Building barriers for safer spaces™

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BA Systems Test Report

Juliette Balconies
Date of Test: 14/12/21
Date of Report: 21/12/21
Test carried out by: Stephen Hynd

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Contents

1. Introduction

On balustrade projects it is often the case that fixings into the floor finish are not possible or need to be minimized to avoid penetration of a completed water proofing membrane. This test was carried out to test the effectiveness of fixings into a typical brick cavity wall. In the case of a Juliette Balustrade or end fixing of a balustrade to an inset balcony, the bolted connection is under shear load and not tension. Typically, on a residential external balcony the load requirement is 0.74kN/m.

2. Test Methodology

The test rig is designed to test the deflection of balustrades under load, in accordance with the requirements of BS6180:2011 Barriers in and about Buildings – Code of Practice.
The code of practice states that “Barriers for the protection of people should be of adequate strength and stiffness to sustain the applied loads given in Table 2. In addition, a barrier that is structurally safe should not possess sufficient flexibility to alarm building users when subject to normal service conditions.”
The maximum permissible deflection of a free-standing balustrade under the load is 25mm. Table 2 is shown below, shows the minimum load requirements for imposed loads on balustrades specific to each occupancy type. In this test the load applied was done with a Hydra jaws bolt pullout tester.

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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/m^2)	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 susceptile 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
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

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Cont.

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.

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3. Test Equipment and Setup

Bricks with hollow cores were used for the test and built into a small brickwork setup to simulate a typical external brick wall with a return brick for the reveal. The brickwork was allowed to cure for only three days before the test was carried out. The brick courses were tied into the main brick wall with stainless steel brick ties.

A 10mm diameter hole was drilled into the centre of the end brick to receive a 10mm stainless steel stud. The stud was resin anchored into the hole to an embedment depth of 110mm and allowed to cure overnight.

A steel frame was used to support the Hydrajaws unit and transfer the load against the bottom brick course and the top brick course and horizontally a distance of about 300mm away from the edge of the brick corner. An M10 bolt and welded nut were used to apply a pullout load on the stud.

1. **Bricks laid prior to setup of test**

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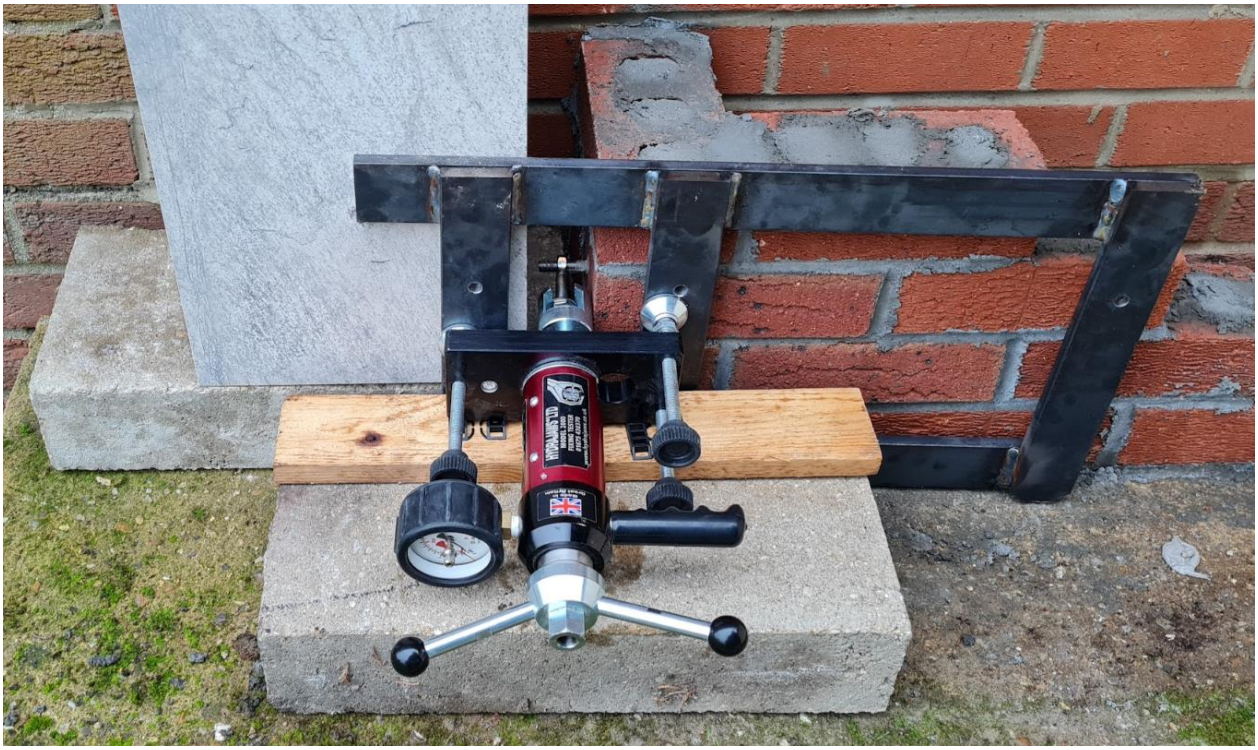
2. Brick corner set up with Hydrajws and steel frame



3. Hydrajaws connected to welded fixing bolt attached to resin stud.

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4. **Hydrajaws with load taken up to 5kN.**

5. **5kN load applied showing the stud bending under load. Load is nearly 7 times higher than the required load on the stud.**

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4. Test Results

- Loads were applied in 1kN forces on the bolt up to a total load of 5kN with no loss of force over a one-minute period.
- At 5.5kN the M10 bolt started bending as shown in the image here.
- There was no sign of stress or cracking in the brick itself nor in the brick joint even at 5.5kN load.

5. Observations and recommendations

- When drilling the hole with a 10mm drill, there was no cracking of the brick but great care is needed for this and suggested that holes no bigger than 10mm should be carefully drilled with an SDS drill as close to the centre of the brick as possible.
- It is important to have a minimum embedment depth of the bolt of 100mm so that the stud spans the hollow brick core to the other side of the brick.
- It is important that the brickwork in the zone of the fixing is suitably tied back to the inner wall.
- The brick cores should be filled with mortar as far as possible in the region of the fixing.

6. Conclusion

A typical load on a single fixing on a 2m wide Juliette Balcony is 0.74kN. The 5kN load applied is well in excess of this and the fixing method considered suitable.

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