	mm	Pass

Test Engineer

Signed Adrian Brown

Name Adrian Brown

Date 06/11/2017

Line Load

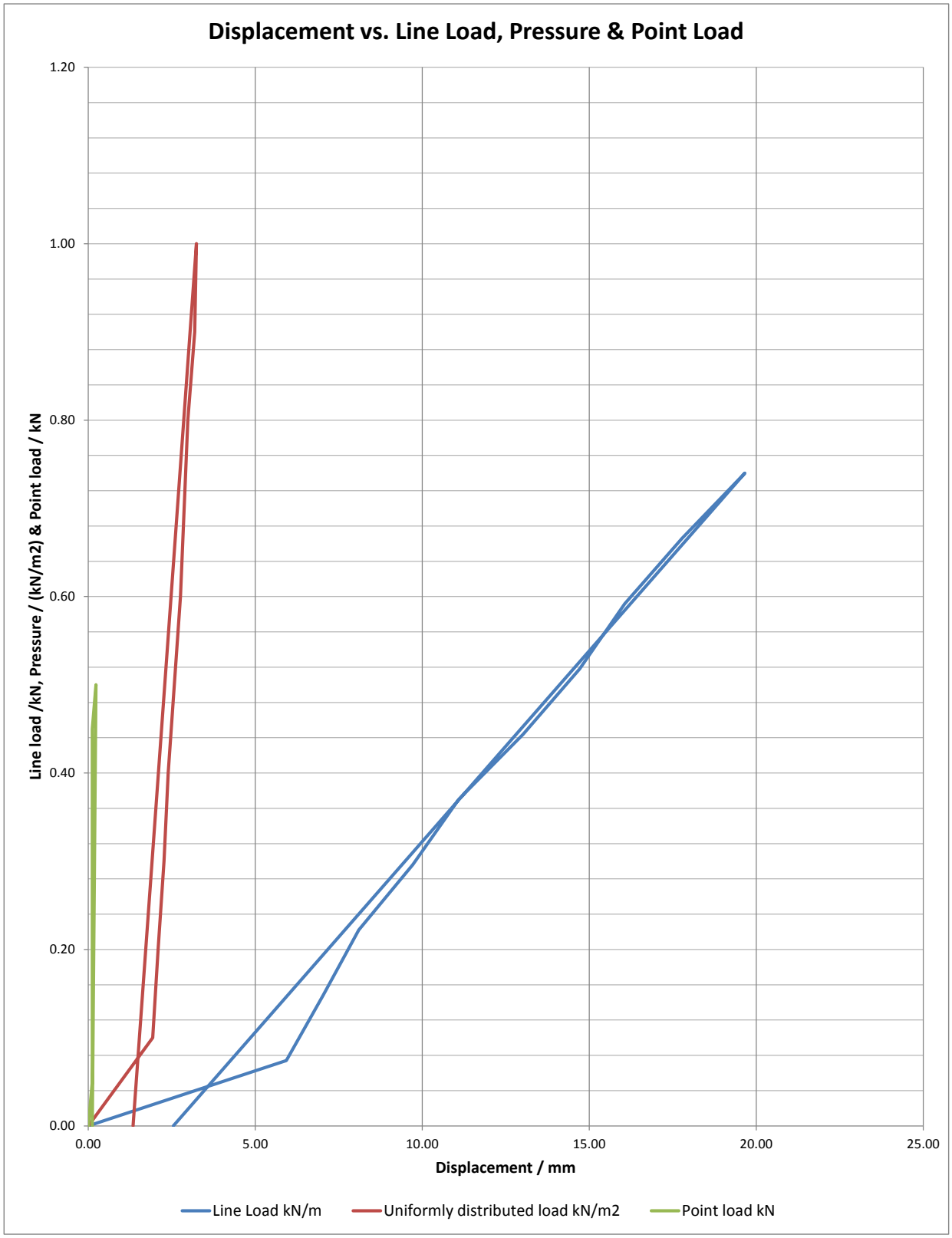
Line Load / (kN/m)	Applied Load / kN	Applied Pressure / kPa	Applied Pressure / Bar	Measured Deflection / mm
0.00	0.00	0.00	0.00	0.00
0.07	0.08	125.23	1.25	5.93
0.15	0.16	250.46	2.50	7.03
0.22	0.24	375.69	3.76	8.10
0.30	0.33	500.92	5.01	9.72
0.37	0.41	626.15	6.26	11.09
0.44	0.49	751.38	7.51	13.02
0.52	0.57	876.62	8.77	14.71
0.59	0.65	1001.85	10.02	16.06
0.67	0.73	1127.08	11.27	17.78
0.74	0.81	1252.31	12.52	19.66
0.00	0.00	0.00	0.00	2.55

Uniform Load

Pressure / (kN/m^2)	Applied Load / kN	Applied Pressure / kPa	Applied Pressure / Bar	Measured Deflection / mm
0.00	0.00	0.00	0.00	0.00
0.10	0.10	153.85	1.54	1.93
0.20	0.20	307.69	3.08	2.09
0.30	0.30	461.54	4.62	2.27
0.40	0.40	615.38	6.15	2.39
0.50	0.50	769.23	7.69	2.58
0.60	0.60	923.08	9.23	2.76
0.70	0.70	1076.92	10.77	2.87
0.80	0.80	1230.77	12.31	2.98
0.90	0.90	1384.62	13.85	3.19
1.00	1.00	1538.46	15.38	3.24
0.00	0.00	0.00	0.00	1.34

Point Load 25 mm diameter point load

Point Load / kN	Applied Pressure / kPa	Applied Pressure / Bar	Deflection / mm
0.00	0.00	0.00	0.00
0.05	76.92	0.77	0.12
0.10	153.85	1.54	0.12
0.15	230.77	2.31	0.12
0.20	307.69	3.08	0.12
0.25	384.62	3.85	0.12
0.30	461.54	4.62	0.12
0.35	538.46	5.38	0.12
0.40	615.38	6.15	0.12
0.45	692.31	6.92	0.12
0.50	769.23	7.69	0.23
0.00	0.00	0.00	0.12


Displacement vs. Line Load, Pressure & Point Load
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Line load /kN, Pressure / (kN/m2) & Point load / kN
0.00
5.00
10.00
15.00
20.00
25.00
Displacement / mm
Line Load kN/m
Uniformly distributed load kN/m2
Point load kN