

Test Report 9633837

Part 4 of 4 Issue 2.


Q-Railing Europe GmbH & Co.KG

Introduction.

This report has been prepared by Gary Essam and Chris Rayment and relates to the activity detailed below:

Job/Registration Details	Client Details
Job number: 9633837 Job type: Testing Start Date: 30/07/2018 Test type: Type test Sample ID: Not applicable Registration: KM 656489 Scheme: BS 6180:2011 Protocol: PP937 Scheme Manager: Peter Rossington	Q-Railing Europe GmbH & Co.KG Marie-Curie-Strasse 8-14 Emmerich am Rhein 46446 Germany

The report has been approved for issue by Mark Manito – Team Manager

Approved For Issue	
	Issue Date: 14 September 2018

Objectives.

Type testing for product certification

Product Scope.

Balustrade system

Report Summary.

The balustrade system met the requirements or parts thereof of the Specification against which assessments were made

Issue 2 of this report supersedes all previous issues. The amendments on pages 12 to 16 giving rise to this issue can be ascertained by contacting the authorising signatory.

Test Samples.

Sample Id	Description
1	Q-Line Extra Strong Post mounted in top and fascia modes

Test Requirements.

BS 6180:2011 clauses 6.3.1 and 6.4.1 only - Barriers in and about buildings - Code of practice

Clause	Requirements
6	DESIGN CRITERIA
6.3	Loading
6.3.1	General N/As
6.4	Deflection
6.4.1	Barriers for the protection of people N/As
Results Tables	Actual test results <i>See Table A - BS 6180:2011</i>

Summary of Test Comments.

Clause	Comments
6.3.1 & 6.4.1	<p>BS 6180:2011 is a code of practice and the loaded deflections of barrier systems are given as recommendations only.</p> <p>The Structural Use of Glass in Buildings (Second Edition), February 2014, O'Regan, C., The Institution of Structural Engineers states "It must be noted that BS 6180 is a guideline and as such it is ultimately up to the designer to determine acceptable deflection limits on the balustrade under consideration."</p> <p>Further, the tables for summaries for suitability on pages 15 and 16 are given for indication only</p> <p>The testing was supervised at the Emmerich am Rhein site of Q-Railing from 31 July 2018 to 02 August 2018</p>

Glossary of Terms.

PASS: Complies. Tested by BSI engineers at BSI laboratories.

PASS1: Complies. Witnessed by BSI engineers in manufacturers laboratory.

PASS2: Complies. Tests carried out by third party lab; results accepted by BSI.

PASS*: Report resulted in uncertainty and states that Compliance is more probable than non-compliance.

FAIL: Non compliance – Product does not meet the requirements of this clause.

FAIL*: Report resulted in uncertainty and states that Non-compliance is more probable than compliance.

N/A: Not applicable to design under consideration.

N/T: Not tested due to similarity to previously tested item; reference earlier test report.

Conditions of Issue.

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Table A - BS 6180:2011

Test Results.

CLAUSE

6 DESIGN CRITERIA

6.3 Loading

6.3.1 General

Minimum horizontal imposed loads appropriate to the design of parapets, barriers, balustrades and other elements of structure intended to retain, stop or guide people, should be determined in accordance with Table 2 [of BS 6180:2011], which recommends a uniformly distributed line load for the barrier and a uniformly distributed and point load applied to the infill. These are not additive and should be considered as three separate load cases, all loads being determined according to the type of occupancy which reflects the possible in-service conditions.

Horizontal uniformly distributed line loads should be applied at the design height as presented in Table 1 [of BS 6180:2011] or at the design level 1100mm for barriers higher than the design height.

Uniformly distributed load should be applied at the area below the design height.

Point load should be applied at the most onerous point anywhere on the barrier structure.

6.4 Deflection

6.4.1 Barriers for the protection of people

Barriers for the protection of people should be of adequate strength and stiffness to sustain the applied loads given in Table 2 [of BS 6180:2011]. In addition, a barrier that is structurally safe should not possess sufficient flexibility to alarm building users when subject to normal service conditions. Therefore, for serviceability considerations, the limiting condition for deflection appropriate for a barrier for the protection of people is that the total horizontal displacement of the barrier at any point from its original unloaded position should not exceed the deflection limits determined from the relevant structural design code (where applicable) for the material used, or 25 mm, whichever is the smaller.

Where the infill of a barrier is subjected to imposed loads given in Table 2 [of BS 6180:2011], or if appropriate, other calculated design loads, the displacement of any point of the barrier should not exceed $L/65$ or 25 mm, whichever is the smaller where L is the given in **8.3**, **8.4** or defined in **8.5** [of BS 6180:2011]. A suitable fracture load, factored by a minimum partial safety factor of 4.0 (as recommended in BS 4592-0) should be obtained from the material manufacturer when considering glass barrier design.

Test Results (Continued).

Table 2 Minimum horizontal imposed loads for parapets, barriers and balustrades

Type of occupancy for part of the building or structure	Examples of specific use	Horizontal uniformly distributed line load (kN/m)	Uniformly distributed load applied to the infill (kN/m²)	A point load applied to part of the infill (kN)
Domestic and 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	0.5	0.25
	(ii) Other residential, i.e. houses of multiple occupancy and balconies, including Juliette balconies and edges of roofs in single family dwellings	0.74	1.0	0.5
Offices and work areas not included elsewhere, including storage areas	(iii) Light access stairs and gangways not more than 600 mm wide	0.22	-	-
	(iv) Light pedestrian traffic routes in industrial and storage buildings except designated escape routes	0.36	0.5	0.25
	(v) Areas not susceptible to overcrowding in office and institutional buildings, also industrial and storage buildings except as given above	0.74	1.0	0.5
Areas where people might congregate	(vi) Areas having fixed seating within 530 mm of the barrier, balustrade or parapet	1.5	1.5	1.5
Areas with tables or fixed seatings	(vii) Restaurants and bars	1.5	1.5	1.5

Test Results (Continued).

Table 2 Minimum horizontal imposed loads for parapets, barriers and balustrades (Continued)

Type of occupancy for part of the building or structure	Examples of specific use	Horizontal uniformly distributed line load (kN/m)	Uniformly distributed load applied to the infill (kN/m ²)	A point load applied to part of the infill (kN)
Areas without obstacles for moving people and not susceptible to overcrowding	(viii) Stairs, landings, corridors, ramps	0.74	1.0	0.5
	(ix) External balconies including Juliette balconies and edges of roofs. Footways and pavements within building curtilage adjacent to basement/sunken areas	0.74	1.0	0.5
Areas susceptible to overcrowding	(x) Footways or pavements less than 3 m wide adjacent to sunken areas	1.5	1.5	1.5
	(xi) Theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas, studio. Footways or pavements greater than 3 m wide adjacent to sunken areas.	3.0	1.5	1.5
	(xii) Grandstands and stadia ^{A)}	-	-	-
Retail areas	(xiii) All retail areas including public areas of banks/building societies or betting shops	1.5	1.5	1.5
Vehicular	(xiv) Pedestrian areas in car parks, including stairs, landings, ramps, edges or internal floors, footways, edges of roofs	1.5	1.5	1.5
	(xv) Horizontal loads imposed by vehicles ^{B)}	-	-	-

A) See requirements of the appropriate certifying authority

B) See Annex A

Test Results (Continued).

TEST METHODS

A single section of each size of balustrade system was bolted to a 3.2m x 0.5m x 0.5m concrete block which, in turn, was bolted to the concrete floor of the testing facility.

Horizontal uniformly distributed line loads

The horizontal uniformly distributed line loads were applied to the handrail using a hand operated hydraulic cylinder through a calibrated load cell and display unit system to a 0.9m long aluminium beam to spread the load.

The deflection measurements of the handrail were taken from a fixed datum point at the same level as the application of the load using a calibrated digital indicator.



Top mounted



Fascia mounted

Typical arrangement for application of horizontal uniformly distributed line loading assembly

Test Results (Continued).

TEST METHODS (Continued)

Uniformly distributed load applied to the infill

The uniformly distributed loads were applied to the glass in a horizontal orientation with the balustrade system bolted to vertical rigid steel girders using bags of sand. The loads were calculated according to the total glass area.

The deflection measurements at the underside of the centre of the glass were taken from a fixed datum point using a calibrated digital indicator.



Typical arrangement for application of uniformly distributed load applied to the balustrade system

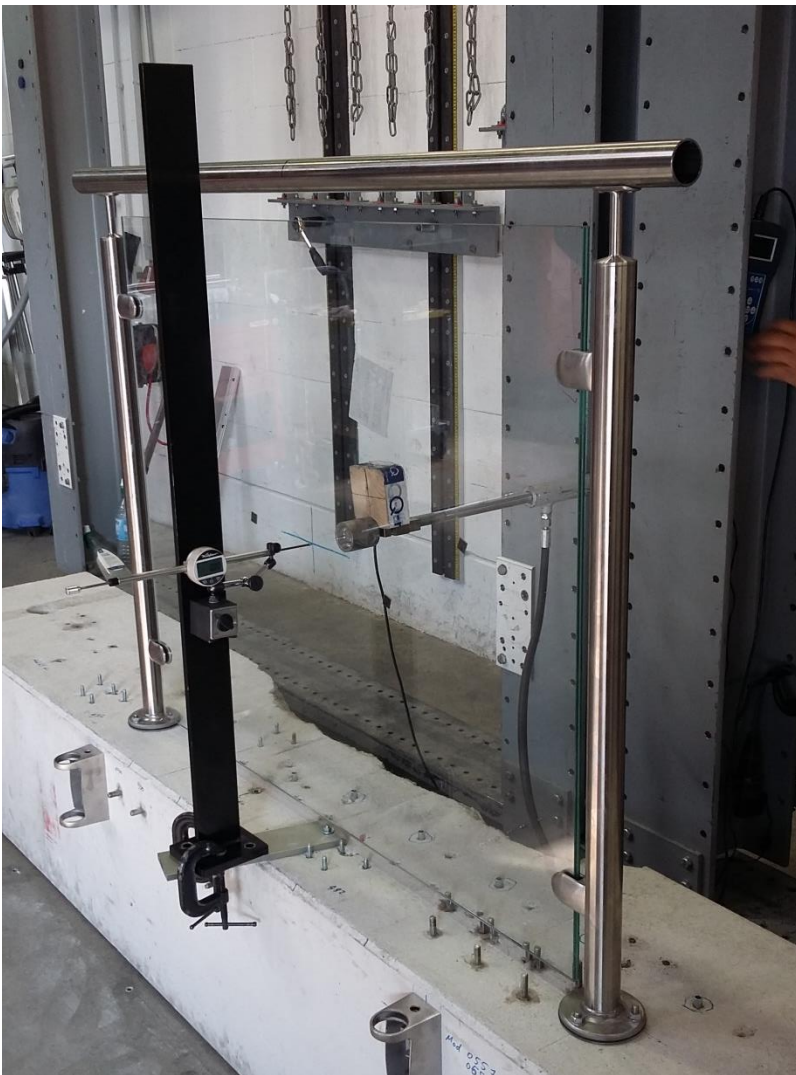
Test Results (Continued).

TEST METHODS (Continued)

Point load applied to part of the infill

The point loads were applied to the centre of the glass through a 100mm x 100mm wooden block using a hydraulic cylinder. The loads were measured using a calibrated load cell and display unit system.

The deflection measurements on the opposite side of the glass to the loading point were taken from a fixed datum point using a calibrated digital indicator.

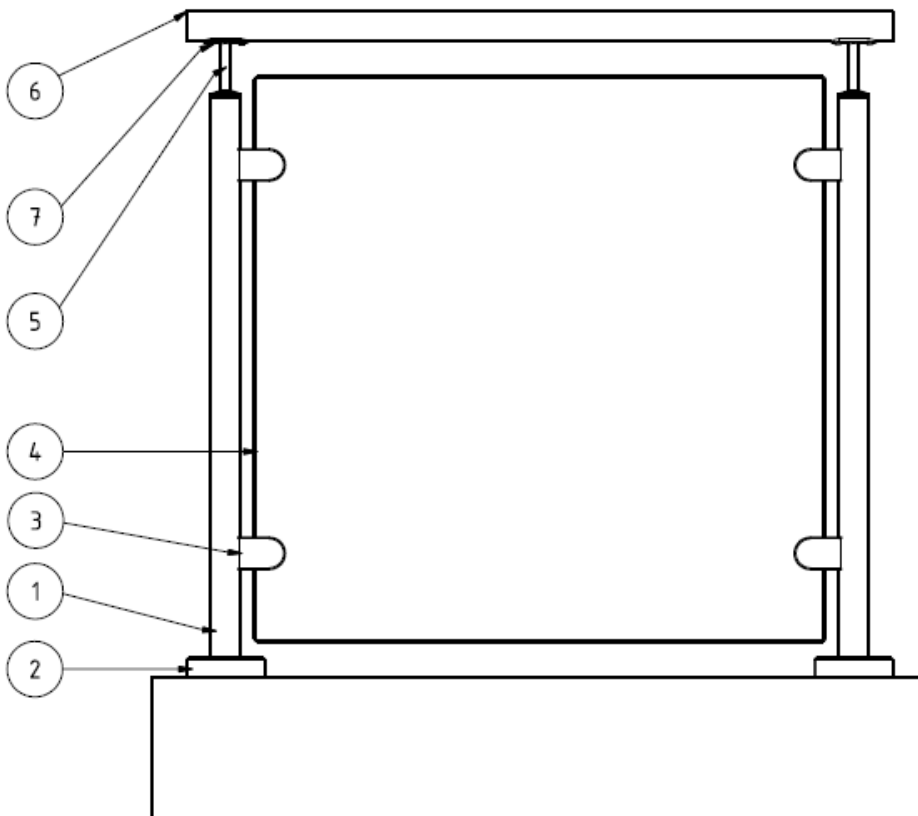


Typical arrangement for application of point load to the centre of the balustrade system

Test Results (Continued).

TEST METHODS (Continued)

1. Extra strong post
2. covercap
3. glass clamp
4. glass
5. handrail bracket
6. handrail
7. Q-screw



Q-Line Extra Strong Post assembly drawing

Test Results (Continued).

SUMMARY OF TESTING

Horizontal uniformly distributed line loads

Reference	Glass type	Glass size (mm x mm)	Handrail height (mm)	Dist. between posts (mm)	Mounting mode	0.36 kN/m line load deflection (mm)	0.74 kN/m line load deflection (mm)	1.50 kN/m line load deflection (mm)	25mm equivalent line load (kN/m) (for information)	Comments
A	8.76mm PVB	1000 x 900	1100	1100	Top	4.24	8.37	17.44	>2.00	
B	8.76mm PVB	1200 x 800	1100	1300	Top	5.31	10.77	22.16	1.67	
C	8.76mm PVB	1000 x 1000	1200	1100	Top	5.24	10.77	22.95	1.79	
D	8.76mm PVB	1000 x 900	1100	1100	Fascia MOD 0558	5.55	11.37	23.65	- ¹⁾	
E	8.76mm PVB	1000 x 900	1100	1100	Fascia MOD 0557	5.16	10.22	21.54	1.68	
F	8.76mm PVB	800 x 1000	1200	900	Fascia MOD 0558	5.44	10.95	22.28	1.67	
G	8.76mm PVB	800 x 1000	1200	900	Fascia MOD 0557	5.35	11.00	22.58	1.64	

Note:

1) Deflection not recorded

Test Results (Continued).

SUMMARY OF TESTING (Continued)

Uniformly distributed load applied to the infill

Reference	Glass type	Glass size (mm x mm)	Distance between posts (mm)	Mounting mode	1.5 kN/m ² UDL deflection (mm)	Comments
C	8.76mm PVB	1000 x 1000	1100	Top	22.16 ¹⁾	
H	10.76mm PVB	1200 x 1000	1300	Top	15.50	Reported for information
I	8mm mono	1200 x 1000	1300	Top	17.21	Reported for information

Note:

1) By calculation performed by the manufacturer from test results

Test Results (Continued).

SUMMARY OF TESTING (Continued)

Point load applied to part of the infill

Reference	Glass type	Glass size (mm x mm)	Distance between posts (mm)	Mounting mode	0.25 kN point load deflection (mm)	0.50 kN point load deflection (mm)	1.50 kN point load deflection (mm)	Load to give 25mm deflection (kN)	Comments
B	8.76mm PVB	1200 x 800	1300	Top	5.45	10.73	-	1.14	
C	8.76mm PVB	1000 x 1000	1100	Top	3.73	7.39	20.23	- ¹⁾	
H	10.76mm PVB	1200 x 1000	1300	Top	2.88	6.00	16.70	>2.00	Reported for information
I	8mm mono	1200 x 1000	1300	Top	3.15	6.50	19.27	1.97	Reported for information
D	8.76mm PVB	1000 x 900	1100	Fascia	3.65	7.42	22.22	- ¹⁾	Standard length post brackets

Note:

1) Deflection not recorded

Test Results (Continued).

SUMMARY OF SUITABILITY OF BARRIER SYSTEMS

Type of occupancy for part of the building or structure	Examples of specific use	Horizontal uniformly distributed line load (kN/m)	Reference						
			A	B	C	D	E	F	G
Domestic and 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 and balconies, including Juliette balconies and edges of roofs in single family dwellings	0.74	✓	✓	✓	✓	✓	✓	✓
Offices and work areas not included elsewhere, including storage areas	(iii) Light access stairs and gangways not more than 600 mm wide	0.22	✓	✓	✓	✓	✓	✓	✓
	(iv) Light pedestrian traffic routes in industrial and storage buildings except designated escape routes	0.36	✓	✓	✓	✓	✓	✓	✓
	(v) Areas not susceptible to overcrowding in office and institutional buildings, also industrial and storage buildings except as given above	0.74	✓	✓	✓	✓	✓	✓	✓
Areas where people might congregate	(vi) Areas having fixed seating within 530 mm of the barrier, balustrade or parapet	1.5	✓	X	✓	✓	✓	✓	✓
Areas with tables or fixed seatings	(vii) Restaurants and bars	1.5	✓	X	✓	✓	✓	✓	✓

Test Results (Continued).

SUMMARY OF SUITABILITY OF BARRIER SYSTEMS (Continued)

Type of occupancy for part of the building or structure	Examples of specific use	Horizontal uniformly distributed line load (kN/m)	Reference						
			A	B	C	D	E	F	G
Areas without obstacles for moving people and not susceptible to overcrowding	(viii) Stairs, landings, corridors, ramps 0.74	0.74	✓	✓	✓	✓	✓	✓	✓
	(ix) External balconies including Juliette balconies and edges of roofs. Footways and pavements within building curtilage adjacent to basement/sunken areas	0.74	✓	✓	✓	✓	✓	✓	✓
Areas susceptible to overcrowding	(x) Footways or pavements less than 3 m wide adjacent to sunken areas	1.5	✓	X	✓	✓	✓	✓	✓
	(xi) Theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas, studio. Footways or pavements greater than 3 m wide adjacent to sunken areas.	3.0	X	X	X	X	X	X	X
	(xii) Grandstands and stadia ^{A)}	-	-	-	-	-	-	-	-
Retail areas	(xiii) All retail areas including public areas of banks/building societies or betting shops	1.5	✓	X	✓	✓	✓	✓	✓
Vehicular	(xiv) Pedestrian areas in car parks, including stairs, landings, ramps, edges or internal floors, footways, edges of roofs	1.5	✓	X	✓	✓	✓	✓	✓
	(xv) Horizontal loads imposed by vehicles ^{B)}	-	-	-	-	-	-	-	-

*** End of Report ***