TECHNOLOGY CENTRE

Technical Report

Title: Product wind resistance, dynamic watertightness and impact resistance testing of a standing seam rainscreen system for Catnic Limited

Report No: N950-19-17807

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Title: Product wind resistance, dynamic water tightness and impact resistance testing a standing seam rainscreen system for Catnic Limited

Customer: Catnic Limited
Pontypandy Industrial Estate,
Caerphilly CF83 3GL

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UKAS TESTING
0057

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CONTENTS

1 INTRODUCTION

This report describes tests carried out at VINCI Technology Centre UK Limited at the request of Catnic Limited.

The test sample consisted of a sample of standing seam rainscreen manufactured by Catnic Limited.

The tests were carried out on 19 November 2019 and were to determine the wind, water and impact resistance of the test sample. The test methods were in accordance with the CWCT Standard Test Methods for building envelopes, 2005, for:

Wind resistance – serviceability & safety.

Watertightness – dynamic pressure.

Impact resistance.

The testing was carried out in accordance with Technology Centre Method Statement C7571/MS rev 0.

This test report relates only to the actual sample as tested and described herein.

The results are valid only for sample(s) tested and the conditions under which the tests were conducted.

The long-term durability of the façade system is not assessed by these test methods.

VINCI Technology Centre UK Limited is accredited to ISO/IEC 17025:2017 by the United Kingdom Accreditation Service as UKAS Testing Laboratory No. 0057.

VINCI Technology Centre UK Limited is Notified Body No. 1766.

VINCI Technology Centre UK Limited is certified by BSI for:

- ISO 9001:2008 Quality Management System,
- ISO 14001:2004 Environmental Management System,
- BS OHSAS 18001:2007 Occupational Health and Safety Management System.

The tests were witnessed by:

Gordon Crichton - Tata Steel UK Ltd

Richard Price - Tata Steel UK Ltd

2 SUMMARY AND CLASSIFICATION OF TEST RESULTS

The following summarises the results of the tests carried out. For full details refer to Sections 6, 7 and 8.

2.1 SUMMARY OF TEST RESULTS

TABLE 1

Date	Test number	Test description	Result
19 November 2019	1	Wind resistance – serviceability	Pass
19 November 2019	2	Wind resistance – safety	Pass
19 November 2019	3	Watertightness - dynamic	Pass
19 November 2019	4	Impact resistance	Pass

2.2 CLASSIFICATION

TABLE 2

Test	Standard	Classification / Declared value
Wind resistance	CWCT	±2400 pascals serviceability ±3600 pascals safety
Watertightness - dynamic	CWCT	600 pascals
Impact resistance	CWCT TN76	See section 8

3 DESCRIPTION OF TEST SAMPLE

3.1 GENERAL ARRANGEMENT

The sample was as shown in the photo below and the drawings included as an appendix to this report.

The test sample measured 5.0 m high by 6.1m wide.

PHOTO 0915

TEST SAMPLE ELEVATION

PHOTO 0982

TEST SAMPLE DURING WIND RESISTANCE TESTING

3.2 CONTROLLED DISMANTLING

During the dismantling of the sample no discrepancies from the drawings were found.

PHOTO 0905

SAMPLE DURING DISMANTLE

PHOTO 0906

SAMPLE DURING DISMANTLE

PHOTO 1005

SAMPLE DURING DISMANTLE

PHOTO 1007

PANELS REMOVED FROM TEST RIG

PHOTO 1010

SAMPLE DURING DISMANTLE

PHOTO 1015

SUPPORT FRAME

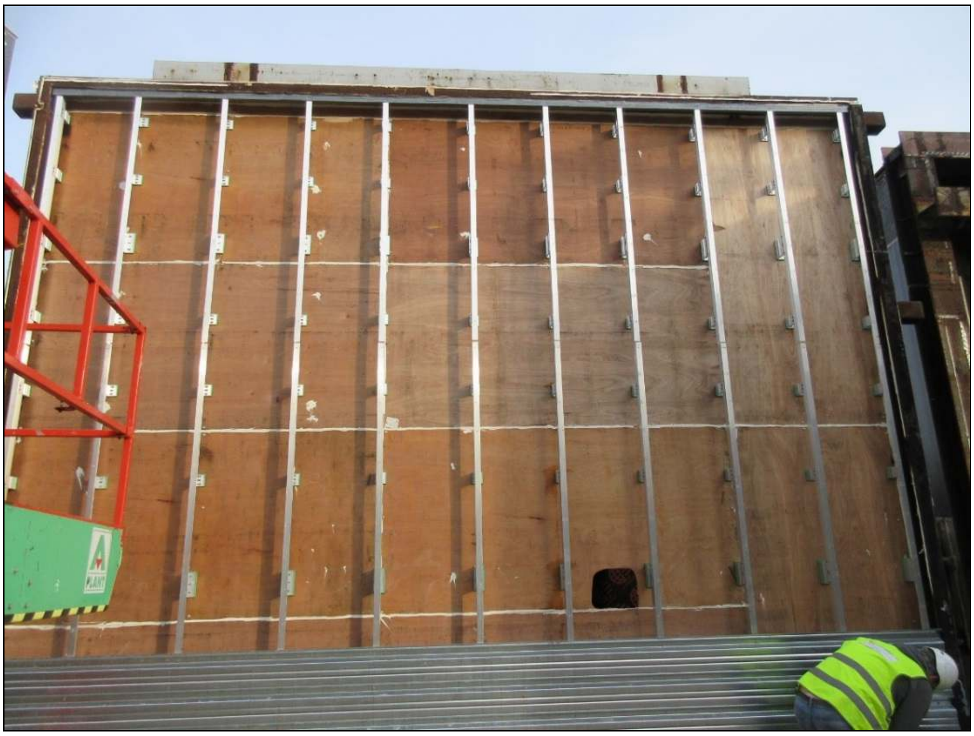


PHOTO 1016

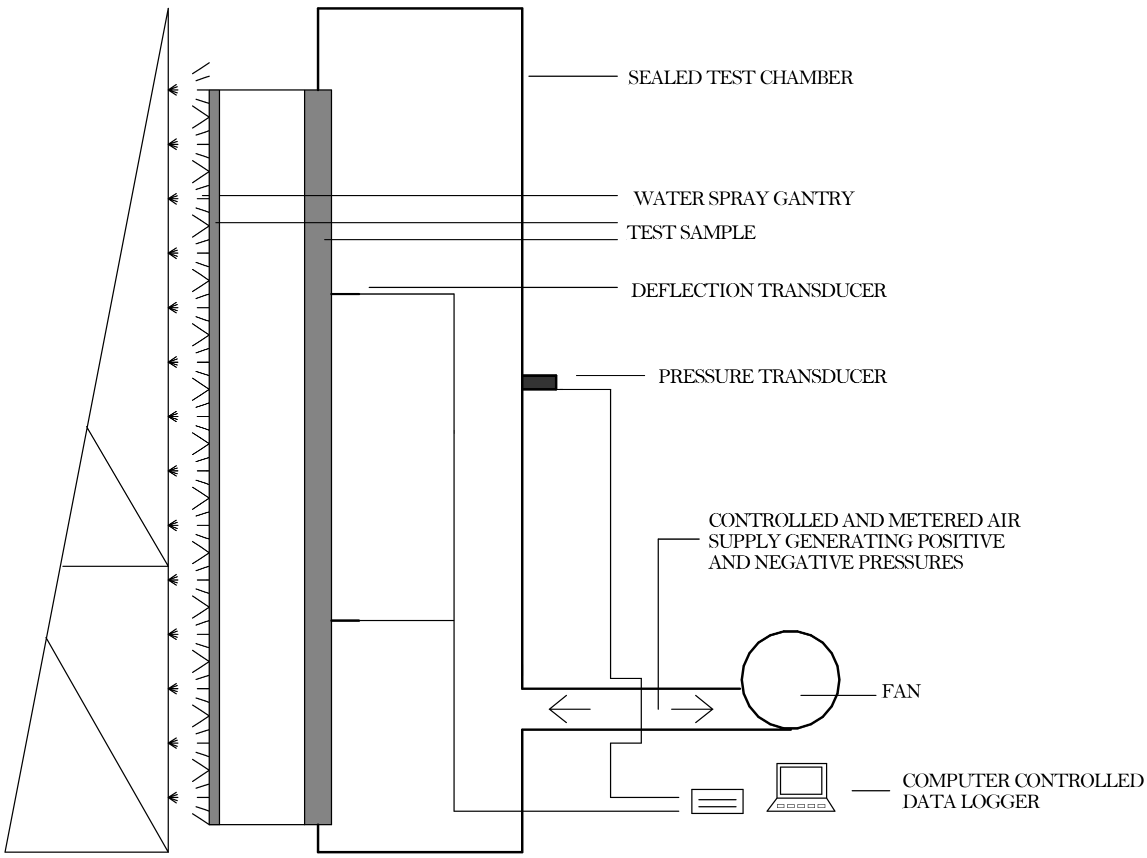
FIXING BRACKET

4 TEST RIG GENERAL ARRANGEMENT

The test sample was mounted on a rigid test rig with support steelwork designed to simulate the on-site/project conditions. The test rig comprised a well sealed chamber, fabricated from steel and plywood. A door was provided to allow access to the chamber. Representatives of Catnic Limited installed the sample on the test rig. See Figure 1.

FIGURE 1

TEST RIG SCHEMATIC ARRANGEMENT



SECTION THROUGH TEST RIG

5 TEST SEQUENCE

The test sequence was as follows:

(1) Wind resistance – serviceability

(2) Wind resistance - safety

(3) Watertightness – dynamic

(4) Impact resistance

6 WIND RESISTANCE TESTING

6.1 INSTRUMENTATION

6.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

6.1.2 Deflection

Displacement transducers were used to measure the deflection of principle framing members to an accuracy of 0.1 mm. The gauges were set normal to the sample framework at mid-span and as near to the supports of the members as possible and installed in such a way that the measurements were not influenced by the application of pressure or other loading to the sample. The gauges were located at the positions shown in Figure 2.

6.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air temperatures to within 1°C.

6.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

6.2 FAN

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

6.3 PROCEDURE

6.3.1 Wind Resistance – serviceability

Three positive pressure differential pulses of 600 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 1200 pascals to 0. The pressure was increased in four equal increments each maintained for 15 ±5 seconds. Displacement readings were taken at each increment. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

The test was then repeated using a negative pressure of -1200 pascals.

Three positive pressure differential pulses of 900 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 1800 pascals to 0. The pressure was increased in four equal increments each maintained for 15 ±5 seconds. Displacement readings were taken at each increment. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

The test was then repeated using a negative pressure of -1800 pascals.

Three positive pressure differential pulses of 1200 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 2400 pascals to 0. The pressure was increased in four equal increments each maintained for 15 ±5 seconds. Displacement readings were taken at each increment. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

The test was then repeated using a negative pressure of -2400 pascals.

6.3.2 Wind Resistance – safety

Three positive pressure differential pulses of 1200 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 3600 pascals to 0. The pressure was increased as rapidly as possible but not in less than 1 second and maintained for 15 ±5 seconds. Displacement readings were taken at peak pressure. Residual deformations were measured on the pressure returning to zero.

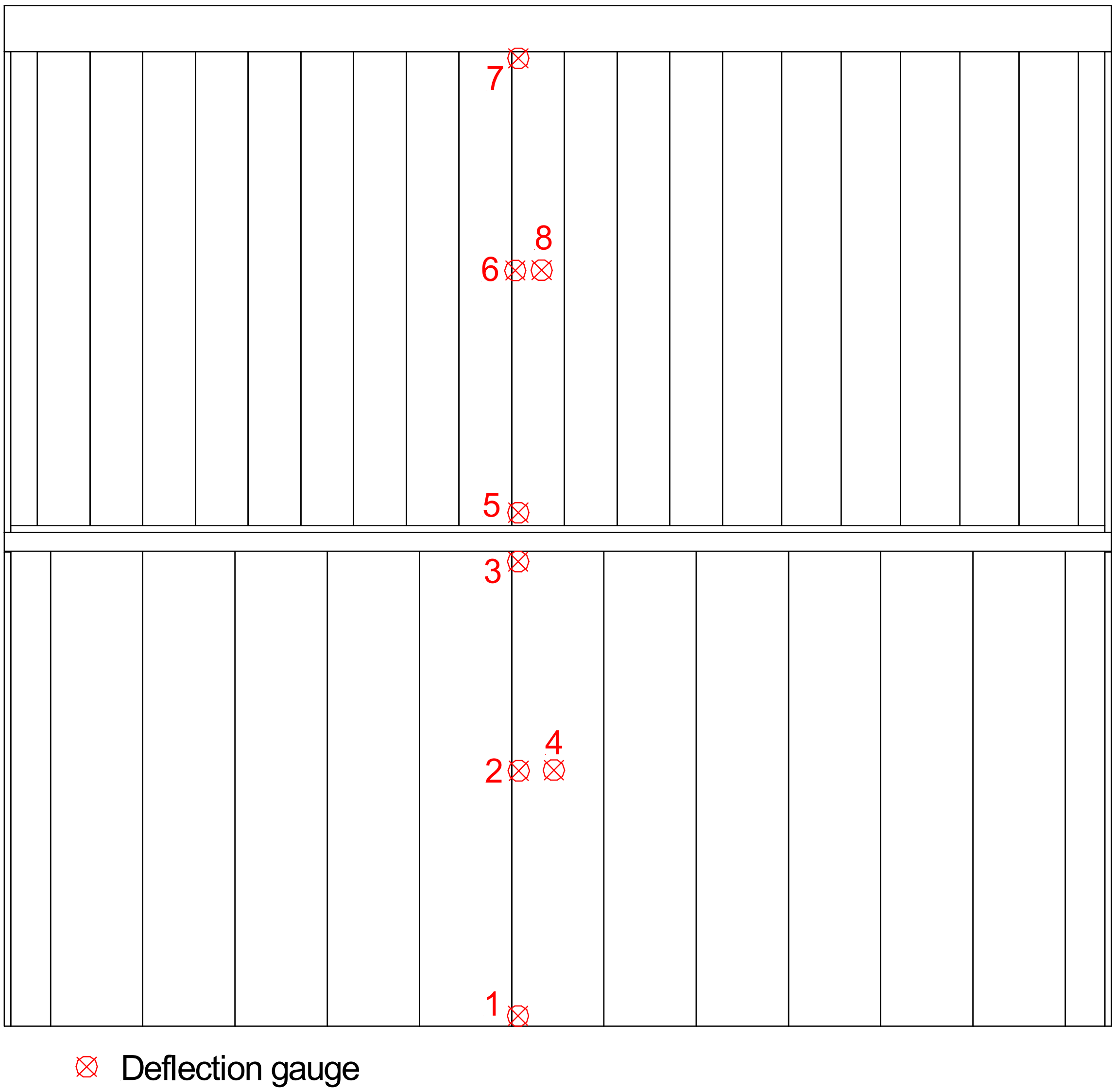
Any damage or functional defects were recorded.

The test was then repeated using a negative pressure of –3600 pascals.

FIGURE 2

DEFLECTION GAUGE LOCATIONS

External View



6.4 PASS/FAIL CRITERIA

6.4.1 Calculation of permissible deflection

Serviceability Test TABLE 3

Gauge number	Member	Span (L) (mm)	Permissible deflection (mm)	Permissible residual deformation
2	Vertical rail	2409	L/200 = 12.6	1 mm
6	Vertical rail	-2397	L/200 = 12.3	1 mm

Safety Test TABLE 4

Gauge number	Member	Span (L) (mm)	Permissible deflection (mm)	Permissible residual deformation
2	Vertical rail	2409	n/a	L/500 = 5.0 mm
6	Vertical rail	-2397	n/a	L/500 = 4.9 mm

6.5 RESULTS

<u>Test 1 (serviceability)</u> Date: 19 November 2019

The deflections measured during the wind resistance test, at the positions shown in Figure 2, are shown in Tables 7 to 12.

Summary:

Serviceability Test TABLE 5

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
2	Vertical rail	2409 -2397	2.1 -5.8	0.2 -0.4
6	Vertical rail	2409 -2397	0.9 -5.9	0.0 0.1

No damage to the test sample was observed.

Ambient temperature = 0°C
Chamber temperature = 2°C

<u>Test 2 (safety)</u> Date: 19 November 2019

The deflections measured during the structural safety test, at the positions shown in Figure 2, are shown in Table 13.

Summary

Safety Test TABLE 6

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
2	Vertical rail	3602 -3605	2.5 -7.5	-0.1 -0.6
6	Vertical rail	3602 -3605	0.8 -7.0	0.1 0.0

No damage to the sample was observed.

Ambient temperature = 1°C
Chamber temperature = 2°C

TABLE 7

<u>WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS</u>

Position	**Pressure (pascals) / Deflection (mm)**				
	303	**598**	**911**	**1201**	**Residual**
1	0.6	1.2	1.7	2.2	0.2
2	2.2	2.8	3.4	4.0	0.1
3	0.7	1.4	2.0	2.5	0.1
4	11.8	12.7	13.2	13.7	0.3
5	0.7	1.4	2.0	2.5	0.1
6	1.0	1.9	2.6	3.1	0.1
7	0.4	0.7	1.1	1.5	0.1
8	2.4	5.0	6.6	7.3	0.1
2 *	1.6	1.5	1.6	1.7	0.0
6 *	0.3	0.8	1.0	1.1	0.0

* Mid-span reading adjusted between end support readings

TABLE 8

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	-328	**-603**	**-921**	**-1237**	**Residual**
1	-0.8	-1.5	-2.7	-3.8	-0.6
2	-2.8	-4.4	-6.4	-8.3	-0.4
3	-0.9	-1.8	-3.0	-4.3	-0.1
4	-9.4	-13.7	-17.8	-21.3	-1.1
5	-0.7	-1.5	-2.7	-3.7	-0.1
6	-1.6	-3.0	-4.9	-6.7	-0.1
7	-0.5	-1.0	-1.7	-2.5	-0.1
8	-4.0	-8.1	-12.7	-16.4	0.0
2 *	-1.9	-2.8	3.5	-4.2	0.0
6 *	-1.0	-1.7	-2.8	-3.6	0.0

* Mid-span reading adjusted between end support readings

TABLE 9

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	474	**913**	**1382**	**1796**	**Residual**
1	1.1	1.8	2.7	3.2	0.4
2	2.9	3.9	4.9	5.5	0.2
3	1.2	2.1	3.1	3.7	0.1
4	13.6	14.5	15.5	16.0	0.7
5	1.2	2.2	3.3	4.0	0.1
6	1.6	2.6	3.5	3.9	0.1
7	0.6	1.2	1.7	1.9	0.1
8	4.1	6.6	7.8	8.3	0.2
2 *	1.7	1.9	2.0	2.0	-0.1
6 *	0.7	0.9	1.0	1.0	0.0

* Mid-span reading adjusted between end support readings

TABLE 10

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	-480	**-891**	**-1368**	**-1802**	**Residual**
1	-1.3	-2.5	-4.0	-5.5	-0.3
2	-3.6	-6.1	-8.7	-11.1	-0.3
3	-1.5	-3.1	-4.9	-6.7	-0.1
4	-11.4	-16.8	-21.6	-25.4	-0.6
5	-1.1	-2.7	-4.3	-6.1	-0.1
6	-2.4	-4.9	-7.5	-9.8	-0.1
7	-0.8	-1.7	-2.8	-3.8	-0.1
8	-6.7	-12.7	-18.0	-22.0	0.0
2 *	-2.2	-3.3	-4.2	-5.0	-0.1
6 *	-1.4	-2.7	-4.0	-4.8	0.0

* Mid-span reading adjusted between end support readings

TABLE 11

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	603	**1201**	**1822**	**2409**	**Residual**
1	1.4	2.3	3.2	4.0	0.4
2	3.2	4.4	5.5	6.5	0.1
3	1.5	2.6	3.7	4.9	0.1
4	13.7	14.8	15.8	16.7	0.2
5	1.2	2.6	4.0	5.3	0.1
6	1.9	3.0	3.9	4.7	0.1
7	0.8	1.5	1.9	2.2	0.1
8	5.0	7.2	8.3	9.2	0.1
2 *	1.7	2.0	2.0	2.1	-0.2
6 *	0.9	1.0	1.0	0.9	0.0

* Mid-span reading adjusted between end support readings

TABLE 12

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	-593	-1234	-1831	-2397	Residual
1	-1.6	-3.6	-5.5	-8.1	-0.7
2	-4.1	-7.7	-10.9	-14.4	-0.8
3	-1.9	-4.3	-6.6	-9.2	-0.3
4	-12.7	-19.9	-25.0	-30.1	-1.4
5	-1.3	-3.7	-6.1	-8.9	-0.2
6	-3.0	-6.8	-9.9	-13.0	-0.1
7	-1.1	-2.5	-3.8	-5.2	-0.1
8	-8.6	-16.8	-22.3	-27.0	-0.1
2 *	-2.4	-3.7	-4.8	-5.8	-0.4
6 *	-1.8	-3.6	-4.9	-5.9	0.0

* Mid-span reading adjusted between end support readings

TABLE 13

WIND RESISTANCE - **SAFETY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)			
	3602	**Residual**	**-3605**	**Residual**
1	5.5	0.7	-10.7	-0.9
2	8.7	0.4	-19.1	-1.2
3	6.9	0.4	-12.5	-0.3
4	19.1	0.9	-35.1	-2.3
5	7.6	0.3	-12.5	-0.2
6	6.0	0.3	-16.6	-0.1
7	2.8	0.1	-6.8	-0.1
8	10.5	0.3	-33.6	0.0
3 *	2.5	-0.1	-7.5	-0.6
3 *	0.8	0.1	-7.0	0.1

* Mid-span reading adjusted between end support readings

7 WATERTIGHTNESS TESTING

7.1 INSTRUMENTATION

7.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

7.1.2 Water Flow

An in-line water flow meter was used to measure water supplied to the spray gantry to within 5%.

7.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air and water temperatures to within 1°C.

7.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

7.2 FAN

A wind generator was mounted adjacent to the external face of the sample and used to create positive pressure differentials during dynamic testing. The wind generator comprised a piston type aero-engine fitted with 4 m diameter contra-rotating propellers.

7.3 WATER SPRAY

The water spray system comprised nozzles spaced on a uniform grid not more than 700 mm apart and mounted approximately 400 mm from the face of the sample. The nozzles provided a full-cone pattern with a spray angle between 90° and 120°. The spray system delivered water uniformly against the exterior surface of the sample.

7.4 PROCEDURE

Water was sprayed onto the sample using the method described above at a flow rate of at least 3.4 litres/m^2/minute.

The aero-engine was used to subject the sample to wind of sufficient velocity to produce average deflections in the principle framing members equal to those produced by a static pressure differential of 600 pascals. These conditions were maintained for 15 minutes. Throughout the test the inside of the sample was examined for water penetration.

7.5 PASS/FAIL CRITERIA

There shall be no water penetration to the internal face of the backing wall throughout testing. At the completion of the test there shall be no standing water in locations intended to remain dry.

PHOTO 0983

DYNAMIC WIND GENERATOR

7.6 RESULTS

Test 3 Date: 19 November 2019

No water penetration was observed throughout the test

Chamber temperature= 4°C
Ambient temperature = 3°C
Water temperature = 8°C

8 IMPACT TESTING

8.1 IMPACTOR

8.1.1 Soft body

The soft body impactor comprised a canvas spherical/conical bag 400 mm in diameter filled with 3 mm diameter glass spheres with a total mass of 50 kg suspended from a cord at least 3 m long.

8.1.2 Hard body

The hard body impactor was a solid steel ball of 50 mm or 62.5 mm diameter and approximate mass of 0.5 kg or 1.0 kg.

8.2 PROCEDURE (CWCT TN76)

8.2.1 Soft body

The impactor almost touched the face of the sample when at rest. It was swung in a pendular movement to hit the sample normal to its face. The test was performed at the locations shown in Figure 3. The impact energies were 120 Nm for serviceability and 350 Nm and 500 Nm for safety.

8.2.2 Hard body

The impactor almost touched the face of the sample when at rest. It was swung in a pendular movement to hit the sample normal to its face. The test was performed at the locations shown in Figure 4. The impact energies were 3 Nm, 6 Nm and 10 Nm.

8.3 PASS/FAIL CRITERIA

Note: Tables 1 to 2 are taken from CWCT TN76.

Table 1 - Classes for serviceability performance

Class	Definition	Explanation/Examples
1	No damage.	No damage visible from 1m, and Any damage visible from closer then 1m unlikely to lead to significant deterioration.
2	Surface damage of an aesthetic nature which is unlikely to require remedial action.	Dents or distortion of panels not visible from more than 5m (note visibility of damage will depend on surface finish and lighting conditions – damage will generally be more visible on reflective surfaces), and Any damage visible from closer than 5m unlikely to lead to significant deterioration.
3	Damage that may require remedial action or replacement of components to maintain appearance or long term performance but does not require immediate action.	Dents or distortion of panels visible from more than 5m, or Spalling of edges of panels of brittle materials, or Damage to finishes that may lead to deterioration of the substrate.
4	Damage requiring immediate action to maintain appearance or performance. Remedial action may include replacement of a panel but does not require dismantling or replacement of supporting structure.	Significant cracks in brittle materials e.g. cracks that may lead to parts of tile falling away subsequent to test, or Fracture of panels causing significant amounts of material to fall away during test.
5	Damage requiring more extensive replacement than 4.	Buckling of support rails.

Table 2 - Classes for safety performance

Class	Explanation/examples
Negligible risk	No material dislodged during test, and No damage likely to lead to materials falling subsequent to test, and No sharp edges produced that would be likely to cause severe injury to a person during impact, and Cladding not penetrated by impactor.
Low risk	Maximum mass of falling particle 50g, and Maximum mass of particle that may fall subsequent to impact 50g, and No sharp edges produced that would be likely to cause severe injury during impact.
Moderate risk	Maximum mass of falling particle less than 500g, and Maximum mass of particle that may fall subsequent to impact less than 500g, and Cladding not penetrated by impact, and No sharp edges produced that would be likely to cause severe injury during impact.
High risk	Maximum mass of falling particle greater than 500g, or Cladding penetrated by impact, or Sharp edges produced that would be likely to cause severe injury during impact.

8.4 RESULTS

Test 4 Date: 19 November 2019

The impact test results are shown in Table 10.

Ambient temperature = 5°C

FIGURE 3

SOFT BODY IMPACT TEST LOCATIONS

External View

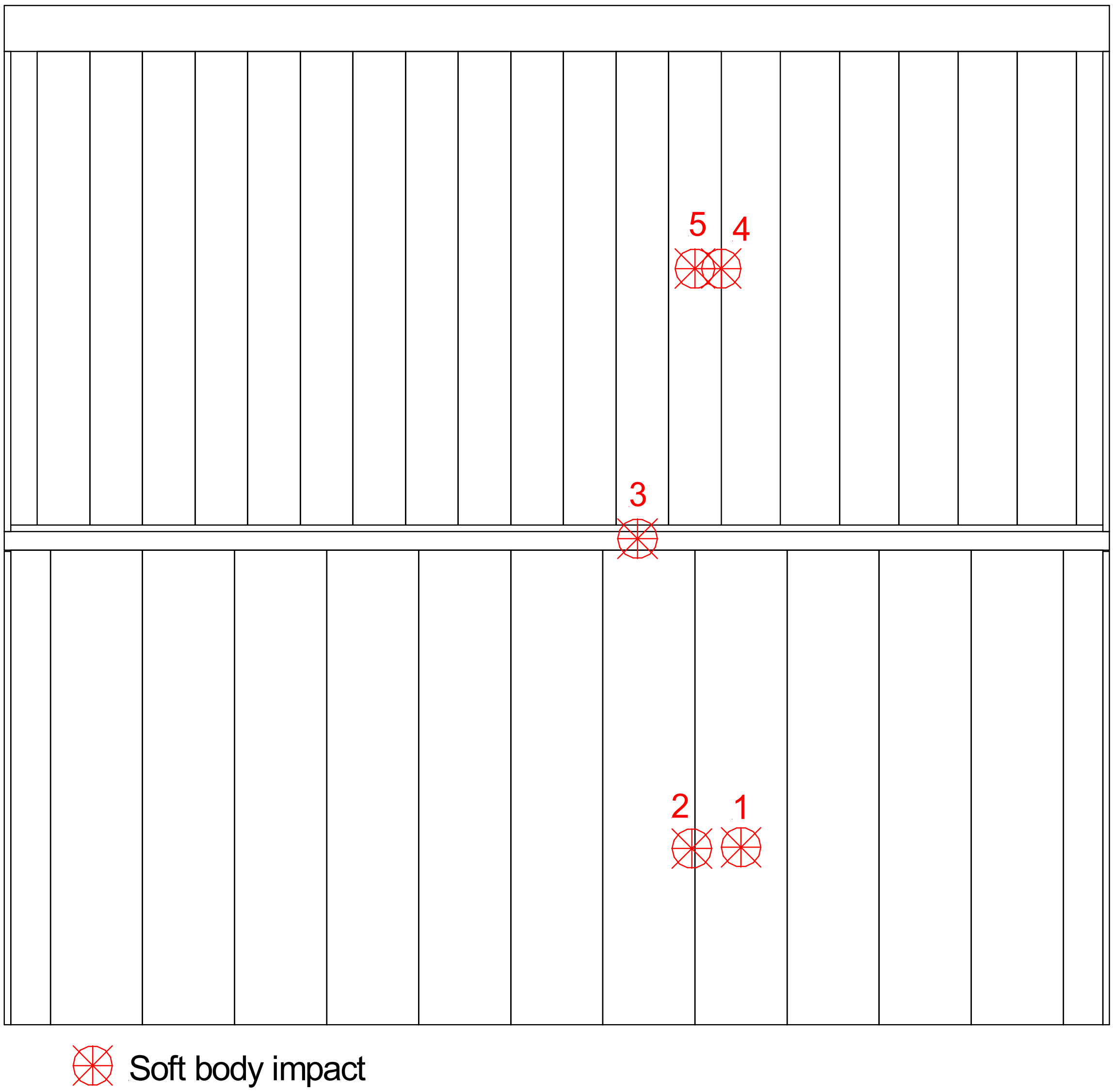


FIGURE 4

HARD BODY IMPACT TEST LOCATIONS

External View

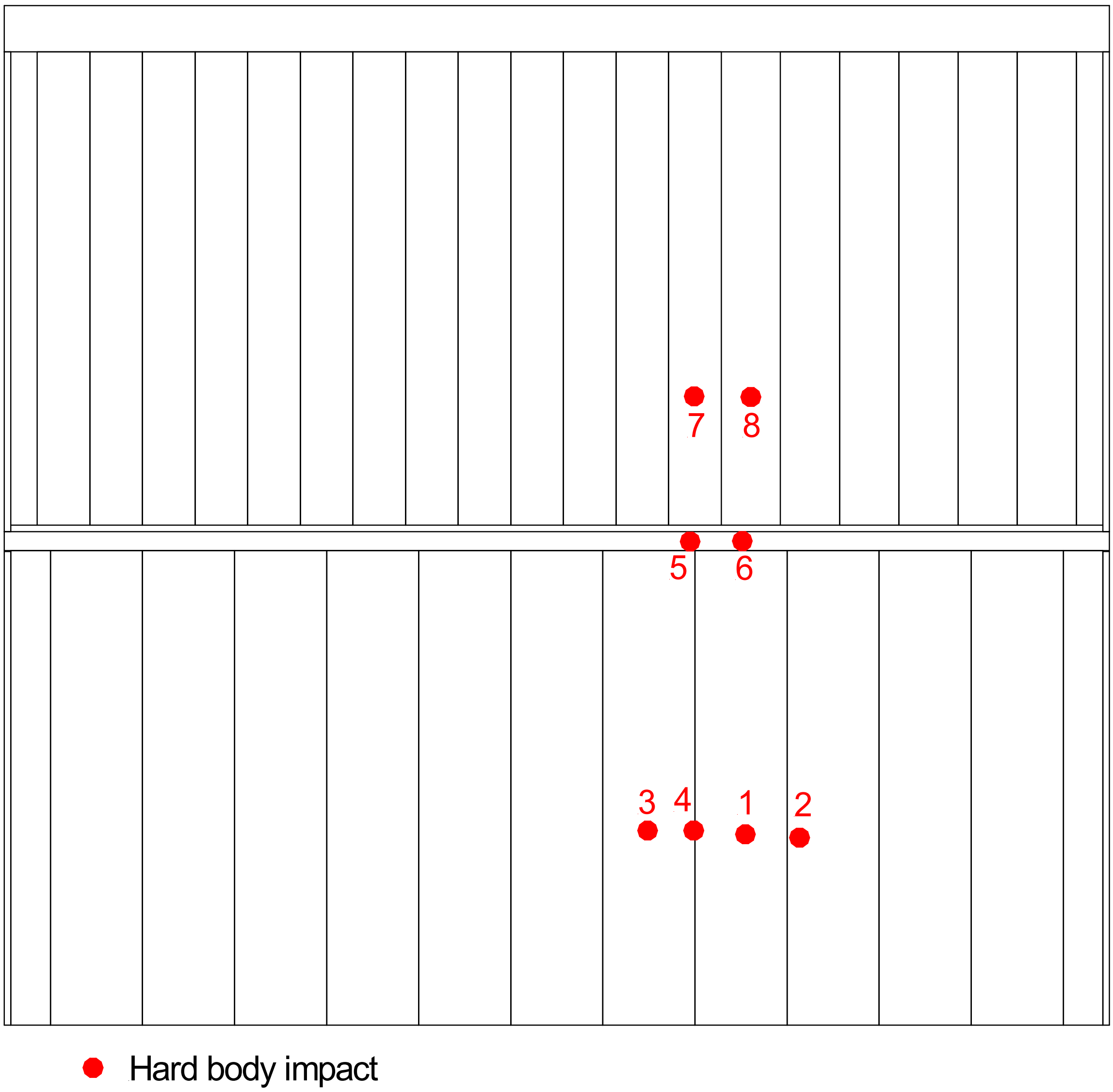


TABLE 14

SOFT BODY IMPACT RESISTANCE TEST RESULTS

Impact location	Impact energy (Nm)	Observations	Classification
1	120 x 3 350 500	No damage No damage No damage	Class 1 Negligible risk Negligible risk
2	120 x 3 350 500	No damage No damage No damage	Class 1 Negligible risk Negligible risk
3	120 x 3 350 500	No damage No damage No damage	Class 1 Negligible risk Negligible risk
4	120 x 3 350 500	No damage No damage No damage	Class 1 Negligible risk Negligible risk
5	120 x 3 350 500	No damage No damage No damage	Class 1 Negligible risk Negligible risk

TABLE 15

HARD BODY IMPACT RESISTANCE TEST RESULTS

Impact location	Impact energy (Nm)	Observations	Classification
1	3 6	Minor indent Minor indent	Class 1 / Negligible risk Class 2
2	3 6	Minor indent Minor indent	Class 1 / Negligible risk Class 2
3	10	Minor indent	Class 3 / Negligible risk
4	10	Minor indent	Class 3 / Negligible risk
5	3 6	Minor indent Minor indent	Class 1 / Negligible risk Class 3
6	10	Minor indent	Class 3 / Negligible risk
7	3 6	Minor indent Minor indent	Class 1 / Negligible risk Class 2
8	10	Minor indent	Class 3 / Negligible risk

PHOTO 0984

SOFT BODY IMPACT

PHOTO 0986

SOFT BODY IMPACT

PHOTO 0987

SOFT BODY IMPACT

PHOTO 0988

SOFT BODY IMPACT

PHOTO 0990

SOFT BODY IMPACT

PHOTO 0991

HARD BODY IMPACTor

PHOTO 0994

HARD BODY IMPACT

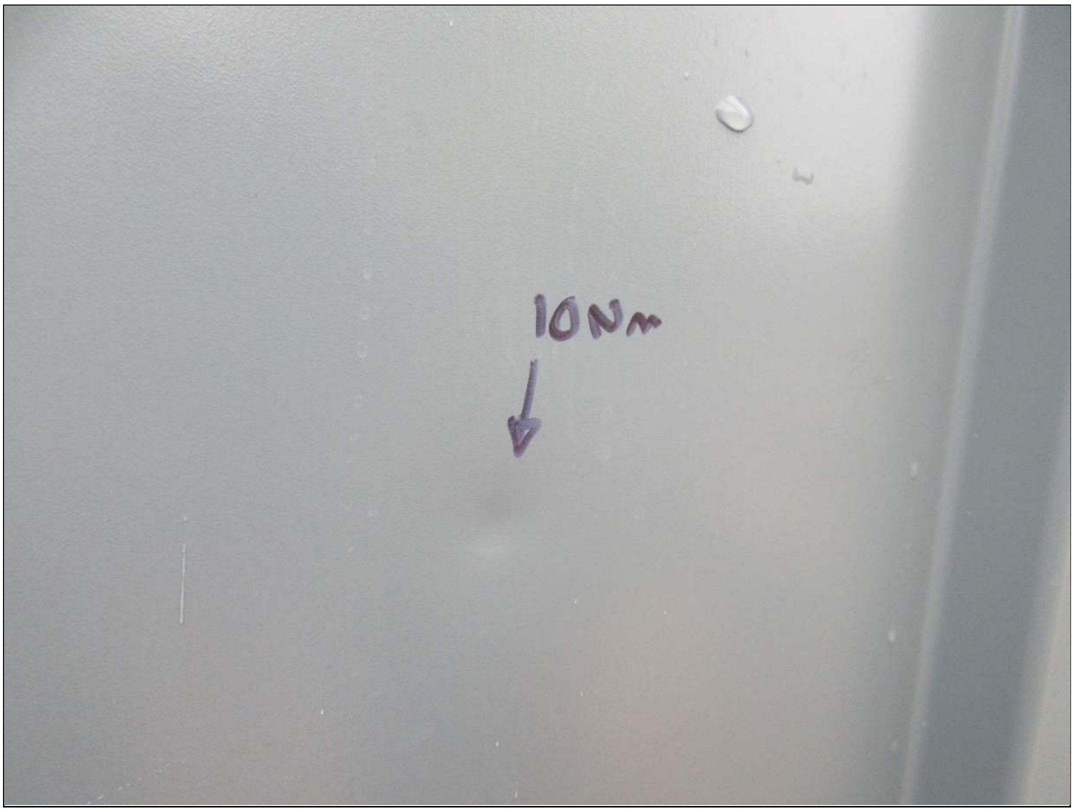


PHOTO 0995

HARD BODY IMPACT

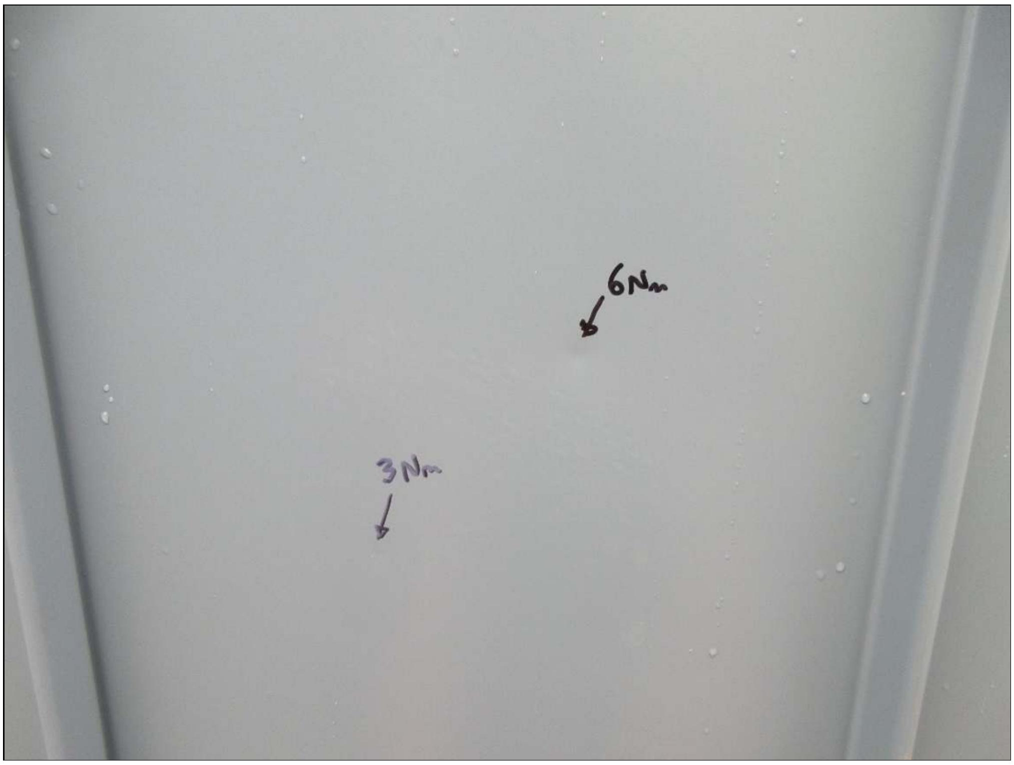


PHOTO 0996

HARD BODY IMPACT

PHOTO 0997

HARD BODY IMPACT

PHOTO 0997

HARD BODY IMPACT

PHOTO 0999

HARD BODY IMPACT

9 APPENDIX

The following unnumbered page is a copy of Tata Steel drawing numbered CWCT-1.

END OF REPORT

TATA

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www.colorcoaturban.com

Colorcoat Urban Standing Seam Cladding

CWCT Test Layout

Drn By	App'd	Drg No.
RP	GC	CWCT-1
Date	Scale	Rev
10/9/19	1:20 (A1)	

Rev	Description	By	Date

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