

Simple Space Studio Unit
Structural Calculations and Lifting Information

FORMOLOGY – TYPICAL L8 UNIT – CLASS 1
STRUCTURAL REPORT

DOCUMENT ISSUE REGISTER

Job	BROOK GARDENS			
Document	STRUCTURAL REPORT			
Issue	Date	Description	By	Checked
01		First issue	Philip Wainwright, <i>CEng, MStructE</i>	

REVISION 01 NOTES

This is the first issue of information relating to this project.

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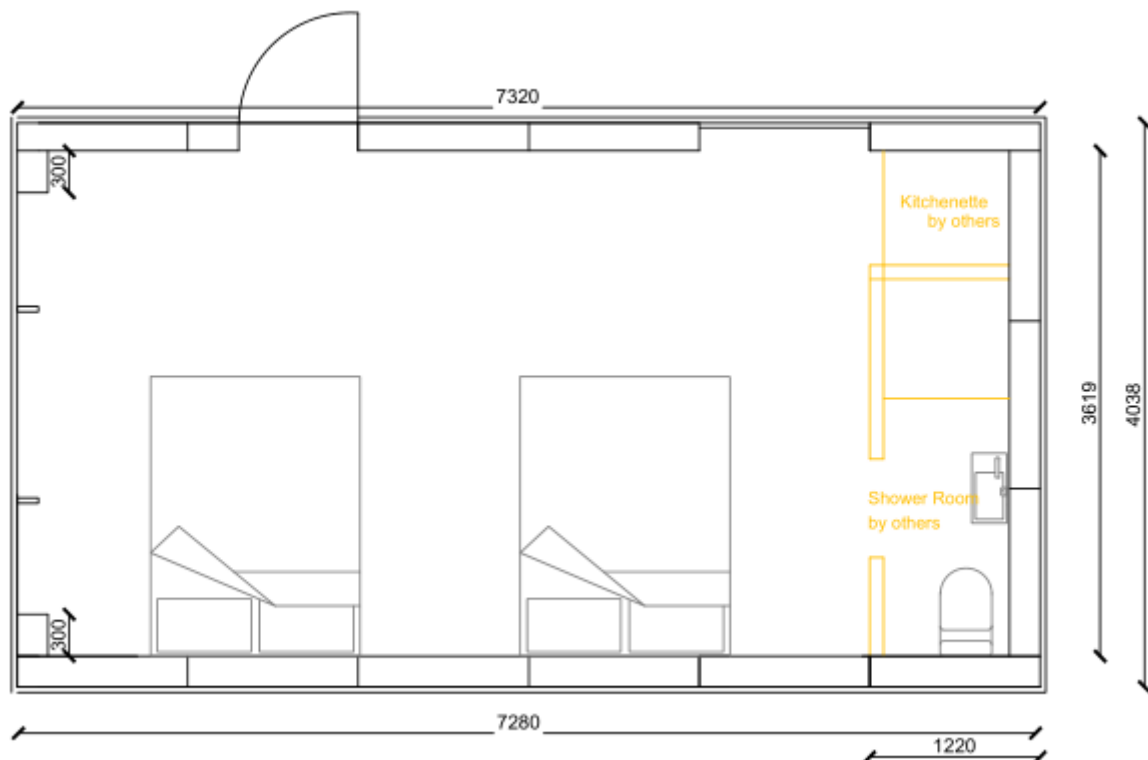
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SECTION 1 – INTRODUCTION

Creative Side structures have been appointed by *Formology* to confirm the required member sizes for the new SIPS garden room and to confirm the lifting requirements.

The unit is a simple rectangle on plan with a predominantly open glazed side elevation (see plan below)

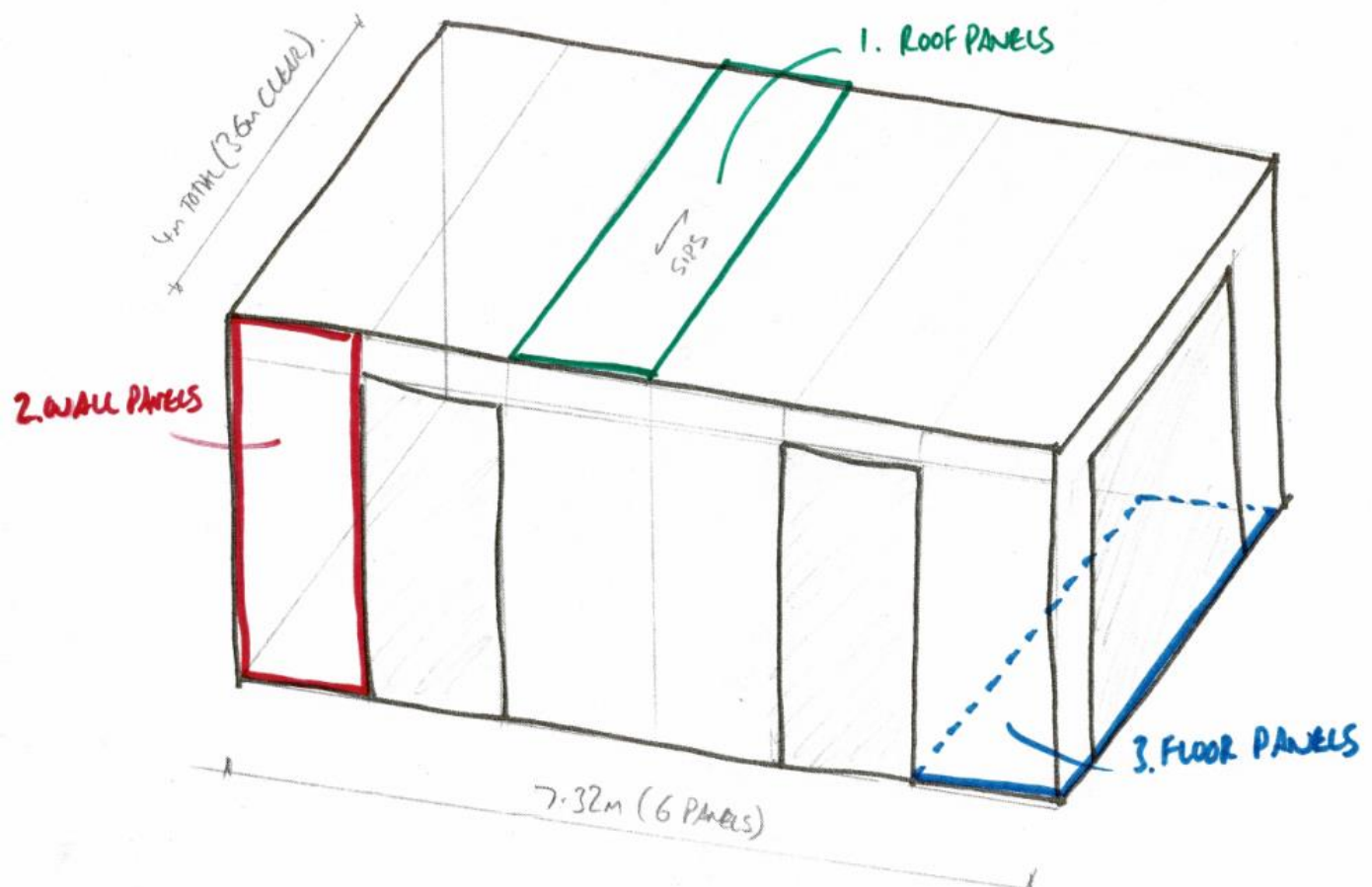


The unit comprises standard 200mm thick SIPS panels, 1.22m wide spanning across the width to form the floor and roof members with the floor units only spanning 1.0m between screw piles, which are located at 1.0m c/c in both axis.

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SECTION 2 – STRUCTURAL MEMBER ANALYSIS



We have broken this down into the main structural components that are required to ensure the module is structurally sound.

These are typical;

1. Roof panels
2. Wall panels
3. Floor Panels

The above image shows the main structural items appraised. In addition, the typical lifting trimmers down each long side are discussed within section 3.

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1. Typical Roof Panel

The span of the roof panels is 3.6m clear with a single ply membrane covering over and the minimum permissible imposed loading, which will be for snow/maintenance only.

A 194mm thick (2x 12mm OSB/3 + 170mm joists) SIPS panel can span 3.78m clear. It is noted that the SIPS panel(s) which will be used will have thicker (15mm) OSB/3 sheets to result in a 200mm thick SIPS panel.

TABLE A.3.2 : 194mm SIP Roof Panels - 0.9KN/m² wind load

Pitch (degrees)	Dead Load DL (KN/m ²)	Imposed load DL (KN/m ²)	SIP Splines		2 no. 170 x 45 C16 timber splines		2 no. 170 x 45 C24 timber splines		2 no. 170 x 45 C30 timber splines	
			Clear span on plan	Clear Span on slope	Clear span on plan	Clear Span on slope	Clear span on plan	Clear Span on slope	Clear span on plan	Clear Span on slope
			L _{plan} (m)	L _{slope} (m)	L _{plan} (m)	L _{slope} (m)	L _{plan} (m)	L _{slope} (m)	L _{plan} (m)	L _{slope} (m)
0	0.60	0.60	2.75	2.75	3.4	3.4	3.78	3.78	3.9	3.9
	1.00	0.60	2.06	2.06	3.1	3.1	3.45	3.45	3.56	3.56

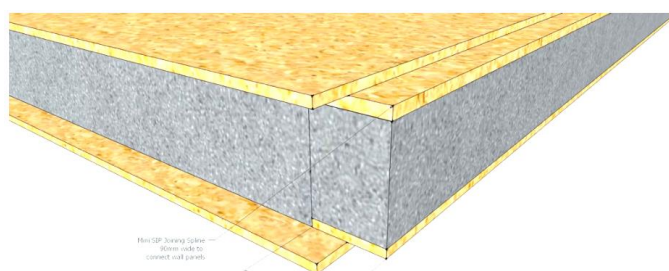
2No C24 timber splines are required down each side of the 200mm thick SIPS panel. These are to be continuous lengths that span from bearing to bearing.

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2. Typical Wall Panels

The wall panels span vertically between the floor structure and the roof structure and act as a beam to resist any lateral wind loads. The wall panels are joined with the standard SIPS jointing action with a male & female node. The floor(s) and roof(s) then act as rigid diaphragms to transfer the lateral forces down through the rear internal and perimeter walls that act as racking panels.



This document addresses a unit within the suburban South-East thus a typical wind loading value could be taken as 0.45 kN/m^2 . The below table is taken from a SIPS suppliers' technical documentation and shows that a 119mm thick SIP panel at 3m clear height can resist a lateral load value of 0.960 kN/m^2 . That wall thickness is the smallest manufactured however following on this project a 200mm panel (2x 15mm OSB/3 + 170mm C16+ studs) are to be used. The table below shows a 194mm thick panel (2x 12mm OSB/3 + 170mm C16+ studs) is capable of resisting almost 4x the design wind load.

SIP Wall Panel - Load Span Table

Table B.1

Lateral Load Capacities for SIP Wall Panels (with SIP splines)

Vertical Load (kN/m)	Panel Height (m)	119mm thick SIP Panels (kN/m ²)	144mm thick SIP panels (kN/m ²)	169mm thick SIP panels (kN/m ²)	194mm thick SIP panels (kN/m ²)	219mm thick SIP panels (kN/m ²)
12	2.40	1.456	1.900	2.365	2.831	3.302
	2.70	1.180	1.570	1.966	2.371	2.781
	3.00	0.960	1.285	1.635	1.991	2.351
	3.60	0.658	0.900	1.159	1.428	1.706
	4.80	0.300	0.483	0.555	0.699	0.851

3. Typical Floor Joists

Whilst the SIPS manufacturer contacted are awaiting BBA approval on their floor span tables this element can be deemed acceptable as they floor spans are only 1.0m clear between supports as the whole building unit is to sit on to screw piles and square capping plates at 1.0m c/c in both directions.

The floor structure is to be fixed down to the screw piles to resist any wind uplift of sliding.

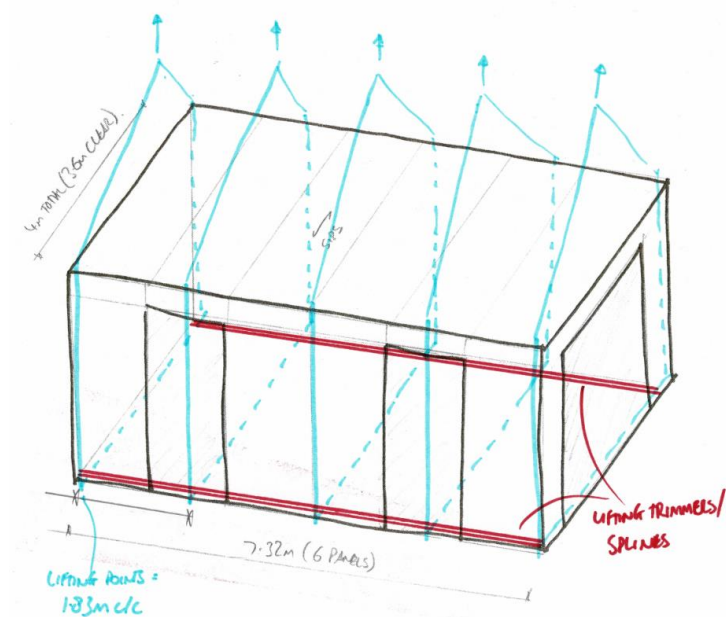
SECTION 4 – LIFTING REQUIREMENTS

It is proposed that the units are to be lifted in to position by crane, thus the units must be able to be lifted fully assembled.

There are two main requirements to achieve this;

- a) the floor structure being able to adequately support the weight of the assembled structure by spanning between the proposed lifting positions.
- b) the structure being able to resist any racking.

a) To support the weight of the assembled structure it is proposed that edge splines are installed at each end of the floor structure. The floor trimmers are redundant in the static condition when the modules are sat on to the screw pile caps, however when the module(s) are required to be lifted then it is proposed that straps are routed below the modules at predetermined centres to support the loads.



The calculations within section 5.1 confirm that 2No 44x170 C24 joists are proposed at each long side, i.e. below the long side walls to span between the lifting strap locations. These are to be pairs of 3.66m long timbers butt jointed with enhanced screws at 150mm c/c for 1.2m either side of the joint through the OSB sheets to act as a 'splice' to the nominal shear & moment forced during lifting.

The lifting straps are to be at maximum 1.83m centres, i.e. 5No straps in total.

SECTION 5 – APPENDICES

5.1 – SUPPORTING STRUCTURAL CALCULATIONS

5.2 – ARCHITECTURAL DRAWINGS

CALCULATION SHEET

CREATIVE SIDE STRUCTURES Ltd
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Brighton, BN1 1AL

Creative
SIDE
STRUCTURES
CONSULTING CIVIL AND
STRUCTURAL ENGINEER

Project: BROOK GARDENS - FORMOLOGY

Part of Structure: LIFTING TRIMMERS.

Project No: 20-061

Date: 16/10/2020

Engineer: P.W.

Sheet No:

LIFTING TRIMMERS

THE LIFTING TRIMMERS SPAN BETWEEN THE LIFTING STRAPS AT 1.83m C/C
& SUPPORT THE SELF-WEIGHT OF THE WALLS & ROOF.

LOADS AND LIFTING TRIMMERS:

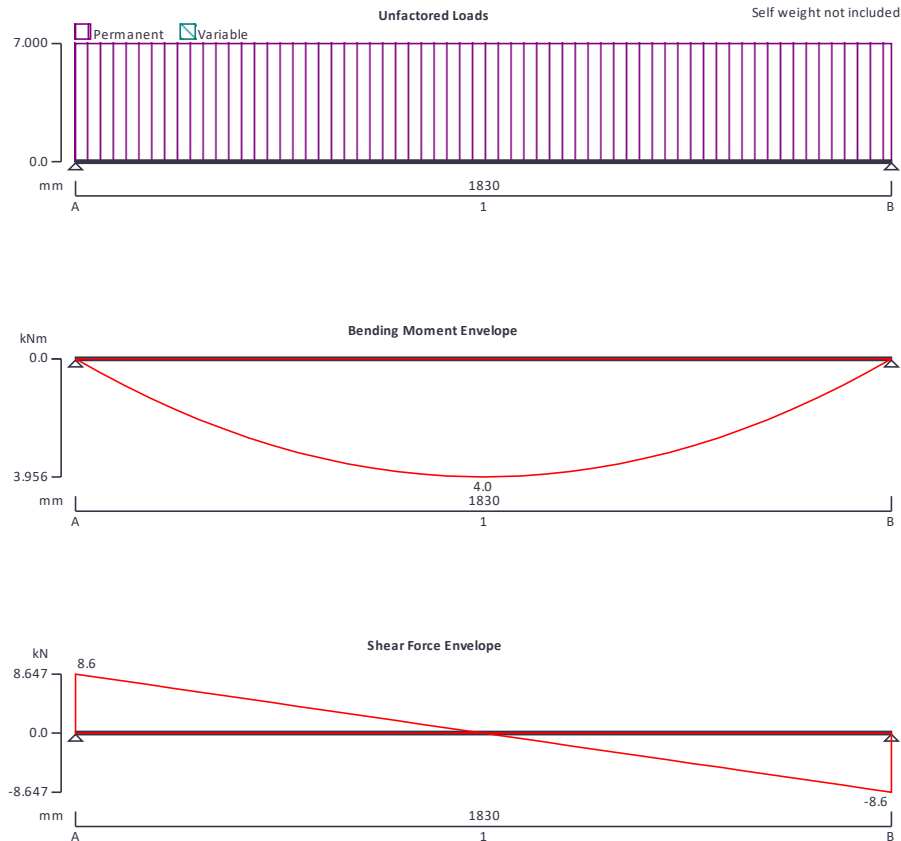
$$\begin{aligned} \text{Grav.} &= \text{Roof} = \frac{4.0\text{m}}{2} \times 1.00 \text{ kN/m}^2 = 2.00 \text{ kN/m} \\ &\text{Plan WALL} = 3.0\text{m} \times 1.00 \text{ kN/m}^2 = 3.00 \text{ kN/m} \\ &\text{Plan GF} = \frac{4.0\text{m}}{2} \times 1.00 \text{ kN/m}^2 = \frac{2.00 \text{ kN/m}}{7.00 \text{ kN/m}} \end{aligned}$$

USE 2NO 44-170 C24 JOISTS AS SPRINGS IN SIPS PANELS.

TIMBER BEAM ANALYSIS & DESIGN TO EN1995-1-1:2004

In accordance with EN1995-1-1:2004 + A2:2014 and Corrigendum No.1 and the UK National Annex incorporating National Amendment No.1

Tedds calculation version 1.7.03



Applied loading

Beam loads

Permanent full UDL 7.000 kN/m

Analysis results

Design moment

$M = 3.956 \text{ kNm}$

Design shear

$F = 8.647 \text{ kN}$

Total load on member

$W_{\text{tot}} = 17.294 \text{ kN}$

Reactions at support A

$R_{A_{\text{max}}} = 8.647 \text{ kN}$

$R_{A_{\text{min}}} = 8.647 \text{ kN}$

Unfactored permanent load reaction at support A

$R_{A_{\text{Permanent}}} = 6.405 \text{ kN}$

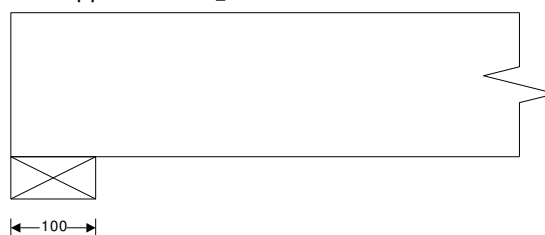
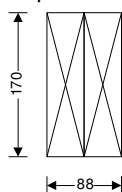
Reactions at support B

$R_{B_{\text{max}}} = 8.647 \text{ kN}$

$R_{B_{\text{min}}} = 8.647 \text{ kN}$

Unfactored permanent load reaction at support B

$R_{B_{\text{Permanent}}} = 6.405 \text{ kN}$



Project FORMOLOGY - BROOK GARDENS				Job no. 20-061	
Calcs for LIFTING TRIMMERS				Start page no./Revision 2	
Calcs by PW	Calcs date 16/10/2020				

Timber section details

Breadth of section	$b = 44$ mm	Depth of section	$h = 170$ mm
Number of sections	$N = 2$	Breadth of member	$b_b = 88$ mm
Timber strength class	C24		

Member details

Service class of timber	1	Load duration	Medium-term
Length of span	$L_{s1} = 1830$ mm		
Length of bearing	$L_b = 100$ mm		

Compression perpendicular to grain - cl.6.1.4

Design compressive stress	$\sigma_{c,90,d} = 0.983$ N/mm ²	Design compressive strength	$f_{c,90,d} = 1.538$ N/mm ²
PASS - Design compressive strength exceeds design compressive stress at bearing			

Bending - cl 6.1.6

Design bending stress	$\sigma_{m,d} = 9.333$ N/mm ²	Design bending strength	$f_{m,d} = 14.769$ N/mm ²
PASS - Design bending strength exceeds design bending stress			

Shear - cl.6.1.7

Applied shear stress	$\tau_d = 1.294$ N/mm ²	Permissible shear stress	$f_{v,d} = 2.462$ N/mm ²
PASS - Design shear strength exceeds design shear stress			

Deflection - cl.7.2

Deflection limit	$\delta_{lim} = 8.235$ mm	Total final deflection	$\delta_{fin} = 4.672$ mm
PASS - Total final deflection is less than the deflection limit			