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OnLevel Test Report

Sky Force Balustrade Testing to BS 6180: 2011

DOCUMENT REFERENCE: DR-5219
PROJECT FILE REFERENCE: P10002

Prepared for: OnLevel
18 Church Street, Ashton under Lyne, Lancashire, OL6 6XE

Revision	Date	Reason for Issue:
Rev0	31/10/2019	Draft for External Review
Rev1	26/11/2019	Amended, Final Issue

CONTENTS

APPENDIX:

1. INTRODUCTION

STS-UK Group were commisioned by Onlevel to undertake a series of balustrade tests on their own products in accordance with BS 6180:2011. Static load testing was carried out as described in the aforementioned standard to determin the load charactoristics of the products. All testing was carried out by STS-UK Group our their Ellesmere Port Testing facility. The purpose of the testing was to attain results and findings that could be analysed to see if the systems were capable of withstanding the imposed loadings described in BS 6180:2011.

Installation of the barriers were carried out by STS-UK Group with On Levels's own personel overseeoing the install.

The testing took place at the following address:

Site Address: STS-UK Group, Unit 4 Poole Hall Business Park, Poole Hall Road, Ellesmere Port, Cheshire, CH66 1UA

This report summarises the test results obtained during testing by STS-UK Group and does not provide any interpretation of those results.

2. TEST SAMPLES

The test samples were all provided by Onlevel and including all balustrade equipment and fixings. Each balustrade was fixed to a concrete section for testing. The concrete section was cast indoors and with a C60 grade concrete.

The samples provided were as follows:

- Sky Force Side Mount – various sizes

See Appendix A for Test Sample Drawings.

3. TEST PROGRAMME

The results tabulated below were found during testing between the 5th and 6th June 2019. For further analysis on the results found see section 4 of this report.

Test Item	System Size (mm)	Glass (mm)	Notes/Comments
Sky Force Side Mount	1200 x 1100	6-1.5-4	
Sky Force	1500 x 1100	8-1.5-8	
Sky Force	2600 x 1100	10-1.5-10	

Table 1 – Test Programme

4. TEST METHOD

All balustrade testing was undertaken, as per BS 6180, by three separate methods. Firstly, a UDL (Uniformly Distributed Load) over the width of an individual panel, secondly an infill load over a m^2 section and finally a point load of 20mm^2 placed on the infill panel. The loads required for the standard varied from 0.36kN/m up to 3.0kN/m, depending on the client's request, the load is referenced in BS 6180:2011.

Following the installation of the balustrade by an OnLevel representative, the system was reviewed by and STS-UK technician. Following this a bespoke load frame was positioned in front of the balustrade and fixed down to the concrete floor.

The load frame held one hydraulic cylinder that was connected to a hand pump by way of hydraulic hoses and an in-line hydraulic pressure sensor. Once the frame and hydraulics were positioned, a draw wire displacement sensor was placed along the balustrade on a free-standing tripod as close to the hydraulic jack positions as possible and wired back to a logging system. The load was then applied in a steady manner, all displacement and forces were then dynamically recorded directly to a data logger. Once the test achieved its criteria, all imposed load was removed, and the permanent deflection noted down.

The tests were be deemed a success if the system's (1) demonstrated they did not suffer non-elastic displacements and (2) displacements did not exceed 25mm respectively to their individual criteria, in accordance with BS 6180. If non-elastic displacements do occur the test was aborted, and the system declared unfit for purpose.

5. RESULTS

All Testing found in this report was carried out in accordance with guidance found in BS 6180:2011. This standard states that the maximum allowable deflection at full load is 25mm.

Table 2 below shows the results found during the testing, for test certificates please see Appendix B.

Test Number	Product Type – Size - Glass	Date Tested	Test Type (UDL, Infill, Point load)	Load Applied	Result at Full Load (mm)	Pass/Fail
1	Sky Force – 1100 x 1200 – 6-6-4	3rd July 2019	UDL	1.5kN/m	14.00	Pass
2	Sky Force – 1100 x 1200 – 6-6-4	3rd July 2019	Point Load	1.5kN	9.33	Pass
3	Sky Force – 1100 x 1200 – 6-6-4	3rd July 2019	Infill	1.5kN/m²	3.91	Pass
15	Sky Force – 1100 x 1500 – 8-1.52-8	4th July 2019	UDL	1.5kN/m	20.64	Pass
16	Sky Force – 1100 x 1500 – 8-1.52-8	4th July 2019	Infill	1.5kN/m²	7.31	Pass
17	Sky Force – 1100 x 1500 – 8-1.52-8	4th July 2019	Point Load	1.5kN	9.21	Pass
26	Sky Force – 1100 x 2600 – 10-1.52-10	4th July 2019	UDL	1.5kN/m	21.22	Pass
30	Sky Force – 1100 x 2600 – 10-1.52-10	5th July 2019	Infill	1.5kN/m²	4.19	Pass
31	Sky Force – 1100 x 2600 – 10-1.52-10	5th July 2019	Point Load	1.5kN	9.47	Pass

Table 3 – Product Test Results

All Information found in this report is formed from factual results found during the testing of the products.

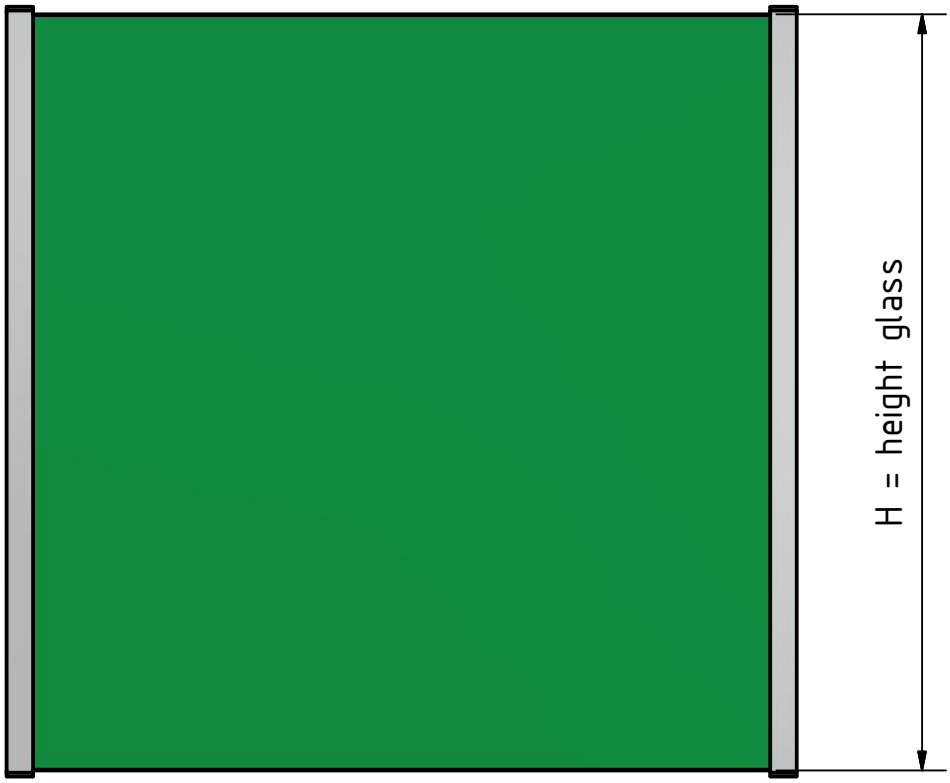
For photographic records of sample testing please see Appendix C.

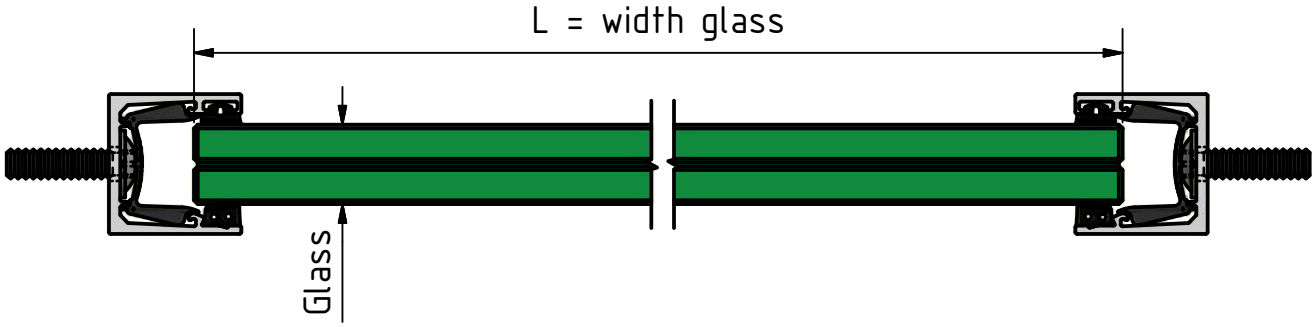
	Name	Signature	Date
Created By: Technical Director	Andrew Gore		26.11.2019
Checked By: Commercial Director	Ryan Kundi		26.11.2019

For and on behalf of Specialist Technical Services (U.K) Limited

APPENDIX A

OnLevel Balustrade Drawings





REACHED LOADS					
GLASS	H = HEIGHT GLASS	L = WIDTH GLASS	LINE LOAD	INFILL LOAD	POINT LOAD
6/6/4	1100mm	max. 1200mm	1.5 kN/m	1.5kN/m^2	1.5 kN
8/8/4	1100mm	max. 1500 mm	1.5 kN/m	1.5kN/m^2	1.5 kN
10/10/4	1100mm	max. 2600mm	1.5 kN/m	1.5kN/m^2	1.5 kN

Glass type: laminated tempered glass with PVB foil

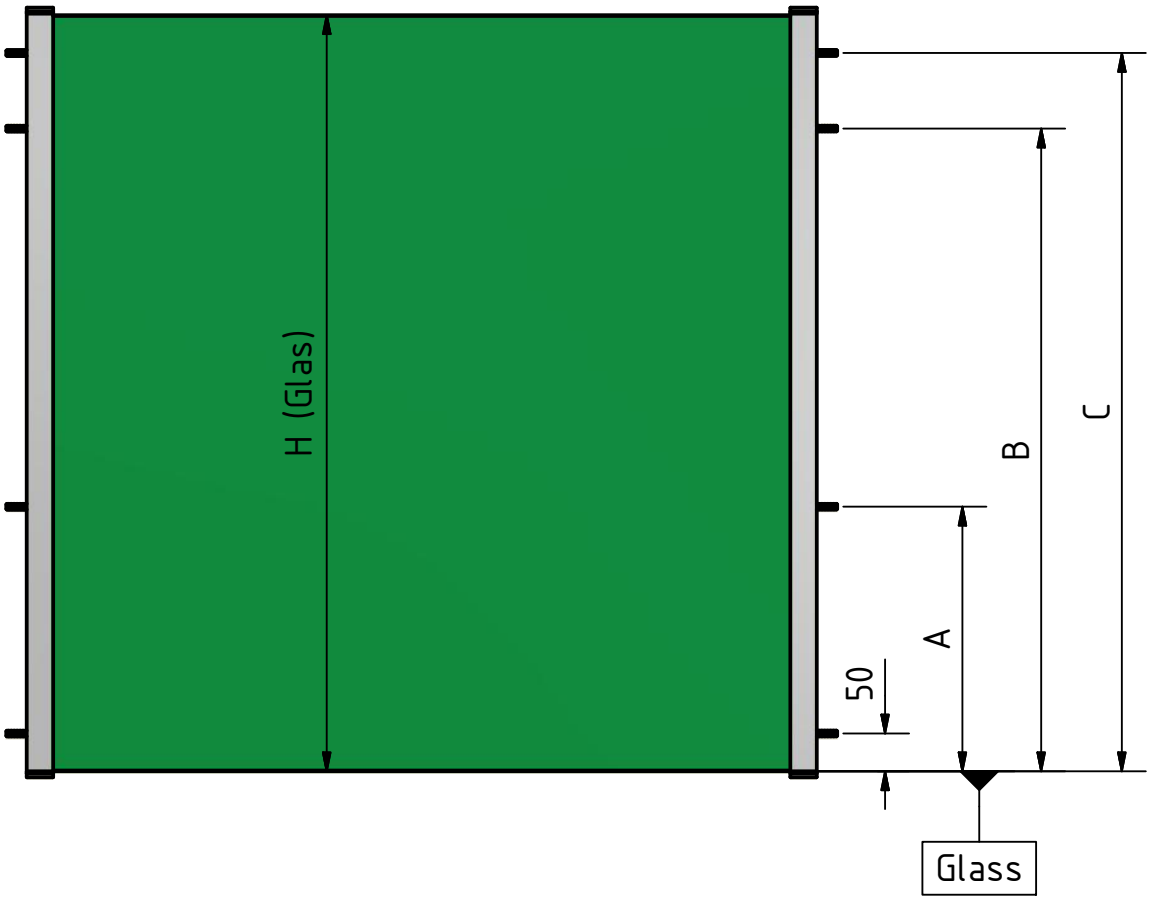
Designed by	Created	Modificated	Comment
FV	14-10-2019		

ONLEVEL

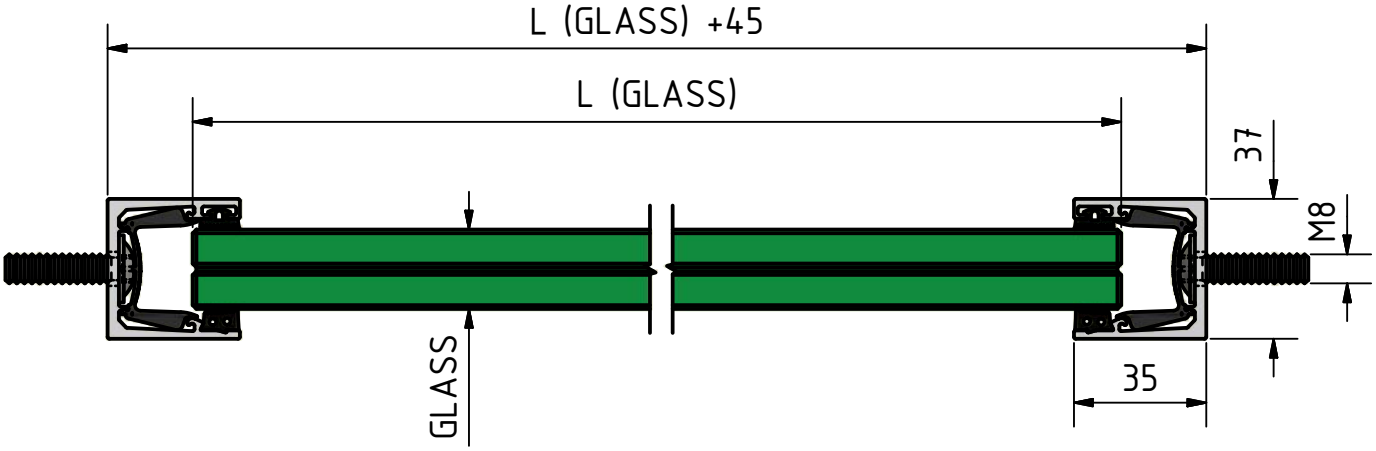
Description

Detail 1: SKYFORCE SIDE MOUNT

Article number	Size	Scale
SKYFORCE	A4	1 : 2



Glass height	500mm	600mm	700mm	800mm	900mm	1000mm	1100mm	1200mm
A	200	250	300	350	400	450	500	550
B	350	450	550	650	750	850	950	1050
C	450	550	650	750	850	950	1050	1150



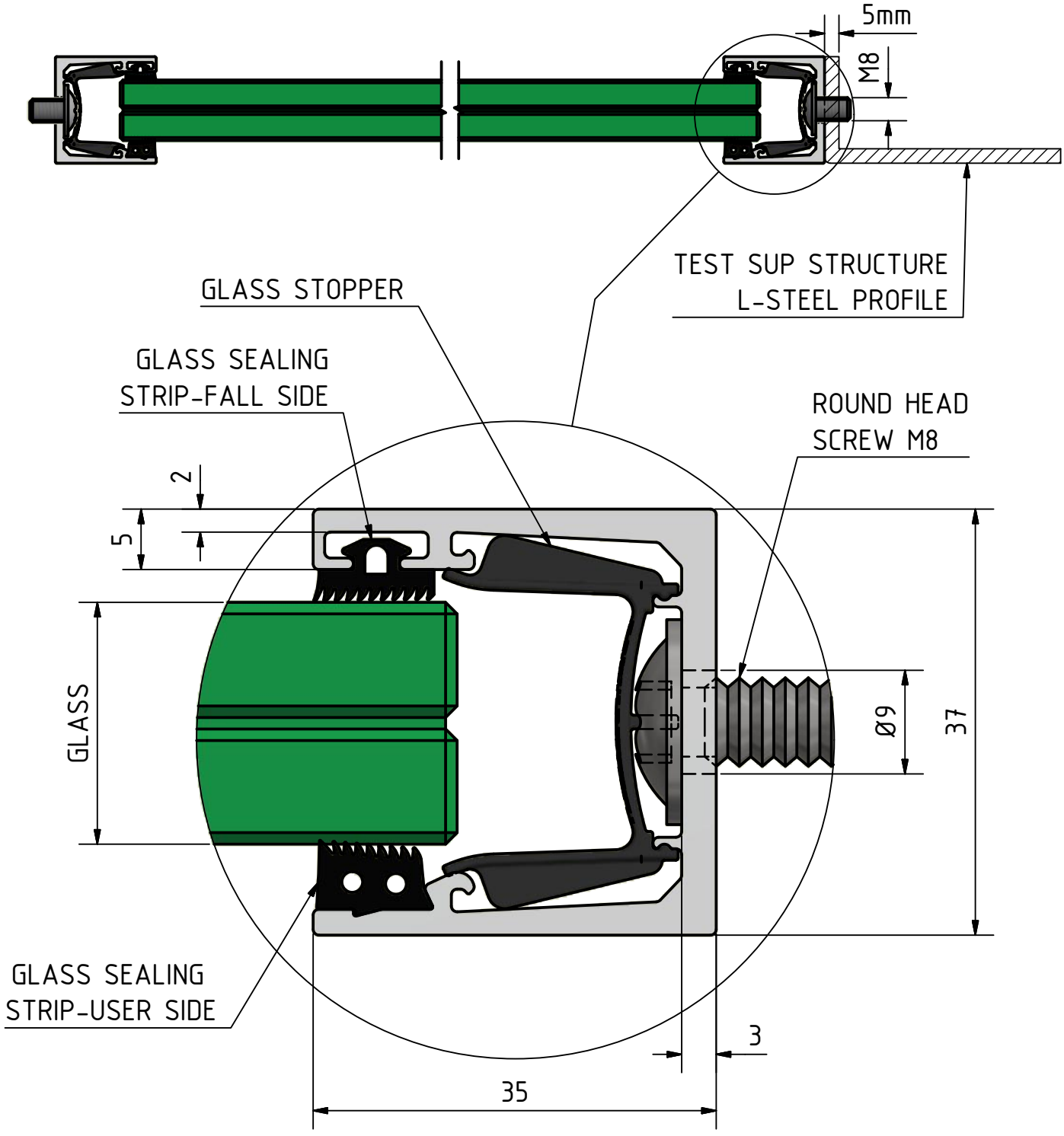
Designed by	Created	Modificated	Comment
FV	14-10-2019		

ONLEVEL

Description

Detail 2: SKYFORCE SIDE MOUNT DIMENSIONS

Article number	Size	Scale
SKYFORCE	A4	1 : 2



Designed by	Created	Modificated	Comment
FV	14-10-2019		

ONLEVEL

Description

Detail 3: SKYFORCE SIDE MOUNT DIMENSIONS

Article number	Size	Scale
SKYFORCE	A4	

APPENDIX B

Test Certificates

TEST CERTIFICATE
BALUSTRADE TESTING IN ACCORDANCE WITH BS 6180:2011

On behalf of OnLevel Ltd
8 Alexandria Court, Ashton Commerce Park, Ashton Commerce Park,
Ashton-under-Lyne, Lancashire, OL7 0QN, United Kingdom

HORIZONTAL UDL 1.5kN, Skyforce Side Mounted System

TEST DESCRIPTION: A uniformly distributed load was applied to the balustrade system at a height of 1100mm to determine the deflection of the balustrade system when assembled. Independent drawstring potentiometers where positioned accordingly to measure the deflection of the installed system throughout the testing procedure. The balustrade system was installed by the client to their own specification.

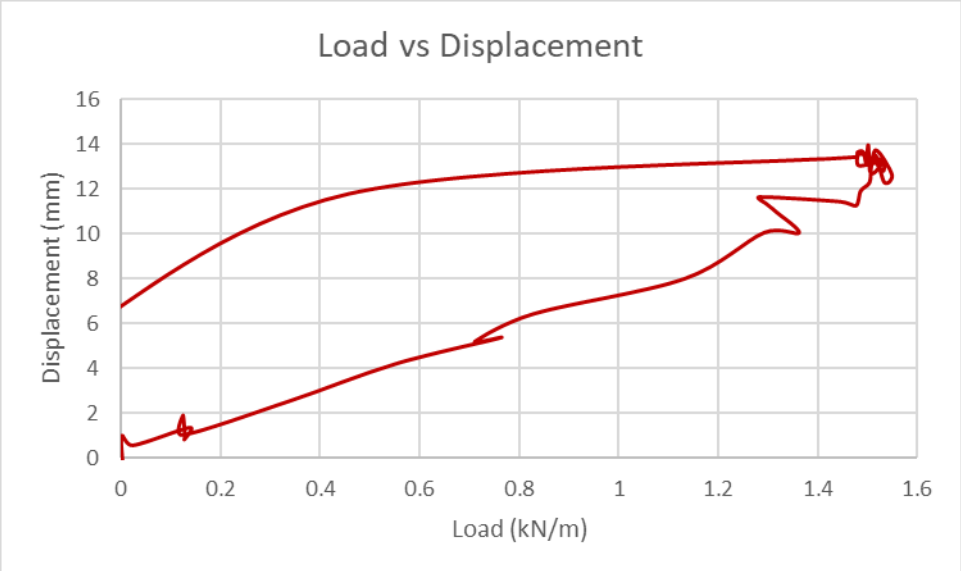
REF NO.:	DR-5204	**DATE TESTED:**	03rd July 2019
JOB NO.:	P10002	**DATE REPORTED:**	N / A
CERTIFICATE NO.:	IC8587	**CERTIFICATE DATE:**	17th July 2019

TEST DETAILS:

Barrier Test Height: 1100mm
Barrier Test Length: 1200mm
Test Description: Test 1 – 1.5kN UDL – Skyforce – 6x4x6 Glass

TEST RESULTS:

Load (kN/m)	Displacement (mm)	Permanent Displacement (mm)
1.5kN	14.00	2.32



ANALYSIS:
The balustrade system when assembled and tested in the manor indicated within this certificate conforms to BS6180:2011. The balustrade barrier achieved a loading of 1.5kN/m with a maximum recorded displacement of 14.00mm.

NAME: **Evan Wiggins**
POSITION: **Junior Technician**

TEST CERTIFICATE
BALUSTRADE TESTING IN ACCORDANCE WITH BS 6180:2011

On behalf of OnLevel Ltd
8 Alexandria Court, Ashton Commerce Park, Ashton Commerce Park,
Ashton-under-Lyne, Lancashire, OL7 0QN, United Kingdom

Point Load 1.5kN,
Skyforce Side Mounted System

TEST DESCRIPTION: A point load was applied to the balustrade system central of the glass pane to determine the deflection of the balustrade system when assembled. Independent drawstring potentiometers where positioned accordingly to measure the deflection of the installed system throughout the testing procedure. The balustrade system was installed by the client to their own specification.

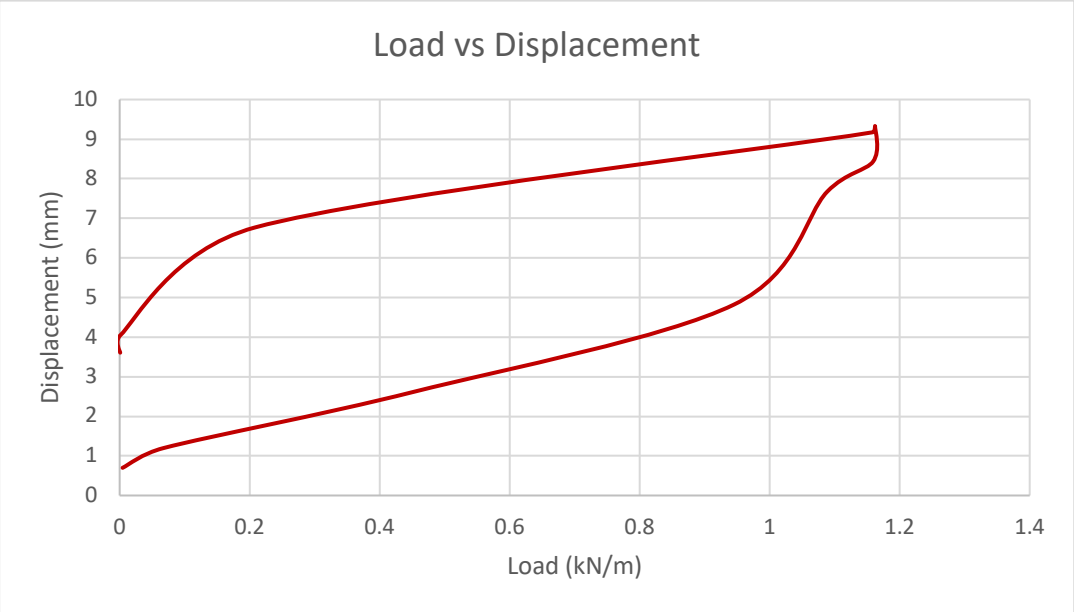
REF NO.: DR-5204
JOB NO.: P10002
CERTIFICATE NO.: IC8588
DATE TESTED: 03rd July 2019
DATE REPORTED: N / A
CERTIFICATE DATE: 17th July 2019

TEST DETAILS:

Barrier Test Height: 1100mm
Barrier Test Length: 1200mm
Test Description: Test 2 – 1.5kN Point Load – Skyforce – 6x4x6 Glass

TEST RESULTS:

Load (kN/m)	Displacement (mm)	Permanent Displacement (mm)
1.5kN	9.33	3.61



ANALYSIS:
The balustrade system when assembled and tested in the manor indicated within this certificate conforms to BS6180:2011. The balustrade barrier achieved a loading of 1.5kN/m with a maximum recorded displacement of 9.33mm.

NAME: **Evan Wiggins**
POSITION: **Junior Technician**

TEST CERTIFICATE
BALUSTRADE TESTING IN ACCORDANCE WITH BS 6180:2011

On behalf of OnLevel Ltd
8 Alexandria Court, Ashton Commerce Park, Ashton Commerce Park,
Ashton-under-Lyne, Lancashire, OL7 0QN, United Kingdom

Infill UDL 1.5kN,
Skyforce Side Mounted System

TEST DESCRIPTION: An Infill UDL was applied to the balustrade system using a large, square spreader reacting on the glass pane to determine the deflection of the balustrade system when assembled. Independent drawstring potentiometers where positioned accordingly to measure the deflection of the installed system throughout the testing procedure. The balustrade system was installed by the client to their own specification.

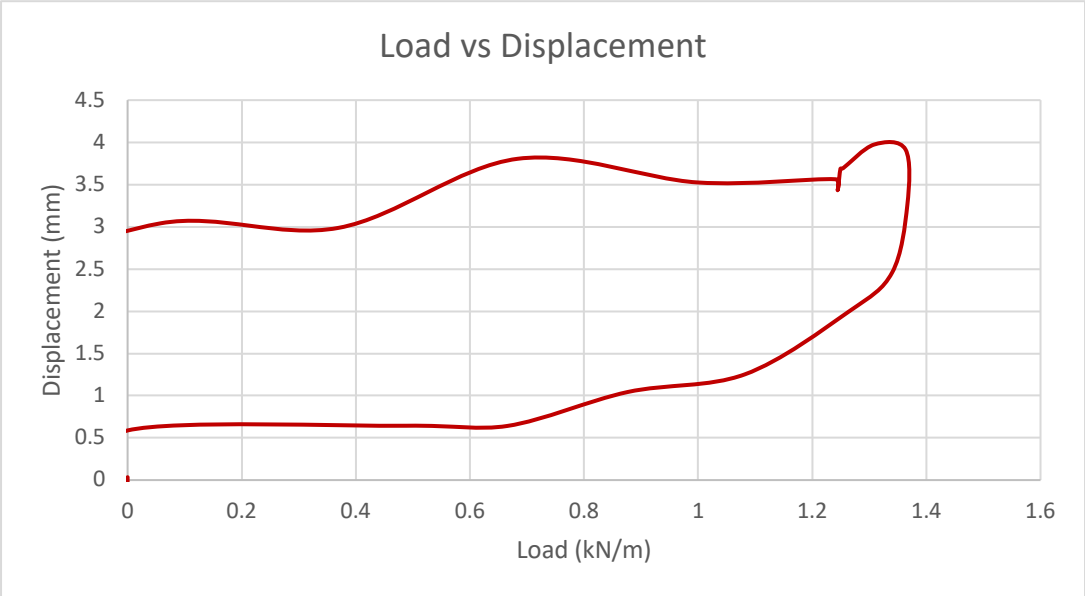
REF NO.:	DR-5204	**DATE TESTED:**	03rd July 2019
JOB NO.:	P10002	**DATE REPORTED:**	N / A
CERTIFICATE NO.:	IC8589	**CERTIFICATE DATE:**	17th July 2019

TEST DETAILS:

Barrier Test Height: 1100mm
Barrier Test Length: 1200mm
Test Description: Test 3 – 1.5kN Infill UDL – Skyforce – 6x4x6 Glass

TEST RESULTS:

Load (kN/m)	Displacement (mm)	Permanent Displacement (mm)
1.5kN	4.00	0.65



ANALYSIS:
The balustrade system when assembled and tested in the manor indicated within this certificate conforms to BS6180:2011. The balustrade barrier achieved a loading of 1.5kN/m with a maximum recorded displacement of 4.00mm.

NAME: **Evan Wiggins**
POSITION: **Junior Technician**

TEST CERTIFICATE
BALUSTRADE TESTING IN ACCORDANCE WITH BS 6180:2011

On behalf of OnLevel Ltd
8 Alexandria Court, Ashton Commerce Park, Ashton Commerce Park,
Ashton-under-Lyne, Lancashire, OL7 0QN, United Kingdom

HORIZONTAL UDL 1.5kN, Skyforce Side Mounted System

TEST DESCRIPTION: A uniformly distributed load was applied to the balustrade system at a height of 1100mm to determine the deflection of the balustrade system when assembled. Independent drawstring potentiometers where positioned accordingly to measure the deflection of the installed system throughout the testing procedure. The balustrade system was installed by the client to their own specification.

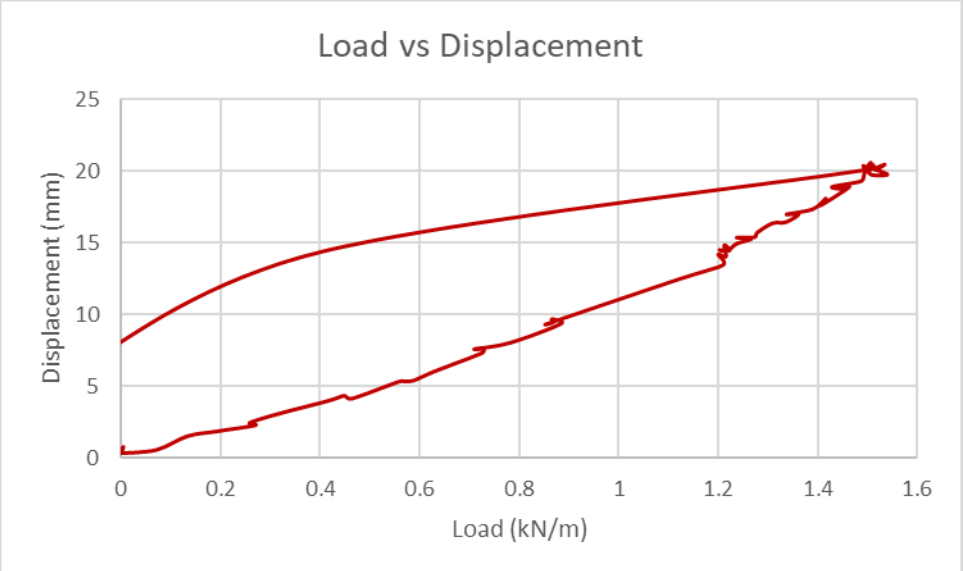
REF NO.:	DR-5204	**DATE TESTED:**	04th July 2019
JOB NO.:	P10002	**DATE REPORTED:**	N / A
CERTIFICATE NO.:	IC8601	**CERTIFICATE DATE:**	22nd July 2019

TEST DETAILS:

Barrier Test Height: 1100mm
Barrier Test Length: 1500mm
Test Description: Test 15 - Sky Force Side Mount – 8mm x 1.5mm x 8mm glass - 1.5kN

TEST RESULTS:

Load (kN/m)	Displacement (mm)	Permanent Displacement (mm)
1.5kN	20.64	1.86



ANALYSIS:
The balustrade system when assembled and tested in the manor indicated within this certificate conforms to BS6180:2011. The balustrade barrier achieved a loading of 1.5kN/m with a maximum recorded displacement of 20.64mm.

NAME: **Evan Wiggins**
POSITION: **Junior Technician**

TEST CERTIFICATE
BALUSTRADE TESTING IN ACCORDANCE WITH BS 6180:2011

On behalf of OnLevel Ltd
8 Alexandria Court, Ashton Commerce Park, Ashton Commerce Park,
Ashton-under-Lyne, Lancashire, OL7 0QN, United Kingdom

Infill UDL 1.5kN,
Skyforce Side Mounted System

TEST DESCRIPTION: An Infill UDL was applied to the balustrade system using a large, square spreader reacting on the glass pane to determine the deflection of the balustrade system when assembled. Independent drawstring potentiometers where positioned accordingly to measure the deflection of the installed system throughout the testing procedure. The balustrade system was installed by the client to their own specification.

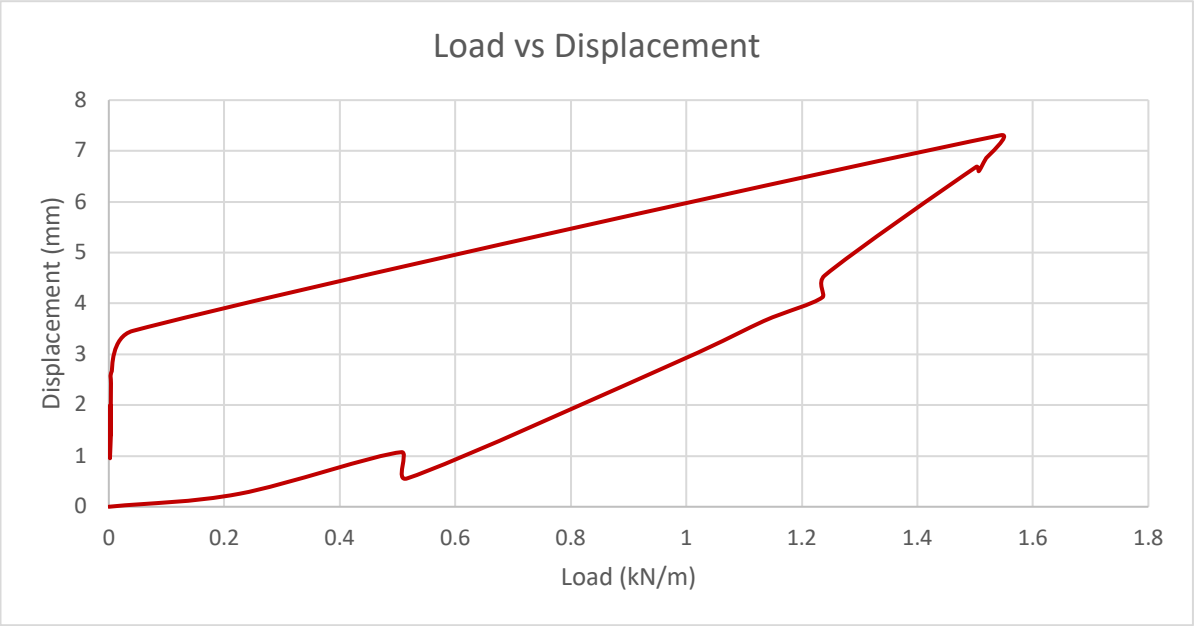
REF NO.:	DR-5204	**DATE TESTED:**	04th July 2019
JOB NO.:	P10002	**DATE REPORTED:**	N / A
CERTIFICATE NO.:	IC8602	**CERTIFICATE DATE:**	22nd July 2019

TEST DETAILS:

Barrier Test Height: 1100mm
Barrier Test Length: 1500mm
Test Description: Test 16 - Sky Force Side Mount – 8mm x 1.5mm x 8mm glass - 1.5kN - In Fill

TEST RESULTS:

Load (kN/m)	Displacement (mm)	Permanent Displacement (mm)
1.5kN	7.31	1.16



ANALYSIS:
The balustrade system when assembled and tested in the manor indicated within this certificate conforms to BS6180:2011. The balustrade barrier achieved a loading of 1.5kN/m with a maximum recorded displacement of 7.31mm.

NAME: **Evan Wiggins**
POSITION: **Junior Technician**

TEST CERTIFICATE
BALUSTRADE TESTING IN ACCORDANCE WITH BS 6180:2011

On behalf of OnLevel Ltd
8 Alexandria Court, Ashton Commerce Park, Ashton Commerce Park,
Ashton-under-Lyne, Lancashire, OL7 0QN, United Kingdom

Point Load 1.5kN,
Skyforce Side Mounted System

TEST DESCRIPTION: A point load was applied to the balustrade system central of the glass pane to determine the deflection of the balustrade system when assembled. Independent drawstring potentiometers where positioned accordingly to measure the deflection of the installed system throughout the testing procedure. The balustrade system was installed by the client to their own specification.

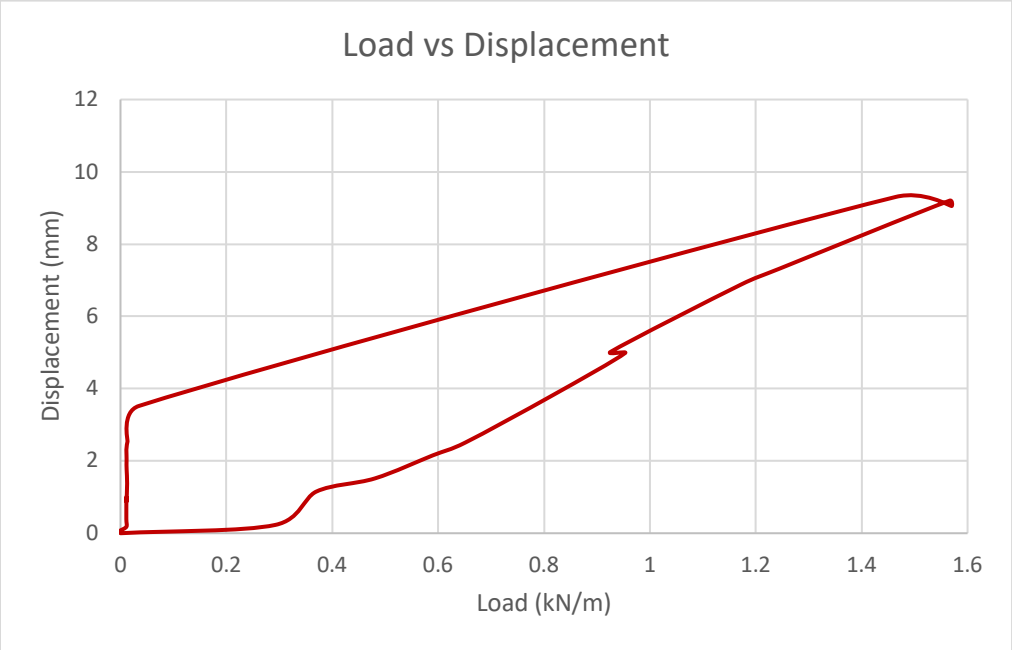
REF NO.:	DR-5204	**DATE TESTED:**	04th July 2019
JOB NO.:	P10002	**DATE REPORTED:**	N / A
CERTIFICATE NO.:	IC8603	**CERTIFICATE DATE:**	22nd July 2019

TEST DETAILS:

Barrier Test Height: 1100mm
Barrier Test Length: 1500mm
Test Description: Test 17 - Sky Force Side Mount – 8mm x 1.5mm x 8mm glass - 1.5kN - Point Load

TEST RESULTS:

Load (kN/m)	Displacement (mm)	Permanent Displacement (mm)
1.5kN	9.21	0.08



ANALYSIS:
The balustrade system when assembled and tested in the manor indicated within this certificate conforms to BS6180:2011. The balustrade barrier achieved a loading of 1.5kN/m with a maximum recorded displacement of 9.21mm.

NAME: **Evan Wiggins**
POSITION: **Junior Technician**

TEST CERTIFICATE
BALUSTRADE TESTING IN ACCORDANCE WITH BS 6180:2011

On behalf of OnLevel Ltd
8 Alexandria Court, Ashton Commerce Park, Ashton Commerce Park,
Ashton-under-Lyne, Lancashire, OL7 0QN, United Kingdom

HORIZONTAL UDL 1.5kN, Skyforce Side Mounted System

TEST DESCRIPTION: A uniformly distributed load was applied to the balustrade system, using two testing rigs, at a height of 1100mm to determine the deflection of the balustrade system when assembled. Independent drawstring potentiometers where positioned accordingly to measure the deflection of the installed system throughout the testing procedure. The balustrade system was installed by the client to their own specification.

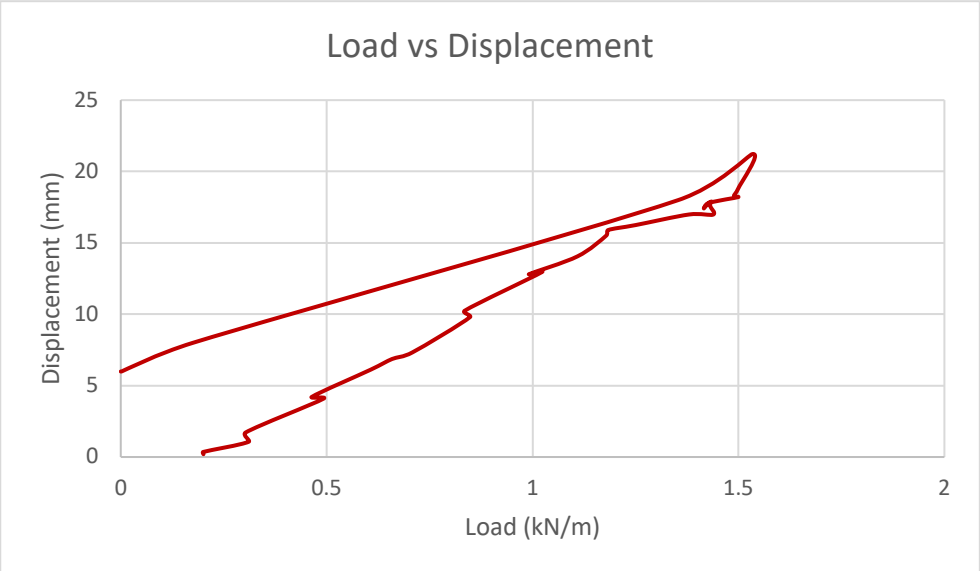
REF NO.:	DR-5204	**DATE TESTED:**	04th July 2019
JOB NO.:	P10002	**DATE REPORTED:**	N / A
CERTIFICATE NO.:	IC8612	**CERTIFICATE DATE:**	22nd July 2019

TEST DETAILS:

Barrier Test Height: 1100mm
Barrier Test Length: 2600mm
Test Description: Test 26 - Sky Force Side Mount – 10mm x 1.5mm x 10mm glass - 2 frames Test Frames

TEST RESULTS:

Load (kN/m)	Displacement (mm)	Permanent Displacement (mm)
1.5kN	21.22	5.99



ANALYSIS:
The balustrade system when assembled and tested in the manor indicated within this certificate conforms to BS6180:2011. The balustrade barrier achieved a loading of 1.5kN/m with a maximum recorded displacement of 21.22mm.

NAME: **Evan Wiggins**
POSITION: **Junior Technician**

TEST CERTIFICATE
BALUSTRADE TESTING IN ACCORDANCE WITH BS 6180:2011

On behalf of OnLevel Ltd
8 Alexandria Court, Ashton Commerce Park, Ashton Commerce Park,
Ashton-under-Lyne, Lancashire, OL7 0QN, United Kingdom

Infill UDL 1.5kN,
Skyforce Side Mounted System

TEST DESCRIPTION: An Infill UDL was applied to the balustrade system using a large, square spreader reacting on the glass pane to determine the deflection of the balustrade system when assembled. Independent drawstring potentiometers where positioned accordingly to measure the deflection of the installed system throughout the testing procedure. The balustrade system was installed by the client to their own specification.

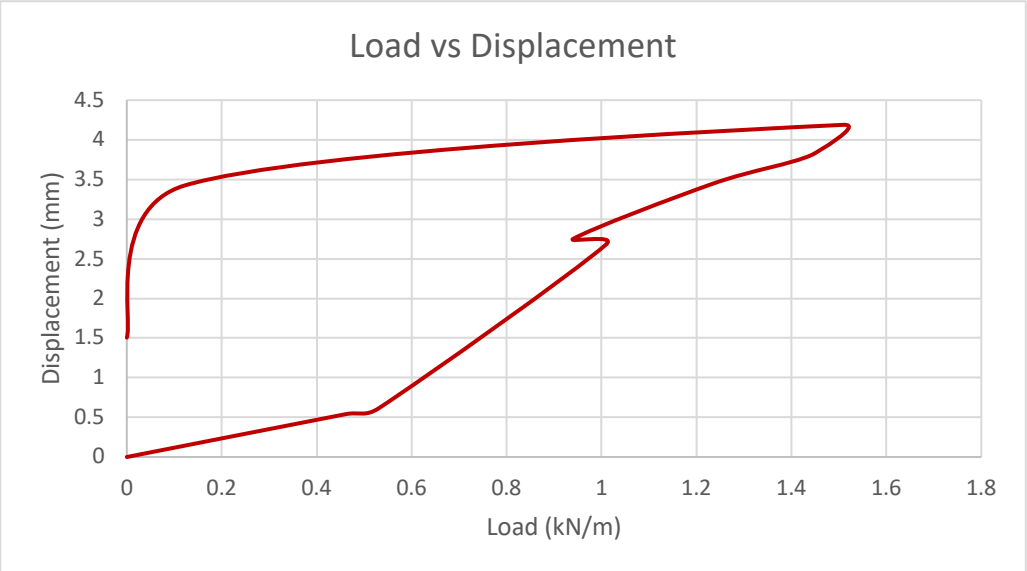
REF NO.:	DR-5204	**DATE TESTED:**	05th July 2019
JOB NO.:	P10002	**DATE REPORTED:**	N / A
CERTIFICATE NO.:	IC8616	**CERTIFICATE DATE:**	26th July 2019

TEST DETAILS:

Barrier Test Height: 1100mm
Barrier Test Length: 2600mm
Test Description: Test 30 - Sky Force Side Mount – 10mm x 1.5mm x 10mm glass - 1.5kN - In Fill

TEST RESULTS:

Load (kN/m)	Displacement (mm)	Permanent Displacement (mm)
1.5kN	4.19	1.51



ANALYSIS:
The balustrade system when assembled and tested in the manor indicated within this certificate conforms to BS6180:2011. The balustrade barrier achieved a loading of 1.5kN/m with a maximum recorded displacement of 4.19mm.

NAME: **Evan Wiggins**
POSITION: **Junior Technician**

TEST CERTIFICATE
BALUSTRADE TESTING IN ACCORDANCE WITH BS 6180:2011

On behalf of OnLevel Ltd
8 Alexandria Court, Ashton Commerce Park, Ashton Commerce Park,
Ashton-under-Lyne, Lancashire, OL7 0QN, United Kingdom

Point Load 1.5kN,
Skyforce Side Mounted System

TEST DESCRIPTION: A point load was applied to the balustrade system central of the glass pane to determine the deflection of the balustrade system when assembled. Independent drawstring potentiometers where positioned accordingly to measure the deflection of the installed system throughout the testing procedure. The balustrade system was installed by the client to their own specification.

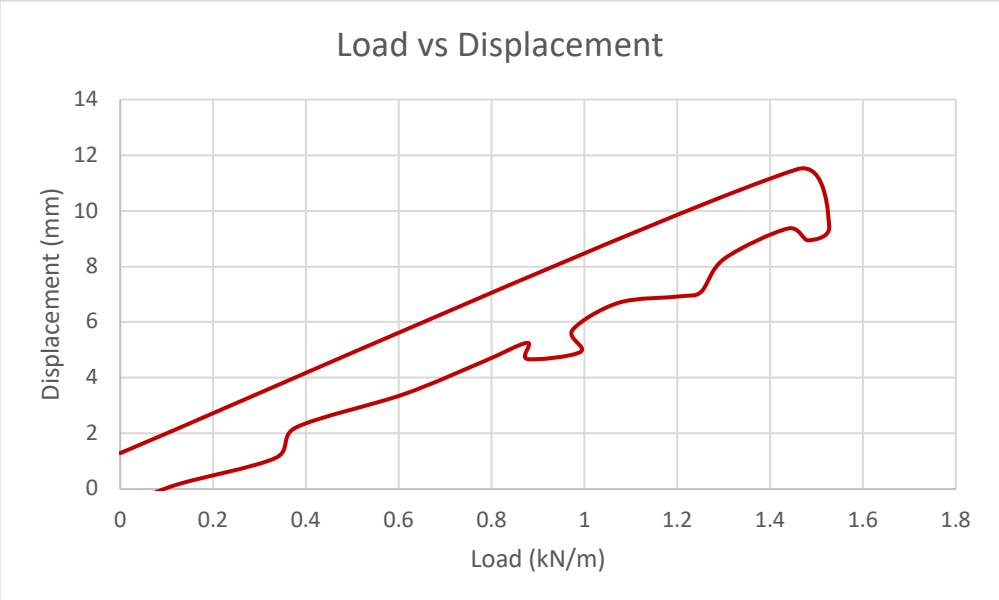
REF NO.:	DR-5204	**DATE TESTED:**	05th July 2019
JOB NO.:	P10002	**DATE REPORTED:**	N / A
CERTIFICATE NO.:	IC8617	**CERTIFICATE DATE:**	22nd July 2019

TEST DETAILS:

Barrier Test Height: 1100mm
Barrier Test Length: 2600mm
Test Description: Test 31 - Sky Force Side Mount- 10mm x 1.5mm x 10mm glass - 1.5kN -Point Load

TEST RESULTS:

Load (kN/m)	Displacement (mm)	Permanent Displacement (mm)
1.5kN	9.47	1.29



ANALYSIS:
The balustrade system when assembled and tested in the manor indicated within this certificate conforms to BS6180:2011. The balustrade barrier achieved a loading of 1.5kN/m with a maximum recorded displacement of 9.47 mm.

NAME: **Evan Wiggins**
POSITION: **Junior Technician**