2373-OSE-SPD-EA-005-D0 Part L Compliance REPORT
Rev 0

CI STRUCTURES LTD
62 UPPER CLANBRASSIL STREET,
DUBLIN 8,
IRELAND.

TYPICAL SPORTS HALL PART L EVALUATION REPORT

Client
CI STRUCTURES LTD Prefabricated Sports and Fitness Buildings Sprung Since 1887

Gilligan's Lane, Town Hall Rd, Claremorris, Co. Mayo.
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Document History

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Document Identification

Document Code	Document Title	Date	Author
2374-OSE-SPD-EA-005	Mt Mercy Part L Compliance Report	20.11.23	KB

Revision History

Rev Number	Rev Date	Release / Summary of Changes	Author
P03.00	29-11-2023	Issue for Information	GOS

Reference Documents

Please see the following documents for more information:

Document Number	Document Name	Version
N/A	Sprung Building Layout	N/A
N/A	Mt Mercy Building Layout	N/A
N/A	Sprung Foundation & Ring beam Details	N/A
N/A	Section Drawing Walls & Roof	N/A
N/A	U-Value Modelling Information- Passivate Energy Consultants.	N/A

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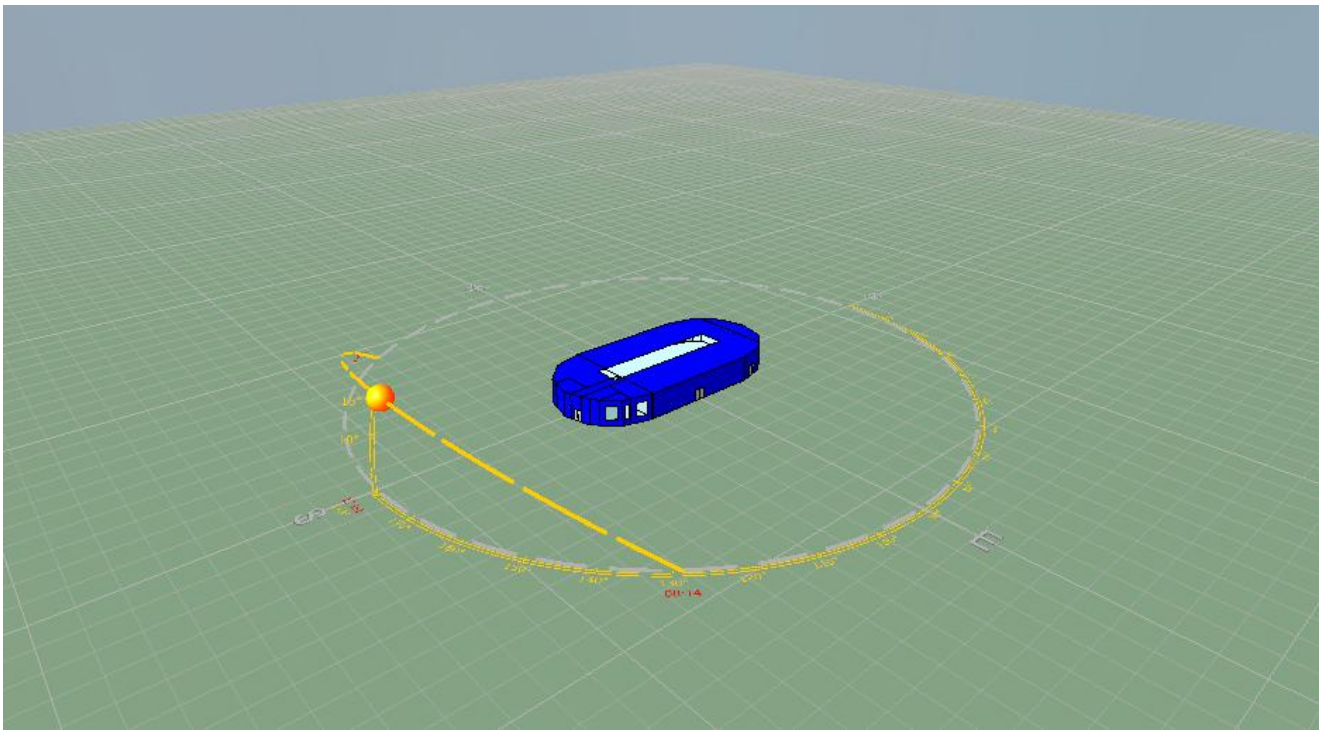
Contents

1.0 Introduction

This report has been prepared to determine Part L energy compliance and solar gain limit checks under Building Regulations 2017: Technical Guidance Document L - Buildings other than Dwellings for a proposed new Build Sports Centre Facility in Ireland.

Building Part L Compliance Model (Simplified Building Energy Model [SBEM]):



Note the building is simplified for Part L Energy modelling as per Simplified Building Energy Model Guide. This particularly applies to the buildings sloped "mansard" type roof style, average heights are taken across this space to simplify the geometry for Part L in line with SBEM National Energy Assessment Procedure (NEAP) Modelling Guide.

Part L Requirements for New Builds in Ireland.

The requirements for the Conservation of Fuel and Energy in buildings in Ireland, as detailed in the latest Non-Domestic Part L Regulations, include specific values for the Carbon Performance Coefficient (CPC), Maximum Permitted Energy Performance Coefficient (MPEPC), and Renewable Energy Ratio (RER). The CPC is a measure of the building's carbon emissions relative to a standard reference building, and it needs to be minimized to comply with energy efficiency standards. The MPEPC sets a cap on the allowed energy performance of a building, ensuring that it does not exceed a specified limit, which is critical for maintaining energy efficiency. The RER, on the other hand, assesses the proportion of energy used by the building that is derived from renewable sources, with a higher ratio indicating greater use of sustainable energy. These values are essential in ensuring that buildings meet the Nearly Zero Energy Building (NZEB) standards, focusing on reduced carbon emissions, optimized energy performance, and a significant reliance on renewable energy sources.

In Ireland, for new buildings other than dwellings, the specific values for the Maximum Permitted Energy Performance Coefficient (MPEPC), Maximum Permitted Carbon Performance Coefficient (MPCPC), and Renewable Energy Ratio (RER) are as follows:

- MPEPC: The value of the MPEPC should be no greater than 1.0. This coefficient is calculated based on the primary energy consumption of the proposed building, divided by that of a reference building.

- MPCPC: The MPCPC is set at a maximum value of 1.15. This coefficient is derived from comparing the calculated CO2 emission rate of the proposed building with that of a reference building.

- RER: For buildings achieving an MPEPC of 1.0 and an MPCPC of 1.15, an RER of 0.20 is required (20% of buildings energy delivered from renewables), a very significant level of energy provision from renewable energy technologies. The RER is the ratio of primary energy from renewable sources to the total primary energy as defined and calculated in the Non-domestic Energy Assessment Procedure (NEAP).

Solar Gain Limit Specific Requirements:

The following guidance applies to all buildings, irrespective of whether they are airconditioned or not. The intention is to limit solar gains during the summer period to either:

- reduce the need for air-conditioning; or
- reduce the installed capacity of any air conditioning system that is installed.

For the purposes of Part L , reasonable provision for limiting solar gain through the building fabric would be demonstrated by showing that for each space in the building that is either occupied or mechanically cooled, the solar gains through the glazing aggregated over the period from April to September inclusive are no greater than would occur through one of the following glazing systems with a defined total solar energy transmittance (g-value) calculated according to I.S. EN 410: 2011.

- For every space that is defined in NEAP database as being side lit, the reference case is an east-facing façade with full width glazing to a height of 1.0m. having a framing factor of 10 per cent and a normal solar energy transmittance (g-value) of 0.68. For every space that is defined in the NEAP as being top lit, and whose average zone height is not greater than 6m. the reference case is a horizontal roof of the same total area that is 10% glazed as viewed from the inside out and having roof lights that have a framing factor of 25% and a normal solar energy transmittance (g-value) of 0.68.

- For every space that is defined in the NEAP database as being top lit and whose average zone height is greater than 6m, the reference case is a horizontal roof of the same total area that is 20% glazed as viewed from the inside out and having roof-lights that have a framing factor of 15 % and a normal solar energy transmittance (g value) of 0.46.

Note:
The assessment of solar gain in is not an assessment of the internal comfort condition of the building as many other factors have a bearing on comfort e.g., room loads, thermal capacity, ventilation provisions. CIBSE TM 52 provide recommendations for new buildings and adaptation strategies, and this has been calculated separately in the Overheating Analysis Report prepared for this project.

2.0 Methodology

2.1 Geometry

A dynamic thermal model of the building was built within Integrated Environmental Solutions Software (Version 2023.0.1.0) to determine compliance with Part L of the Building Regulations.

The building layout, including room locations, orientation, window and door positions and openable areas, shading and other geometry, was based on latest CAD drawings provided by the architect as of 20.11.2023.

2.2 Environmental Conditions and Weather Data

For the purposes of Part L Compliance, the building is assumed to be in Dublin, and the SBEM (Simplified Energy Building Model) weather data set for Dublin was applied to the model to simulate weather conditions. Dublin is the standard requirement for weather data to fulfil Part L requirements.

2.3 Building Fabric

Based on preliminary specifications provided and by using the Part L elemental U-Values (based on a new build specification), for the purpose of the Part L Compliance Assessment the following U-Values have been assigned to the building:

ID	Category	Description	U value ($W/m^2 \cdot K$)	G-Value Glazing
DOOR	Door	External Doors	1.6	
STD_EXTW	External Window	Triple Glazing	0.9	0.36
STD_ROOFL	Rooflight	10mm Single glazed with 10mm cavity	2.2	0.30*
STD_FLO1	Ground/Exposed Floor	Floor	0.15	
STD_ROOF	Roof	Sloped Roof	0.26	
STD_WAL1	External Wall	Ext Wall	0.18	

These values should be considered minimum targets as the reference Part L building uses these as a baseline. The references for the assigned u-values are provided in Appendix 2. It is noted based on provided data sheets these values may bettered upon in detailed design and construction phase, however, for preliminary Part L compliance some redundancy has been applied to provide flexibility if required in the detailed design phase.
A low g-value is required to sky lights to meet the solar gain limitation for this space.

Building Air Infiltration Rate: **2.8 m3/hr@50 PA.**

2.4 Calculation Methods

All modelling and simulations were carried out in the IES Virtual Environment software suite version 2023.0.1.0. The following applications were utilised to help compile the results:

- SunCast: To determine effect of solar gains and solar shading.
- VE Compliance SBEMie: To carry out Part L Compliance Calculations

2.5 Internal Gains

Occupancy and Equipment data for all rooms were based on NCM (national calculation methodology) templates as required by Part L of the Building Regulations.

2.6 Electrical Services

Lighting efficiencies are assumed to be approximately 110 lumens/circuit watt throughout the building, due to the absence of a full lighting design been carried out, this is a reasonable assumption based on modern LED technology.

Daylight dimming was applied to rooms which have good exposure to natural lighting (Sports Hall, Offices). Absence detection controls were applied to all toilets, corridors, changing rooms stores etc. A manual on/Auto off presence control system was applied to Offices and Meeting Rooms.

2.7 Mechanical Services

As no design for mechanical systems have been carried out it is assumed that the following several different HVAC systems serve the building, these include:

- System 1 – LTHW Heating Air Source Heat Pump with Radiators/Radiant Panels:
    - Minimum SCOP: 3.0
    - Mechanical Ventilation with 75% Efficiency Plate Heaty Exchanger to sports hall, changing rooms and offices.
    - Extract Ventilation to Toilets
- System 2 DHW:
    - Dedicated Domestic Hot Water Heat Pump
    - 1000 Litre Storage Capacity Factory Insulated Cylinder
    - Minimum SCOP: 2.0

All efficiencies for building services plant are outlined in the Part L Compliance Report BRIRL output document appended to this report.

This would have to be reviewed on a project-by-project basis by Engineering Consultant.

3.0 Results

Primary Energy and CO2 Emissions, Renewable Energy Ratio.

Overall Result: Pass

Primary Energy Consumption, CO2 Emissions, and Renewable Energy Ratio	
The compliance criteria in the TGD-L have been met.	
Calculated CO2 emission rate from Reference building	91.5 kgCO2/m2.annum
Calculated CO2 emission rate from Actual building	48 kgCO2/m2.annum
Carbon Performance Coefficient (CPC)	**0.52**
Maximum Permitted Carbon Performance Coefficient (MPCPC)	**1.15**
Calculated primary energy consumption rate from Reference building	472.1 kWh/m2.annum
Calculated primary energy consumption rate from Actual building	271 kWh/m2.annum
Energy Performance Coefficient (EPC)	**0.57**
Maximum Permitted Energy Performance Coefficient (MPEPC)	**1**
Renewable Energy Ratio (RER)	**0.43**
Minimum Renewable Energy Ratio	**0.1**

Building Fabric.

All new constructions apart from skylights are either equal or better than reference building which help in achieving cost optimal performance and we therefore are compliant with Part L of the Building Regulations. The skylights are compensated in the weighted average u-values.

Overall Result: Pass

Heat Transmission through Building Fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface with maximum U-value*
Walls**	0.21	0.15	0.6	0.15	MT000001_W1
Floors (ground and exposed)	0.21	0.15	0.6	0.15	MT000001_F
Pitched roofs	0.16	-	0.3	-	"No heat loss pitched roofs"
Flat roofs	0.2	0.16	0.3	0.16	MT000001_C
Windows, roof windows, and rooflights	1.6	1.61	3	1.8	MT000002_C_O0
Personnel doors	1.6	0.89	3	0.89	MT000002_W1_O4
Vehicle access & similar large doors	1.5	-	3	-	"No ext. vehicle access doors"
High usage entrance doors	3	-	3	-	"No ext. high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m2K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m2K)]
$U_{i\text{-}Limit}$ = Limiting individual element U-values [W/(m2K)]
$U_{i\text{-}Calc}$ = Calculated individual element U-values [W/(m2K)]

* There might be more than one surface with the maximum U-value. ** Automatic U-value check by the tool does not apply to curtain walls whose area-weighted average and individual limiting standards are 1.8 and 3 W/m2K, respectively.

Air Permeability	Upper Limit	This Building's Value
m3/(h.m2) at 50 Pa	5	2.8

Building Services and Lighting

All new building services and lighting surpass the requirements of the minimum Part L requirements and we therefore are compliant.

Overall Result: Pass

Solar Gain Limits

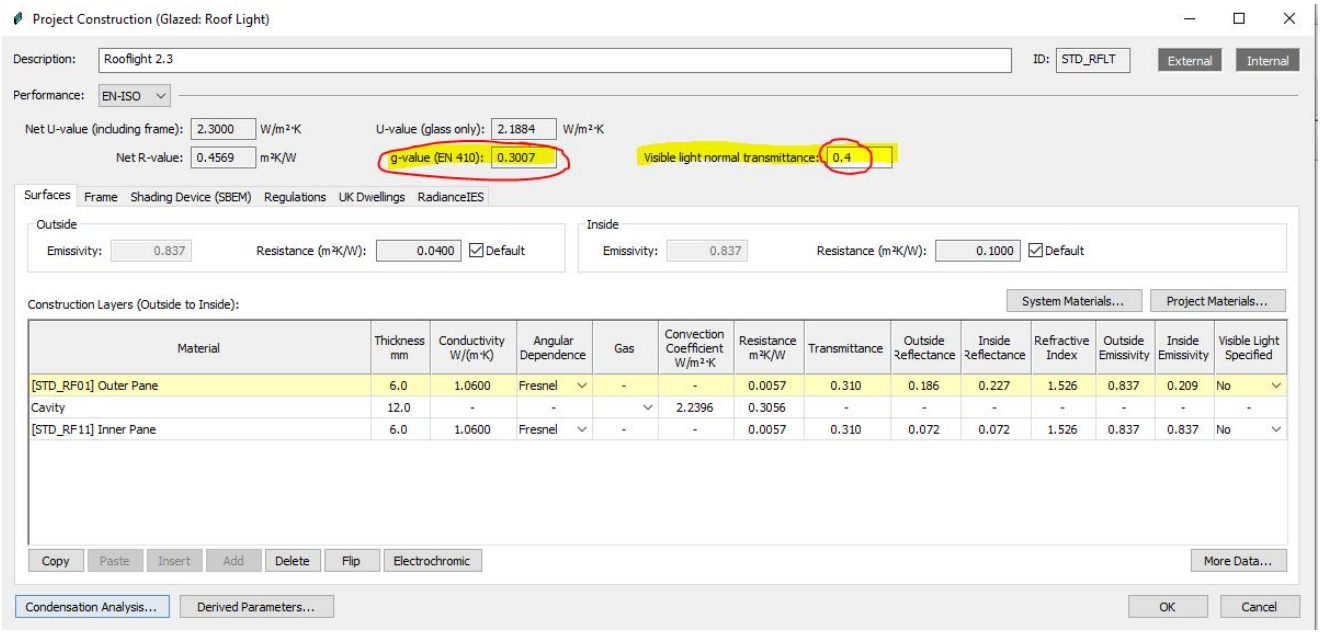
All rooms comply with the solar gain criteria set out in Part L of the building regulations. Refer to Appendix 1 for details.

Overall Result: **Pass**

Mitigation measures:

- **Sky lights in sports hall require a minimum g-value of 0.3. Recommend a target of at least 0.28.**

The specifications required to meet solar gain limits for the sky lights are provided below:



A datasheet will be required to demonstrate this values can be achieved in final part L compliance calculation.

Note: It is recommended that a separate Daylight Factor calculation is carried out to ensure that recommended daylight levels are been maintained within the space. The Chartered Institute of Building Services Engineers recommend daylight levels within 2-5% Daylight Factor ranges, such targets are likely to achieve in a high amount of hours in a year where artificial lighting may not be required and through daylight sensors in LED lighting can significantly reduce energy usage.

Appendix 1. Part L Compliance BRIRL Document

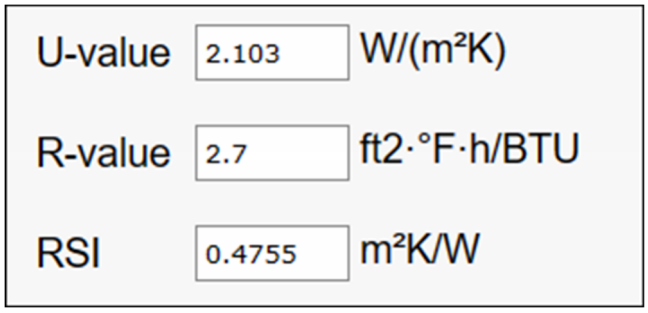
Appendix 2. U-Values References

Skylights:

ID	Component	Thickness Inches (mm)	Conductivity Btu·in / ft²·hr·°F (W/m K)	Nominal Resistance hr·ft²·°F/Btu (m²K/W)	Density lb/ft³ (kg/m³)	Specific Heat Btu/lb·°F (J/kg K)
1	Interior Film	-	-	R-0.7 (0.12 RSI)	-	-
2	Interior Air Space	-	-	R-0.9 (0.16 RSI)	0.075 (1.2)	0.24 (1000)
3	Foil-faced Batt Insulation	6", 8" or 9" (152,203,or 229)	-	R-19, 25 or 30 (3.35, 4.49, or 5.28 RSI)	4 (64)	0.20 (850)
4	Exterior Air Space	-	-	R-0.9 (0.16 RSI)	0.075 (1.2)	0.24 (1000)
5	Sprung Instant Structures Aluminum Ribs and Purlins	-	1595 (230)	-	168 (2700)	0.22 (900)
6	Sprung Instant Structures Interior Thermal Cap	-	1.73 (0.25)	-	54 (860)	0.48 (2000)
7	Sprung Instant Structures Exterior Aluminum Cap	-	1595 (230)	-	168 (2700)	0.22 (900)
8	Nylon Rope	-	1.73 (0.25)	-	51 (820)	0.48 (2000)
9	Fabric not explicitly modelled, as it provides no additional thermal resistance. The thermal conductivity of small air spaces including in the interior and exterior caps was found using ISO 100077-2					
10	Exterior Film	-	-	R-0.2 (0.03 RSI)	-	-

R VALUE - 2.7
RSI VALUE - 0.47

Reference: Morrison Hershfield 2019-04-10 Sprung U-Factor Report



U-Value calculated by OSEng

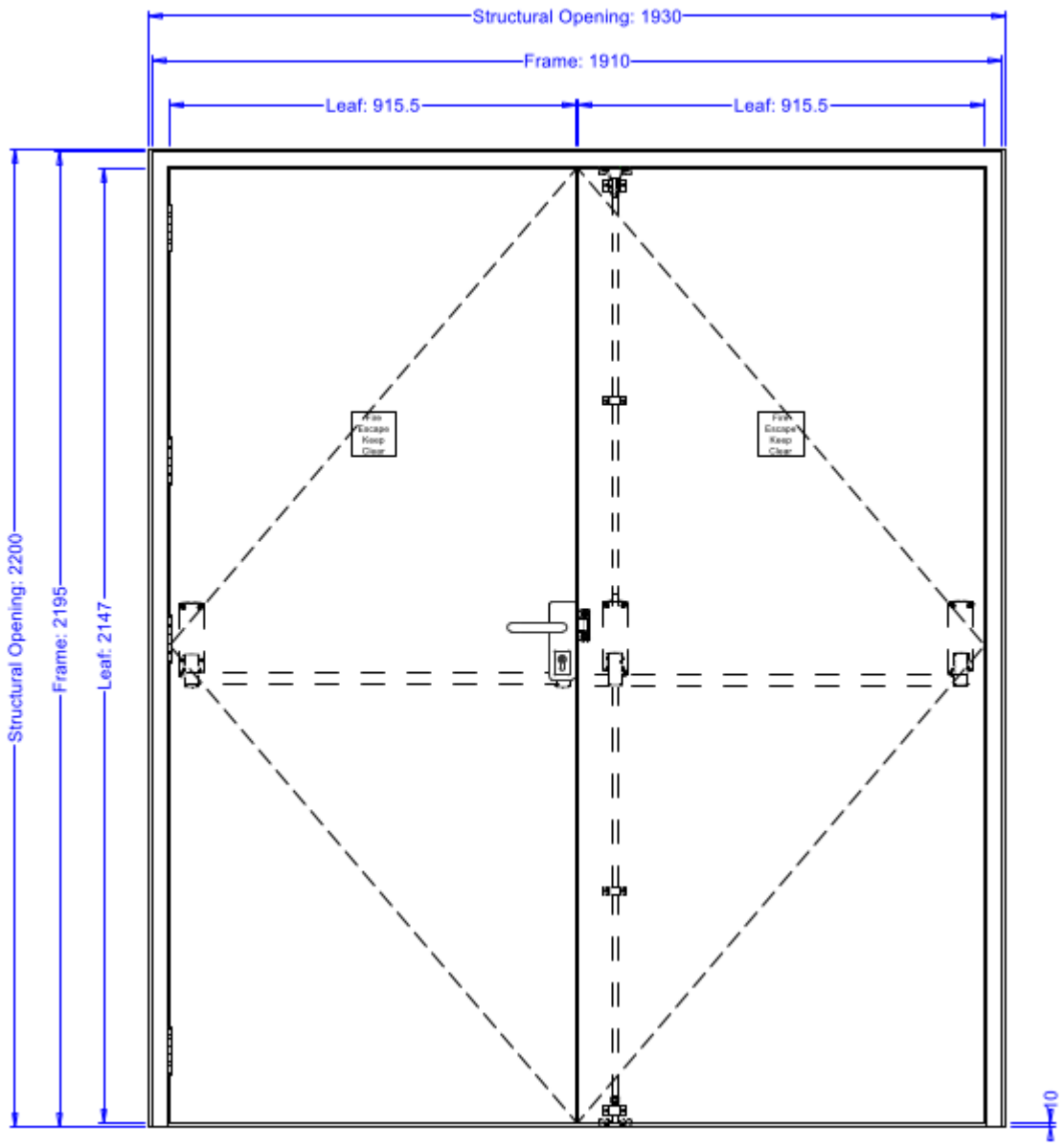
Windows:

Details: Office Space Only

- Colour: Standard single ral
- Glazing: Triple glazing 4T/20/4T U1.0
- System: ASM XT66 Performance Plus
- Includes adaptors for **80mm** Kingspan panels
- Hardware
  - Espag handles
  - Restrictor
- Overall U Value U0.9

Reference: As per client specification.

External Doors:



Infill: Polyurethane 1.6 W/m2K

Reference: IDS Doors for Sprung Specification Document

Wall Roof:

EXTERNAL WALL ELEMENT SPRUNG SYSTEMS			Reference standard
Total area (m^2)	U-value (undisturbed) W/m^2K	Heat loss (W/K)	
270.18	0.114	30.80	ISO 6946
5 X 10" Post length	Psi-value (W/mK)	Heat loss (W/K)	
53.636	0.287	15.39	ISO 10211
Area-weighted average wall U-value (W/m^2K)		0.171	ISO 6946

Reference: Sprung System provided specification

ROOF ELEMENT SPRUNG SYSTEMS		Reference standard
Total area (m^2)	1074.58	
Undisturbed U-value (W/m^2K)	0.157	ISO 6946
Roof heat loss (W/K)	168.71	
Rafter beam psi-value (W/mK)	0.376	ISO 10211
Total rafter length (m)	291.74	
Rafter heat loss (W/K)	109.69	
Area-weighted average roof U-value (W/m2K)	0.259	ISO 6946

Reference: Sprung System provided specification

Floor:

BuildDesk U 3.4

MOUNT MERCY GROUND FLOOR U-VALUE 190mm PIR

Documentation of the component
Thermal transmittance (U-value)
Source: **own catalogue - SPRUNG SYSTEMS**
Component: **MOUNT MERCY GROUND FLOOR**

29. March 2023
Page 1/3

INSIDE

OUTSIDE

Assignment: Ground floor

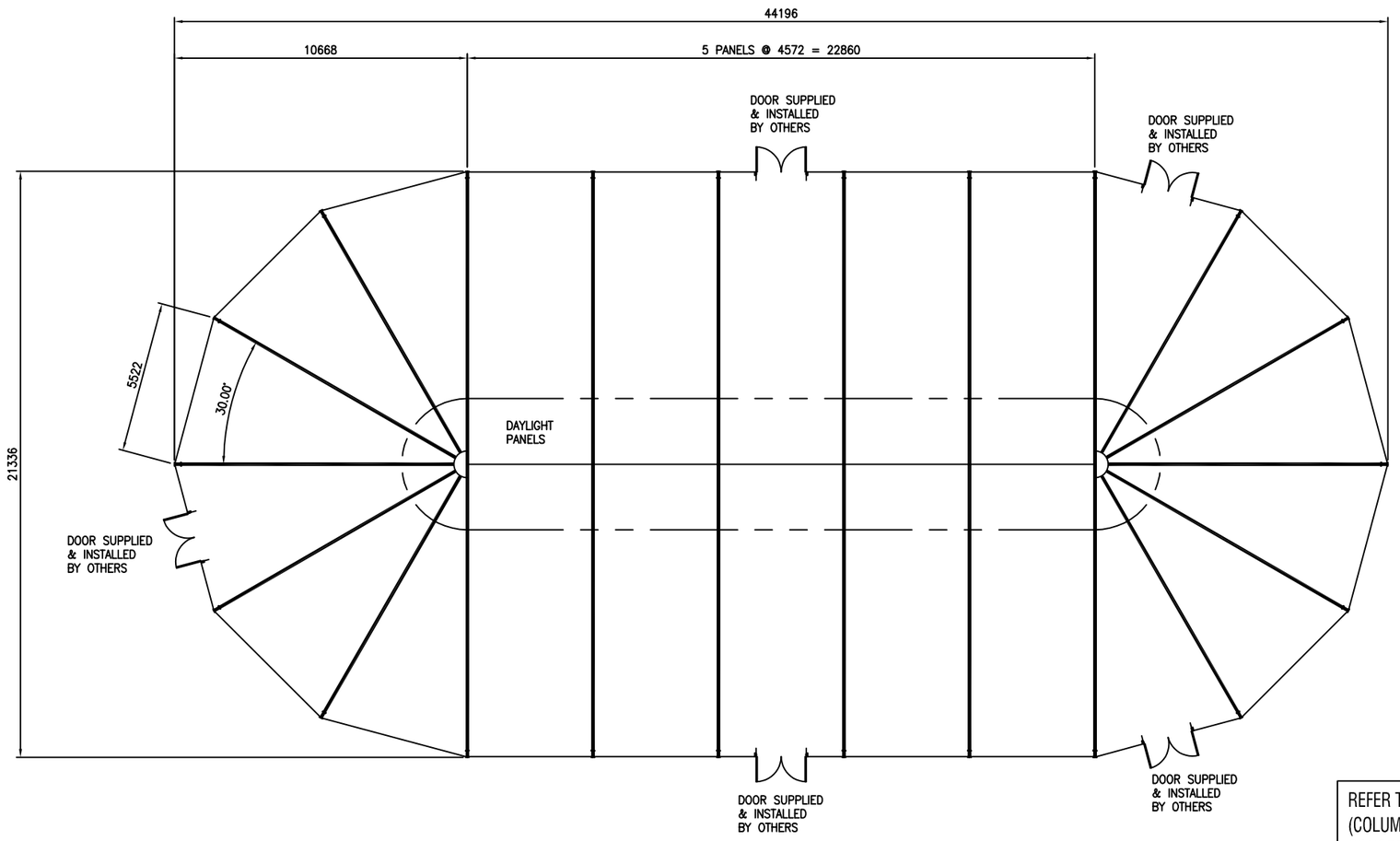
		Manufacturer	Name	Thickness [m], number	Lambda [W/(mK)]	Q	R [m²K/W]
		Rsi					0.1700
☑	1	BS EN 12524	Concrete, Reinforced (with 2% of steel)	0.1500	2.500	D	0.0600
☑	2	Xtratherm Limited	Thin-R XT/UF Underfloor	0.0900	0.022	C	4.0909
☑	3	Xtratherm Limited	Thin-R XT/UF Underfloor	0.1000	0.022	C	4.5455
		Rse					0.0000
				0.3400			

U = 0.08 W/(m²K)

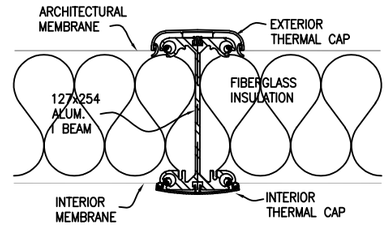
Explanation see next page

Reference: Sprung Foundation Specification

Appendix 3. Concept Building Floor Plan



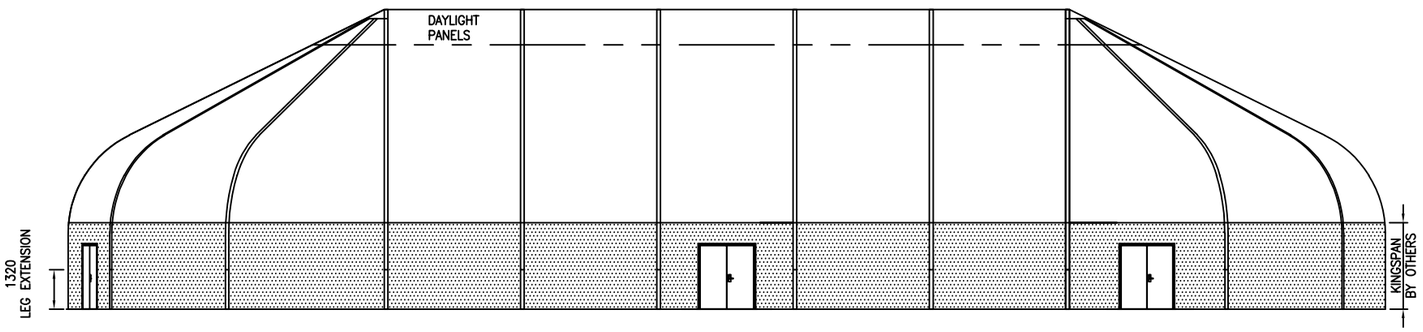
1 / 399.0 PLAN VIEW
1:100



3 / 399.0 127x254 INSULATED BEAM SECTION
1:5

REFER TO DRAWING S-1 FOR SPECIAL INSPECTION & ADDITIONAL MATERIAL NOTES.

REFER TO DWG P20-399.1 (COLUMN BASE LAYOUT) FOR CONCRETE PAD DIMENSIONS



2 / 399.0 ELEVATION
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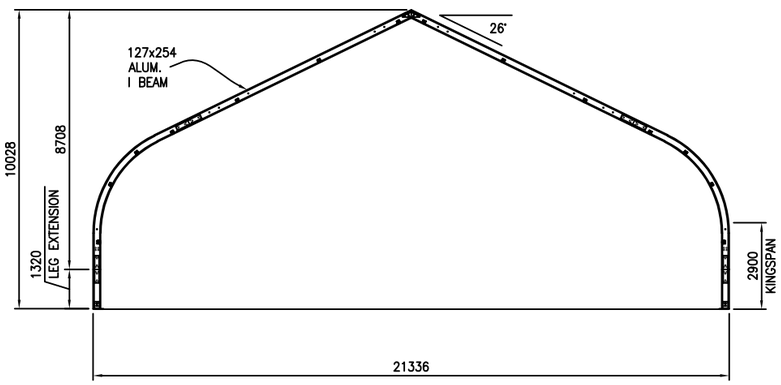

4 / 399.0 SECTION 21.3m INSULATED STRUCTURE
1:100

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GENERAL NOTES:

1. ALL PERSONNEL DOORS C/W PANIC HARDWARE & HOODS, AS NOTED.
2. STRUCTURE TO BE INSULATED WITH FIBERGLASS BATT INSULATION C/W INNER LINER, TO DAYLIGHT PANEL LEVEL ONLY.
3. INNER & OUTER MEMBRANE TO BE FINISHED TO CONCRETE USING ALUMINUM FLAT BAR.
4. STRUCTURE MEMBRANE MEETS: NFPA 701, CALIFORNIA STATE FIRE MARSHAL, ASTM E84, CAN/ULC-S-109 & CAN/ULC-S-102 SPECIFICATIONS.
5. THIS STRUCTURE IS DESIGNED TO SHED/RELEASE SNOW. THE PERIMETER OF THE STRUCTURE SHALL BE KEPT CLEAR.
6. WHEN DESIGNING A HEATING, VENTILATION OR AIR CONDITIONING SYSTEM FOR ANY TYPE OF BUILDING, IT IS IMPORTANT TO ENSURE THAT THIS SYSTEM INTAKES MORE AIR THAN IS BEING EXHAUSTED AT ANY GIVEN TIME. THIS PROCESS WILL RESULT IN A POSITIVE PRESSURE BEING MAINTAINED. CONVERSELY, IF NEGATIVE PRESSURE EXISTS WITHIN THE STRUCTURE, IT WILL BE DIFFICULT TO OPEN DOORS AND MOISTURE WILL BE DRAWN INTO THE STRUCTURE.
7. ALL INTERIOR WALLS & PARTITIONS (IF APPLICABLE) TO BE FREE STANDING & INDEPENDENT OF SPRUNG STRUCTURE.

SIGNATURE SERIES

REV	MM/DD/YY	BY	DESCRIPTION
2	08/13/20	EH	REVISE ANCHOR BOLT

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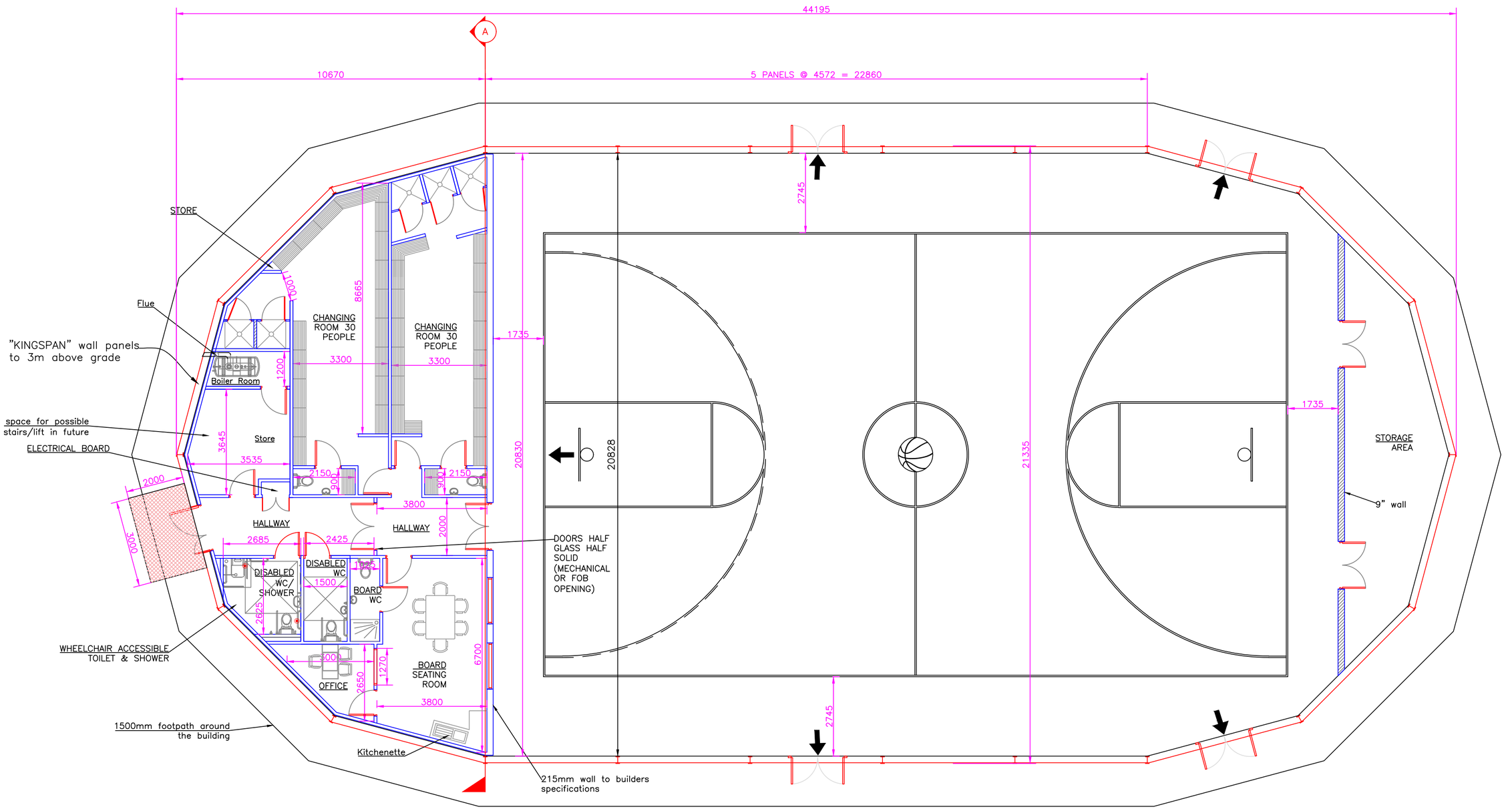
CI STRUCTURES

21.3m x 44.2m
MOUNT MERCY

DRAWN BY: P. DUMONT	DATE: 03/04/2020
SCALE: AS NOTED	DRAWING # P20-399.0
SPRUNG WO: 25881	



FLOOR PLAN LAYOUT
SCALE 1:100
USEABLE FLOOR AREA TO
INTERIOR MEMBRANE = 801.48 m2

W
S
N
E

CONCEPT DESIGN
Consulting Engineers & Project Managment
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Email: info@cdpm.ie

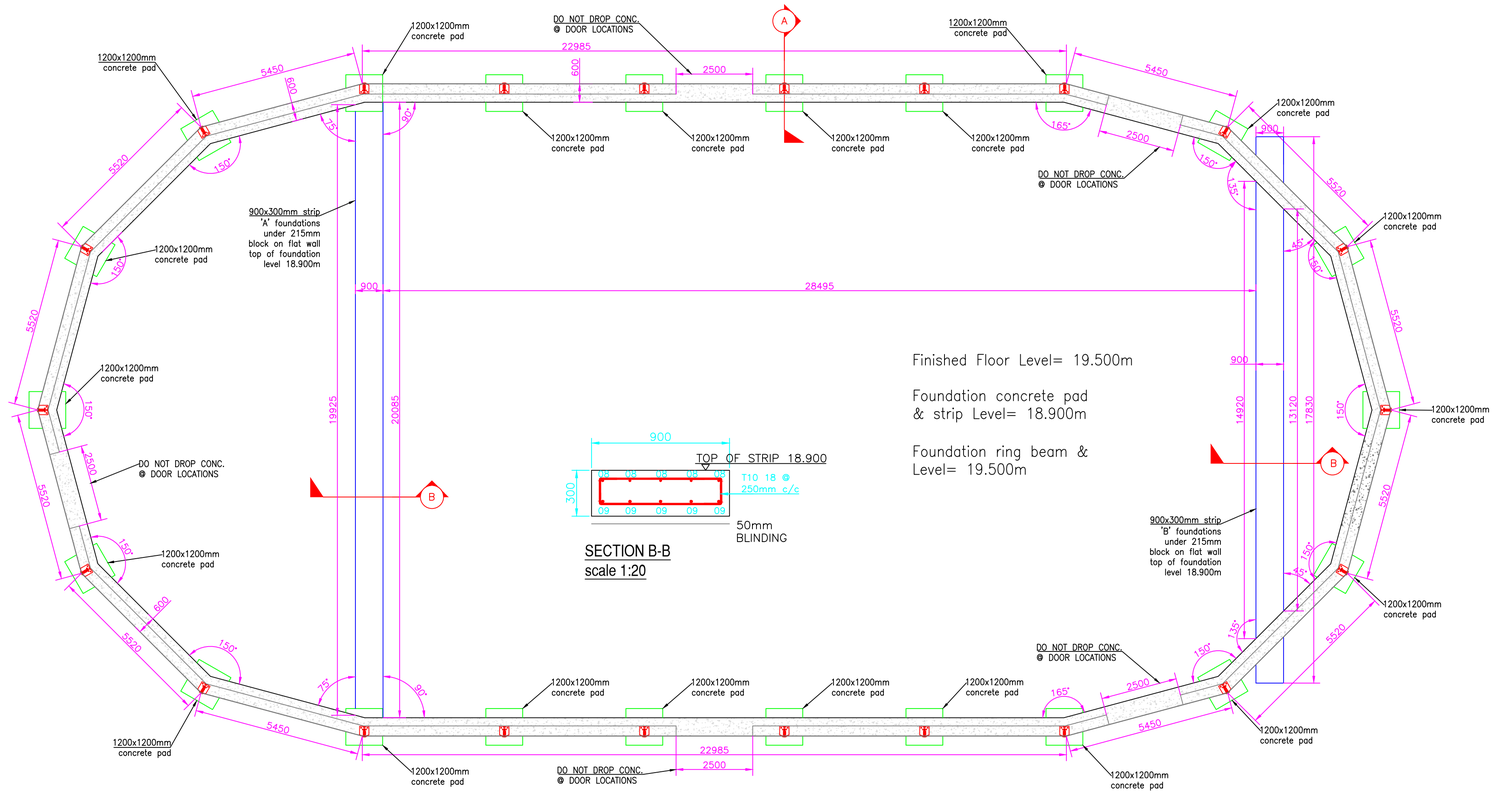
client: GGA DEVELOPMENTS LTD.

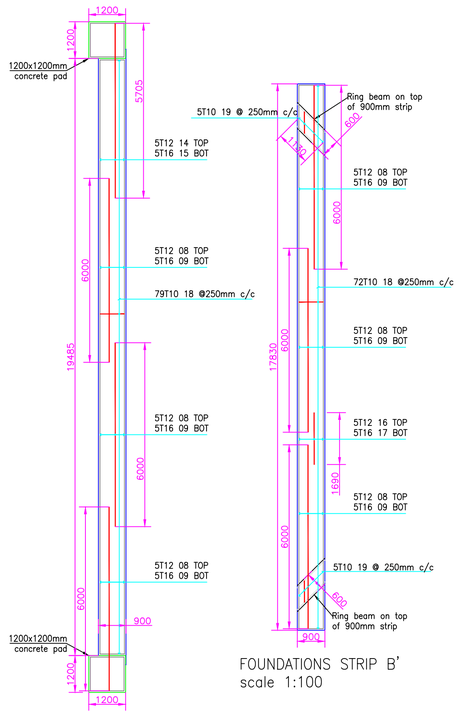
project: MOUNT MERCY COLLEGE, SPORTS HALL, MODEL FARM ROAD

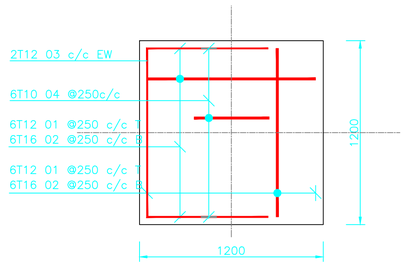
drawing: OVERALL LAYOUT OF THE PROPOSED STADIUM

job no.	date	drawn by
17-100	25/08/20	KB
drawing no.	scale	issue
05	1:100	D

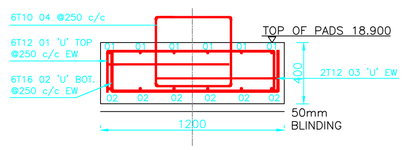
revision	issue	date	by
FOR INFORMATION	D	25/08/20	KB
FOR PLANNING	C	21/08/19	KB

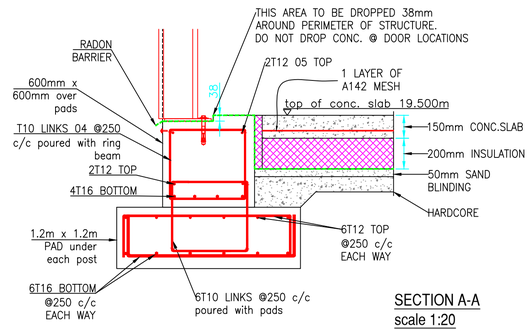


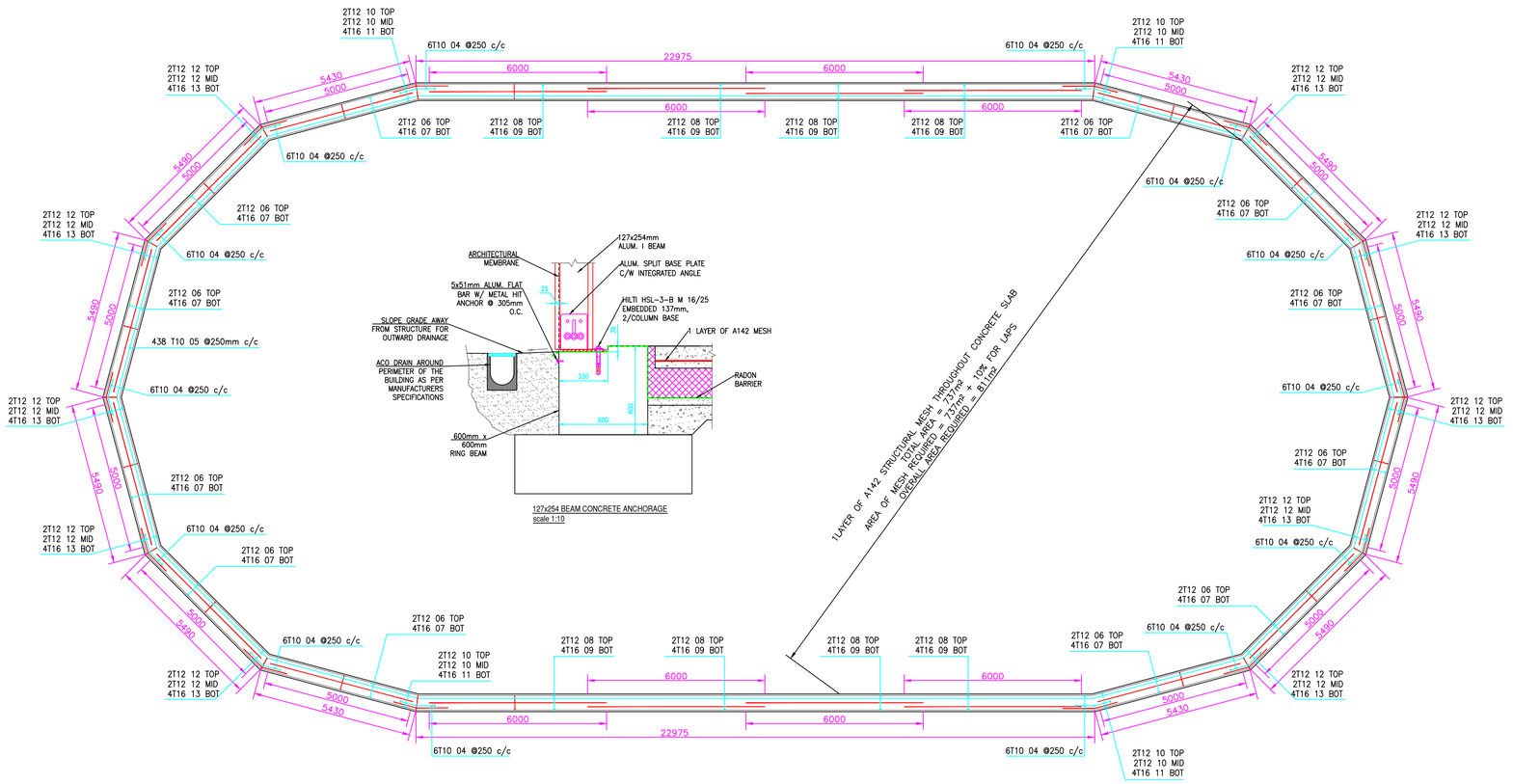




PLAN OF PAD FOUNDATION TYPE 1 (F.P.T.1)
22No. REQUIRED (SCALE 1:20)







NOTES

2. FOUNDATIONS

a– DO EXCAVATIONS AS NEARLY AS POSSIBLE TO NEAT LINES REQUIRED BY SIZE AND SHAPE OF FOOTINGS WHICH ARE CAST IN EARTH TRENCHES WITHOUT FORMING UNLESS OTHERWISE SHOWN.

b– KEEP FOOTINGS PUMPED CLEAR OF GROUND WATER AND SURFACE WATER RUN OFF.

c– RETAIN AND SUPPORT THE SIDES OF EXCAVATIONS.

d– USE 50mm GRADE C16/20 CONCRETE BLINDING OR HARDCORE UNDER ALL FOUNDATIONS WHERE FOUNDATIONS ARE NOT POURED IMMEDIATELY.

e– POURING OF CONCRETE SHALL NOT START UNTIL THE PLACEMENT OF REINFORCEMENT HAS BEEN APPROVED BY THE INSPECTING ENGINEER.

f– TOLERANCES – VARIATION IN LEVEL OF TOP OF FOOTING FROM TARGET PLANE +/–20mm.

3. CONCRETE WORKS

a– ALL CONCRETE WORK SHALL BE IN ACCORDANCE WITH EUROCODE 2.

b– ALL CONCRETE MATERIALS SHALL BE IN ACCORDANCE WITH EUROCODE 2.

c– ALL PROPOSED MIXED PROPORTIONS TO BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO CONCRETE WORK COMMENCING.

d– ALL CONCRETE WHERE NOT SHOWN ON DRAWINGS SHALL BE GRADE C28/35. W/C RATIO 0.55, MAX. AGG. SIZE 20mm MAX. SLUMP 100mm.

e– REINFORCEMENT TO EUROCODE 2
R=ROUND MILD STEEL BARS,
fy=250N/mm2
T=HIGH YIELD STEEL BARS fy=500N/mm2
MIN. LAP LENGTHS = T12 = 480mm
T16 = 640mm
T20 = 800mm
T25 = 1000mm
REINFORCEMENT MESH = 400mm.

f– NOMINAL COVER TO REINFORCEMENT:

MEMBER	TOP	BOTTOM	SIDES
FOOTINGS	50	50	50

TOLERANCES –5mm AND +5mm
WHERE CONCRETE IS POURED AGAINST EARTH FACE MIN. COVER IS 75mm.

g– SUPPORT HORIZONTAL REINFORCEMENT ON GALVANIZED CHAIRS EXCEPT MORTAR BLOCKS OR OTHER APPROVED METHOD OF SUPPORT MAY BE USED AT FOOTINGS AND SLABS ON GRADE.

h– REMOVE FORMS AT FOLLOWING MINIMUM TIMES AFTER POURING:
AT SLAB EDGES – 24 HOURS
AT WALLS LESS THAN 1.5m HIGH – 36 HOURS
WALLS GREATER THAN 1.5m HIGH – 72 HOURS.

j– ALL REINFORCEMENT SHALL BE COLD BENT.

NF– NEAR FACE
FF– FAR FACE
EW– EACH WAY
EF– EACH FACE
T&B – TOP AND BOTTOM

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS DRAWINGS AND SPECS.

revision	issue	date	by
FOR CONSTRUCTION	B	03/06/20	KB
FOR COMMENCEMENT	A	20/05/20	KB

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client
GGA DEVELOPMENTS LTD.

project
MOUNT MERCY COLLEGE, SPORTS HALL, MODEL FARM ROAD

CONCEPT DESIGN
Consulting Engineers & Project Management
16 North Main Street, Bandon, Co. Cork, Ireland.
Phone: (023) 8854904 / 8854905 Fax (023)8854907
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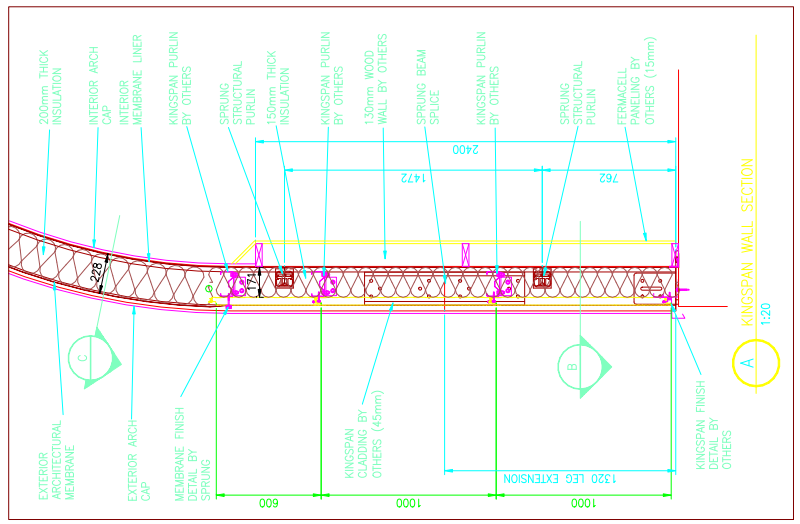
drawing
FOUNDATIONS DETAIL

job no.	drawing no.	scale
19–38	C01	1:100/1:20/1:10

drawn by	checked by	date	issue
KB	D.D	20/05/20	AB



SIGNATURE SERIES

SALERNO
SECONDARY SCHOOL

KINGSPAN WALL SECTION

DATE 02/15/2016

SCALE AS NOTED

DRAWING # KINGSPAN WALL SECTION A

Appendix 4. Passivate Energy Consultants U-Value Calculations

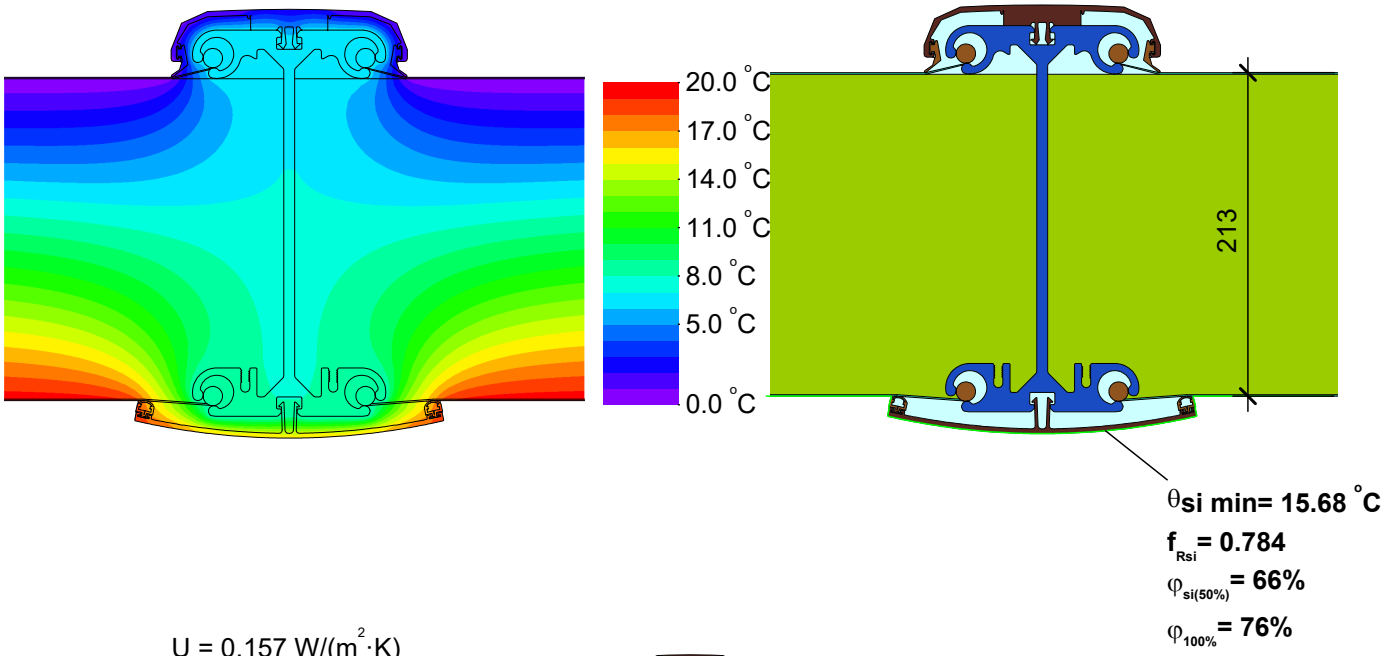
EXTERNAL WALL ELEMENT SPRUNG SYSTEMS			Reference standard
Total area (m^2)	**U-value (undisturbed) W/m^2K**	**Heat loss (W/K)**	
270.18	0.114	30.80	ISO 6946
5 X 10" Post length	**Psi-value (W/mK)**	**Heat loss (W/K)**	
53.636	0.287	15.39	ISO 10211
Area-weighted average wall U-value (W/m^2K)		**0.171**	ISO 6946

ROOF ELEMENT SPRUNG SYSTEMS		Reference standard
Total area (m^2)	1074.58	
Undisturbed U-value (W/m^2K)	0.157	ISO 6946
Roof heat loss (W/K)	168.71	
Rafter beam psi-value (W/mK)	0.376	ISO 10211
Total rafter length (m)	291.74	
Rafter heat loss (W/K)	109.69	
Area-weighted average roof U-value (W/m2K)	**0.259**	ISO 6946

	Area (m^2)	**TGD L**	**Heat loss (W/K)**	**Design proposal**	**Heat loss (W/K)**
Roof U-value	1074.58	0.16	171.93	0.259	278.40
Wall U-value	270.18	0.21	56.74	0.171	46.19
Ground floor U-value	790	0.21	165.90	0.086 Th	67.94
Total heat loss (W/K)			**394.57**		**392.54**

Project: Generic
Client: Sprung Systems
Element: Roof element
Date: 29/03/23

All calculations carried out in accordance with IS EN ISO 10077-2:2017 using the radiosity method.
Software: Flixo v.8 validated to IS EN ISO 10077-2



$$\psi_{A-C} = \frac{14.455}{20.0} - 0.157 \cdot 2.203 = 0.376 \text{ W/(m·K)}$$

Material	λ[W/(m·K)]	ε	μ[-]
Aluminium (Si Alloys)	160.000	0.900	
Aluminium (Si Alloys)	160.000	0.100	
EPDM (ethylene propylene diene monomer)	0.250	0.100	
EPDM (ethylene propylene diene monomer)	0.250	0.900	
Knauf Omnifit Stud	0.034	0.900	1.000
Polyvinylchloride (PVC)	0.170	0.900	50000.000
Polyvinylchloride (PVC) flexible	0.140	0.900	100000.000
Unventilated air cavity *			1.000

* EN ISO 10077-2:2017, 6.4.3/anisotrop

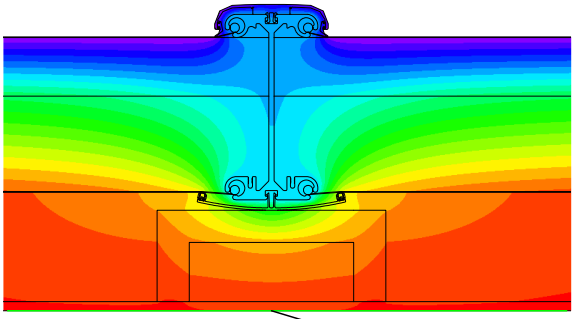
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε	φ[%]
Exterior IRE		0.000	0.040		
Interior, heat flux, upwards		20.000	0.100		
Symmetry/Model section	0.000				
Epsilon 0.1				0.100	
Epsilon 0.9				0.900	

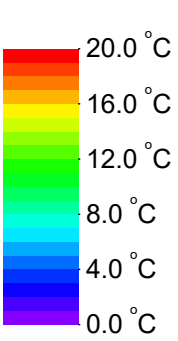
PASSIVATE.
BUILDING ENERGY CONSULTING

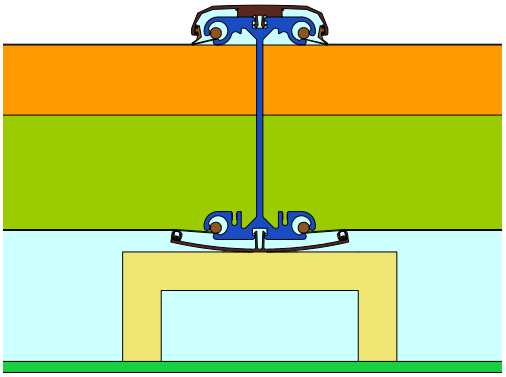
NSAI Agrément
Andrew Lundberg
Passivate
Registration Number IAB/TM/02
NSAI Approved Thermal Modeller

Project: Generic
Client: Sprung Systems
Element: External wall
Date: 29/03/23

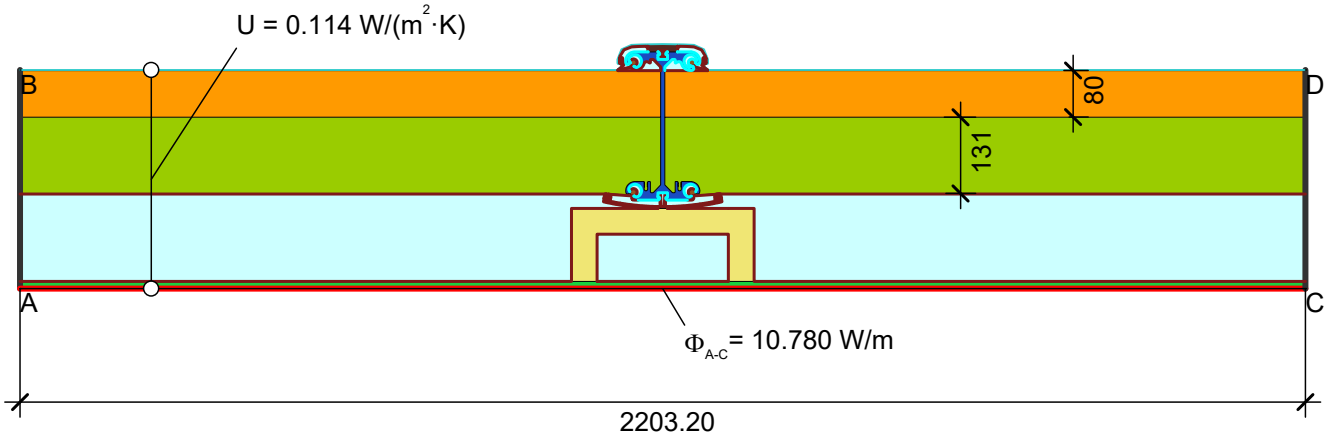
All calculations carried out in accordance with IS EN ISO 10077-2:2017 using the radiosity method.
Software: Flixo v.8 validated to IS EN ISO 10077-2







$\theta_{si\ min}$= 18.93 °C
f_{Rsi} = 0.947
$\varphi_{si(50\%)}$ = 53%
$\varphi_{100\%}$ = 94%



$$\psi_{A-C} = \frac{10.78}{20.0} - 0.114 \cdot 2.203 = 0.287\ W/(m \cdot K)$$

Material	λ[W/(m·K)]	ε
Aluminium (Si Alloys)	160.000	0.900
Aluminium (Si Alloys)	160.000	0.100
EPDM (ethylene propylene diene monomer)	0.250	0.100
EPDM (ethylene propylene diene monomer)	0.250	0.900
FERMACELL Gipsfaser-Platte	0.320	0.900
KINGSPAN QUADCORE CORE	0.018	0.900
Knauf Omnifit Stud	0.034	0.900
Polyvinylchloride (PVC)	0.170	0.900
Polyvinylchloride (PVC) flexible	0.140	0.900
Softwood 500, typical construction timber	0.130	0.900
Unventilated air cavity *		

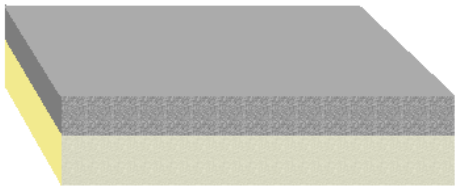
* EN ISO 10077-2:2017, 6.4.3/anisotrop

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Epsilon 0.1				0.100
Epsilon 0.9				0.900
Exterior IRE		0.000	0.040	
Interior, normal, horizontal		20.000	0.130	
Symmetry/Model section	0.000			

Documentation of the component
Thermal transmittance (U-value)
Source: **own catalogue - SPRUNG SYSTEMS**
Component: **MOUNT MERCY GROUND FLOOR**

29. March 2023

INSIDE



OUTSIDE

Assignment: Ground floor

		Manufacturer	Name	Thickness [m], number	Lambda [W/(mK)]	Q	R [m²K/W]
		Rsi					0.1700
☑	1	BS EN 12524	Concrete, Reinforced (with 2% of steel)	0.1500	2.500	D	0.0600
☑	2	Xtratherm Limited	Thin-R XT/UF Underfloor	0.0900	0.022	C	4.0909
☑	3	Xtratherm Limited	Thin-R XT/UF Underfloor	0.1000	0.022	C	4.5455
		Rse					0.0000
				0.3400			

U = 0.08 W/(m²K)

Explanation see next page

Q .. The physical values of the building materials has been graded by their level of quality. These 5 levels are the following
A .. A: Data is entered and validated by the manufacturer or supplier. Data is continuously tested by 3rd party.
B .. B: Data is entered and validated by the manufacturer or supplier. Data is certified by 3rd party
C .. C: Data is entered and validated by the manufacturer or supplier.
D .. D: Information is entered by BuildDesk without special agreement with the manufacturer, supplier or others.
E .. E: Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

U = 0.08 W/(m²K) R_T= 8.87 m²K/W

Slab-on-ground floor according to BS EN ISO 13370

Input data:

λ	Thermal conductivity [W/(mK)]	2.00	(Thermal conductivity of the ground)
A	Floor area [m²]	790.00	
P	Exposed perimeter [m]	109.80	
R_f	Thermal resistance [m²K/W]	8.696	(see construction layer list)
w	Thickness of walls [m]	0.30	

Kind of edge insulation:		vertical edge insulation
D	Depth of insulation [m]	0.52
d_n	Thickness of insulation [m]	0.10
R_n	Thermal resistance [m²K/W]	2.0

Intermediate results:

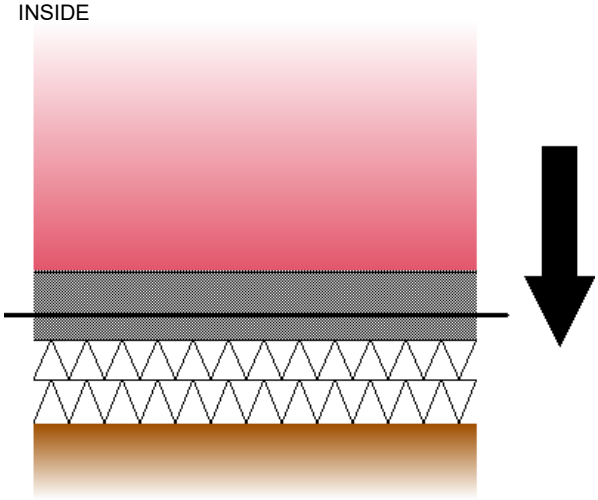
B'	Characteristic dimension [m]	14.390
d_t	Equivalent thickness [m]	18.113
U_0	Thermal transmittance [W/(m²K)]	0.081
$\Delta\Psi$	Correction term [W/(mK)]	-0.006

$U = 0.08$ W/(m²K) **Thermal Transmittance**

$L_S = 63.3$ W/K **Steady-state thermal coupling coefficient**

Documentation of the component
Heat capacity
Source: **own catalogue - SPRUNG SYSTEMS**
Component: **MOUNT MERCY GROUND FLOOR**

INSIDE



OUTSIDE

The list of materials shown below may differ from those in the U-value calculation printout. Only material layers which are used in the heat capacity calculation are listed.

Single material layers shown in the U-value calculation printout may be separated to meet the exclusion criteria:

A .. The total thickness of the layers exceed 0.1 m.
B .. The mid point in the construction is reached.

For insulation layers the following criteria applies:

C .. An insulating layer is reached (defined as lambda <= 0.08 W/(mK)).

	Name	Thickness [m]	lambda [W/(mK)]	Q	Thermal capacity [kJ/(kgK)]	Q	Density [kg/m³]	Q	Thermal mass kJ/(m²K)	Criteria Exclusion
	Start of calculation - Warm									
1	Concrete, Reinforced (with 2% of steel)	0.1000	2.500	D	1.00	D	2400.0	D	240.0	-, -, -
1	Concrete, Reinforced (with 2% of steel)	0.0500	2.500	D	1.00	D	2400.0	D	~~120.0~~	A, -, -
2	Thin-R XT/UF Underfloor	0.0900	0.022	C	1.40	C	32.0	C	~~0.0~~	A, -, C
3	Thin-R XT/UF Underfloor	0.1000	0.022	C	1.40	C	32.0	C	~~0.0~~	A, -, C
	End of calculation - Earth									
		0.3400							**240.0**	

Heat capacity = 240.0 kJ/(m²K)

The following exclusion criteria apply:
A .. The total thickness of the layers exceed 0.1 m.
C .. An insulating layer is reached (defined as lambda <= 0.08 W/(mK)).

Q .. The physical values of the building materials has been graded by their level of quality. These 5 levels are the following
A .. A: Data is entered and validated by the manufacturer or supplier. Data is continuously tested by 3rd party.
B .. B: Data is entered and validated by the manufacturer or supplier. Data is certified by 3rd party
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