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Consulting Structural & Civil Engineers

STRUCTURAL CALCULATIONS

PROJECT	Annex Lift
PROJECT No.	23731
CLIENT	
DATE	February 2017
NOTES	Design of temporary lifting beams to be installed under an annex structure to enable safe lifting for transportation.
BY	*JG Smith*

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LOADING (kN/m²) - dead load only considered

Roof	Concrete tiles	0.8	(worst)
	Battens	.03	
	on slope	.83	(22½°)
	on plan	.90	
	Trussed rafters	.20	
	Ceiling	.15	
	Services (norm)	.05	
	Insulation	.03	
		1.48	say 1.5
Floor	Boards	.10	
	Joists	.15	
	Insulation	.05	
	"Under" board	.10	
	Partitions (norm)	.50	
		.90	

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Walls	Cedral panels	.20
	Studs	.15
	Insulation	.05
	Plasterboard	.2
		.60

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Lifting beams designed to support loads at foundation positions. Refer to plan for references - loads in kN

Position A

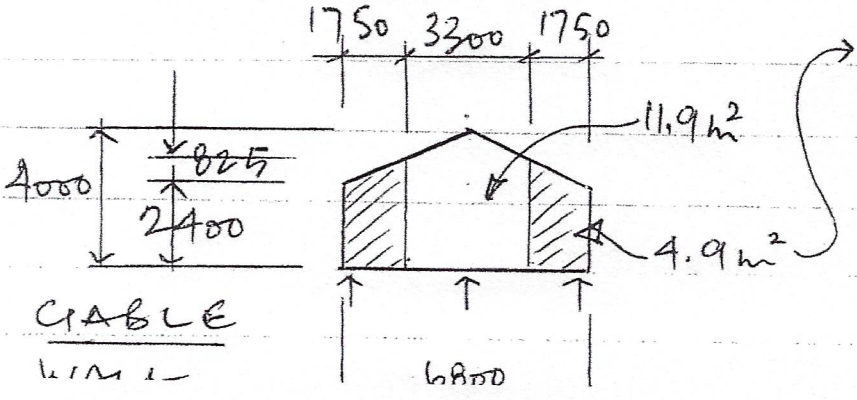
3.4 x 2.3m	roof	11.7
1.65 x 2.3m	floor	3.4
2.3 x 2.4m	wall	3.3
		18.4

Position B

3.3 x 2.3m	floor	6.8

Position C

3.4 x 1.15m	roof	5.9
1.65 x 1.15m	floor	1.7
1.15 x 2.4m	side wall	1.7
		2.9
		12.2



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Position D

3.3 x 1.15 floor — 3.4

11.9 m² gable wall — 7.1

10.5

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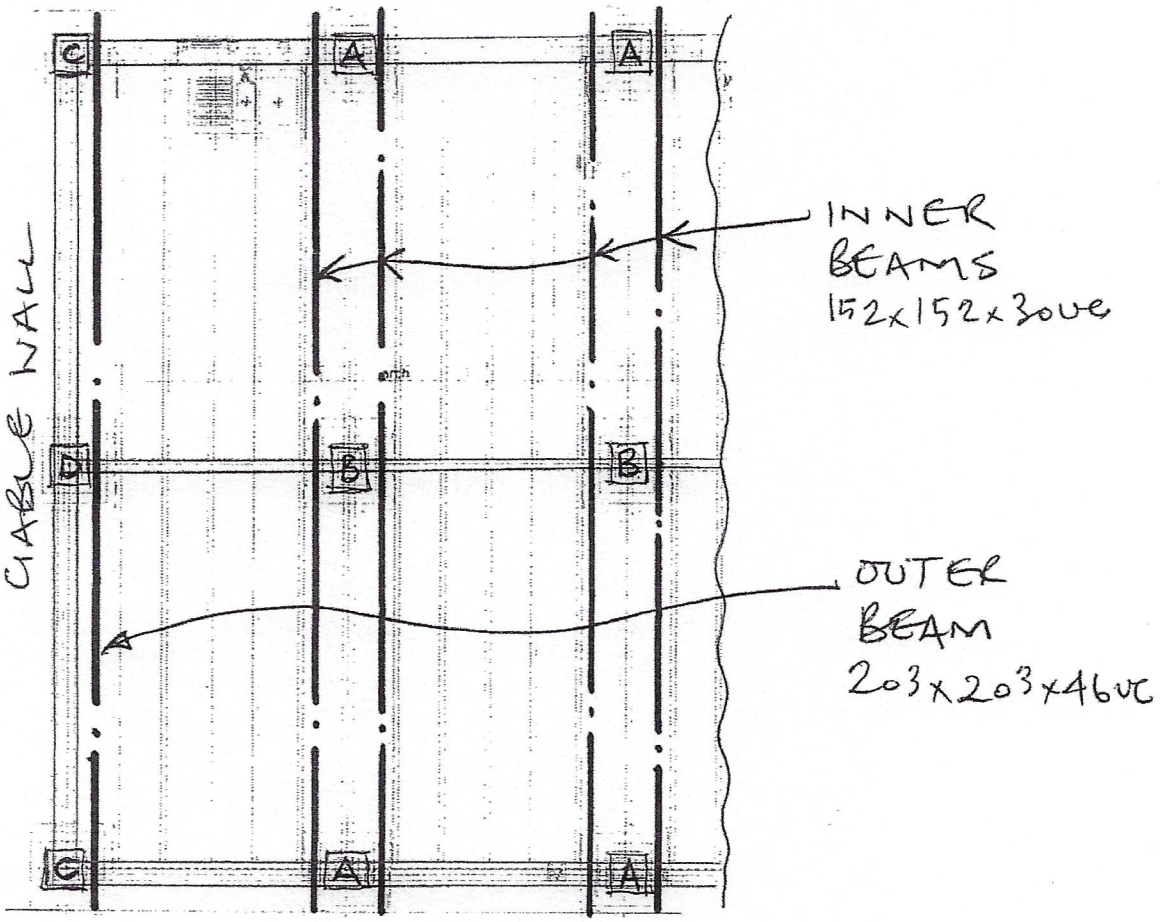
Position lifting beams under the annex next to foundation positions — on inner line of support use a beam either side of the foundation connection point, on outer line of support position just inside the line of the wall:



PART PLAN NTS.

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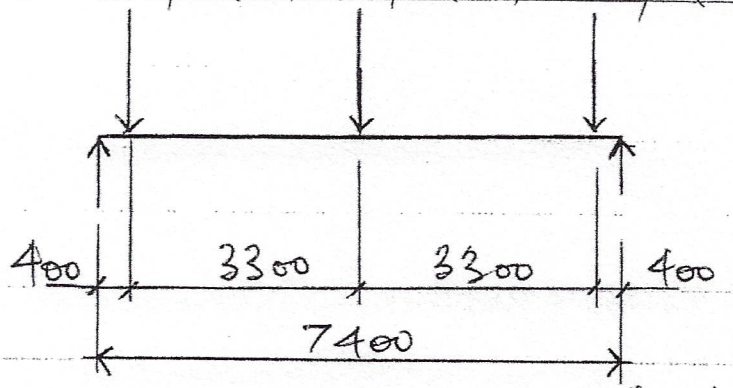
Loads onto lifting beams (kN):

12.2 (14.6) 10.5 (12.6) 12.2 (14.6) OUTER BEAM
18.4/2 (11.0) 6.8/2 (4.1) 18.4/2 (11.0) INNER BEAM



Values in parentheses include 20% for dynamic effect

See overleaf.

Outer beams 203 x 203 x 46UC

Inner beams 152 x 152 x 30UC in pairs.

Beam reactions for crane lifting including 20% allowance for dynamic effect.

Inner beams	13 kN
Outer beams	21 kN

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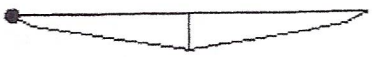
OUTER BEAM

Loads described as "live" for analysis but γ = 1.4 used for design

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.4 L1

L1 PY -014.600 0.400 (kN,m)
L1 PY -012.600 3.700 (kN,m)
L1 PY -014.600 7.000 (kN,m)



Member Forces in Load Case 1 and Maximum Deflection from Load Case 2						
Level No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
1	1	0.000C	31.603	0.000	45.144	15.601
	2	0.000C	-31.603	0.000	@ 3.700	@ 3.700

Classification and Properties (BS 5950: 2000)

Section (46.1 kg/m)	203x203 UC 46 [Grade 43]		
Class = Fn(b/T,d/t,py,F,Mx,My)	9.25, 22.33, 275, 0, 45.14, 0	(Axial: Non-Slender)	Compact
Auto Design Load Cases	1		

Moment Capacity Check Mc

Fv/Pv	8.82 / 241.402 =	0.037	Low Shear
Mc = py.Sxx≤1.2 py.Zxx	275 x 497.4≤1.2 x 275 x 449.87 =	136.785 kN.m	
MA/Mc	45.143 / 136.785 =	0.330	OK

Equivalent Uniform Moment Factor mLT

$m_{LT}=0.2+(.15M_2+.5M_3+.15M_4)/M_{max}$	0.2+(.15x28+.5x45+.15x28)/45 = 0.44	0.884	Table 18

Lateral Buckling Check Mb

Le = 1.00 L	1 x 7.4 =	7.4 m	
λ = Le/ryy	7.4 / 5.14	143.97	OK
v = Fn (x,Le,ryy,λ)	17.71, 7.4, 5.14, 143.97	0.694	Table 19
λ_{LT}= u.v.λ.√β_w	0.847 x 0.694 x 143.97 √ 1	84.65	
pb = Fn (py,λ_{LT})	275, 84.65	154.6 N/mm²	Table 16
Mb = Sxx.pb ≤ Mc	497.4 x 154.6 ≤ 136.785 =	76.900 kN.m	
MA/(Mb/m_{LT})	45.144 / (76.9 / 0.884)	0.519	OK

Deflection Check - Load Case 2

δ ≤ Span/360	15.6 ≤ 7400 / 360	15.6 mm	OK

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INNER BEAM

Loads described as "live" for analysis but γ = 1.4 used for design

Member Loading and Member Forces

Loading Combination : 1 UT + 1.4 D1 + 1.4 L1

```
L1 PY   -011.000 0.400      ( kN,m )
L1 PY   -004.100 3.700      ( kN,m )
L1 PY   -011.000 7.000      ( kN,m )
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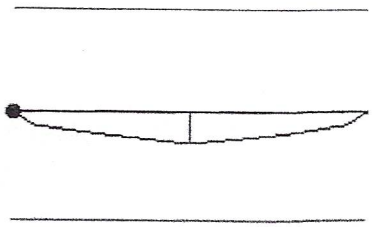

Member Forces in Load Case 1 and Maximum Deflection from Load Case 2

Level No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
1	1	0.000C	19.796	0.000	19.602	18.020
	2	0.000C	-19.796	0.000	@ 3.700	@ 3.700

Classification and Properties (BS 5950: 2000)

Section (30.03 kg/m)	152x152 UC 30 [Grade 43]		
Class = Fn(b/T,d/t,py,F,Mx,My)	8.13, 19.02, 275, 0, 19.6, 0	(Axial: Non-Slender)	Plastic
Auto Design Load Cases	1		

Moment Capacity Check Mc

Fv/Pv	2.87 / 169.026 =	0.017	Low Shear
Mc = py.Sxx≤1.2 py.Zxx	275 x 247.7≤1.2 x 275 x 221.94 =	68.118 kN.m	
MA/Mc	19.6 / 68.118 =	0.288	OK

Equivalent Uniform Moment Factor mLT

$m_{LT}=0.2+(.15M_2+.5M_3+.15M_4)/M_{max}$	0.2+(.15x14+.5x20+.15x14)/20 = 0.44	0.908	Table 18

Lateral Buckling Check Mb

Le = 1.00 L	1 x 7.4 =	7.4 m	
λ = Le/ryy	7.4 / 3.83	193.21	OK
v = Fn (x,Le,ryy,λ)	15.946, 7.4, 3.83, 193.21	0.588	Table 19
λ_{LT}= u.v.λ.√β_w	0.849 x 0.588 x 193.21 √ 1	96.53	
pb = Fn (py,λ_{LT})	275, 96.53	131.05 N/mm²	Table 16
Mb = Sxx.pb ≤ Mc	247.7 x 131.05 ≤ 68.118 =	32.461 kN.m	
MA/(Mb/m_{LT})	19.6 / (32.461 / 0.908)	0.548	OK

Deflection Check - Load Case 2

δ ≤ Span/360	18.02 ≤ 7400 / 360	18.02 mm	OK

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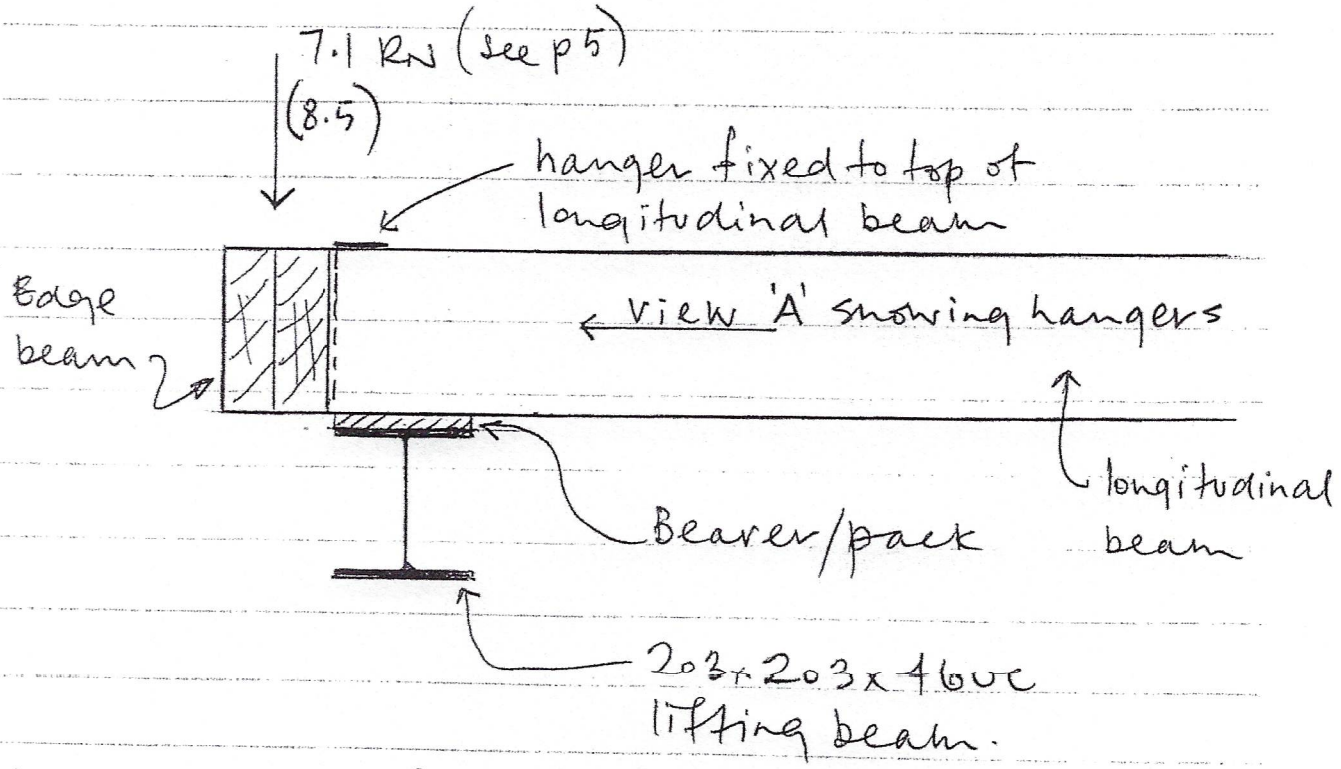
Inner beams will carry loads from the longitudinal timber beams ∴ downward forces directly onto the lifting beams.
The outer beams will transfer loading from the gable walls onto the ends of the longitudinal beams ∴ a suitable connection must be made between the timber beams:

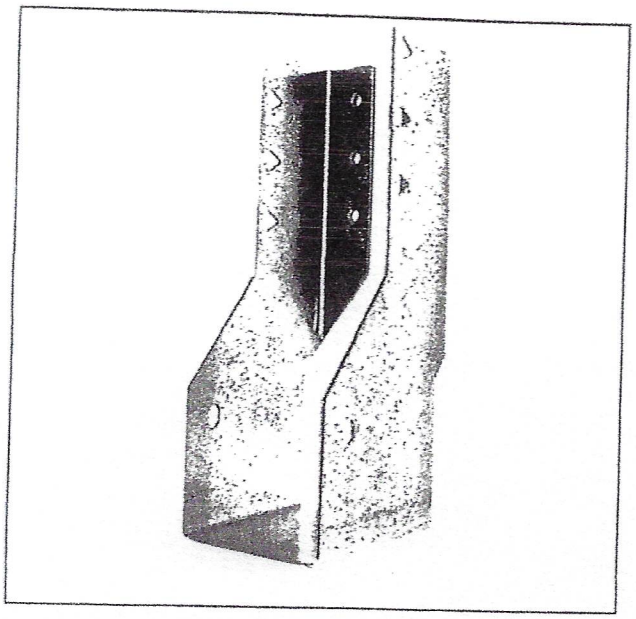


Use Simpson Strong-Tie IUC hangers - see table overleaf - for joists at least 50mm wide, 2 no hangers have SWL > 8.5 Rd

Technical data sheet

IUC - FACE FIX CONCEALED FLANGE HANGER

SIMPSON Strong-Tie



IUC is a face fix concealed flange hanger for both I-joists and solid timber sections.

UK-DoP-e04/0042, ETA-04/0042

FEATURES

Material

Pre-galvanised milld steel.

* Suitable hangers - for very short term 4.88×1.75×2 (2 hangers) = 17.1 kN.

TECHNICAL DATA

IUC Installed with 3.75x30mm Nails - Safe Working Load

References	Dimensions			Fasteners				Safe Working Loads [kN]		
	A	B	C	Header		Joist		C16 & I-Joist Header	LSL or LVL Header	
				Qty	Specification	Qty	Specification	Long Term Download	Long Term Download	
IUC142/40	40	142	51	6	3.75 x 30	2	3.75 x 30	2.09	2.44	
IUC192/40	40	192	51	10	3.75 x 30	2	3.75 x 30	3.48	4.06	
IUC217/40	40	217	51	12	3.75 x 30	2	3.75 x 30	4.17	4.88	
IUC142/47	47	142	51	6	3.75 x 30	2	3.75 x 30	2.09	2.44	
IUC192/47	47	192	51	10	3.75 x 30	2	3.75 x 30	3.48	4.06	
IUC217/47	47	217	51	12	3.75 x 30	2	3.75 x 30	4.17	4.88	
IUC192/50	50	192	51	10	3.75 x 30	2	3.75 x 30	3.48	4.06	
IUC217/50	50	217	51	12	3.75 x 30	2	3.75 x 30	4.17	4.88	*
IUC192/53	53	192	51	10	3.75 x 30	2	3.75 x 30	3.48	4.06	
IUC217/53	53	217	51	12	3.75 x 30	2	3.75 x 30	4.17	4.88	*
IUC192/61	61	192	51	10	3.75 x 30	2	3.75 x 30	3.48	4.06	
IUC217/61	61	217	51	12	3.75 x 30	2	3.75 x 30	4.17	4.88	*
IUC192/66	66	192	51	10	3.75 x 30	2	3.75 x 30	3.48	4.06	
IUC217/66	66	217	51	12	3.75 x 30	2	3.75 x 30	4.17	4.88	*
IUC192/72	72	192	51	10	3.75 x 30	2	3.75 x 30	3.48	4.06	
IUC217/72	72	217	51	12	3.75 x 30	2	3.75 x 30	4.17	4.88	*

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Project
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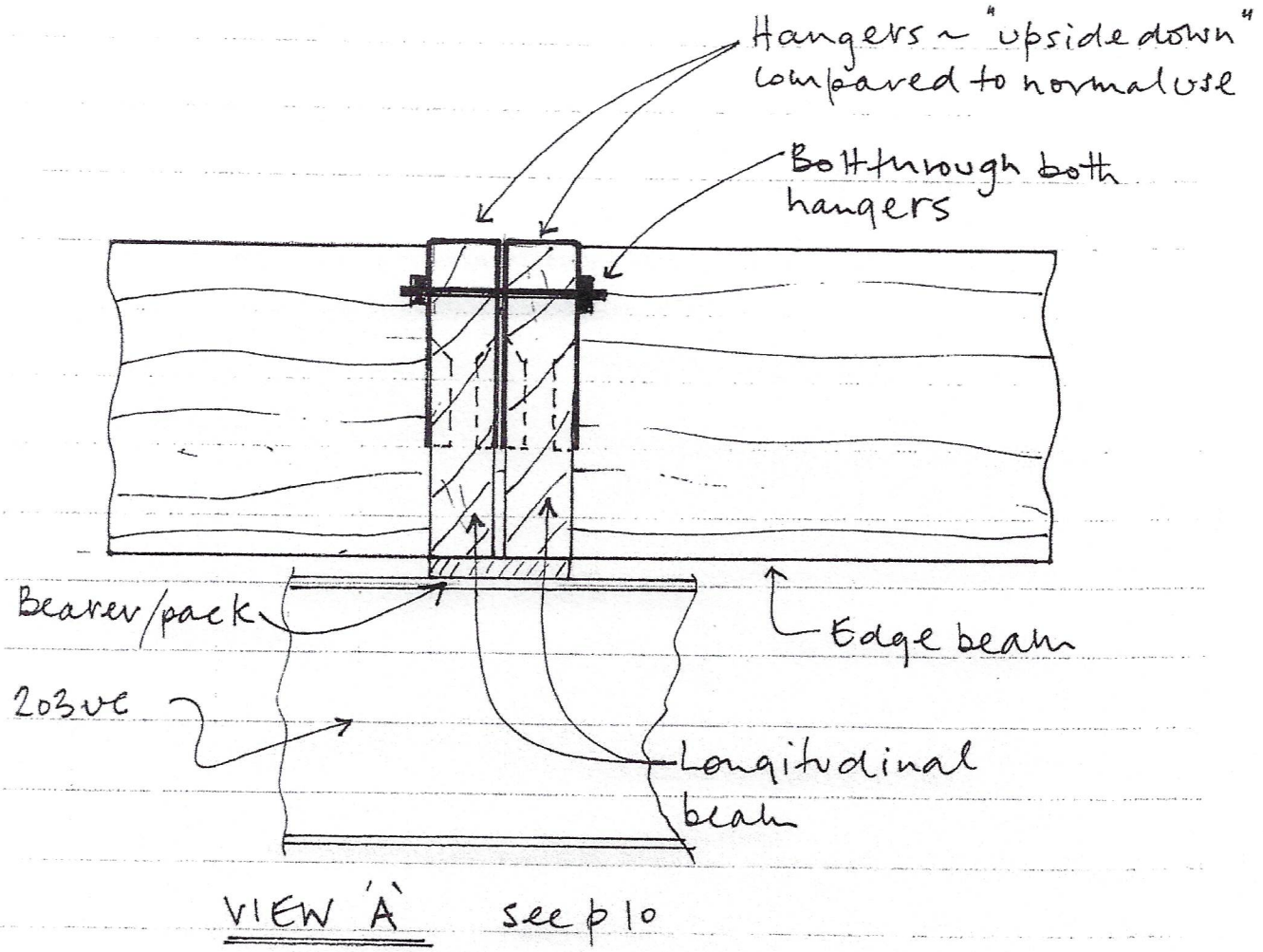


VIEW 'A' see p 10

Appendix B – Construction Methodolgy

The photos show the following;

A. Shows section 1 of floor laid on swift plinth foundation system

B. Shows sections 1 & 2 of floor on central swift plinth

C. Shows a concrete pad foundation system

D. Shows the external walls for section 1 & 2 and the roofing spars for section 1

E. Shows the roof with section 1 fitted with breather membrane and latts, section 2 roofing spars only. Shows the pitched roof with breather membrane and plats, with central divide between section 1 & 2

F. Shows the roof tiled with the divide used between sections 1 & 2

G. Shows the 2 sections of floor deck, section 1 complete, section 2 to be insulated and board covered

H. Shows a close up of the external wall cassettes for sections 1 & 2, with a coach bolt loosely inserted ready for the final structural act of joining the 2 sections together

I. Shows section 1 & 2 wall frames ready to be jointed as the final structural act of bring the 2 sections together

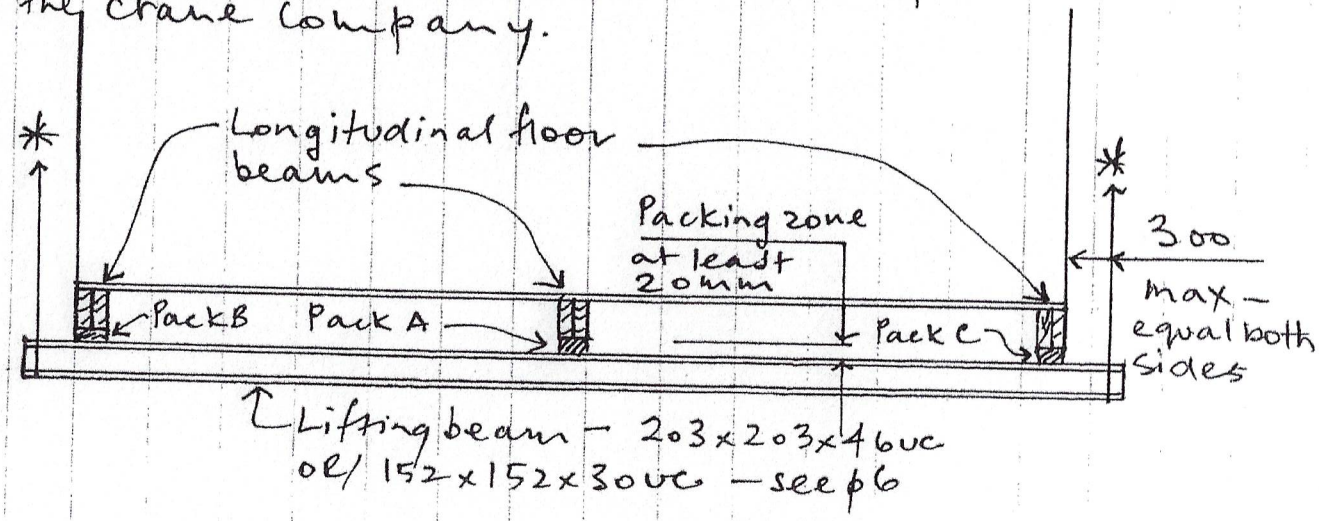
J. Shows a cross section photo through the 2 sections of roof joists, external wall cassettes and floor

K. Shows the water pipes with connecter joints splitting the water pipes between sections 1 & 2

L. Shows the electrical wiring with connectors splitting the electrics between sections 1 & 2

'ack A to be fixed to top flange of steel lifting beam. Beams to be passed under the annex so pack A is located directly under central longitudinal floor beam. Crane to apply slight tension to ensure pack A is bearing correctly. Packs B and C then to be installed prior to lifting the annex.

* Denotes lifting straps/chains fixed to the lifting beams below the annex floor and supported on a suitable steel spreader beam supplied by the crane company.



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Project: ANNEX LIFT

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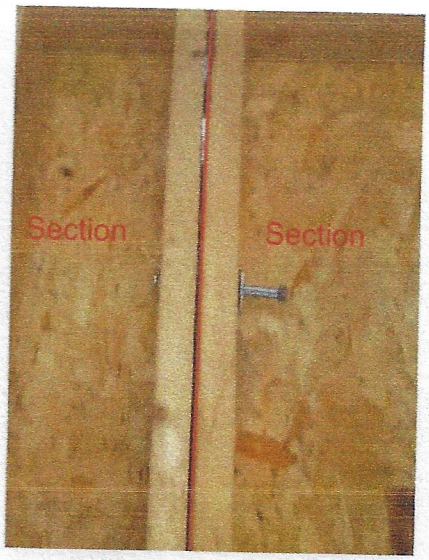
Sheet 14
Date 02/2017

Application for a certificate of lawfulness Under the Caravan Sites Act 1968

This is ADDENDUM 1 to the application submitted

Photographic evidence Cont'd

G



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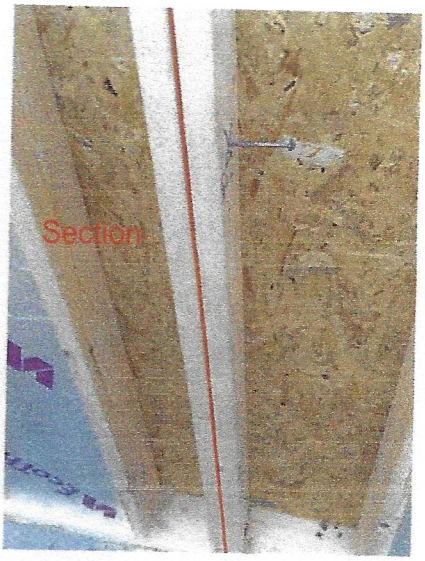

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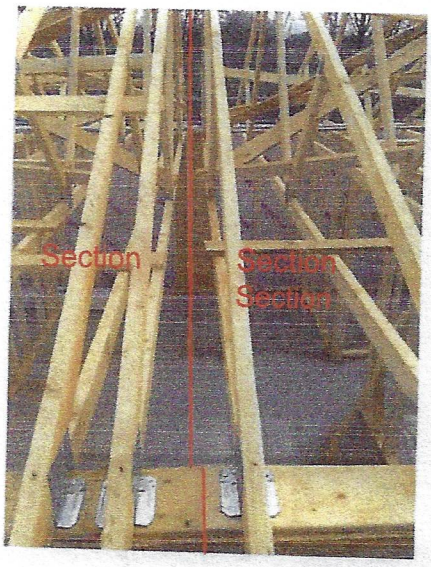

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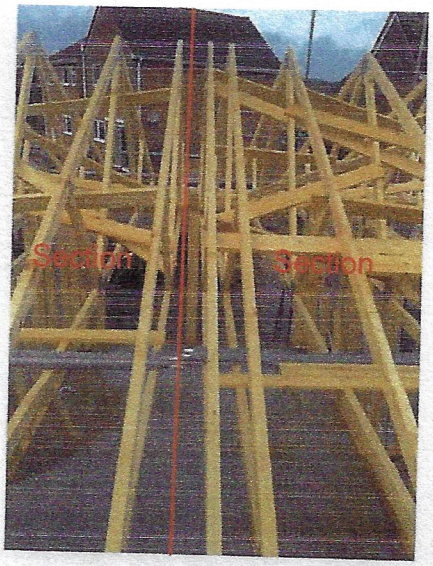

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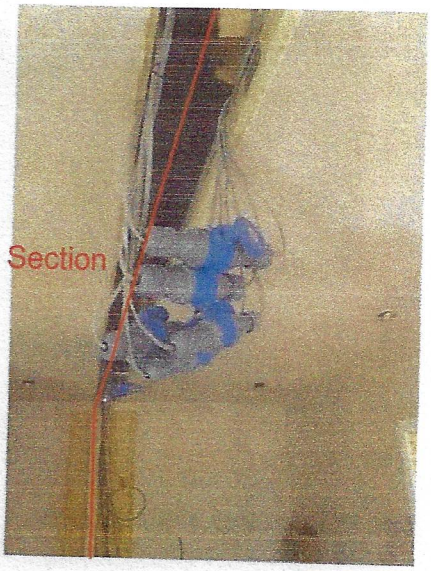

L

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Photographic evidence