TEST REPORT

Reference:	UK201020 (QT59843/1/AM)/Ref. 1/CR1
Project Title:	Balustrade Testing of Engineered Composites' Circular Tube System
Client:	
For the Attention of:	
Author(s):	Mr Justin Fryer
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This report supersedes the report issued on 30.03.2020.

Miss Joanne Booth
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Reviewer

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CONTENTS

	Page
1 INTRODUCTION	3
2 SAMPLES	3
3 PROGRAMME OF WORK	3
4 TEST ARRANGEMENT	4
5 TEST METHOD	4
6 RESULTS	4
PLATES	6-7
CHART	8

1 INTRODUCTION

Following previous testing that determined the horizontal load bearing capacity of Engineered Composites' circular tube balustrade system 50 mm outside dimension (OD), 40 mm inside dimension (ID) to be that of the general duty load of 0.36 kN/m, as defined by BS 4592-0:2006[1], Engineered Composites Ltd required verification of this loading.

Lucideon Limited conducted a programme of work to establish the system's structural suitability up to a load of 0.4 kN/m.

2 SAMPLES

3 no. 2200 mm long balustrades were delivered.

Each balustrade was constructed using glass reinforced plastic (GRP) circular tubing with a 50 mm outside dimension (OD), 40 mm inside dimension (ID).

A post was positioned at either end of the sample and one at mid-point of the length (1000 mm), giving 2 no. 1000 mm spans.

Each post had a formed GRP foot, which was connected to the post by way of an m12 bolt, washers and nut.

The top rail was positioned at 1100 mm from the base of the feet, perpendicular to the posts with a mid-rail at mid-height (550 mm).

3 PROGRAMME OF WORK

Per previous testing, the load was applied as a point load at the centre-span of the balustrade. This allows for a direct comparison between testing.

The following programme of testing was completed on 3 no. samples:

- Point loads to be applied simultaneously (1 no. at each span centre).
- The load will be applied in 100 N increments up to the maximum load.
- Deflection to be recorded at each increment.
- Photographs to be taken at maximum load.
- The load will be released in 100 N increments.
- Deflection to be recorded at each increment.
- The residual deflection will be recorded and photographs taken.

[1] BS 4592-0:2006+A1:2012 Flooring, stair treads and handrails for industrial use – Part 0: Common design requirements and recommendations for installation

4 TEST ARRANGEMENT

1 no. steel pre-fabricated channel (PFC), profile dimensions 150 mm x 75 mm x 10 mm and length 3600 mm, was fastened to the laboratory strong-floor.

Each sample in turn was fastened to the steel PFC by way of 4 no. M12 bolts, nuts and washers to each of the 3 no. feet of the sample.

5 TEST METHOD

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 top handrail of the sample at the centre of each span.

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 handrail at each load application point.

The load cell and the LVDT's were connected to a datalogger and a laptop in order to record data during testing at a rate of 1 Hz.

A load was steadily applied up to each loading increment, maximum of 0.4 kN/m and then steadily released.

Photographs can be seen in the Plates Section of this report.

6 RESULTS

Table 1 – Results for Span 1

Sample Number	Deflection (mm) @ Load							
	100 N	**200 N**	**300 N**	**400 N**	**300 N**	**200 N**	**100 N**	**Residual (0 N)**
1	3.28	9.97	17.13	22.19	21.11	14.25	9.11	2.13
2	5.34	9.50	13.94	18.76	18.64	13.25	9.56	3.74
3	6.77	12.46	19.59	24.83	23.08	19.12	13.86	6.54
Mean	**5.13**	**10.64**	**16.89**	**21.93**	**20.94**	**15.54**	**10.84**	**4.14**

Table 2 – Results for Span 2

Sample Number	Deflection (mm) @ Load							
	100 N	**200 N**	**300 N**	**400 N**	**300 N**	**200 N**	**100 N**	**Residual (0 N)**
1	2.22	9.74	18.04	23.64	22.96	15.06	9.69	0.55
2	3.69	7.36	13.32	20.60	19.58	14.98	10.90	3.76
3	3.74	10.04	18.78	24.36	23.76	20.54	15.80	8.82
Mean	**3.22**	**9.05**	**16.71**	**22.87**	**22.10**	**16.86**	**12.13**	**4.38**

The handrails tested were able to support the 0.4 kN load without any obvious or visible damage.

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

END OF REPORT

PLATES

Plate 1 – Typical Feet Fixings

Plate 2 – Typical Test Set-Up (1)

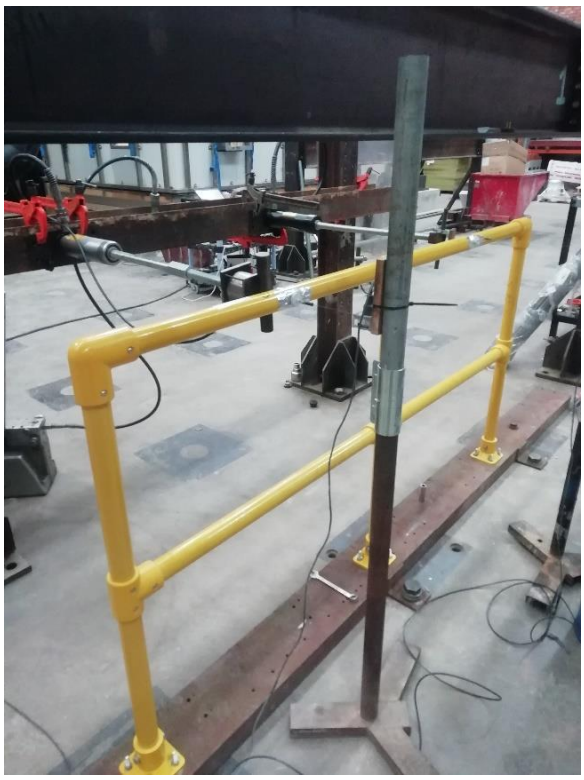

Plate 3 – Typical Test Set-Up (2)

Plate 4 – Typical View of System under Load

Chart 1 - Load Deflection Curves for Balustrade Testing of Engineered Composites Circular Tube System Balustrade

Test Report: UK201020/Ref. 1/CR1