TESTING OF ONE SAMPLE STAIR RAIL ASSEMBLY IN ACCORDANCE WITH THE PRINCIPLES OF BS 585: PART 2: 1985 AND BS 6180: 1995

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TESTING OF ONE SAMPLE STAIR RAIL ASSEMBLY IN ACCORDANCE WITH THE PRINCIPLES OF BS 585: PART 2: 1985 AND BS 6180: 1995

Commercial in Confidence

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Prepared For	:	Richard Burbidge Ltd Whittington Road Oswestry Shropshire SY11 1HZ
Prepared By	:	Product Testing Section

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CONTENTS

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1. INTRODUCTION

As part of the TRADA Certification Ltd (TCL) Balustrade Product Conformity Scheme, TRADA Technology Ltd (TTL) was commissioned to undertake testing of one Richard Burbidge Ltd pre-assembled stair rail unit in accordance with the domestic use requirements of the following documents:

- BS 585: Part 2: 1985 "Wood Stairs - specification for performance requirements for domestic stairs constructed of wood based materials".
- BS 6180: 1995 "Barriers in and about buildings".
- Balustrade Product Conformity Scheme for timber and wood based sheet materials, Performance Requirements, reference 22/19, issue July 1995.

Specimen delivery, installation and testing was carried out during the period 27 November to 5 December 1995.

This work followed on from a full series of stair and landing rail tests covered in TTL Report No. TMT/F95024, dated October 1995.

2. OBJECTIVES

To carry out the following tests:

2.1 Baluster point load test, BS 6180, clause 6.3.4, to be carried out on each baluster for landing and stair rail units.

2.2 Balustrade static load test, BS 585, clause B4.

2.3 Balustrade impact load test, BS 585, clause B5, to be carried out on the stair rail only.

3. TEST SPECIMENS

A full specification for the unit tested is given in the Appendix II attached to the rear of this report. The following table shows a summary of unit which was tested.

Specimen No	System ID	Material	Unit Type	Handrail Type	Spindle Section (mm)	Nom. Span (m)	Comments
12A	CONT	Hemlock	Stair	HDR	32	4.2	Balustrade static load re test

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4. TEST PROCEDURE

4.1 Baluster point load test

The complete assembly was laid horizontally approximately 1m from the ground, supported at the newel posts.

A calibrated load bag with a hook attachment was suspended from the centre point of each baluster in turn. The applied load which each baluster was required to sustain was 25.5kg. The derivation of this load is given in Appendix I.

4.2 Balustrade Static Load Test

The stair rail was mounted on a scaffolding rig with newel posts vertical. The upper newel was secured both top and bottom, while the lower newel was secured at the bottom only. The stringer was fixed at five positions along its length to scaffold bracing in order to simulate the stiffening effect of the stairs. A point load was applied horizontally to the handrail using calibrated load bags via a wire rope and pulley. The deflection of the assembly was measured using displacement transducers positioned at handrail midspan, stringer midspan and at the top of the lower newel post.

The design load to be applied as a point load to the handrail was 0.27kN/m x handrail length (m). Under this load the nett midspan deflection of the handrail should not exceed 25mm.

The performance requirements of the Product Conformity Scheme state that, where the deflection limit given above is exceeded, the unit will be deemed to have satisfied the requirements of the scheme provided that it is capable of supporting 2.5 times the design load given above, for a period of 15 minutes.

4.3 Balustrade Impact Load Test

The stair rail remained mounted in the test rig as for item 4.2. A calibrated 30kg load bag, suspended from a point 2100mm above the midspan of the handrail, was raised 300mm above and aimed "uphill" at an angle of 45° to the rail. The bag was released and allowed to swing freely against the stair rail. This was repeated three times and the assembly was checked for damage after each impact.

5. RESULTS

Full test results together with any comments, observations and photographs, are presented in Appendix II at the rear of this report. The following tables provide a

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summary of the performance of the specimen against the requirements of the individual tests conducted, together with an overall pass/fail in respect of BS 585, BS 6180 and the performance requirements of the Product Conformity Scheme, where appropriate.

Specimen No	BS 6180 cl. 6.3.4	BS 6180 cl. 6.4.1	BS 585 cl. B4	BS 585 cl. B5	Overall
12A	pass	NA	pass	pass	pass

Report written by:

S. Edwards

S Edwards
Product Testing Engineer

Issued under the authority of:

Dr G S Hall
Technical Director

1 Jan '96

Date

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APPENDIX I

DERIVATION OF MINIMUM PERMISSIBLE FAILURE LOAD

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APPENDIX I

DERIVATION OF MINIMUM PERMISSIBLE FAILURE LOAD

General

BS 5268: Part 2: 1991, the structural timber design code, states under Section 8, clause 57 that "load testing is ..... an equally acceptable alternative to calculation and in certain cases can be a more positive method of establishing the adequacy of a particular design". Furthermore, where a component or assembly is tested, the design should be regarded as satisfactory if the ultimate load recorded is 2.5 times design load or, in the case of 5 or more identical items, if the lowest ultimate load recorded is at least 2.0 times design load (clause 6.2.3 and Table 91).

Landing and stair rail balusters

BS 6180 clause 6.3.4 states that "..... each baluster should be designed to resist half the concentrated load given in annex A, applied at mid-height". The half load of $\frac{0.25}{2}$ kN = 0.125kN for domestic use and $\frac{0.50}{2}$ kN = 0.25kN for public use, is the design load. The minimum permissible failure load for more than five identical balusters would therefore be design load times factor of safety or 0.125 x 2 = 0.25kN for domestic use and 0.25 x 2.0 = 0.50kN for public use.

Landing and stair rail assembly

For landing and stair rail assemblies, the factor of safety to be applied to the design load to give the minimum permissible failure load would be 2.5 where one specimen is tested and 2.3 where two identical specimens are tested.

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APPENDIX II

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SPECIMEN NUMBER 12A

SPECIFICATION

Species	Hemlock
System	Continuous
Handrail section (mm)	59 (w) x 59 (d)
Handrail length between newels (mm)	4080
Baluster section (mm)	32 x 32
Bluster length between handrail and stringer (mm)	757
Baluster turning length (mm)	453
Newel cross section (mm)	82 x 82
Stringer cross section (mm)	28 x 215
Handrail to newel joint	Richard Burbidge Ltd Continuous System.
Handrail butt joint	Richard Burbidge Ltd rail bolt system. Reference instruction leaflet "LFLT-HDR". Also included was a 25x150x3mm thick steel plate fixed across the underside of all butt joints using 5 No 1" number 8 screws.
UE ramp to vertical turn joint	Glued mitre joint with a pair of 10mm dia dowels.

RESULTS

Baluster point load test

All balusters withstood the applied load without damage.

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APPENDIX II

Balustrade static load test

Deflection and strength test results are presented below:

Applied load kg	Deflection (mm) Handrail	Newel	Stringer	Nett handrail deflection (mm)	Permissible deflection (mm)
0	0	0	0	0	
20	11.3	2.7	0.4	8.2	
40	26.2	7.0	2.2	18.0	
60	44.1	13.6	4.2	26.3	
80	61.5	21.7	6.2	33.6	
100	80.9	29.2	7.9	43.8	
Design 112	95.1	34.9	9.3	50.9	
Design +15 mins	96.2	35.5	9.4	51.3	25.0
1.5 x design	130.5	44.7	12.5	73.3	
2.0 x design	172.6	66.1	16.3	90.2	
2.5 x design	231.7	88.5	19.3	123.9	
+ 15 mins	232.0	88.7	19.3	124.0	
0	24.5	14.1	5.0	5.4	

Balustrade impact test

The specimen withstood three impact loads without damage.

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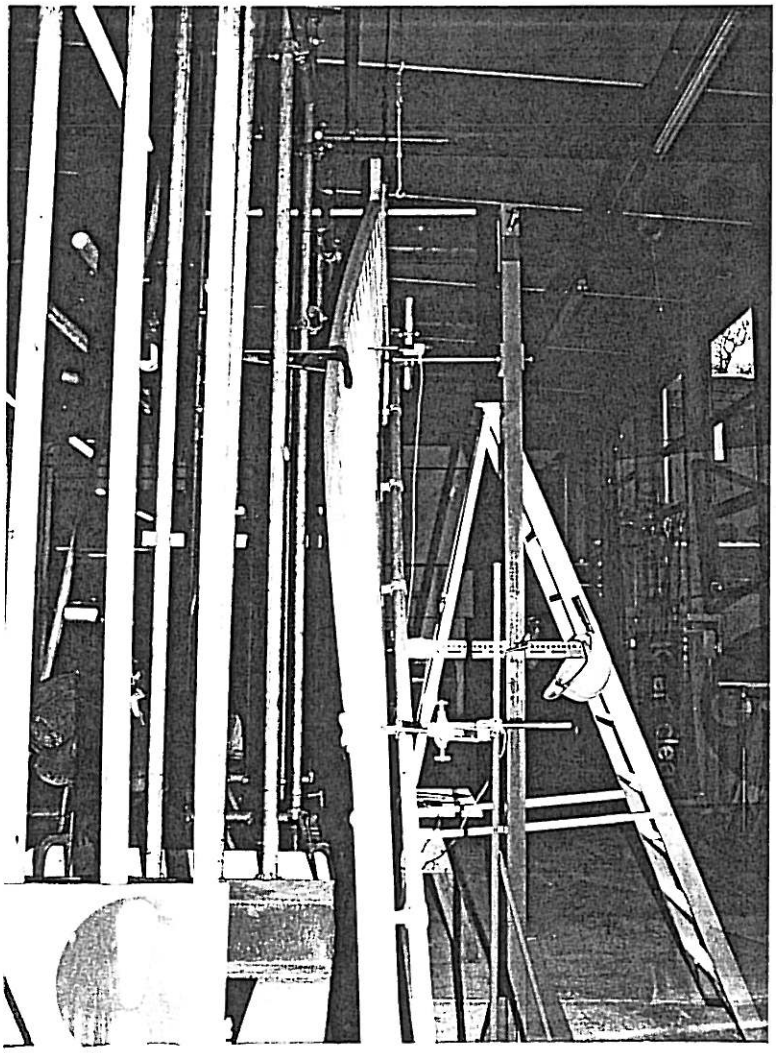

Figure II.1 Balustrade static load test

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