الفطيم Al-Futtaim

اليمنت element

System Development

Laboratory Structural Test Report

Sample type: Insulated Concrete Form (ICF) Wall + Expandable Polystyrene (EPS)

Test sponsor: Alrayyan Building Insulation for Industry Co

Report number: DLR3520

Date: 24 February 2025 Revision: 0

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Quality management

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		Designation	Associate Engineer	Operations Manager
		Signature		
Signed and issued on behalf of Al Futtaim Element Materials Technology Dubai L.L.C				

Al Futtaim Element Materials Technology Dubai L.L.C
Façade Testing & Advisory Services Division

Contents

1. Executive summary

The following summarises the results of the tests performed. For the full details refer to Sections 6 & 7.

1.1 Wind resistance tests

The sample passed the wind resistance tests as per ASTM E330/E330M-14 (Reapproved 2021).

The above results are valid only for the tested sample as received, detailed and constructed as per the drawings with any marked variations as attached in Appendix B of this report, and the conditions under which the tests were conducted. Details of the controlled dismantle of the sample are included in Section 7.

2. Introduction

This report describes the tests performed at the Al Futtaim Element Materials Technology Dubai L.L.C (AFE) laboratory at Plot 597-451, Dubai Investments Park, Dubai, at the request of the test sponsor listed in Table 1.

Table 1 Test sponsor details

Test sponsor	Address
Alrayyan Building Insulation for Industry Co.	Aoyun City Alahsa, Saudi Arabia Tel: +966 543242338

AFE is a UKAS accredited testing laboratory, no. 4559 and is accredited to ISO/IEC 17025:2017, which assesses the technical competence of the laboratory, as well as its quality management systems.

2.1 Purpose of testing

The tests were carried out on 23rd January 2025 to determine the performance of an insulated concreate form wall with respect to wind resistance. The test carried out was in accordance with the following standard.

Table 2 Test standards

Test	Standard code
Wind resistance	ASTM E330/E330M-14 (Reapproved 2021)

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

The tests were witnessed wholly or in part by the test witnesses listed in Table 3.

Table 3 Test witnesses

Test witness	Company
Shafiq Malik	Green Height Contracting LLC
Ghulam M. D.	Green Height Contracting LLC

The tests were conducted by Relston Pereira of AFE.

3. Test sample

3.1 Description

The sample consisted of an insulated concrete form (ICF) wall formed by 60mm thick Expandable Polystyrene (EPS) insulation, mounted on rigid test rig steel beams. The EPS forms on either side with 160mm cavity, which was filled with concrete.

The sample was constructed into the opening provided in the test rig with its external face exposed to the external environmental conditions.

The AFE reference number for the sample was DC4956. The sample dimensions and full construction details are shown in the drawings in Appendix B.

The photograph below shows an external view of the sample.

Figure 1 **External view of the test sample**

3.2 Drawings

The tested sample was as shown in Alrayyan Building Insulation for Industry Co. sample drawings numbered:

DWG - 01

DWG - 02

Except for any variation as described in Section 7.

A copy of these drawings is included in Appendix B in this report.

4. Test apparatus

4.1 Test rig

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 of a sealed chamber, fabricated from steel and plywood. A door was provided to allow access to the chamber.

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 from the chamber.

4.2 Pressure

A pressure transducer, capable of measuring rapid changes in pressure to an accuracy within ±2% of the set point or ±2.5 Pa (whichever is greater), was used to measure the differential pressure across the sample.

4.2.1 Static pressure testing

The air supply system comprised a centrifugal fan, associated ducting and control valves to create positive and negative static pressure differentials. The fan provided a constant air flow at the test pressures for the required periods.

4.3 Wind resistance test

LVDT transducers were used to measure the deflection of the principal framing members to an accuracy of 0.25 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 adversely influenced by the application of pressure or other loading to the sample.

4.4 Ambient conditions

Air and water temperatures, atmospheric pressure, relative humidity and wind speed were recorded using the appropriate test equipment.

4.5 General

All relevant test equipment was calibrated and traceable to international standards.

5. Test procedures & criteria

5.1 Sequence of testing

1. Wind resistance - serviceability
2. Wind resistance - up to failure
3. Controlled dismantle

Note: A positive pressure differential is where the pressure against the weather face is greater than that against the internal face.

5.2 Wind resistance - serviceability

5.2.1 Test procedure

Instrumentation was positioned to measure deflection at the centre of the sample.

One pressure differential pulse of **+3000 Pa**, held for 10 seconds, was applied to prepare the sample. After a recovery period of between 1 and 5 minutes, the displacement transducers were zeroed.

One pressure differential pulse of **+6000 Pa** was then applied, held for 10 seconds and deflection readings taken at every 500 Pa. After a recovery period of between 1 and 5 minutes, residual deflection readings were taken.

One pressure differential pulse of **-3000 Pa**, held for 10 seconds, was applied to prepare the sample. After a recovery period of between 1 and 5 minutes, the displacement transducers were zeroed.

One pressure differential pulse of **-6000 Pa** was then applied, held for 10 seconds and deflection readings taken at every 500 Pa. After a recovery period of between 1 and 5 minutes, residual deflection readings were taken.

Ambient conditions during the test were recorded.

5.2.2 Test pass / fail criteria

There shall be no permanent deformation, no failure of any components.

The measurement positions are shown in Figure 2 in Appendix A. Please see table below for the methodology of the displacement gauge positioning.

Table 4 Methodology of deflection gauge placement

Gauge no.	Element	Measuring the deflection of the…
1	Concrete wall	Centre of concrete wall

See Figure 3 in Appendix A for the gauge locations.

5.3 Wind resistance - up to failure

5.3.1 Test procedure

The sample was subjected to the maximum possible positive pressure differential up to the failure and the observations were recorded.

5.3.2 Test pass / fail criteria

The failure load / mode shall be recorded.

5.4 Controlled dismantle

AFE witnessed the dismantling of the test sample and compared the as-built (and therefore as-tested) installation against the drawings supplied. See Section 7 for details.

6. Test results

Refer to Section 5.1 for the test sequence numbers. Refer to Section 5 for the test procedures and performance criteria.

The following table summarises, in chronological order, the tests performed.

Table 5 All tests in chronological order

Date	Test	Result
23 Jan. '25	Wind resistance - serviceability	Pass
23 Jan. '25	Wind resistance - up to failure	N/A
30 Jan. '25	Controlled dismantle	N/A

Wind resistance - serviceability				Pass
Date	23 Jan. '25	Time	10:00am	
Tables 6 & 7 below show the gross deflection, in mm, for gauge location 1 at the centre of the concrete wall. No visual damages were observed. See Figure 2 in Appendix A for the gauge location.				
Ambient temperature	21 °C		Relative humidity	60 %

Table 6 Wind resistance (serviceability) - positive pressure

Pressure (Pa)	Deflection (mm)
500	+0.2
1000	+0.4
1500	+0.6
2000	+0.8
2500	+1.0
3000	+1.2

Pressure (Pa)	Deflection (mm)
3500	+1.4
4000	+1.7
4500	+1.9
5000	+2.1
5500	+2.3
6000	+2.5
0	+0.1

Table 7 Wind resistance (serviceability) - negative pressure

Pressure (Pa)	Deflection (mm)
500	-0.2
1000	-0.5
1500	-0.9
2000	-1.2
2500	-1.7
3000	-2.2
3500	-2.9
4000	-3.4
4500	-3.8
5000	-4.1
5500	-4.3
6000	-4.6
0	-0.4

Wind resistance - up to failure			N/A
Date	23 Jan. '25	Time	11:00am
At approximately +9906 Pa, cracks started to form at the top perimeter. See photo 3 in Appendix A. Further loading was not possible due to the excessive air leakage through the cracks.			
Ambient temperature	21 °C		
Atmospheric pressure	1017 mbar	Relative humidity	61 %

7. Controlled dismantle

AFE witnessed the controlled dismantle of the sample, performed visual & dimensional checks on the components, where possible, and compared them against the supplied information. Refer to the drawings in Appendix B

Any material properties, classifications, item no. / catalogue no. / brand references detailed in the drawings, if applicable, were not verified by AFE.

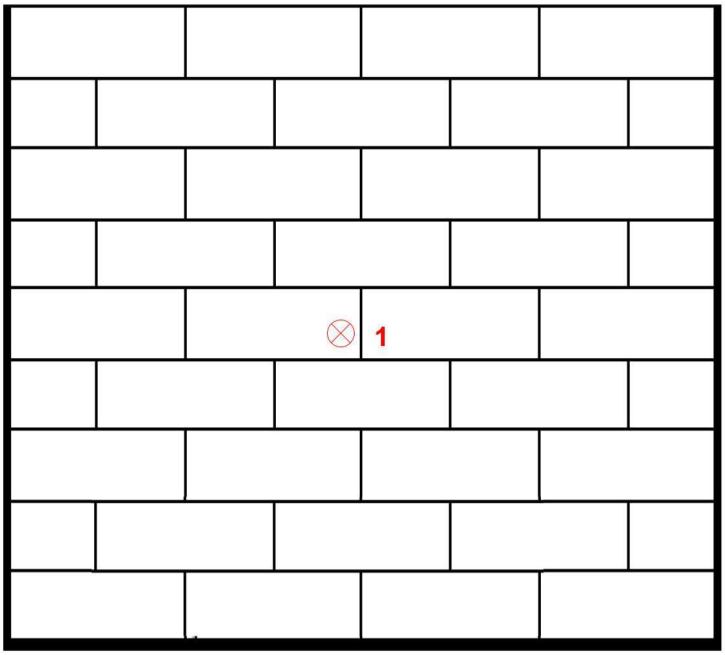
Date of dismantle: 30 Jan 2025

No variations were observed.

8. Test Photographs

Sl no.	Description	Photograph
1.	Deflection gauge.	
2.	Cracks observed during the failure test.	
3.	Cross-sectional view of the EPS	

Appendix A Figures



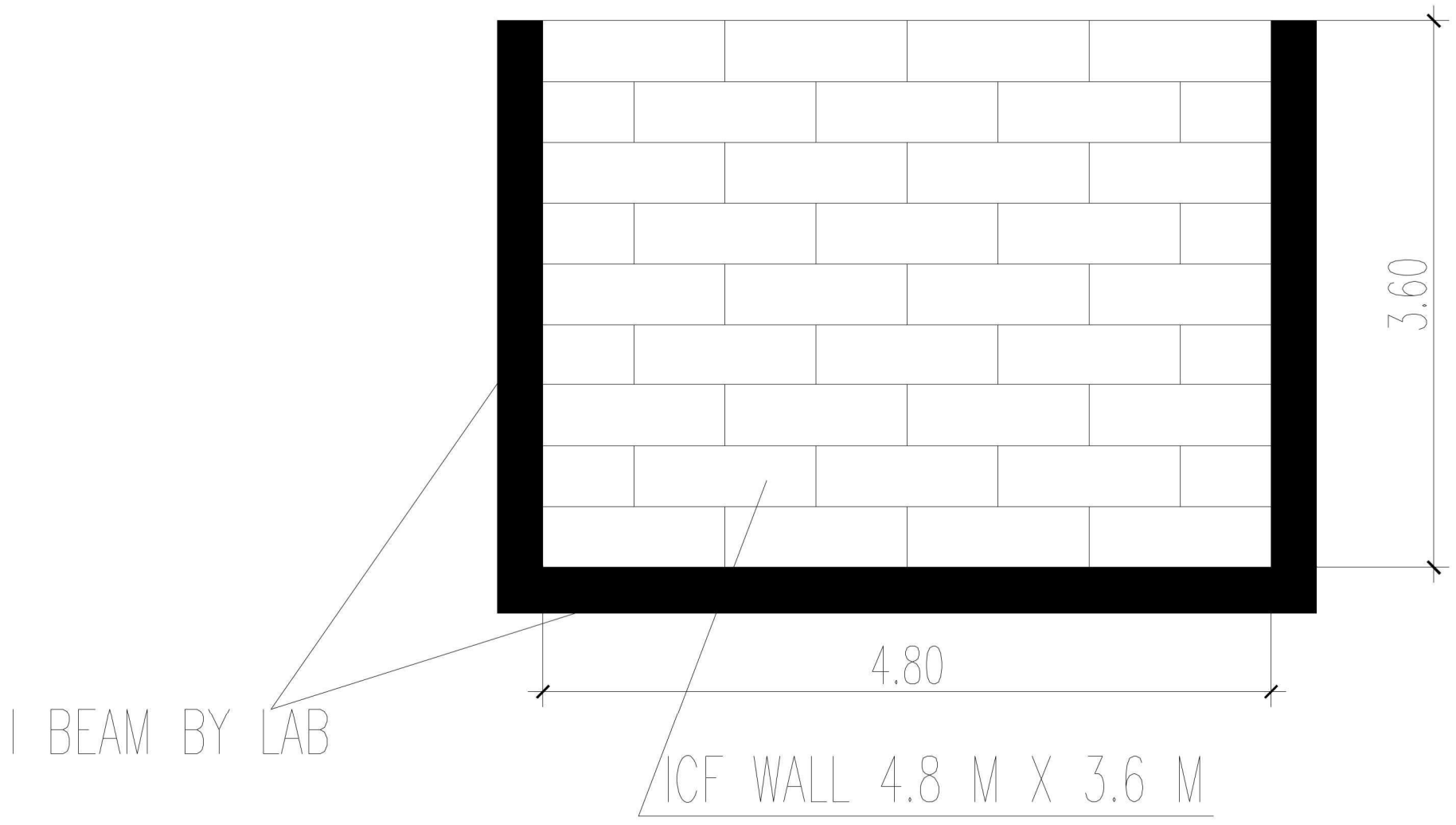
⊗ Deflection gauge

Figure 2 Deflection gauge location (as viewed from outside)

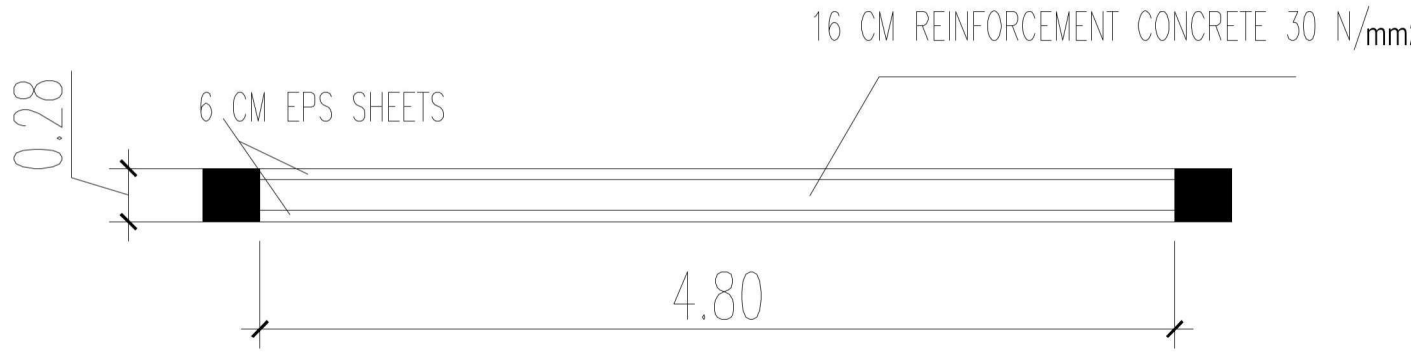
Appendix B Drawings

The following two un-paginated sheets are copies of Alrayyan Building drawings numbered:

- DWG - 01
- DWG - 02



16 CM REINFORCEMENT CONCRETE 30 N/mm2



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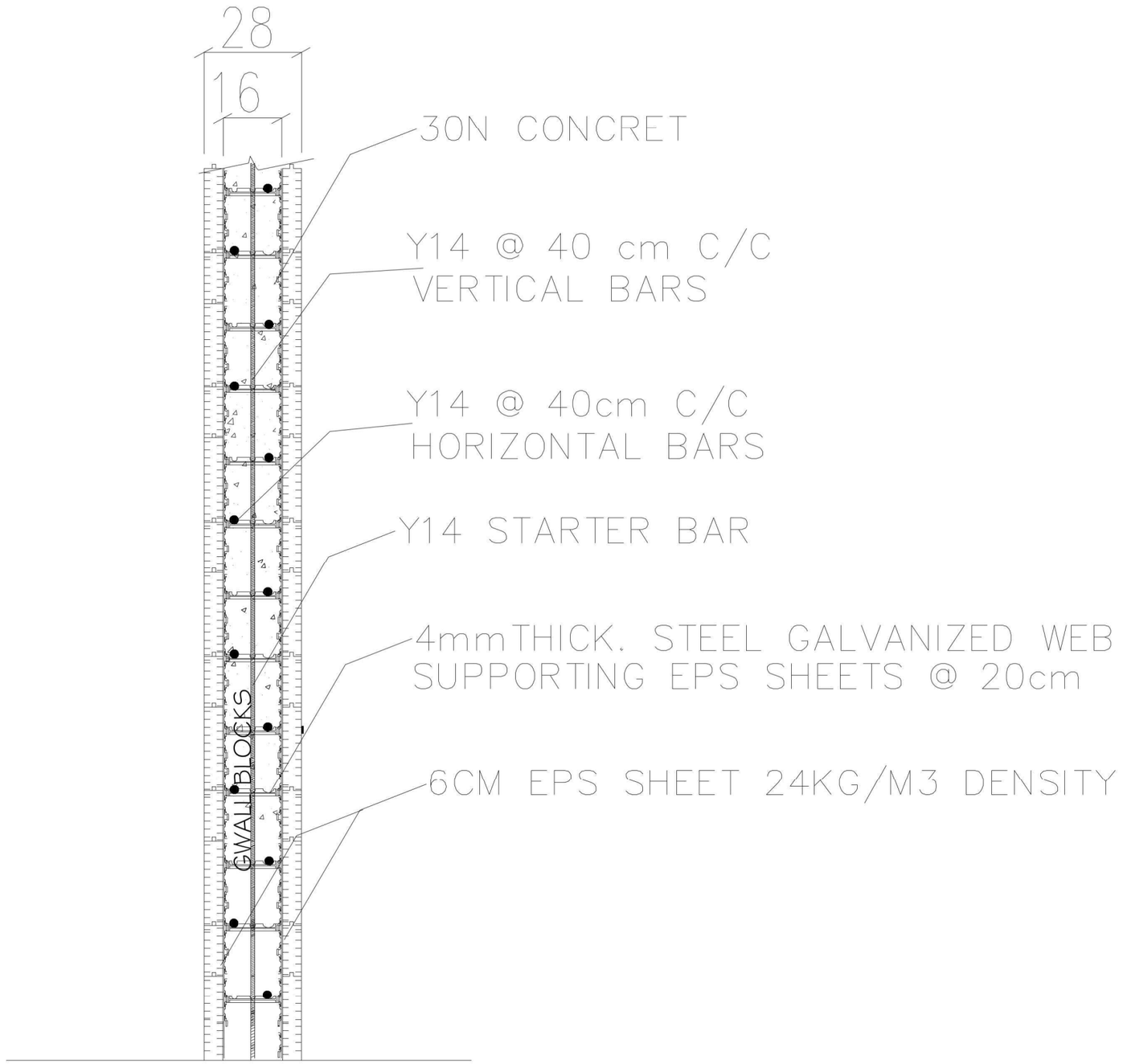
ICF WALL FOR WIND LOAD TEST



ICF WALL SECTION

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