

STRUCTURAL REPORT

With respect to the proposed development and conversion of the existing
single storey barns

at

DEADMAN'S HILL, SANDON SG9 0RH

22nd April 2025

*Written by : Karen Nolloth MICE MStructE
Cornerstone Consulting Engineers Ltd*



PROPERTY DESCRIPTION

The barns at Deadman's Hill, Sandon comprise 2 linked structures. The site is accessed via Deadman's Hill and set back from the road by approximately 13m to the nearest gable end. The 2 buildings form an L shape with a concrete slab to the yard space to the front.

For the purposes of this report the terms Left hand, Right hand, front and back are as viewed from the concrete yard looking NNW.

LEFT HAND BARN 1

Barn 1 comprises single storey masonry walls to the Lefthand and Righthand side walls and to the rear (the RH wall is partially attached to Barn 2), with a double door opening to the front. The plan size of the barn is approximately 25x7 metres. The floor comprises a concrete slab. The roof covering has been removed exposing steel beams spanning between the side walls (understood to have previously supported a monopitch lightweight roof). The beams are formed from steel channels with a varying profile reducing at the end bearings.

At the rear there is a short section of duopitch roof framing as a continuation of the roof to Barn 1).

The masonry walls are founded on shallow foundations stepped to suit the external ground levels to the RH side. The foundations are 500mm width founded in chalky, gravelly clay.

RIGHT HAND BARN 2

Barn 2 comprises single storey masonry walls to the rear, left hand gable and right hand end (attached to Barn 2). The front is open, it is not known if this wall was originally clad. The plan size of the barn is approximately 19x5 metres. The floor comprises a concrete slab. The roof covering has been removed exposing steel roof trusses and purlins with the trusses spanning between the rear wall and steel circular posts to the front. It is understood the steel framing previously supported lightweight cladding.

SITE GEOLOGY

British Geological records indicate clay with flints overlying sand and chalk.

The site is flat with a slight slope from the access road up to the rear of the barns.

PROPOSED DEVELOPMENT

The proposed development comprises conversion of the barns to form 2 single storey dwellings. It is understood that the proposal is to be submitted for Planning approval as a class Q conversion from agricultural to dwelling house.

STRUCTURAL CONDITION

An inspection was carried out on 2nd April 2025. The steel elements were inspected from ground floor level and measurements taken to determine the framing sections. Masonry elements were inspected all round. Photos of the structural condition are appended.

In summary:

Steel sections

There is rusting to all elements but generally the steel members are robust and can be cleaned and retained. There are a few areas where repairs will be required, notably to the circular posts to the front elevation of Barn 2.

Masonry

The masonry comprises a mixture of flettons and softer red bricks. The walls are stable but some repairs will be needed to insert vertical movement joints to long panels of masonry to the rear and LH flank walls. There is evidence of root damage to the rear wall requiring crack repairs and maintenance of the trees to the rear elevation.

STRUCTURAL ASSESSMENT

The conversion proposals comprise the retention of the major structural elements to the barns (load bearing external walls, roof structural framing and floor slabs) with the additional of roof and wall coverings/ cladding to comply with current Building Regulations with respect to insulation, weather resistance and ventilation.

The roof structures have been assessed with respect to proposed new roof loading. Calculations are appended. In conclusion, the roof structures are adequate to support new roof cladding as follows:

Barn 1

147mm SIPS panels to span between the existing steel beams with insulation and boarding and a lightweight membrane finish. SIPS panels and timber framing to infill the front elevation

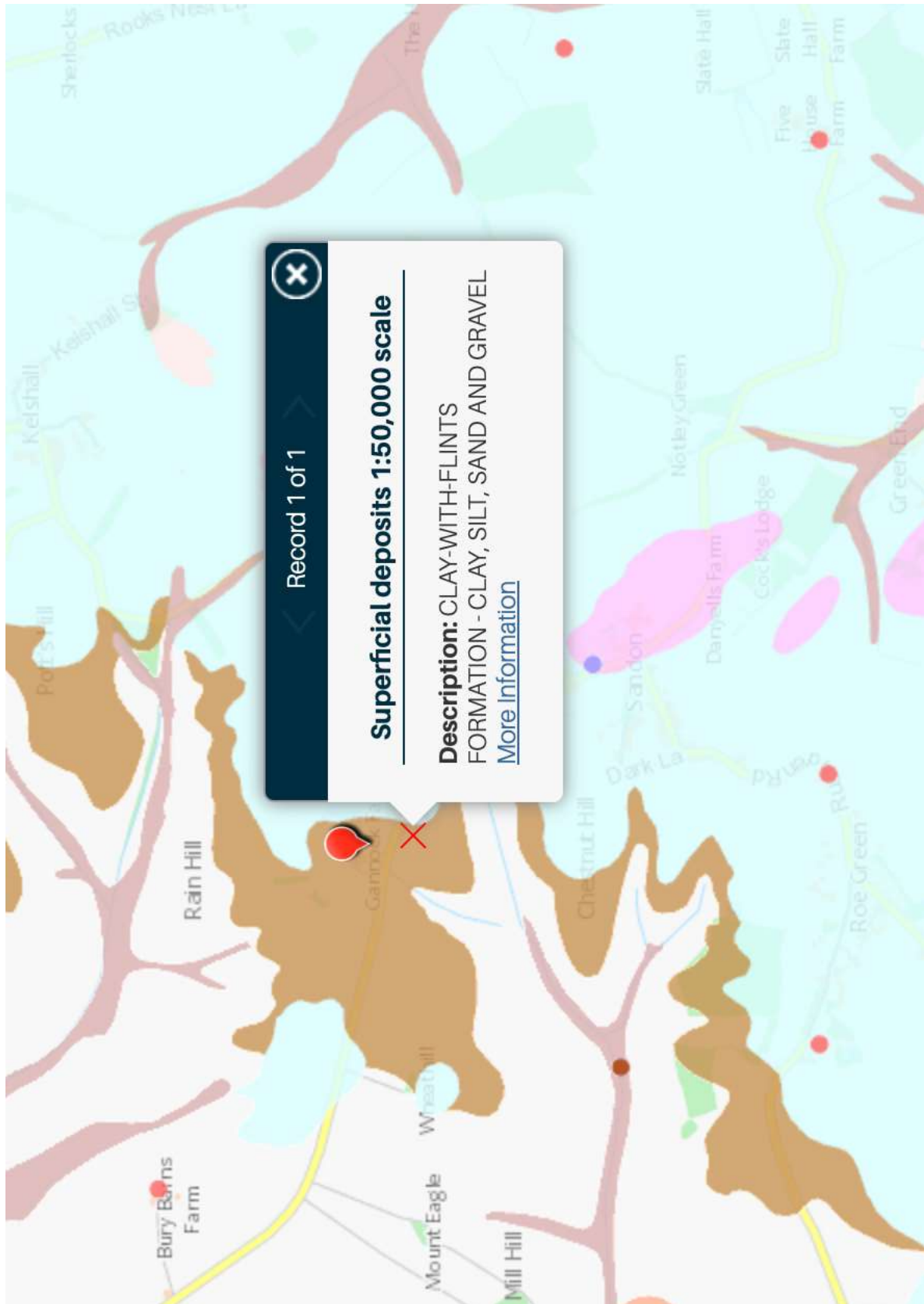
Barn 2

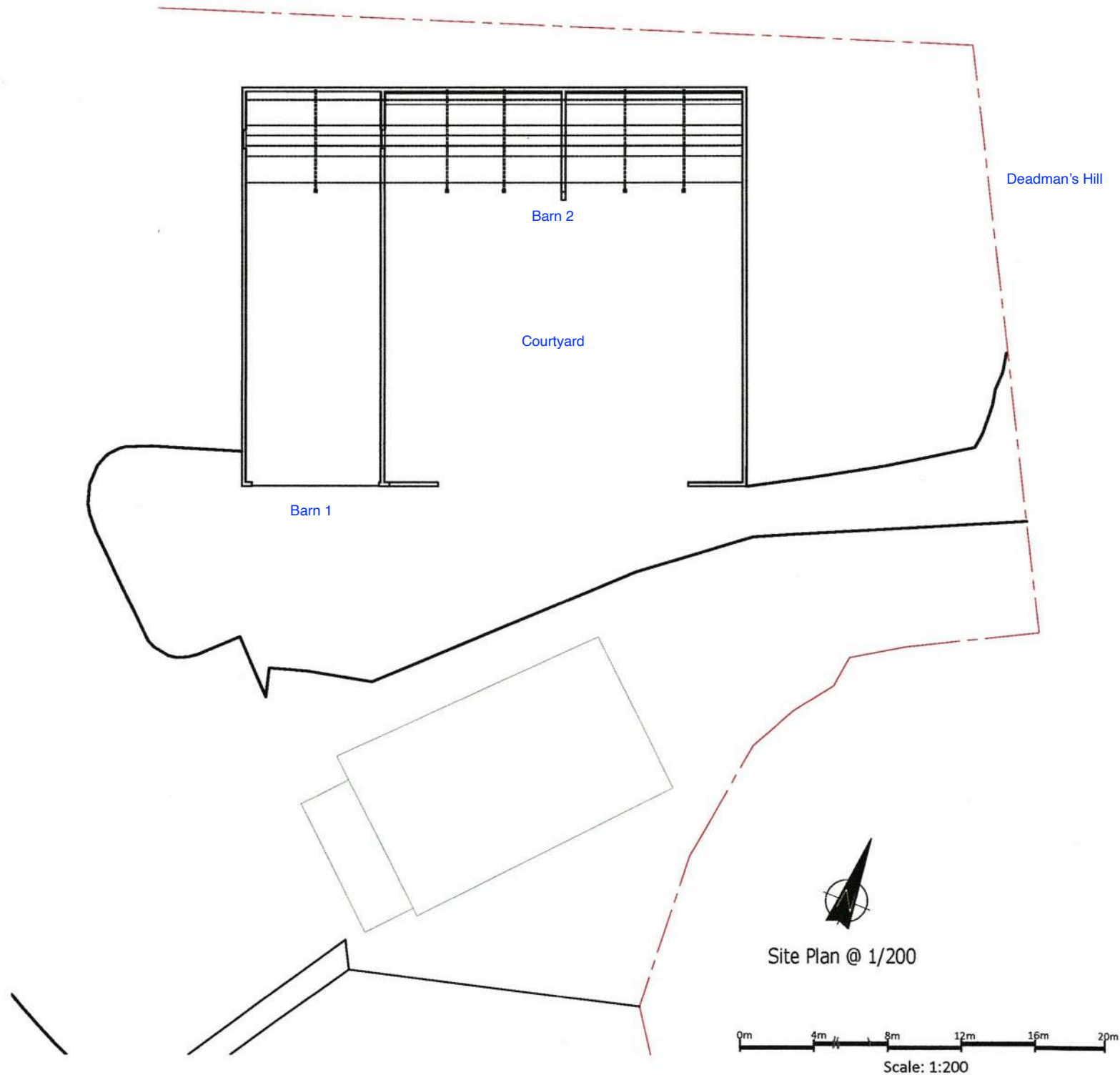
147mm SIPS panels to for the duo pitch roof spanning onto a new timber ridge beam and onto the rear masonry wall and new SIPS walls to the front. Roof finishes to comprise slates on battens + membrane. SIPS panels and timber framing to infill the front elevation.

APPENDICES

Site plans
Site geology
Site Photographs (annotated)
Roof framing calculations

Deadman's Hill- Sandon Geological record





MSAD

Notes

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BUILDING REGULATIONS

All work is to comply with the relevant Building Regulations and all statutory notices are to be given to the chosen Building Control at the appropriate stage of the project.

CDM

All design and construction is to be in accordance with the Construction, Design and Management Regulation 2015.

DESIGN CRITERIA

All of the contractors' works on site are to comply with and meet the approval of the relevant British Standards and the Local Authority's Design Guides, including Building Control and Planning Departments.

DIMENSIONS

Please note, all dimensions on the drawing are shown in millimeters, unless otherwise stated and should be checked prior to any works on site. It is the responsibility of the client or appointed contractor to notify the designers of any discrepancies of the walls and general layouts. No construction dimensions are to be scaled from the drawing.

MATERIALS

Please note, all the materials specified and the construction details shown, are not to be changed without the full knowledge and prior approval of the agent, as any changes may have a detrimental effect on the designed/required carbon emissions of the structure as designed.

Address: Deadmans Hill
Sandon
Herts SG9 0BH

Drawing Size	Scale	Drawn by
A3	1/200	PH
Job No.	Work Stage	Drawing No.
1081	Survey	01

Rev	Description	Date	Rev	Ch
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Site Plan
As Existing

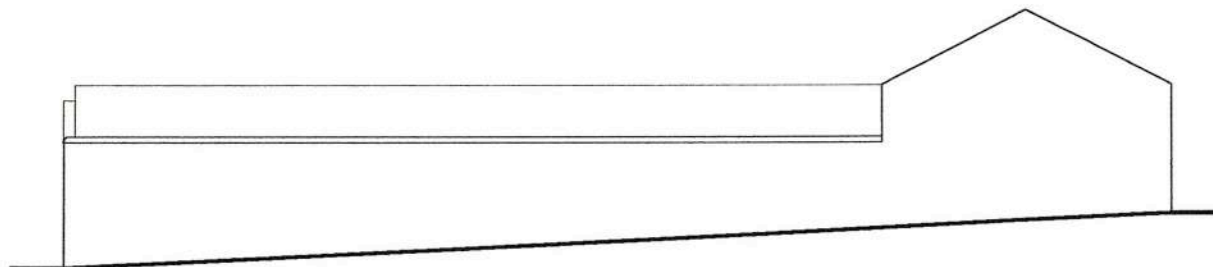
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Tel: 01462 422440

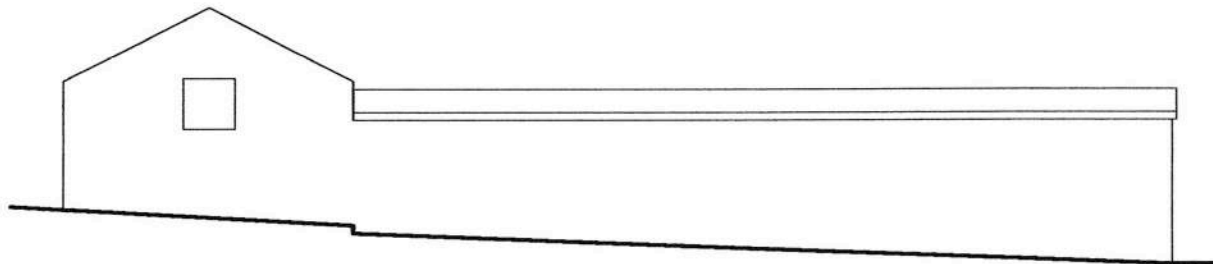
Site Plan @ 1/200

0m 4m 8m 12m 16m 20m

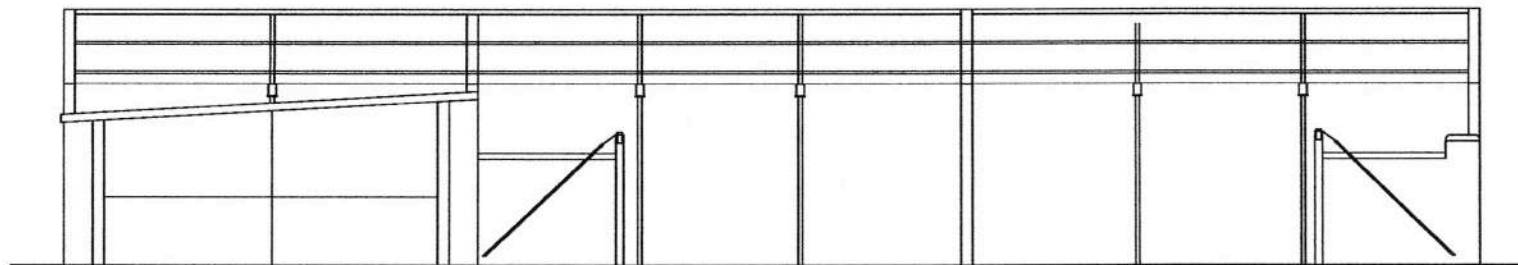
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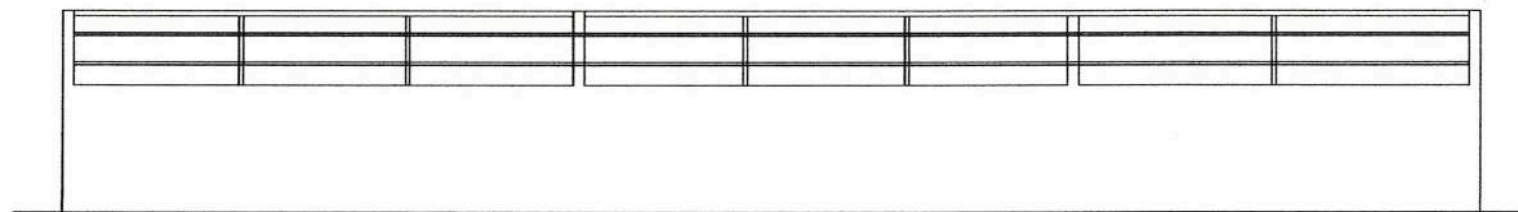
Front Elevation @ 1/100



Rear Elevation @ 1/100



Side Elevation @ 1/100



Side Elevation @ 1/100



Scale: 1:100

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Address: Deadmans Hill
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Drawing Size	Scale	Drawn by
A3	1/100	PH
Job No.	Work Stage	Drawing No.
1081	Survey	02-a

Rev	Description	Date	By	Chk
A	Issued amended	29.10.2021	PH	PH

Elevations
As Existing

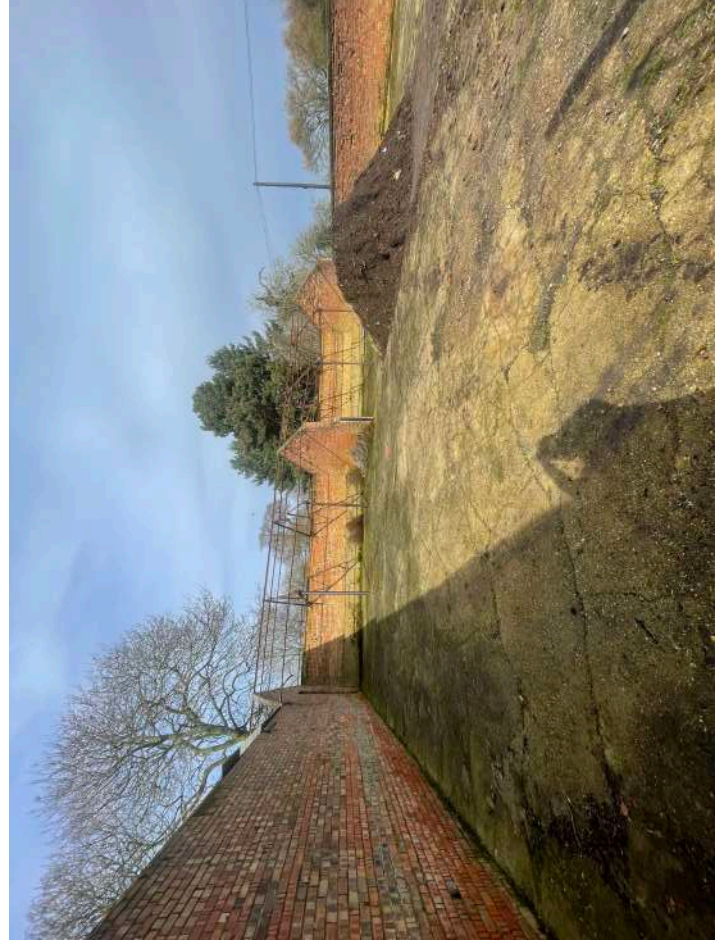
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Deadman's Hill Barns



Access from Deadman's Hill



Courtyard and Barn 2



Courtyard and Barn 1 flank wall



Front view into courtyard



Barn 2 LH flank wall



Barn 2 LH flank wall



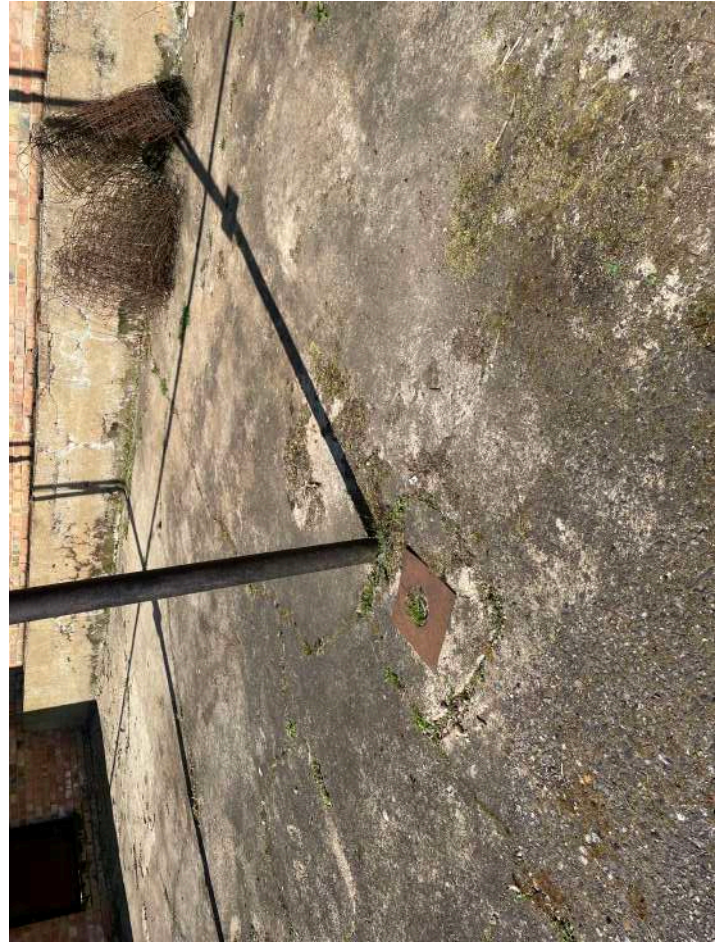
Barn 2



Barn 2



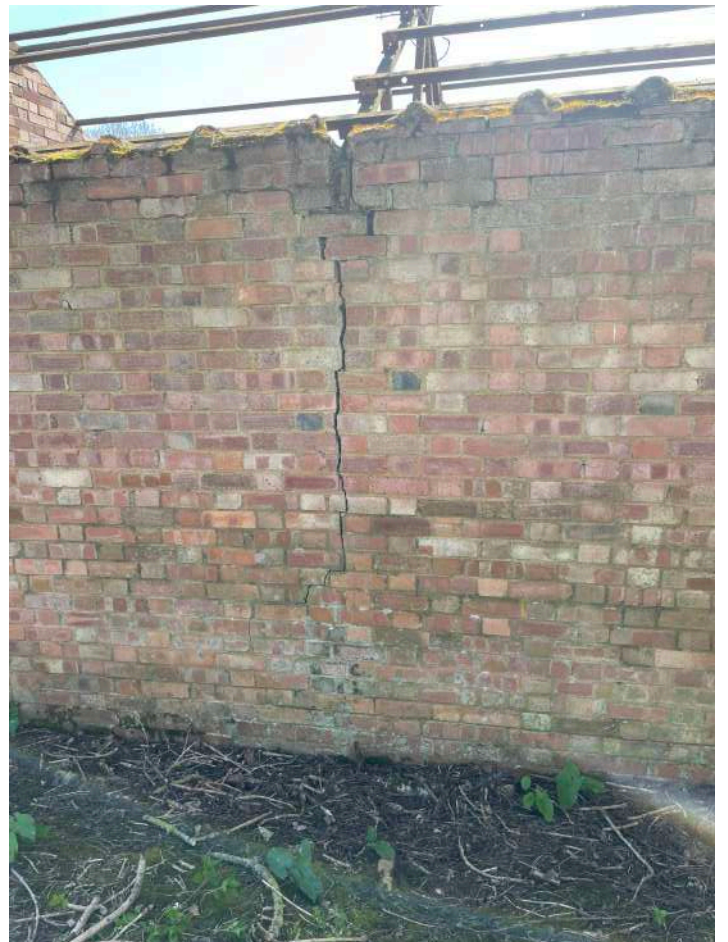
Barn 2



Barn 1 damaged post base



Barn 1 post base



Barn 2 rear wall



Barn 2 rear wall



Barn 1 truss support



Barn 1 trusses



Barn 1 truss post support

STRUCTURAL CALCULATIONS

Deadman's Hill

Roof Assessment

DESCRIPTION

Single storey barn with steel framing to roofs.

Calculation sheets and Drawings

Calculations

Beam design page L/01-03

Cads design printout 01-08

Assumptions

- All beams are designed as simply supported (except portal framing)
- Steelwork assumed mild steel grade 275. Designed to BS 5950 Structural use of steelwork in building: Part 1: 2000
- Timber designed to BS5268: Structural Use of Timber: Part 2: 2002
- Loadings designed to BS6399: Part 1: 1996 Code of practice for dead and imposed loads.

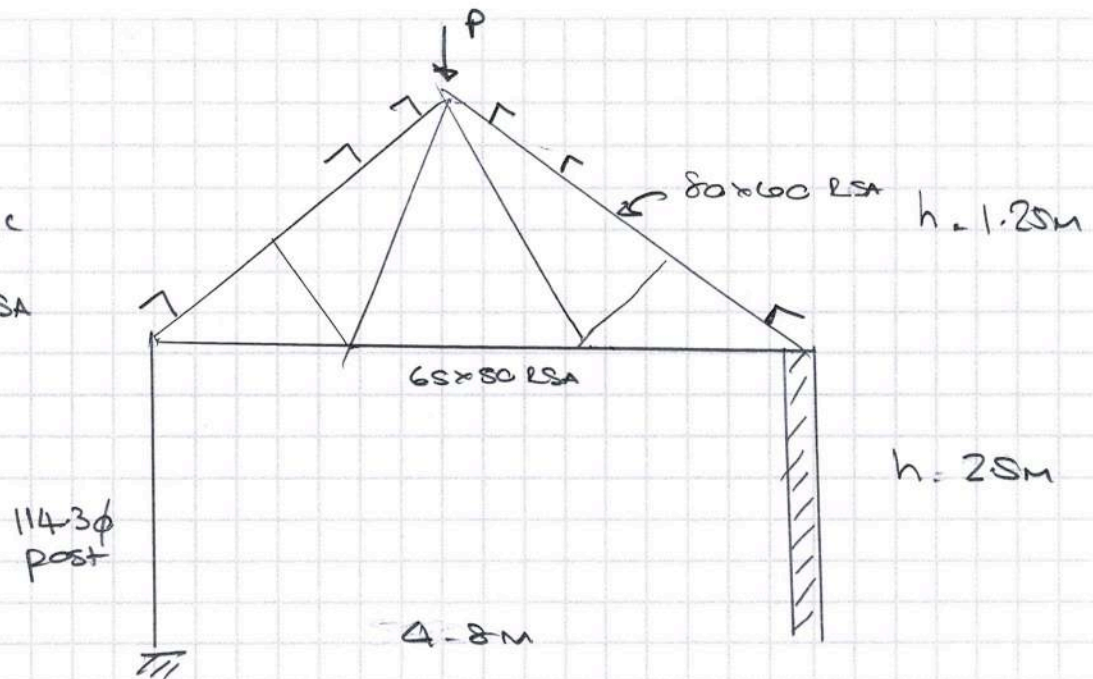
Design calculations utilise CADS SmartEngineer software

Project Title	Project No
DEADMAN'S HILL barn	3041
Date	Sheet No
APRIL 2025	L101

BARN 1

FRAMES @ 3.25m c/c

Purlins 50x50 RSA



$$U = 0.35 \text{ (joists + boarding)} + 0.15 \text{ (ceiling)} + 0.1 \text{ (insulation)} + 0.35 \text{ (slates)} = 0.95 \text{ kJ/m}^2 \text{ on slope}$$

(1.07 kJ/m² in plan)

Snow load = 0.8 kJ/m² Total load = 1.57 kJ/m²

Purlins - span = 3.25 c/c

$$U = 1.57 \times \frac{2.1}{2} = 1.65 \text{ kJ/m}$$

50x50x5 RSA M_{max} = 2.18 kNm $\sigma_b = 740 \text{ N/mm}^2$ } Fail.
 $\Delta \geq 109 \text{ mm}$

SIPS PANKU + SLATE ROOF TO RIDGE BEAM

SIPS ROOF PANKU	0.28
Insulation	0.02
Ceiling	0.12
Services	0.1
Slates	0.35
	0.87 kJ/m ² (0.97 kJ/m ² in plan + 0.8 kJ/m ² snow)

Project Title	Project No
DESIGNING THE ROOF	3041
Date	Sheet No
April 2025	4.02

$$\text{Ridge W} = \frac{(0.97 + 0.5) \times 4.8}{2} = 3.53 \text{ kNm}$$

$$M = 4.65 \text{ kNm}$$

$$2 \text{ No. } 225 \times 50 \text{ RU } \sigma_b = 553 \text{ N/mm}^2$$

$$\Delta = 5.0 \text{ mm } \therefore \text{OK}$$

$$\text{Frame } P = 3.53 \times \frac{3.25}{2} \times 2 = 11.5 \text{ kN}$$

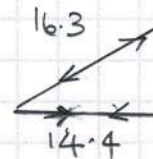
$$W = (0.97 + 0.5) \times 0.5 = 0.73 \text{ kNm nominal}$$

$$\Delta = 1.1 \text{ mm not at ridge}$$

$$M_{\text{max}} = 0.16 \text{ kNm } (80 \times 60 \text{ RSA rafters})$$

$$\sigma_{b_{\text{max}}} = 17.4 \text{ N/mm}^2$$

Eaves connection



6 No. M16 Bolts + gusset plate OK.

CHS POST

$$P = 7.5 \text{ kN SU } (11.5 \text{ kN US})$$

$$114.3 \times 3.2 \text{ CHS}$$

$$\text{Capacity} = 236.3 \text{ kN US OK}$$

Project Title	Project No
DEADMAN'S HILL BASIN	3041
Date	Sheet No
April 2025	L/03

BARN 2

ROOF - (Beams @ 3.0m 'd.c')

SIPS PAVERS + MEMBRANE

	kN/m ²
SIPS	0.28
Insulation	0.12
Boarding	0.13
Services	0.1
Membrane piling	0.07

$$DL = 0.72 \text{ kN/m}^2$$

$$LL = 0.6 \text{ kN/m}^2$$

$$\text{Beam Loading} = (0.72 + 0.6) \times \frac{3.0}{2} \times 2 = 3.96 \text{ kN/m}$$

$$\text{Span} = 6-8 \text{ M}$$

$$M_{\text{max}} = 22.96 \text{ kNm} \quad \sigma_b = 152 \text{ N/mm}^2$$

178 x 76 PFC (varies to 229 deep @ centre span)

$$\Delta \approx 8.3 + 19.5 = 27.8 \text{ mm} \\ (4/275 \therefore 0.6)$$

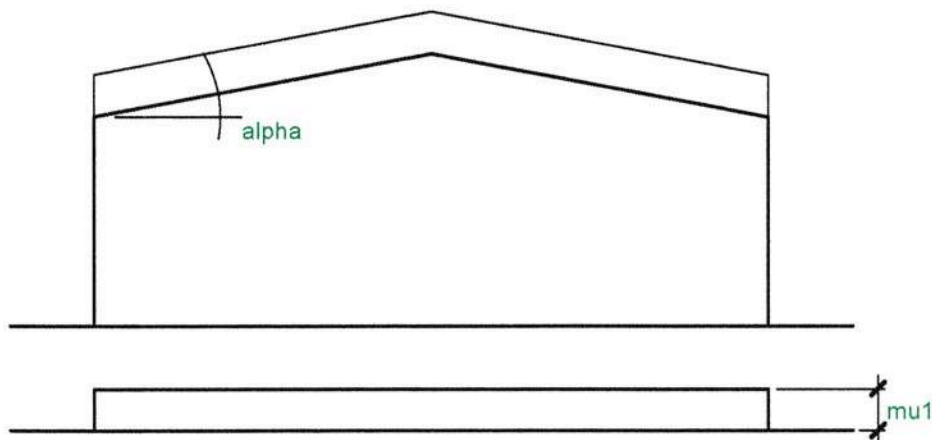
CORNERSTONE CONSULTING ENGINEERS The Studio Shillington SG5 3NS Tel: 01462 379380	Ref: 3044	Ref : 1 SNOW LOAD
	Date: 21/04/25	Page: 1
	DEADMANS BARN General components	

Imposed roof loads

Calculations for imposed roof loads are in accordance with BS6399:Part 3:1988

Roof snow load - in accordance with Clause 7 and Figure 3

Case 1 - uniform load

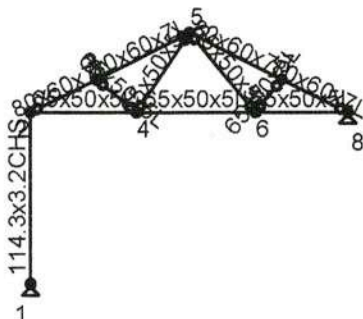


Basic snow load	- S_b	= 0.6 kN/m ²
Site altitude	- A	= 100 m
Roof slope	- α	= 26 °
Altitude correction coefficient	S_{alt}	= 0.1 * S_b + 0.09 = 0.15 kN/m ²
Site snow load	S_0	= $S_b + S_{alt} * ((A - 100) / 100)$ = 0.60 kN/m ²

With a roof slope, α , of 26 °, the shape coefficient $\mu_1 = 0.8$. Hence the snow load on the roof

$$S_d = \mu_1 * S_0 = 0.48 \text{ kN/m}^2$$

CORNERSTONE CONSULTING ENGINEERS The Studio Shillington SG5 3NS Tel: 01462 379380	Ref: 3044	Ref : 2 ROOF FRAME
	Date: 21/04/25	Page: 2
	DEADMANS BARN General components	



Materials Table - units: N/mm²

Type	E
Steel	205000

Sections Table - units: cm², cm⁴

Code	Description	A	I
A	65x50x5 L	5.54	23.20
B	80x60x7 L	9.38	59.00
C	114.3x3.2 CHS	11.20	172.00

Joints Table - units: mm

Joint	X	Y
1	0	0
2	0	2600
3	1000	3096
4	1600	2600
5	2400	3800
6	3400	2600
7	3800	3096
8	4800	2600

Members Table

Member	Code	Description
1-2	C	114.3x3.2 CHS
2-4	A	65x50x5 L
2-3	B	80x60x7 L
3-4	A	65x50x5 L

CORNERSTONE CONSULTING ENGINEERS The Studio Shillington SG5 3NS Tel: 01462 379380	Ref: 3044	Ref : 2 ROOF FRAME
	Date: 21/04/25	Page: 3
	DEADMANS BARN General components	

Members Table

Member	Code	Description
3-5	B	80x60x7 L
4-6	A	65x50x5 L
4-5	A	65x50x5 L
5-6	A	65x50x5 L
5-7	B	80x60x7 L
6-8	A	65x50x5 L
6-7	A	65x50x5 L
7-8	B	80x60x7 L

Load Cases Table

Case	Description
1	Load Case 1
2	Load Case 2 (Undefined)
3	Load Case 3 (Undefined)
4	Load Case 4 (Undefined)

Load Case 1 - "Load Case 1"

Joint Loads - units: Load kN, Angle Degrees

Joint	G	Q	W	Direction
5	7.5	4.0	0.0	vertically down

Member Loads - units: UD Load kN/m, Point Load kN, Distance mm, Angle Degrees

Member	Type	G	Q	W	Direction	Position
2-3	UDL	0.5	0.3	0.0	vertically down	
3-5	UDL	0.5	0.3	0.0	vertically down	
5-7	UDL	0.5	0.3	0.0	vertically down	
7-8	UDL	0.5	0.3	0.0	vertically down	

Joint Deflections - units: Deflections mm, Rotations degrees

Joint	X	Y	Theta
1	0.00	0.00	0.0186
2	-0.59	-0.09	0.0018
3	-0.26	-0.95	-0.0389
4	-0.39	-1.09	-0.0351
5	-0.32	-1.13	-0.0330
6	-0.18	-1.03	0.0311
7	-0.34	-0.91	0.0410
8	0.00	0.00	0.0478

Member Forces - units: Axial kN (-ve tension), Shear kN, Bending kNm

Member		-----End1-----				-----End2-----			
Ref.	Length	Joint	Axial	Shear	Bending	Joint	Axial	Shear	Bending
1-2	2600	1	7.6	0.0	0.0	2	7.6	0.0	-0.1

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Shillington SG5 3NS

Tel: 01462 379380

Ref: 3041

Ref : 2 ROOF FRAME

Date: 21/04/25

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DEADMANS BARN
General components

Member Forces - units: Axial kN (-ve tension), Shear kN, Bending kNm

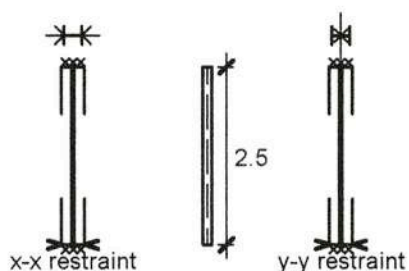
Member			-----End1-----			-----End2-----			
Ref.	Length	Joint	Axial	Shear	Bending	Joint	Axial	Shear	Bending
2-4	1600	2	-14.4	0.1	-0.1	4	-14.4	0.1	0.0
2-3	1116	2	16.3	0.3	0.0	3	15.9	-0.4	0.0
3-4	779	3	1.0	0.0	0.0	4	1.0	0.0	0.0
3-5	1567	3	15.5	0.5	0.0	5	15.0	-0.4	0.0
4-6	1800	4	-13.2	0.0	0.0	6	-13.2	0.0	0.0
4-5	1442	4	-0.7	0.0	0.0	5	-0.7	0.0	0.0
5-6	1562	5	-1.0	0.0	0.0	6	-1.0	0.0	0.0
5-7	1567	5	15.3	0.4	0.0	7	15.8	-0.5	0.0
6-8	1400	6	-14.5	0.0	0.0	8	-14.5	0.0	0.0
6-7	637	6	1.0	0.0	0.0	7	1.0	0.0	0.0
7-8	1116	7	16.0	0.4	0.0	8	16.3	-0.3	0.0

Support Reactions - units: kN

Joint	X	Y	Moment
1	0.0	7.6	0.0
8	0.0	7.5	0.0

CORNERSTONE CONSULTING ENGINEERS The Studio Shillington SG5 3NS Tel: 01462 379380	Ref: 3044	Ref : 25 POSTS
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	DEADMANS BARN General components	

CHS section subject to direct compression (Hot rolled sections only)



Calculations in accordance with BS5950:Part1:2000 and the SCI 'Steelwork Design Guide to BS5950'

Section size	- 114.3x3.2 CHS
Section class	- 1 (Plastic)
Steel grade	- S 275
Design strength of steel	= 275 N/mm ²
Length	= 2500 mm
Applied ultimate compressive load	= 150 kN

End restraint type: (As defined in Table 22)

Bottom, x-x axis	- Effectively held in position and restrained in direction.
Top, x-x axis	- Not held in position but restrained in direction.
Bottom, y-y axis	- Effectively held in position and restrained in direction.
Top, y-y axis	- Not held in position but restrained in direction.

Determine the member slenderness

The effective length factor for the x-x axis combination of restraints is

$$L_{fx} = 1.2$$

and for the y-y axis is

$$L_{fy} = 1.2$$

For the x-x axis the slenderness is

$$\lambda_{xx} = L_o * L_{fx} / r_{xx} = 76.5$$

and for the y-y axis

$$\lambda_{yy} = L_o * L_{fy} / r_{yy} = 76.5$$

Determine the capacity of the section

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	DEADMANS BARN General components	

The allowable compressive strength, based on a maximum slenderness 76.5 , from Table 24(a) is

$$p_c = 211 \text{ N/mm}^2$$

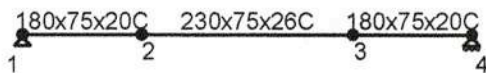
and hence the capacity of the section in accordance with clause 4.7.4 is

$$P_c = p_c \cdot A_g / 1000$$

$$= 236.3 \text{ kN}$$

Section OK

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	Date: 21/04/25	Page: 7
	DEADMANS BARN General components	



Materials Table - units: N/mm²

Type	E
Steel	205000

Sections Table - units: cm², cm⁴

Code	Description	A	I
A	180x75x20 C	25.90	1370.00
B	230x75x26 C	32.70	2750.00

Joints Table - units: mm

Joint	X	Y
1	0	0
2	1800	0
3	5000	0
4	6800	0

Members Table

Member	Code	Description
1-2	A	180x75x20 C
2-3	B	230x75x26 C
3-4	A	180x75x20 C

Load Cases Table

Case	Description
1	Load Case 1
2	Load Case 2 (Undefined)
3	Load Case 3 (Undefined)

Load Cases Table

Case	Description
4	Load Case 4 (Undefined)

Load Case 1 - "Load Case 1"**Member Loads** - units: UD Load kN/m, Point Load kN, Distance mm, Angle Degrees

Member	Type	G	Q	W	Direction	Position
1-2	UDL	3.0	1.2	0.0	vertically down	
2-3	UDL	3.0	1.2	0.0	vertically down	
3-4	UDL	3.0	1.2	0.0	vertically down	

Joint Deflections - units: Deflections mm, Rotations degrees

Joint	X	Y	Theta
1	0.00	0.00	-0.7561
2	0.00	-19.45	-0.3665
3	0.00	-19.45	0.3665
4	0.00	0.00	0.7561

Member Forces - units: Axial kN (-ve tension), Shear kN, Bending kNm

Member		-----End1-----				-----End2-----			
Ref.	Length	Joint	Axial	Shear	Bending	Joint	Axial	Shear	Bending
1-2	1800	1	0.0	14.3	0.0	2	0.0	6.7	18.9
2-3	3200	2	0.0	6.7	18.9	3	0.0	-6.7	18.9
3-4	1800	3	0.0	-6.7	18.9	4	0.0	-14.3	0.0

Support Reactions - units: kN

Joint	X	Y	Moment
1	0.0	14.3	0.0
4	0.0	14.3	0.0