TECHNOLOGY CENTRE

Technical Report

Title: Weathertightness and impact testing of Scalamid panels for Architectural Facades

Report No: N950-21-18110

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Title: Weathertightness and impact testing of Scalamid panels for Architectural Facades

Customer: Architectural Facades, Brewhouse, Wilderspool Park, Greenalls Avenue, Cheshire, WA4 6HL

Issue date: 8 June 2021

VTC job no.: TR0189-3VZ5

Author(s): D. Bennett - Technician

Checked by: N. McDonald – Manager

Authorised by: S. R. Moxon – Operations Director

Distribution: (confidential) 1 copy to Architectural Facades, 1 copy to project file

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 Concept Façade Systems.

The test sample consisted of a sample of rainscreen cladding manufactured by Concept Façade Systems.

The tests were carried out on 20 April 2021 and were to determine the weathertightness 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 C8347/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:

Konrad Masternak - Concept Façade Systems

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
20 April 2021	1	Wind resistance – serviceability	Pass
20 April 2021	2	Wind resistance – safety	Pass
20 April 2021	3	Watertightness – dynamic	Pass
20 April 2021	4	Impact resistance	Pass

2.2 CLASSIFICATION

TABLE 2

Test	Standard	Classification / Declared value
Watertightness	CWCT dynamic	600 pascals
Wind resistance	CWCT	±1800 pascals serviceability ± 2700 pascals safety
Impact resistance	CWCT TN76	<u>Soft body</u> Class 1 serviceability <u>Hard body</u> Class 2 serviceability <u>Soft/hard body</u> Negligible risk - safety

3 DESCRIPTION OF TEST SAMPLE

3.1 GENERAL ARRANGEMENT

The sample was as shown in the top right-hand side of photo below and the drawings included as an appendix to this report.

The Scalamid board was supplied by Architectural Facades.

PHOTO 7569

TEST SAMPLE ELEVATION

3.2 CONTROLLED DISMANTLING

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

PHOTO 7750

TEST SAMPLE DURING DISMANTLE

PHOTO 7751

TEST SAMPLE DURING DISMANTLE

PHOTO 7753

TEST SAMPLE DURING DISMANTLE

PHOTO 7757

TEST SAMPLE DURING DISMANTLE

PHOTO 8077

TEST SAMPLE DURING DISMANTLE

PHOTO 8090

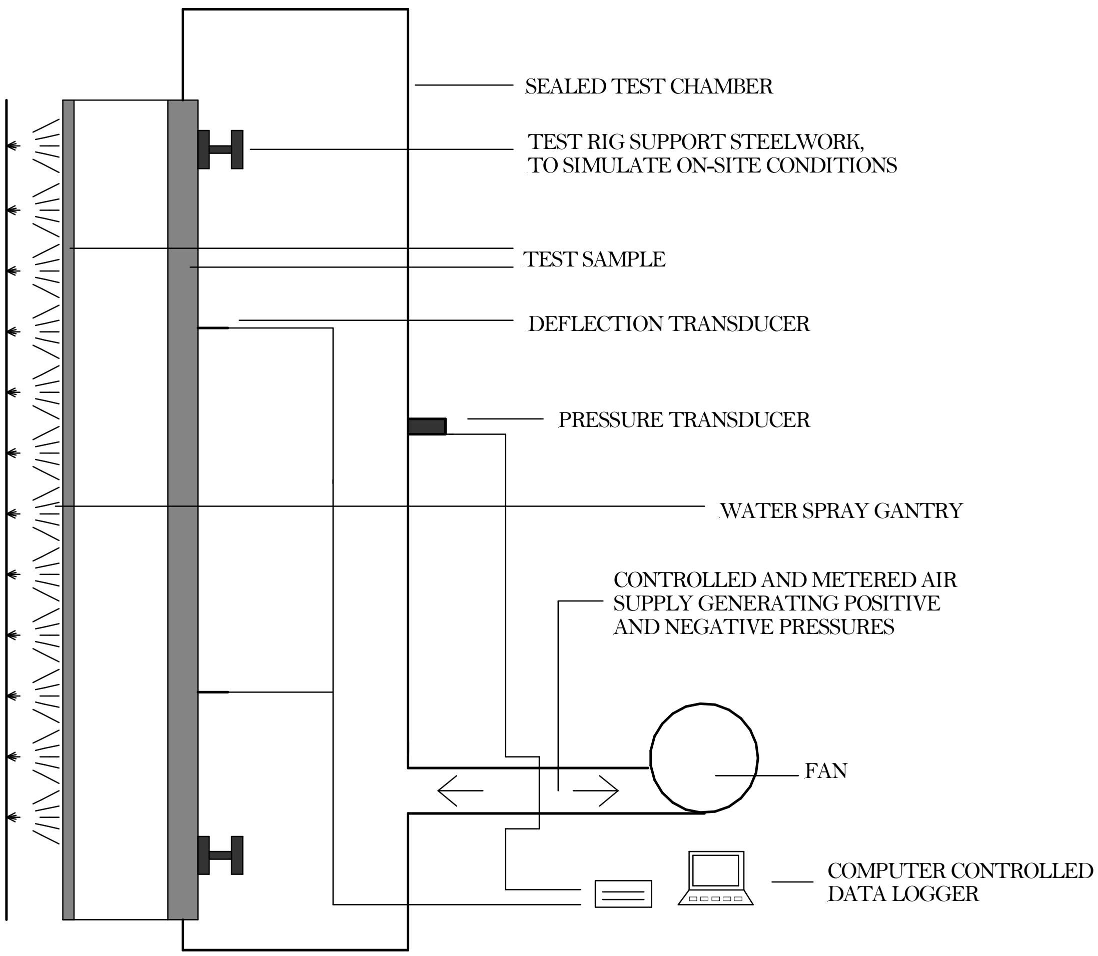
RAILS REMOVED FROM TEST RIG

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 Architectural Facades 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 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.

6.3.2 Wind Resistance – safety

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 2700 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.

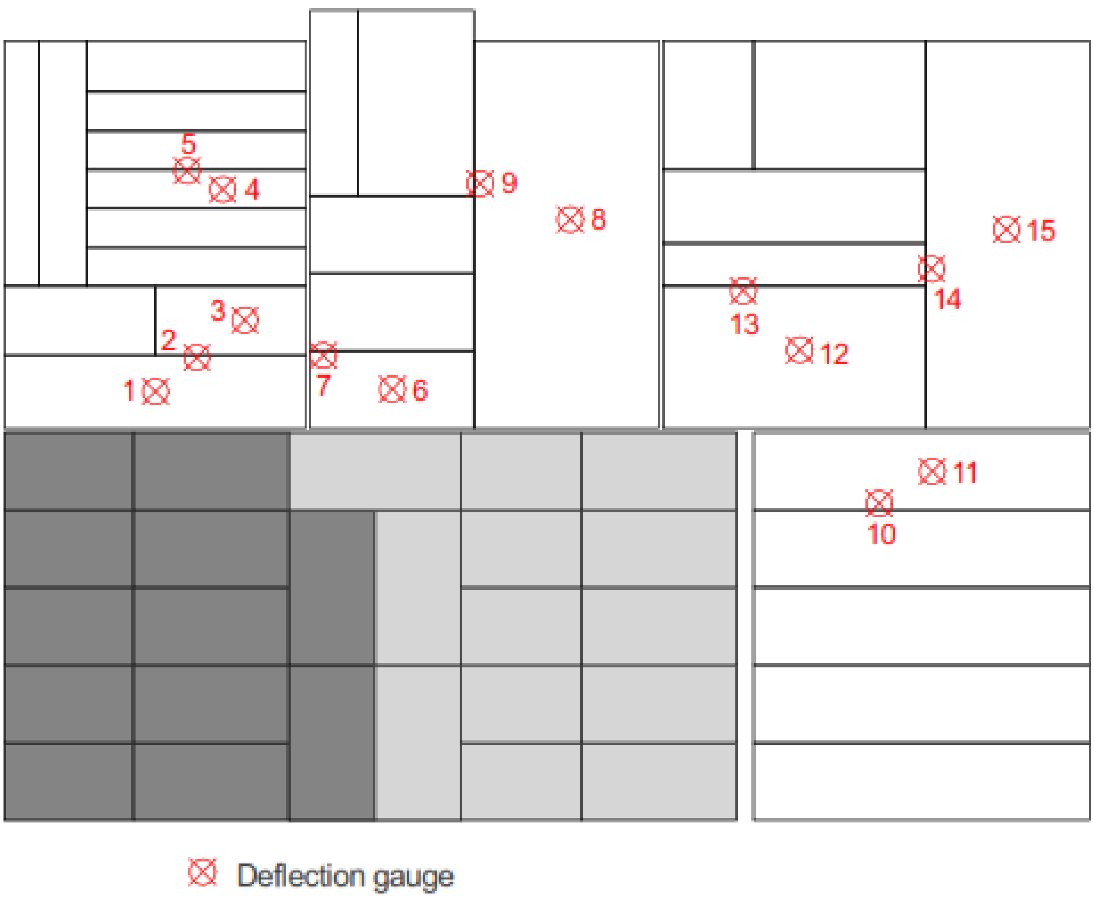
Any damage or functional defects were recorded.

The test was then repeated using a negative pressure of –2700 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)
12	Scalamid panel	2332	L/L/90 = 25.9
15	Scalamid panel	3418	L/90 = 38.0

Note: *Span based on diagonal panel span.*

6.5 RESULTS

Test 1 (serviceability) Date: 20 April 2021

The deflections measured during the wind resistance test, at the positions shown in Figure 2, are shown in Tables 5 and 6.

Summary:

Serviceability Test TABLE 4

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
12	Scalamid panel	1803 -1777	1.7 -10.4	0.0 -0.4
15	Scalamid panel	1803 -1777	1.0 -0.9	0.2 0.1

Note: *Measured deflection adjusted for movement at supports*

No damage to the test sample was observed.

Ambient temperature = 8°C
Chamber temperature = 9°C

Test 2 (safety) Date: 20 April 2021

The deflections measured during the structural safety test, at the positions shown in Figure 2, are shown in Table 7.

No damage to the sample was observed.

Ambient temperature = 13°C
Chamber temperature = 14°C

TABLE 5

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

Position	**Pressure (pascals) / Deflection (mm)**				
	612	**1015**	**1512**	**1803**	**Residual**
12	1.8	3.2	4.5	5.3	0.9
13	2.5	4.2	5.9	7.0	0.9
14	2.5	4.1	5.6	6.6	0.7
15	3.0	4.8	6.5	7.6	0.5

TABLE 6

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Position	**Pressure (pascals) / Deflection (mm)**				
	-458	**-920**	**-1353**	**-1777**	**Residual**
12	-5.5	-10.6	-14.7	-18.4	-1.0
13	-2.1	-4.1	-6.0	-8.0	-0.6
14	-1.6	-3.5	-5.2	-7.0	-0.3
15	-2.0	-4.1	-6.0	-7.9	-0.2

TABLE 7

WIND RESISTANCE - **SAFETY** TEST RESULTS

Position	**Pressure (pascals) / Deflection (mm)**			
	2700	**Residual**	**-2625**	**Residual**
12	9.7	0.6	-25.2	2.5
13	10.8	1.1	-12.8	2.0
14	10.0	0.8	-11.0	1.8
15	10.8	0.8	-11.3	2.0

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.

7.6 RESULTS

Test 3 Date: 20 April 2021

No water penetration was observed throughout the test.

Chamber temperature= 15°C
Ambient temperature = 14°C
Water temperature = 9°C

PHOTO 7758

DYNAMIC WIND GENERATOR

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 3. 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: 20 April 2021

Ambient temperature = 14°C

TABLE 8

SOFT BODY IMPACT TEST RESULTS

Location	Impact energy (Nm)	Observations	Classification
26	120 x 3 350 500	No damage observed No damage observed No damage observed	Class 1 Negligible risk Negligible risk
27	120 x 3 350 500	No damage observed No damage observed No damage observed	Class 1 Negligible risk Negligible risk
28	120 x 3 350 500	No damage observed No damage observed Horizontal crack in panel	Class 1 Negligible risk Low risk

TABLE 9

HARD BODY IMPACT TEST RESULTS

Location	Impact energy (Nm)	Observations	Classification
38	3 6 10	No damage observed No damage observed Minor indent	Class 1 / Negligible risk Class 1 Class 1 / Negligible risk
39	3 6 10	No damage observed No damage observed Corner crack	Class 1 / Negligible risk Class 1 Class 2/ Negligible risk
40	3 6 10	No damage observed No damage observed No damage observed	Class 1 / Negligible risk Class 1 Class 1 / Negligible risk

FIGURE 3

IMPACT TEST LOCATIONS

External View

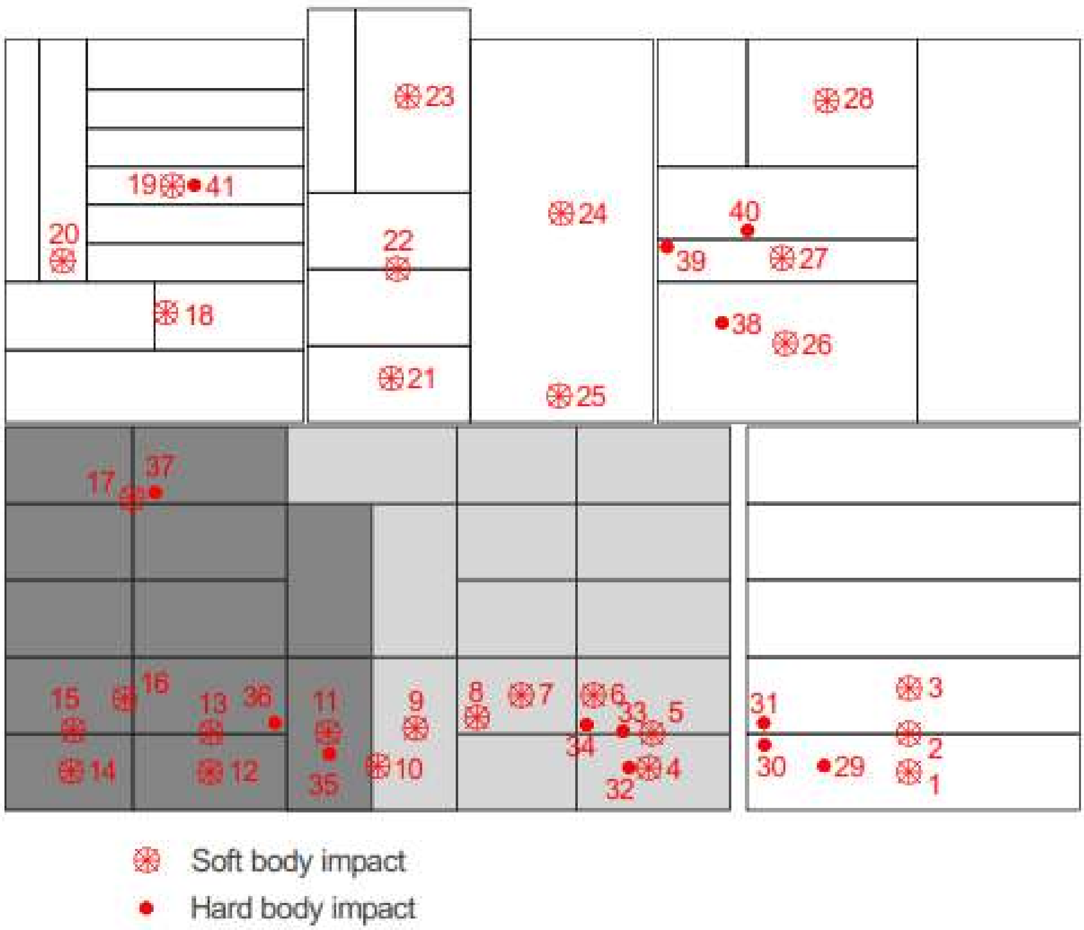


PHOTO 7759

SOFT BODY IMPACTOR

PHOTO 7768

SOFT BODY IMPACT

PHOTO 7770

HARD BODY IMPACTOR

PHOTO 7780

HARD BODY IMPACTS

PHOTO 7782

HARD BODY IMPACTS

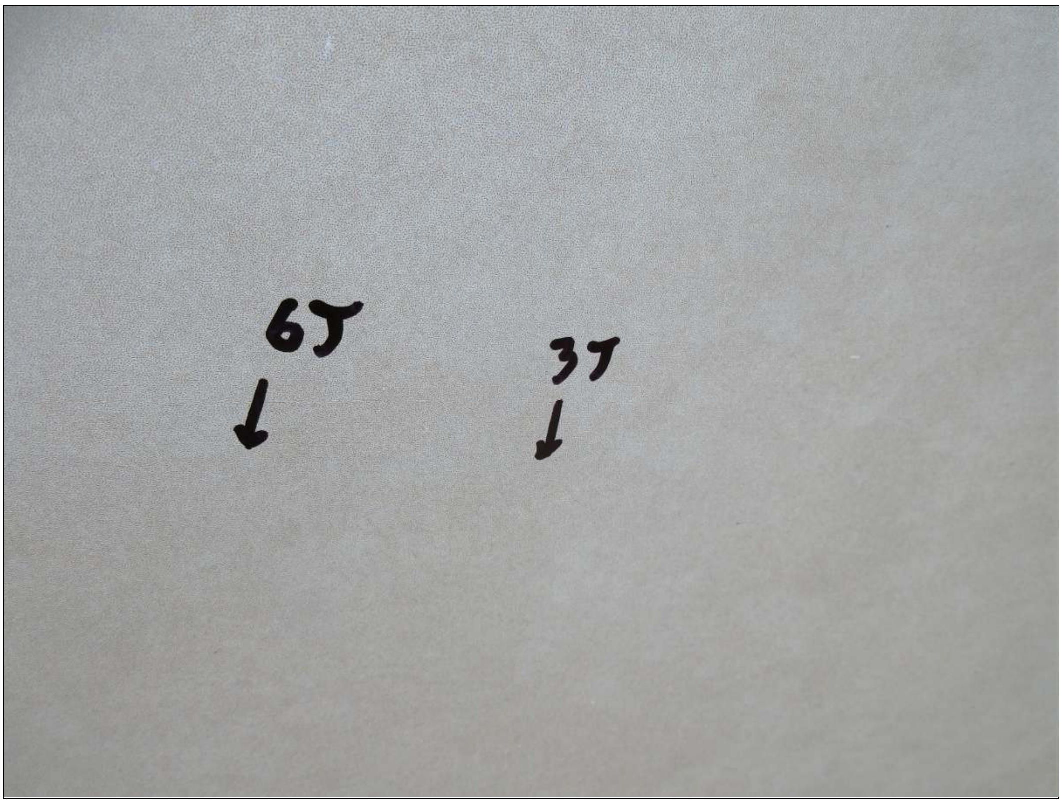


PHOTO 7787

HARD BODY IMPACTS

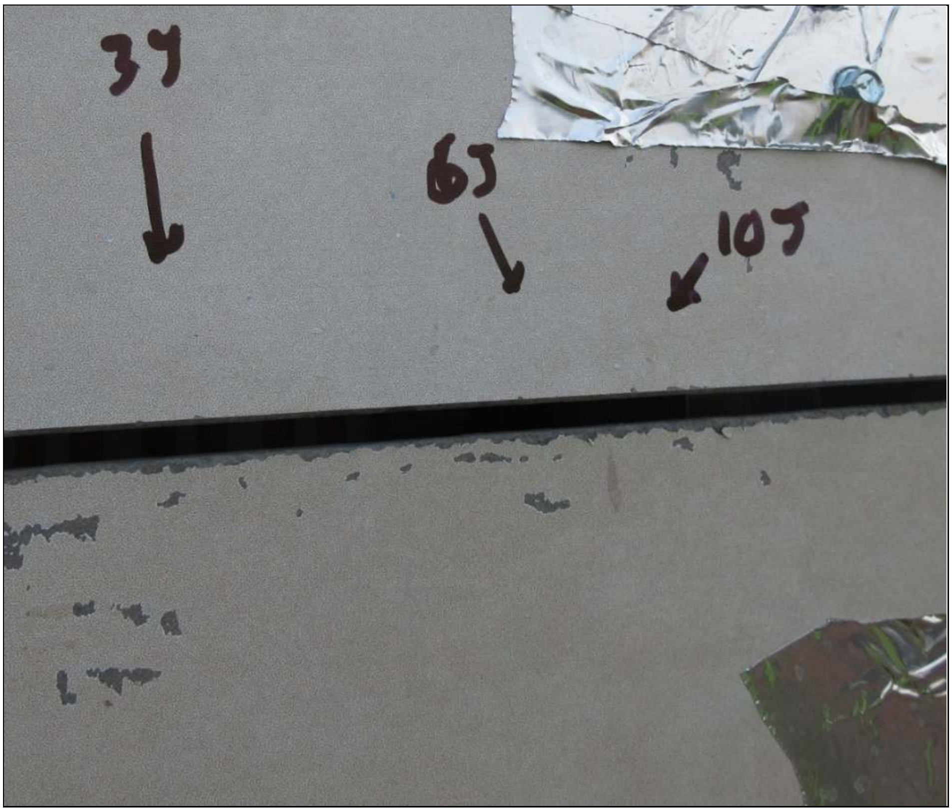


PHOTO 7788

HARD BODY IMPACT

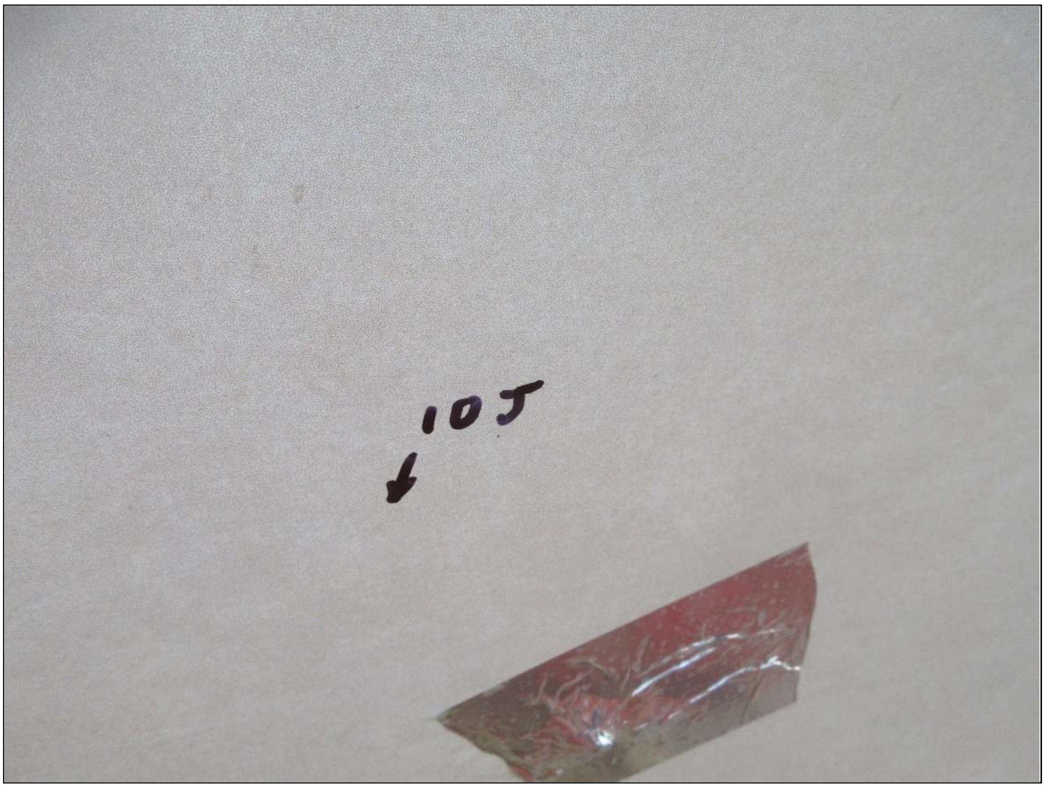


PHOTO 7789

HARD BODY IMPACTS

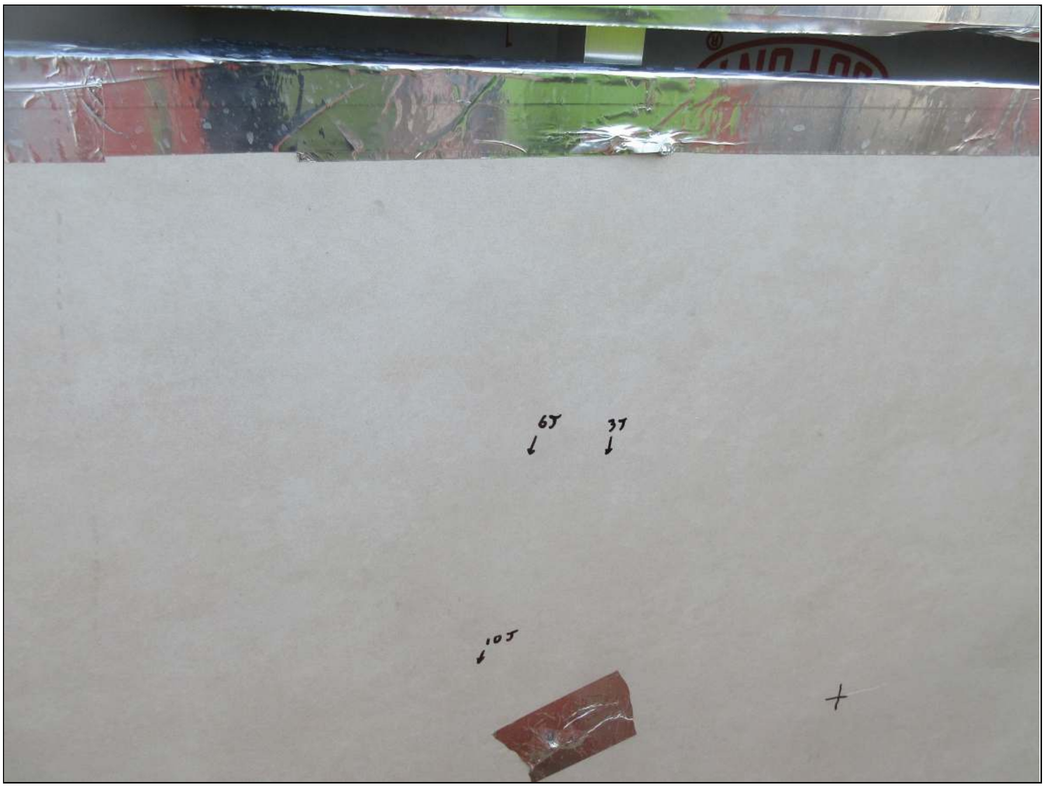
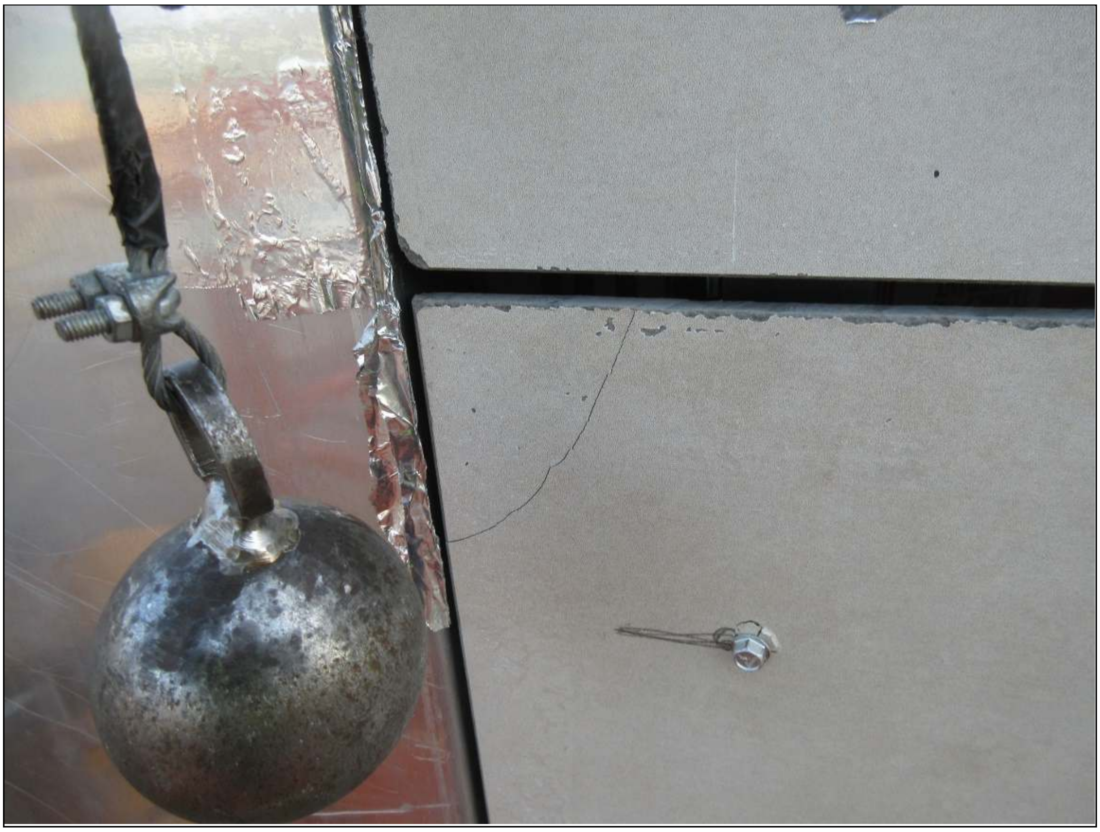


PHOTO 7790

HARD BODY IMPACT



9 APPENDIX - DRAWINGS

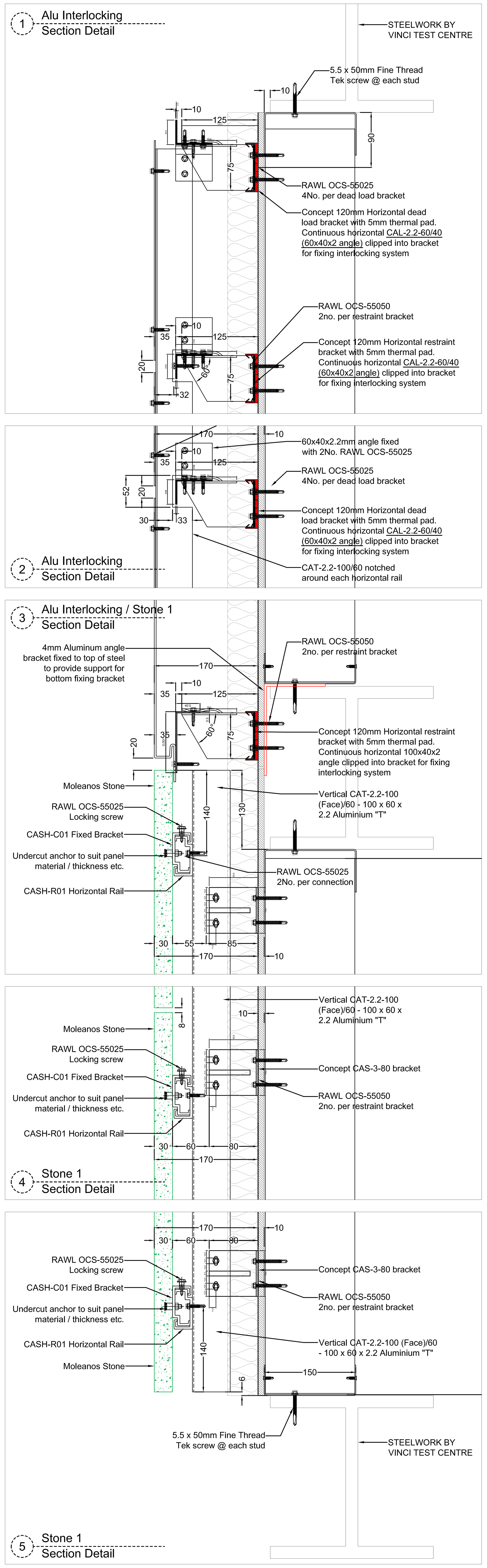
The following 3 unnumbered pages are copies of drawings numbered:

CWCT_D100_C3,

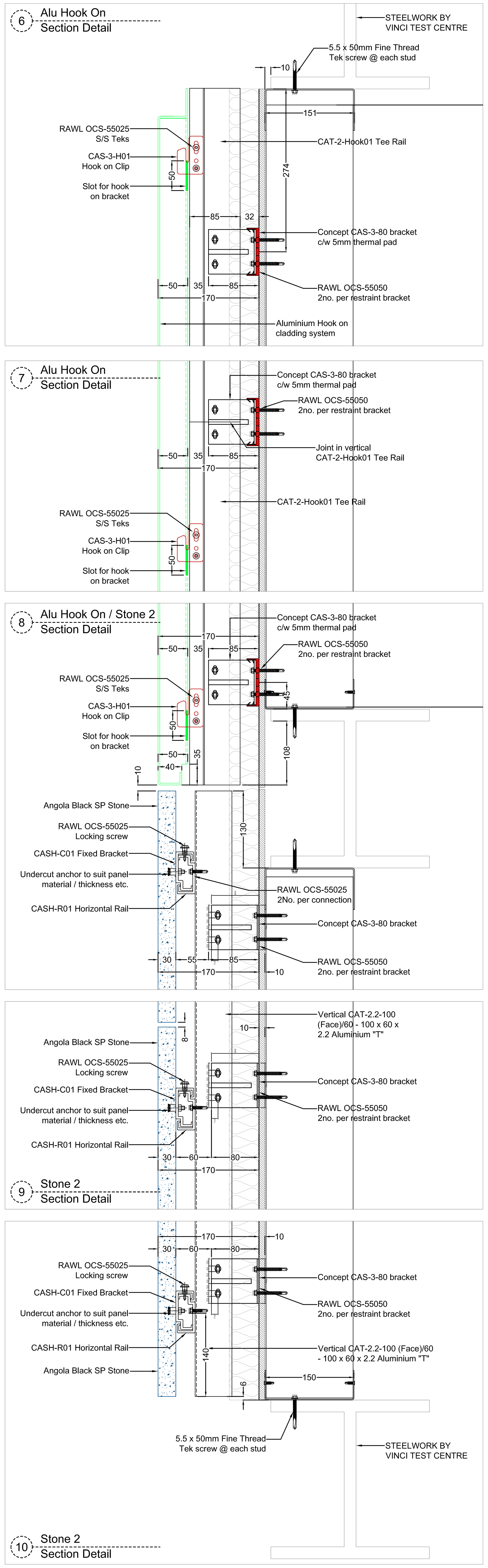
CWCT_D101_C3,

CWCT_E100_C3.

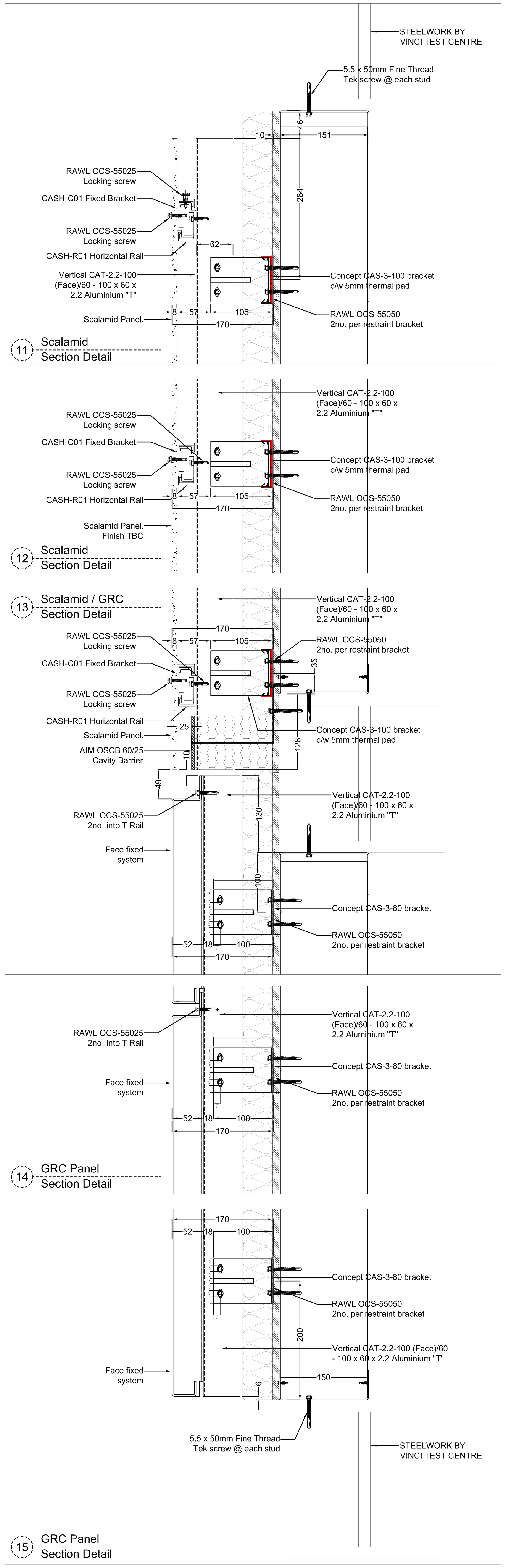
END OF REPORT



SECTION A-A
ENLARGED DETAILS



SECTION B-B
ENLARGED DETAILS



SECTION C-C
ENLARGED DETAILS

Notes:

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TOLERANCES OF PRIMARY STRUCTURE (+/- 10mm), SECONDARY STURCTURE (+/- 10mm)
IN ALL DIRECTIONS NON-ACCUMULATIVE.
ANY DEVIATION FROM ABOVE TO BE NOTIFIED TO AE

REV:	DESCRIPTION:	BY:	DATE:
C3	CONSTRUCTION ISSUE	RM	10/05/2021
C2	CONSTRUCTION ISSUE	CA	06-04-2021
C	CONSTRUCTION ISSUE	CA	09-03-2021

STATUS: **FOR CONSTRUCTION**

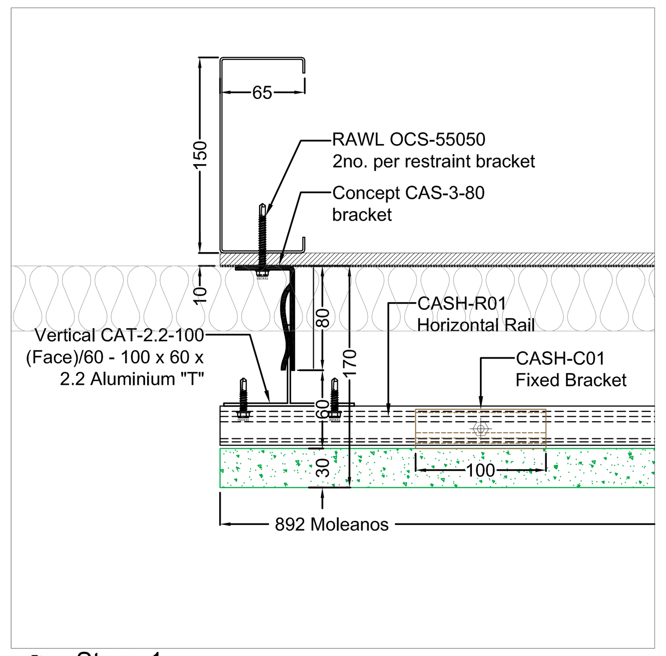
UltraWall Facades

TEST NAME: CWCT TEST

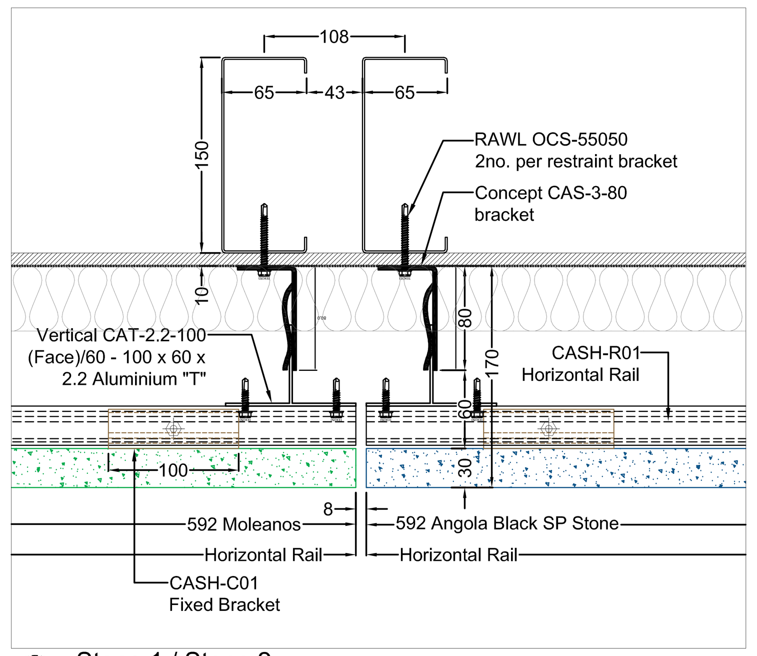
SITE: Vinci Technology Centre

TITLE: VERTICAL SYTEM DETAILS

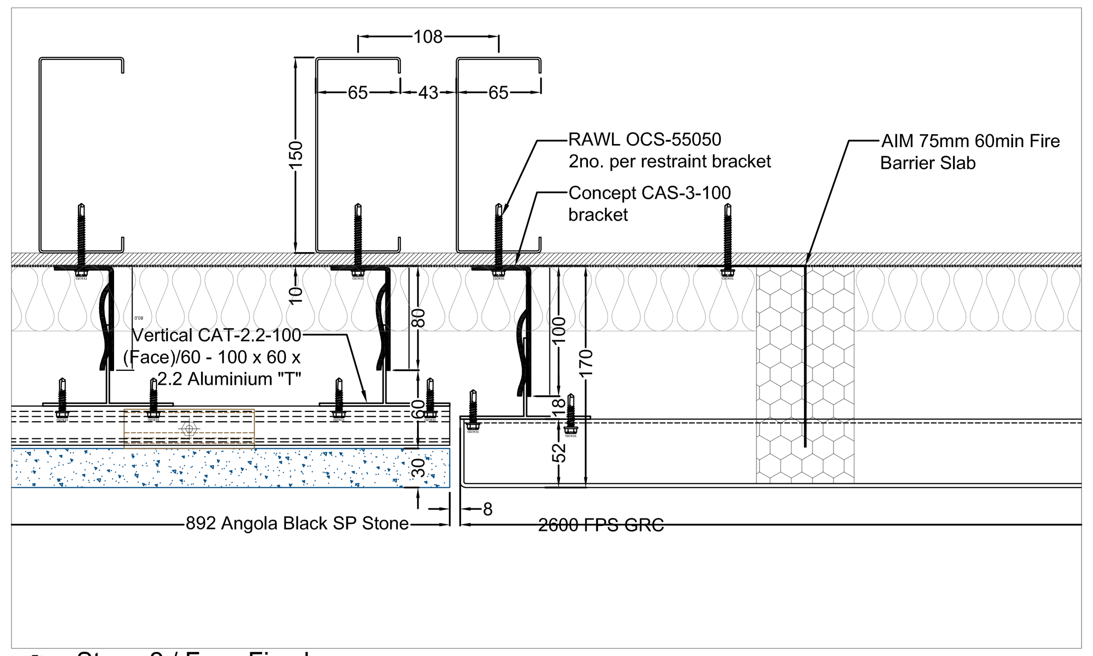
SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:5	09-03-2021	CA	RM
PROJECT NO:	DRAWING NO:		REVISION:
-	CWCT_D100		C3



(16) Stone 1
Section Detail



(17) Stone 1 / Stone 2
Section Detail



(18) Stone 2 / Face Fixed
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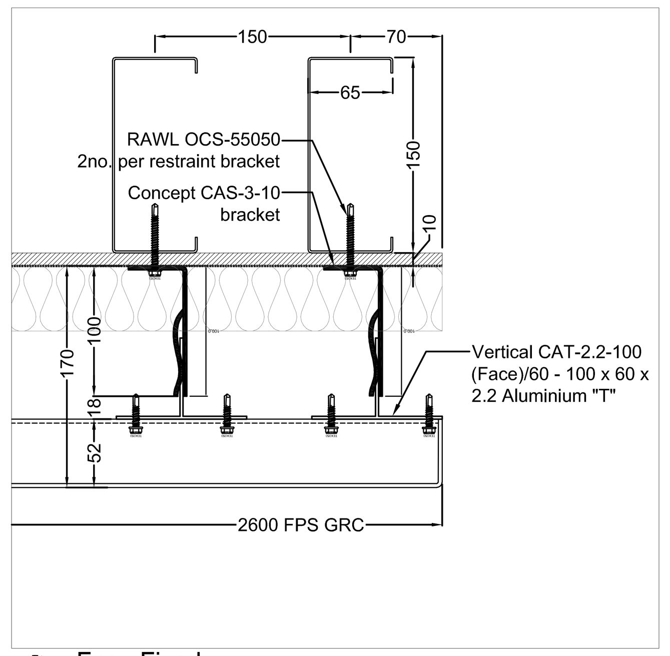
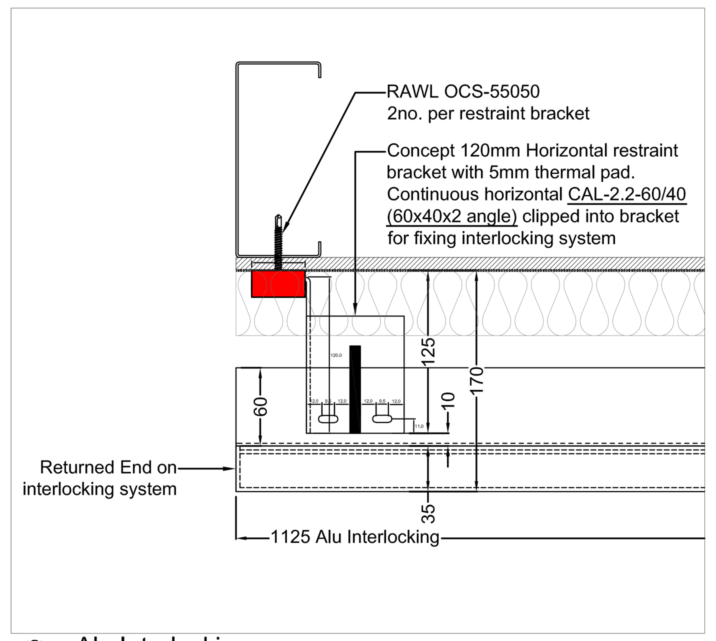


(19) Face Fixed
Section Detail



(20) Alu Interlocking
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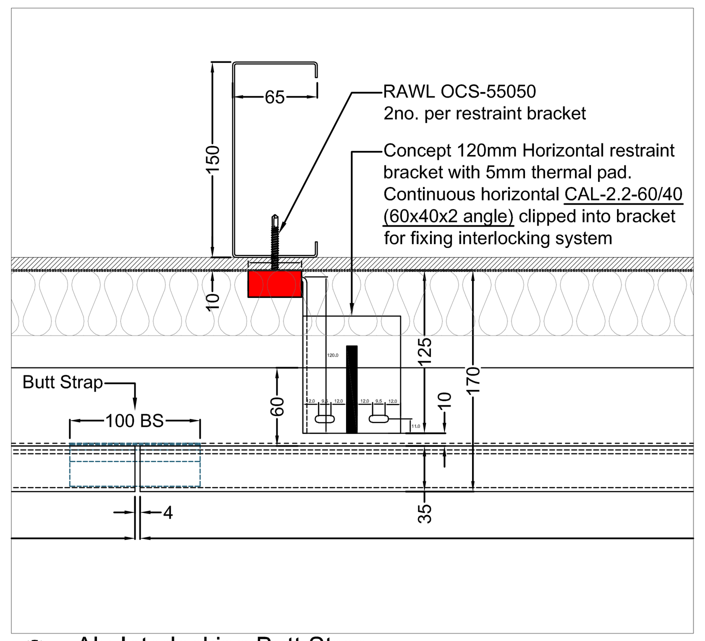
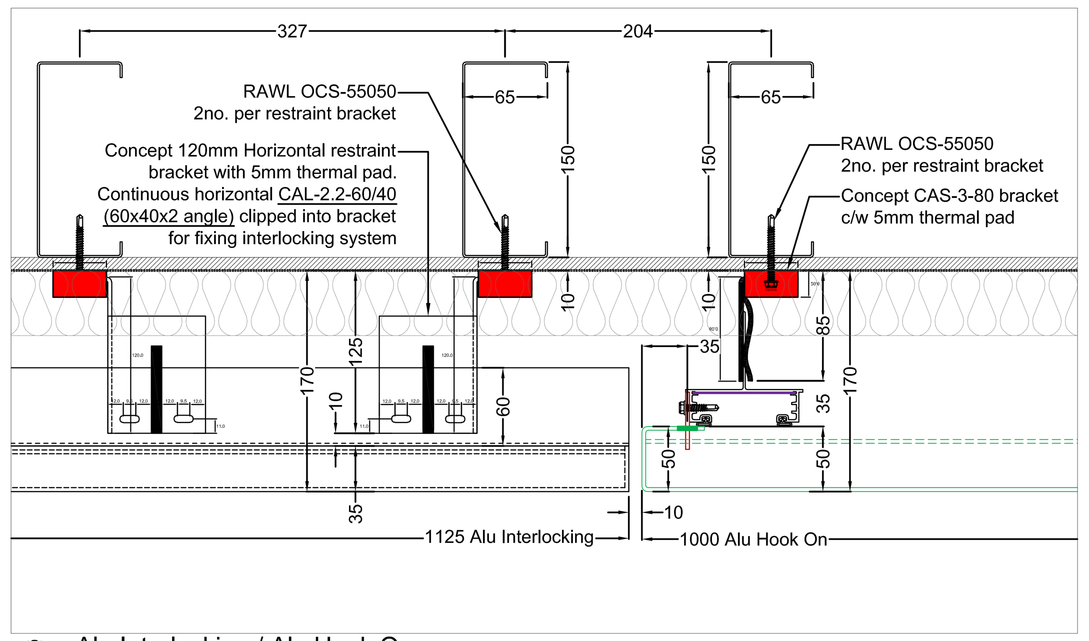
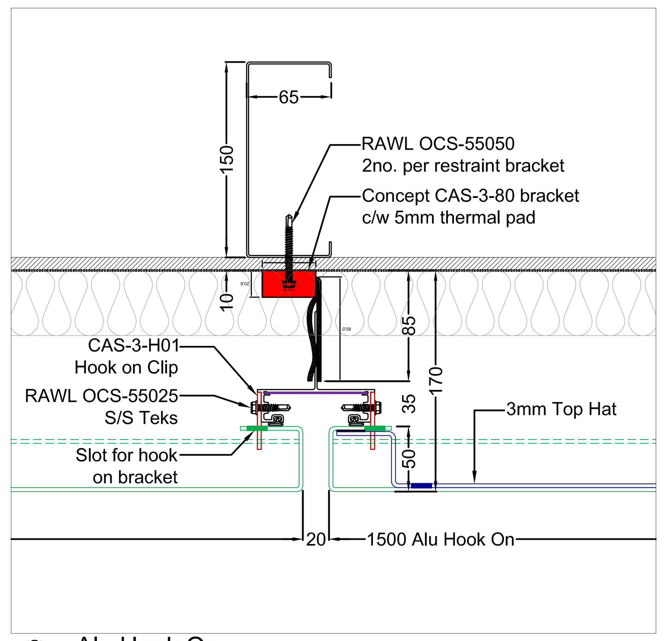


(21) Alu Interlocking Butt Strap
Section Detail



(22) Alu Interlocking / Alu Hook On
Section Detail



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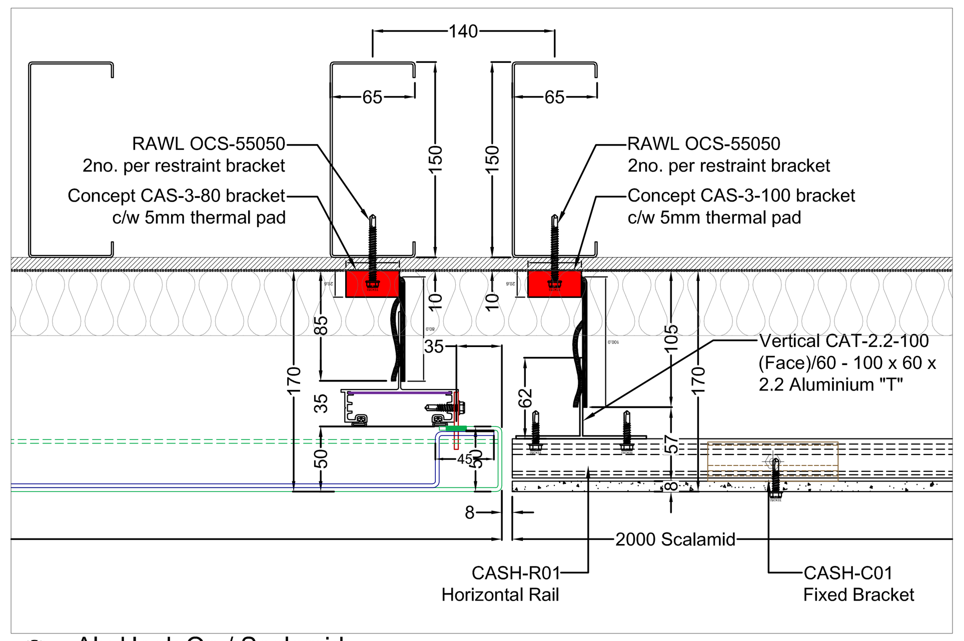
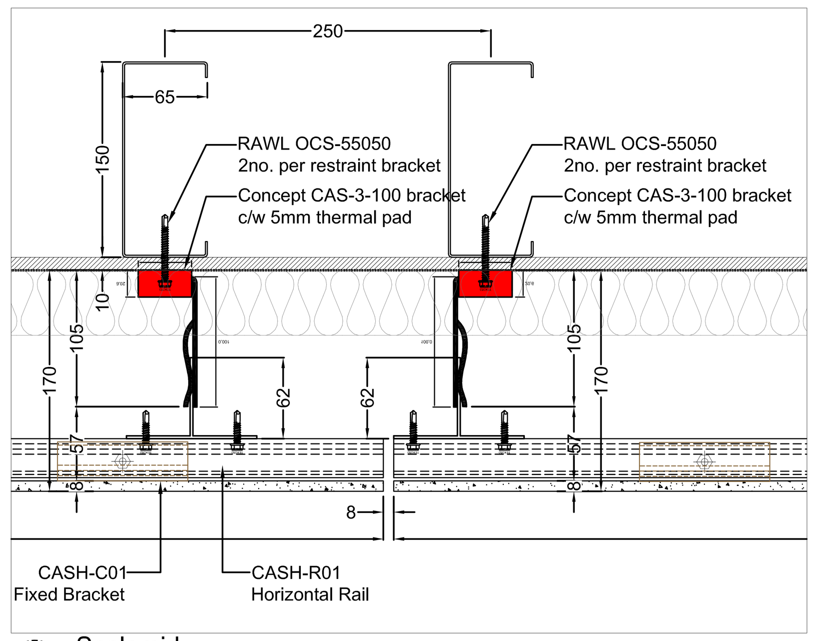


(24) Alu Hook On / Scalamid
Section Detail



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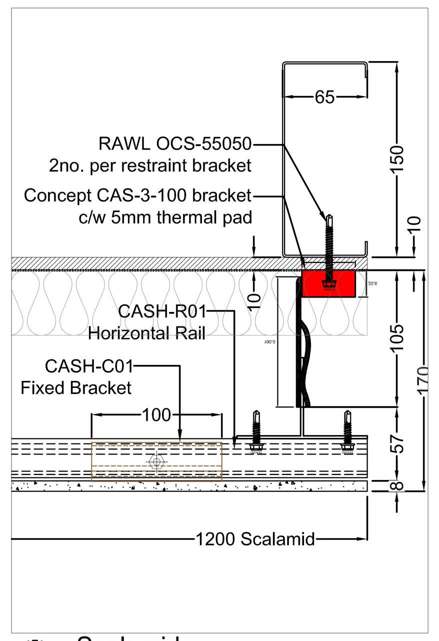

(26) Scalamid
Section Detail

Notes:

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UltraWall Facades

TEST NAME: CWCT TEST

SITE: Vinci Technology Centre

TITLE: VERTICAL SYTEM DETAILS

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:5	09-03-2021	CA	RM
PROJECT NO:	DRAWING NO:		REVISION:
-	CWCT_D101		C3

STONE 1:
Facade Panel Systems: 30mm Moleanos Creme

STONE 2:
Facade Panel Systems: 30mm Angola Black SP

Concept Hanging systems:
CSS-3-80 - 45x80x75x3mm Single Bracket
CAT-2.2-60(Face)/100 - Aluminium 'T'
CASH-4-R01 - Heavy duty rail
CASH-C01 - Adjustment Bracket

Fixings: RAWL OCS-55025 - 5.5x25mm S/S Teks
RAWL OCS-55050 - 5.5x50mm S/S Teks
FISCHER FZP II 11X12 M6/13 A4
RAWL M8x10mm S/S Adjustment Bolt

FACE FIXED ALU:
Profix Panel Systems: 3mm Mill finish Aluu

Concept Hanging systems:
CAS-3-100 - 45x100x75x3mm Single Bracket
CAT-2.2-60(Face)/100 - Aluminium 'T'
CASH-4-R01 - Heavy duty rail
CASH-C01 - Adjustment Bracket

Fixings: RAWL OCS-55025 - 5.5x25mm S/S Teks
RAWL OCS-55050 - 5.5x50mm S/S Teks
FISCHER FZP II 11X12 M6/13 A4
RAWL M8x10mm S/S Adjustment Bolt

SCALAMID:
Facade Panel Systems: 8mm thk Board - Face fixed with OCS-55025 to horizontal rails

Concept Hanging systems:
CAS-3-10 - 45x100x75x3mm Single Bracket
CAT-2.2-60(Face)/100 - Aluminium 'T'
CASH-4-R01 - Heavy duty rail
CASH-C01 - Adjustment Bracket

Fixings: RAWL OCS-55025 - 5.5x25mm S/S Teks
RAWL OCS-55050 - 5.5x50mm S/S Teks
RAWL M8x10mm S/S Adjustment Bolt

ALUMINIUM INTERLOCK and FLAT PANELS:
Profix Panel Systems: 2mm Mill finish Alu

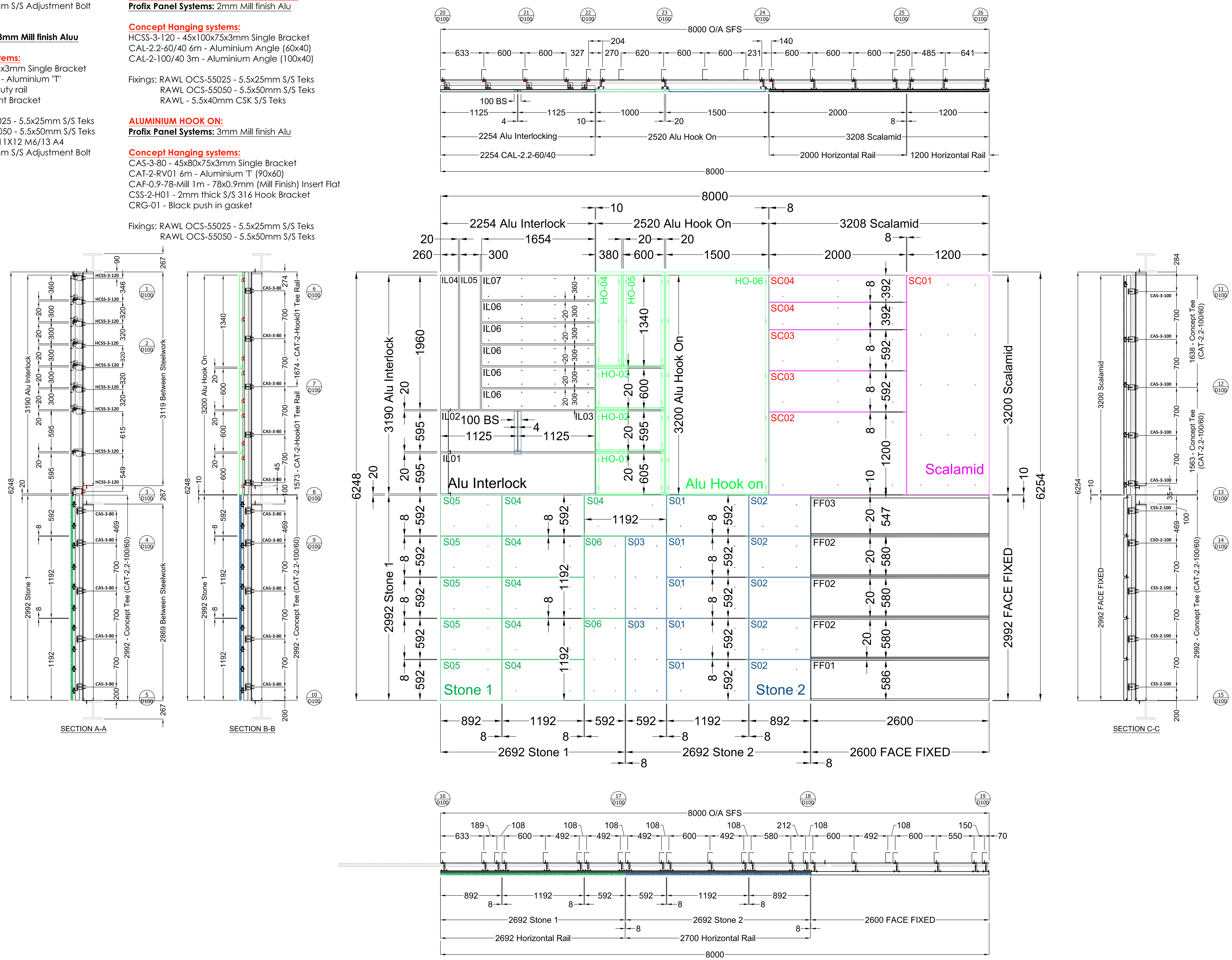
Concept Hanging systems:
HCSS-3-120 - 45x100x75x3mm Single Bracket
CAL-2.2-60/40 6m - Aluminium Angle (60x40)
CAL-2-100/40 3m - Aluminium Angle (100x40)

Fixings: RAWL OCS-55025 - 5.5x25mm S/S Teks
RAWL OCS-55050 - 5.5x50mm S/S Teks
RAWL - 5.5x40mm CSK S/S Teks

ALUMINIUM HOOK ON:
Profix Panel Systems: 3mm Mill finish Alu

Concept Hanging systems:
CAS-3-80 - 45x80x75x3mm Single Bracket
CAT-2-RV01 6m - Aluminium 'T' (90x60)
CAF-0.9-78-Mill 1m - 78x0.9mm (Mill Finish) Insert Flat
CSS-2-H01 - 2mm thick S/S 316 Hook Bracket
CRG-01 - Black push in gasket

Fixings: RAWL OCS-55025 - 5.5x25mm S/S Teks
RAWL OCS-55050 - 5.5x50mm S/S Teks



Notes:

THIS DRAWING MUST NOT BE REPRODUCED IN PART OR FULL WITHOUT THE EXPRESS PERMISSION OF ALTEREGO FACADES

TOLERANCES OF PRIMARY STRUCTURE (+/- 10mm),
SECONDARY STURCTURE (+/- 10mm)
IN ALL DIRECTIONS NON-ACCUMULATIVE.
ANY DEVIATION FROM ABOVE TO BE NOTIFIED TO EFS.

SPECIFICATION WALL:

Frameclad SFS

150x50x1.6mm SFS studs
Fixings: RAWL R-PH-55025-LG-A2 - 5.5x26mm

Euroform 10mm thick A2 Versapanel

Fixings: RAWL R-CWTS-48038-LG - 4.8x38mm

KNAUF Earthwool Rainscreen Insulation

50mm Earthwool to Sheathing Board/SFS Perimeter fixings; R-WX-48T100 + R-KC-60 Capped washers + KWL-090PP Spreader washers

50mm Earthwool to Sheathing Board/SFS Centre fixings; OCS-55/63110 + R-RSW-85-SS washers

Euroform AIM Cavity Barriers

Horizontal - AIM OSCB 60/25
Vertical - 75mm: 60 minutes Slab

REV:	DESCRIPTION:	BY:	DATE:
C3	CONSTRUCTION ISSUE	RM	10/05/2021
C2	CONSTRUCTION ISSUE	CA	06-04-2021
C	CONSTRUCTION ISSUE	CA	05-03-2021

STATUS: **FOR CONSTRUCTION**

UltraWall Facades

TEST NAME: CWCT TEST

SITE: Vinci Technology Centre

TITLE: Elevation drawing

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:30	09-03-2021	RM	RM

PROJECT NO:	DRAWING NO:	REVISION:
-	CWCT_E100	C3

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