TEST REPORT

Lucideon Reference:	19616 (QT-54479/1/RK)/Ref. 2/Supp1
Project Title:	Balustrade Testing of FH Brundle's Pro Railing Tilt-Loc Base Fix Channel System (BR86) with Various Glass Thicknesses in Accordance with BS 6180 & UNI 10806
Client:	FH Brundle 81/82 Middlemore Industrial Estate Middlemore Road Smethwick Birmingham B66 2EP
For the Attention of:	Mr Danny Hull
Author(s):	Mr Justin Fryer
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Work Location:	Lucideon UK

This report supersedes the report issued on 25.02.19.

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1 INTRODUCTION

FH Brundle design and manufacture balustrades and balustrade components to be used as architectural features in new and existing buildings. As part of their product development, they required an extensive programme of testing on the whole systems and on components, to determine their products performance in accordance with British and other European standards.

All tests were to be carried out to BS 6180:2011 Barriers in and about Buildings.

Other standards used for testing were BS 4592-0:2006+A1:2012 Flooring, Stair Treads and Handrails for Industrial Use, Common Design Requirements and Recommendations for Installation and Italian standard UNI 10806 (Italy).

2 TEST ARRANGEMENT

2.1 Three Glass Clamps

All tests were carried out using 3 No. glass clamps set evenly at the base of the glass panel.

1 No. concrete block of nominal dimensions 3500 mm x 1000 mm x 500 mm was fastened to the laboratory strong-floor.

The Pro Railing Tilt-Loc Base Fix Channel System (BR86) was attached to the top surface of the aforementioned concrete block by a representative from FH Brundle.

1 No. glass panels of nominal dimensions 1000 mm x 1059 mm was inserted into the channel, 3 No. thicknesses were tested, these being 17.5, 19 and 21.5 mm. Each was tested in turn.

Details of the balustrade arrangement and of the fixings used can be seen in Appendix A, per manufacturer's instructions.

2.2 Two Glass Clamps

All tests were carried out using 2 No. glass clamps set evenly at the base of the glass panel.

1 No. concrete block of nominal dimensions 3500 mm x 1000 mm x 500 mm was fastened to the laboratory strong-floor.

The Pro Railing Tilt-Loc Base Fix Channel System (BR86) was attached to the top surface of the aforementioned concrete block by a representative from FH Brundle.

1 No. glass panels of nominal dimensions 1000 mm x 1059 mm was inserted into the channel, 3 No. thicknesses were tested, these being 15, 17.5 and 21.5 mm. Each was tested in turn.

Details of the balustrade arrangement and of the fixings used can be seen in Appendix A, per manufacturer's instructions.

3 TEST METHOD

A hardwood spreader beam was placed at a distance of 1100 mm from the finished floor height to simulate a uniformly distributed line-load.

A reaction frame consisting of 2 No. steel stanchions and a steel cross-member was fastened to the laboratory strong-floor such that a ram could be clamped to the steel cross member at the same height as the hardwood spreader.

A calibrated load cell was attached to the hydraulic ram by way of a steel cage to measure the load during testing.

A calibrated Linear Voltage Displacement Transducer (LVDT) to measure the deflection was attached to the opposite side of the glass panel as the load was applied in the centre width of the panel at 1100 mm from the finished floor height.

For BS 6180 a load was steadily applied up to each loading increment or until a deflection of 25 mm was reached as highlighted within BS 6180. The load at the last increment was then recorded.

For the UNI 10806 (Italy), the line load was increased to a load per metre as denoted by a representative from FH Brundle. This was generally taken as 2 kNm^{-1}, unless otherwise stated due to the deflections found during testing.

Photographs can be seen in the Plates Section.

4 RESULTS

Table 1 – BS 6180 Results

Type of Occupancy for Part of the Building	Examples of Specific Use	Horizontal Uniformly Distributed Line Load (kN/m)	15 mm Toughened Glass		17.5 mm PVB Glass		19 mm Toughened Glass	21.5 mm PVB Glass	
			2 Clamps	3 Clamps	2 Clamps	3 Clamps	(3 Clamps Only)	2 Clamps	3 Clamps
Domestic & residential activities	(i) All areas within or serving exclusively one single family dwelling, including stairs, landings etc., but excluding external balconies and edges of roofs	0.36	✓	✓	✓	✓	✓	✓	✓
	(ii) Other residential, i.e. houses of multiple occupancy & balconies, including Juliette balconies & edges of roofs in single family dwellings	0.74	x	x	x	✓	✓	x	✓
Offices & work areas, not included elsewhere, including storage areas	(iii) Light access stairs & gangways not more than 600 mm wide	0.22	✓	✓	✓	✓	✓	✓	✓
	(iv) Light pedestrian traffic routes in industrial & storage buildings, except designated escape routes	0.36	✓	✓	✓	✓	✓	✓	✓
	(v) Areas not susceptible to overcrowding in office & institutional buildings, also industrial & storage buildings, except as given above	0.74	x	x	x	✓	✓	x	✓
Areas where people might congregate	(vi) Areas having fixed seating within 530 mm of the barrier, balustrade or parapet	1.50	x	x	x	x	✓	x	x
Areas with tables or fixed seating	(vii) Restaurants & bars	1.50	x	x	x	x	✓	x	x

Type of Occupancy for Part of the Building	Examples of Specific Use	Horizontal Uniformly Distributed Line Load (kN/m)	15 mm Toughened Glass		17.5 mm PVB Glass		19 mm Toughened Glass	21.5 mm PVB Glass	
			2 Clamps	3 Clamps	2 Clamps	3 Clamps	(3 Clamps Only)	2 Clamps	3 Clamps
Areas without obstacles for moving people and not susceptible to overcrowding	(viii) Stairs, landings corridors ramps	0.74	x	x	x	✓	✓	✓	✓
	(ix) External balconies, including Juliette balconies & edges of roofs; footways & pavements within building cartilage adjacent to basement/sunken areas	0.74	x	x	x	✓	✓	✓	✓
Areas susceptible to overcrowding	(x) Footways or pavements less than 3 m wide adjacent to sunken areas	1.50	x	x	x	x	✓	x	x
	(xi) Theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas, studios; footways or pavements greater than 3 m wide adjacent to sunken areas	3.00	x	x	x	x	x	x	x
	(xii) Grandstands & stadia	(Note 1)			-				
Retail areas	(xiii) All retail areas, including public areas of banks/building societies or betting shops	1.50	x	x	x	x	✓	x	x
Vehicular	(xiv) Pedestrian areas in car parks, including stairs, landings, ramps, edges of internal floors, footways, edges of roofs	(Note 2)	x	x	x	x	x	x	x
	(xv) Horizontal loads imposed by vehicles	(Note 2)	x	x	x	x	x	x	x

Table 2 - UNI 10806 (Italy) Results (3 Glass Clamps)

Glass Thickness	Load (kNm^{-1})	Deflection (mm)
17.5 mm PVB	2.0	64.36
21.5 mm PVB	1.5	58.72

NOTE: The results given in this report apply only to the samples that have been tested.

END OF REPORT

PLATES

Plate 1 – Test Set-Up

Plate 2 – Clamping Mechanism

Chart 1 - Load Deflection Curve for BalustradeTesting in Accordance with BS 6180 of FH Brundle's Pro-Railing Tilt-Loc Base Fix Channel System (BR86) with Various Glass Thicknesses with 3 Glass Clamps

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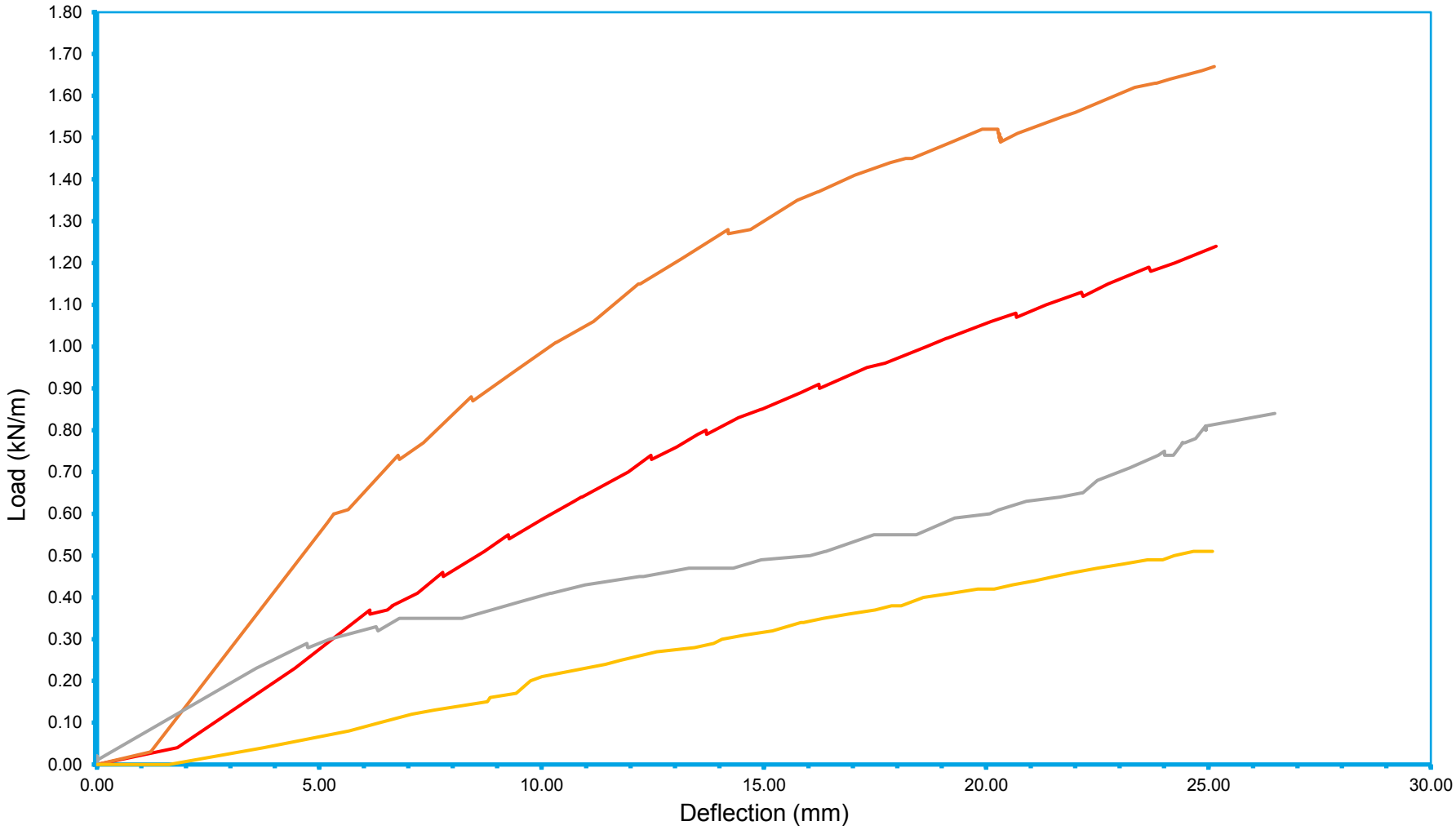

Key

17.5 mm PVB Glass
19 mm Glass
21.5 mm PVB Glass
15 mm

Chart 2 - Load Deflection Curves for Balustrade Testing in Accordance with UNI 10806 (Italy) of FH Brundle's Pro Railing Tilt-Loc Base Fix Channel System (BR86) with Various Glass Thicknesses with 3 Glass Clamps

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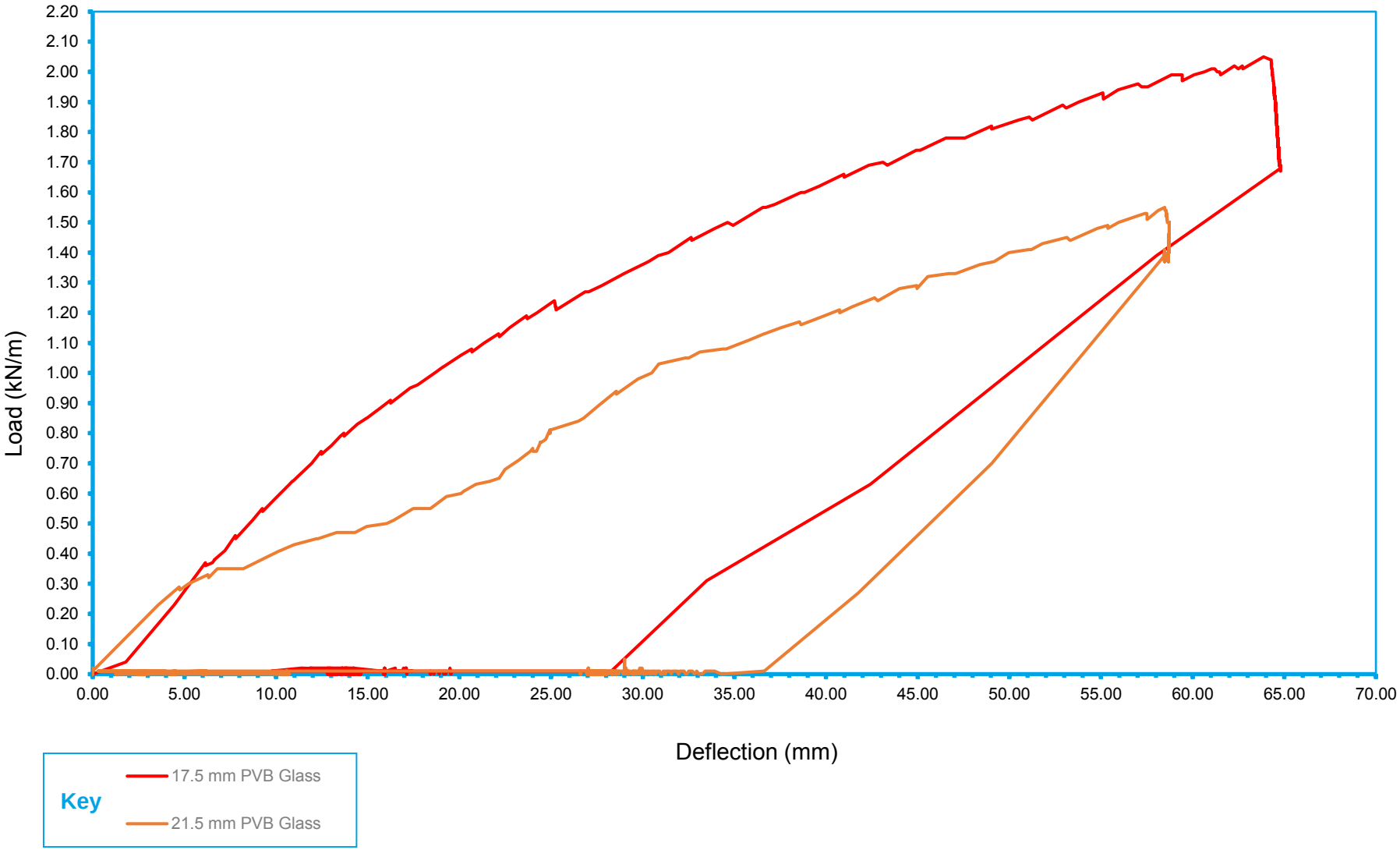

Chart 3 - Load Deflection Curves for Balustrade Testing in Accordance with BS 6180 of FH Brundles
Pro-Railing Tilt-Loc Base Fix Channel System (BR86) Various Glass Thicknesses with 2 Glass Clamps

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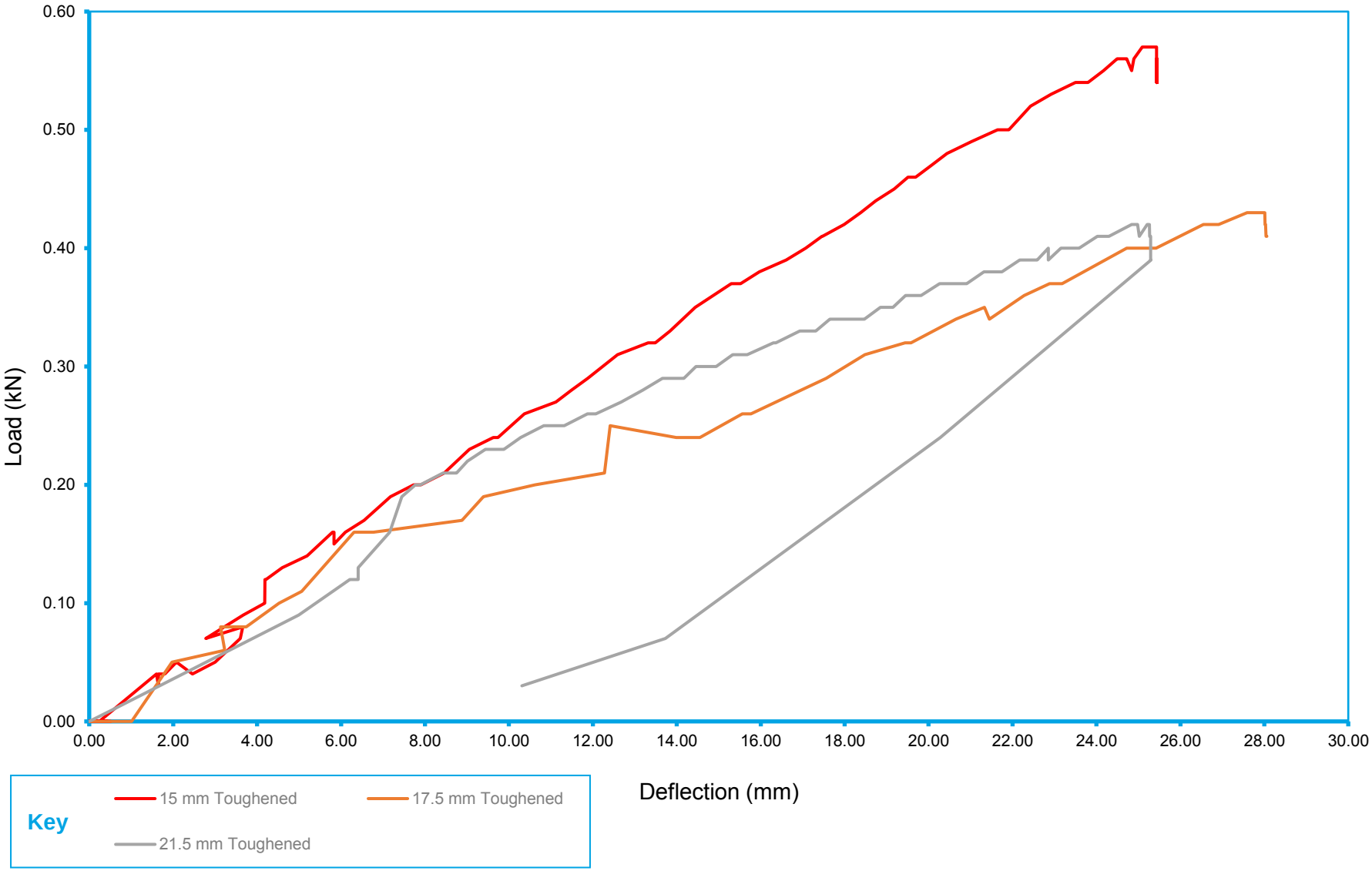


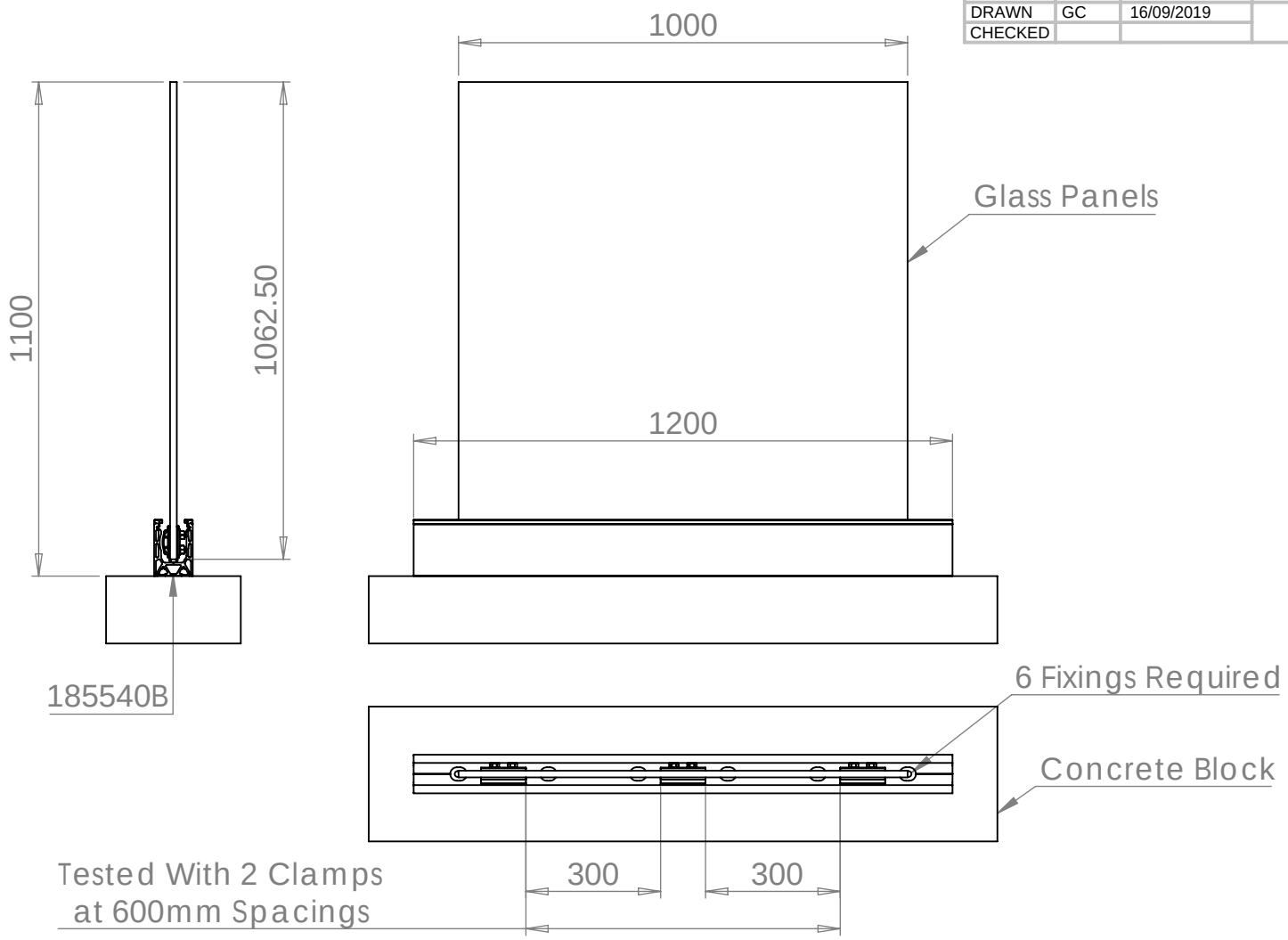
APPENDIX A - Figure
TEST REPORT NUMBER - TR20-003

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN MILLIMETERS

	NAME	DATE	REVISION
DRAWN	GC	16/09/2019	A
CHECKED			

PRO RAILING - TILT-LOCÊ CHANNEL SYSTEM TL86 SERIES



Load Testing of TILT-LOCÊ CHANNEL SYSTEM TL86 SERIES, Which Comprises A Base Fixed Channel With A Range of Glass Panels 1000mm Wide to BS EN 6180:2011 & UNI 10806:1999

Carry out load testing in accordance with BS 6180:2011 Barriers in and about buildings, and EC1-1991-1-1:2002 UK National Annex to Eurocode 1: Actions on structures ï Part 1-1: General actions - Densities, self-weight, imposed loads for buildings.

Carry out load testing in accordance with UNI 10806:1999
Prefabricated Railing Systems - Determination of the mechanical strength under static load.

These tests will allow FH Brundle Tilt-Loc Channel system to be classified for use in accordance with the Code of Practice included within the standards.

Test In Accordance	Parts Required BR86 SERIES	Number of Clamps used in Tests	Foundation Material	Glass Size & Type	Anchor Fixing
BS EN 6180:2011	1 x 1805540B 1 x 180554112	2 Clamps	C35 with glass fibres, aggregate size 20mm slump 100	12mm Toughened	189900647 / Sheild Anchor PSM12SS
BS EN 6180:2011	1 x 1805540B 1 x 180554115	2 & 3 Clamps	C35 with glass fibres, aggregate size 20mm slump 100	15mm Toughened	189900647 / Sheild Anchor PSM12SS
BS EN 6180:2011	1 x 1805540B 1 x 1805541175	2 & 3 Clamps	C35 with glass fibres, aggregate size 20mm slump 100	17.5mm Toughened PVB Laminated	189900647 / Sheild Anchor PSM12SS
BS EN 6180:2011	1 x 1805540B 1 x 1805541215	2 & 3 Clamps	C35 with glass fibres, aggregate size 20mm slump 100	21.5 mm Toughened PVB Laminated	189900647 / Sheild Anchor PSM12SS
UNI 10806:1999	1 x 1805540B 1 x 1805541175	2 & 3 Clamps	C35 with glass fibres, aggregate size 20mm slump 100	17.5mm Toughened PVB Laminated	189900647 / Sheild Anchor PSM12SS
UNI 10806:1999	1 x 1805540B 1 x 1805541215	2 & 3 Clamps	C35 with glass fibres, aggregate size 20mm slump 100	21.5 mm Toughened PVB Laminated	189900647 / Sheild Anchor PSM12SS