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TEST REPORT

Lucideon Reference:	UK231637 (QT-70762/1/PA)/Ref. 1
Project Title:	Racking Resistance Testing in Accordance with BS EN 594:2011 of STS Ltd.'s 9 mm Fibre Cement Construction Boards
Client:	STS Ltd Ravens Park Unit 3 Victoria Road Seacroft, Leeds West Yorkshire LS14 2LA
For the Attention of:	Mr Edward Goody
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Report Date:	26 May, 2023
Purchase Order No.:	POR00002506
Work Location:	Lucideon UK

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

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1 INTRODUCTION

STS Ltd supplied Lucideon Limited with 12 No. STS Fibre Cement Construction Boards to establish the racking resistance in accordance with BS EN 594:2011 - Timber Structures - Test Methods - Racking Strength and Stiffness of Timber Frame Wall Panels.

Testing was completed from 19 to 22 May 2023.

2 SAMPLE DESCRIPTION

The client supplied 12 No. 1200 mm x 2400 mm x 9 mm STS Fibre Cement Construction Boards.

Lucideon Limited constructed 6 No. 2400 mm x 2400 mm timber frames comprising of 65 x 38 mm C16 timber with studs set at 600 mm centres with a single bottom rail and single top rail, fixed using 2 No. 85 mm smooth round nails per stud, top and bottom.

A head and base binder were used during testing but were not fixed to the sheathing.

The face of timber to be clad with the STS Construction Boards had a bead of STS Professional Grade Multi-Purpose Fast Setting MegaStrength PU Adhesive applied to it prior to the installation of the boards.

Two fibre cement boards, of nominal dimensions 2400 mm x 1200 mm x 9 mm, were screwed to the face of the timber frame, using STS 38 mm External Render Board Screws at 150/300 mm centres (perimeter of the board/central stud).

The general arrangement of the panel is shown in Figure 1 of BS EN 594:2011.

There was no gap between the sheathing boards.

3 TEST PROGRAMME

The samples were tested as follows:

Table 1 – Programme of Work

Vertical Top Load per Stud (kN)	Tests	Board Thickness (mm)	Fixing Centres (mm)
0	3	9	150/300
5	3		

4 INSTRUMENTATION

- Linear Voltage Displacement Transducer TRD027 (Displacement 1).
- Linear Voltage Displacement Transducer TRD023 (Displacement 2).
- Linear Voltage Displacement Transducer TRD029 (Displacement 3).

- Hydraulic Ram x 6.
- Manual Pumping Unit x 2.
- Load Cell FOR 009 (Racking load).
- Load cell FOR 032 (Vertical load).
- Data Logger DAQ026.

5 TEST PREPARATION

18 mm diameter holes were cut in the base rail, centred at the anchorage points of the base rig. M16 x 150 mm long bolts were inserted through the holes with large steel plates attached (50 mm wide x 220 mm long x 10 mm thick).

The test panel was bolted to the test rig through a 38 x 89 mm C16 timber rail, ensuring the timber didn't overlap the boards to be tested, such that the bottom rail was fixed down by five M16 x 150 mm long bolts in line with BS EN 594:2011, shown in Figure 2.

The panel was laid flat in the test rig, which had been bolted down to the laboratory strong floor. The panel was placed on Teflon™ coated timber packers to allow it to move freely when loading.

Hydraulic rams were fixed to the test rig at the panel header end such that they would be able to apply a vertical top load to the panel at the 600 mm centres.

In accordance with Figure 3 of BS EN 594:2011, Linear Voltage Displacement Transducers (LVDT's) were fixed in place so as to record horizontal deflection at the head of the panel (Displacement 1), at the base of the panel (Displacement 2) and to measure any uplift at the base of the panel (Displacement 3).

6 METHOD OF TEST

6.1 0 kN Vertical Load

Using hydraulic rams linked via a common manifold, a vertical pre-load of 1 kN/stud was applied to the panel and left for 2 minutes prior to removal.

The panel was then allowed to recover for 5 minutes before applying a racking load at a loading rate such that 90% of the maximum load of the panel was achieved within 300 seconds (± 120) seconds.

The load and displacement were monitored throughout testing via load cells and LVDT's, respectively and recorded via a Data Logger.

6.2 5 kN Vertical Load per Stud

Using hydraulic rams linked via a common manifold a vertical load of 5 kN/stud was applied to the panel and maintained for the duration of the test.

A racking load was then applied at a loading rate such that 90% of the maximum load of the panel was achieved within 300 seconds (± 120) seconds

The load and displacement were monitored throughout testing via load cells and LVDT's, respectively and recorded via a Data Logger.

7 RESULTS

The racking stiffness (R) and *F*max for each panel are given in Tables 1 and 2.

Basic test racking resistance (kN/m) calculations were carried out in accordance with BS 5268-6.1:1996 Structural Use of Timber – Part 6: Code of Practice for Timber Frame Walls – Section 6.1 Dwellings not Exceeding Seven Storeys.

According to BS 5268-6.1:1996 a Category 1 material (9.5 mm plywood, 9.0 mm medium board, 12.0 mm chipboard, 9 mm OSB) nailed at a maximum spacing of 150 mm on the perimeter and 300 mm on the internal studs should give a racking resistance of 1.68 kN/m.

The samples tested with 9 mm STS Fibre Cement Construction Boards gave a racking resistance of 1.79 kN/m with 0 kN top load and 1.78 kN/m with 5 kN top load.

The typical failure modes are shown in the Plates Section.

Moisture content of the timber and STS Construction Boards at the time of testing was as follows: -

Timber – 4.48%

STS Construction Boards – 10.68%

TABLES

Table 2 – Results for Racking Testing Carried Out with 0 kN Top Load

Test No.	Height of Panel (mm)	F_{max} (kN)	20% F_{max} (kN)	40% F_{max} (kN)	Deflection (mm) @		Racking Stiffness (kN/mm)	Racking Stiffness Load (kN)	Test Racking Strength Load (kN)	Test Racking Design Load (kN)	Basic Test Racking Resistance (kN/m)
					20% Fmax	40% Fmax					
1	2400	7.53	1.51	3.01	0.59	1.77	1.28	7.12	7.00	4.30	1.79
2	2400	9.85	1.97	3.94	0.94	2.50	1.26	7.35	9.55		
3	2400	6.88	1.38	2.75	0.77	1.61	1.64	9.83	6.88		
								8.10	6.88		
								(Average)	(Min)		

Table 3 – Results for Racking Testing Carried Out with 5 kN Top Load

Test No.	Height of Panel (mm)	F_{max} (kN)	20% F_{max} (kN)	40% F_{max} (kN)	Deflection (mm) @		Racking Stiffness (kN/mm)	Racking Stiffness Load (kN)	Test Racking Strength Load (kN)	Test Racking Design Load (kN)	Basic Test Racking Resistance (kN/m)
					20% Fmax	40% Fmax					
1	2400	16.21	3.24	6.48	0.87	2.31	2.25	12.56	15.08	7.55	1.78
2	2400	14.74	2.95	5.90	0.93	2.30	2.15	12.52	14.30		
3	2400	12.08	2.42	4.83	0.84	1.98	2.12	12.72	12.08		
								12.60	12.08		
								(Average)	(Min)		

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

END OF REPORT

PLATES

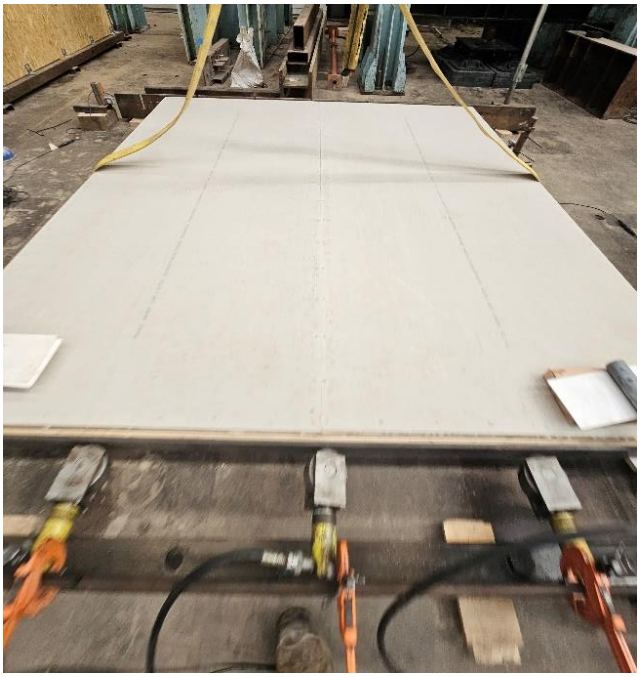

Plate 1 – General View of Racking Test Arrangement

Plate 2 – Typical Mode of Failure (1)

Plate 3 – Typical Mode of Failure (2)

Chart 1 - Load Deflection Curves for Racking Testing with 0 kN Top Load

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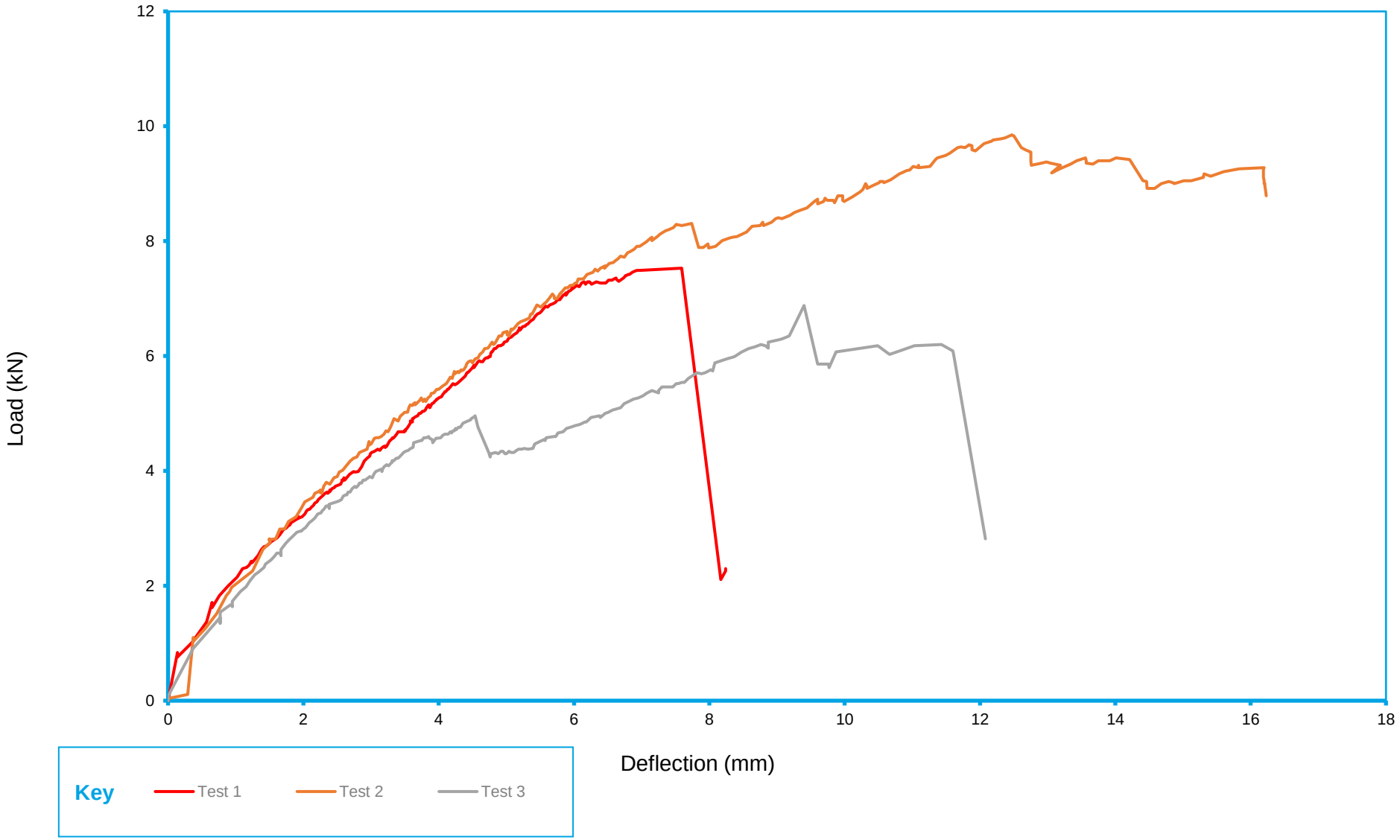

Chart 2 - Load Deflection Curves for Racking Testing with 5 kN Top Load

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