

Job Details

Project:	Stoppers Hill Farm York Lane Brinkworth SN15 5AN
Our Ref:	7198
Date:	Mar-26
Enclosures:	Calcs & Drawing
Produced by:	Lee A Bampfield BEng (Hons)

Notes:

1. These papers have been prepared for Building Regulations submission.
2. Work on site should await receipt of the appropriate Building Control approval, or may be started in advance on the written authority of the building's owner.
3. A copy of these papers should be on site for the Contractor's use during the works.
4. Dimensions quoted in these papers are for design purposes. Design dimensions will not necessarily equate to site dimensions. Dimensions must be confirmed on site before commencement of construction or before off-site manufacture is undertaken. Significant differences should be referred back for possible re-design.
5. Do not scale dimensions off drawings/sketches within these papers.
6. The Building Inspector may carry out inspections or require exploratory work in connection with these proposals especially near new or changed load locations.
7. It is the Client's responsibility to ensure that a competent person is engaged to act in the role of Principal Designer in compliance with the current CDM regulations.

Design Summary

General Job Description (Type of Building, materials, construction methods)	Rear extension and side store conversion. Design of new roof members and roof modifications.	
Structural form, Stability & Robustness	Overall stability achieved through Building Regulations Part A compliant buttressing masonry walls.	
Specific Design Assumptions	Full structural survey not carried out therefore structural elements concealed and/or not directly affected as part of the works are assumed to be structurally adequate.	
Design Methodology	Standard ULS/SLS design in accordance with latest British Standards	
	☒ British Standards	☐ Eurocode
Computer Program	☒ Company produced Excel spreadsheets ☐ CADS – A3Dmax ☒ CADS – Steelwork Member Designer ☐ CADS – Steelwork Moment Connections ☐ CADS – SMART Portal 3D ☐ CADS – RC Pad Base Designer ☐ CADS - Masonry Wall Panel Max ☐ ☐	☐ Ayrshire - AyrSuite ☐ Metsec - MetSPEC ☐ Metsec - LatticeSPEC ☐ Metsec - FrameSPEC ☐ Sand ☐ Scia Engineer ☐ BDES Composite steel & concrete ☐ ☐
Design Codes Used	☒ BS 648 - material weights ☒ BS6399-1 - Loading on Buildings (Dead & Imposed) ☒ BS6399-2 - Loading on Buildings (Wind) ☒ BS6399-3 - Loadings on Buildings (Imposed Roof) ☐ BS8004 - Foundations ☐ BS8002 - Earth retaining structures ☐ BS8110-1 - Concrete ☐ BS8110-2 - Concrete (Special circumstances) ☐ BS8500-1&2 - Specifying Concrete ☐ BS5328 1&2 - Specifying Concrete mixes ☐ BS8102 - Protection against ground water ☐ BS8007 - Water retaining structures	☒ BS5950 - Steel ☒ BS5268-1&2 - Timber ☐ BS5268-4 - Fire resistance of Timber ☐ BS5268-5 - Timber preservative treatment ☐ BS5268-6 - Timber framed walls ☒ BS5628 - Masonry ☐ BS5977-1 - Lintel Design ☐ DMRB & MCHW Series ☐ NHBC Pt.4 - Building near Trees ☐ ☐

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	Design Element	Loadings	Sheet No.	1	
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	<u>Ex. Pitch Roof</u>				
	1No.	Roof Tiles (Interlocking concrete)			0.55
	1No.	Felt & Battens			0.05
	125mm	50mm Timber Joists @400c/c			0.07
	160mm	Insulation			0.06
	50mm	50mm Timber Joists @400c/c			0.03
	1No.	15mm Plasterboard & Skim			0.15
	42° Pitch	Imposed_vertical, R2 - Pitch between 30-60 degrees = $0.6[(60-a)/30]$			0.36
		Total Gk (corrected for pitch)			<u>1.22 kN/m²</u>
		Total Qk			<u>0.36 kN/m²</u>
	<u>New Roof</u>				
	1No.	Membrane			0.01
	12mm	Plywood (hardwood)			0.09
	125mm	50mm Timber Joists @400c/c			0.07
	160mm	Insulation			0.06
	50mm	50mm Timber Joists @400c/c			0.03
	1No.	15mm Plasterboard & Skim			0.15
	1No.	Imposed_vertical, R4 - Flat Roof to Cl4.3.2.....			0.75
		Total Gk			<u>0.40 kN/m²</u>
		Total Qk			<u>0.75 kN/m²</u>

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	To Read in conjunction with loading sheet previous.....				kN/m
<u>Ridge (S1)</u>	1600mm x Ex. Pitch Roof Dead				
	1600mm x Ex. Pitch Roof Imposed				
	1400mm x WW				
UDL	TOTAL Gk/Qk/W				1.95 / 0.57 / 0.63
	2800mm x Wh				
	1000mm x Wwall				
UDL	TOTAL Gk/Qk/W				0 / 0 / 1.72
<u>Purlin 1 (S2)</u>	1400mm x New Roof Dead				
	1400mm x New Roof Imposed				
	650mm x Ex. Pitch Roof Dead				
	650mm x Ex. Pitch Roof Imposed				
	900mm x WW				
UDL	TOTAL Gk/Qk/W				1.35 / 1.28 / 0.40
	900mm x Wh				
	1000mm x Wwall				
UDL	TOTAL Gk/Qk/W				0 / 0 / 0.96
<u>Purlin 2 (S3)</u>	3000mm x New Roof Dead				
	3000mm x New Roof Imposed				
UDL	TOTAL Gk/Qk/W				1.20 / 2.25 / 0

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Timber designs to BS 5268: Part 2

DESIGN METHODOLOGY

Design of timber members based on their plan length. For sloping members it is assumed they are vertically supported at each end and associated loads corrected for the slope angle.

Note: Due to the calculation method of moments a compounded rounding error can create a nominal moment at the right support proportionate to the maximum moment. This is typically ignored throughout the design.

TIMBER PROPERTIES

The output of the various beams are summarised in table format. Each Column is explained below.

Column

- A** Timber Grade - structural grading indicating set of structural parameters
- B** Bending parallel to the grain (N/mm^2) - constant parameter based on column A.
- C** Shear parallel to the grain (N/mm^2) - constant parameter based on column A.
- D** Minimum Modulus of Elasticity (N/mm^2) - constant parameter based on column A.
- E** Mean Modulus of Elasticity (N/mm^2) - constant parameter based on column A.
- F** Compression perpendicular to the grain (N/mm^2) - constant parameter based on column A.
- G** Compression parallel to the grain (N/mm^2) - constant parameter based on column A.
- H** K3 Modification Factor for load duration in accordance with BS5268-2 table 17.
Long term = 1.0, Medium term = 1.25, Short term = 1.50, Very short term = 1.75
- I** K5 Modification Factor for shear at notched ends in accordance with BS5268-2 Cl.2.10.4.
- J** K7 Modification Factor for beam depth in accordance with BS5268-2 Cl.2.10.6.
 $h < 72 = 1.17$
 $72 < h < 300 = (300/h)^{0.11}$
 $h > 300 = 0.81[(h^2 + 92300)/(h^2 + 56800)]$
- K** K8 Modification Factor for load sharing in accordance with Cl.2.9 BS5268-2.
Not load sharing = 1.0, Load sharing = 1.1
- L** K9 Modification Factor for multiple members in accordance with table 20 BS5268-2.
Softwood - 1no. = 1.0, 2no. = 1.14, 3no. = 1.21 & 4+ = 1.24
Hardwood - 1no. = 1.0, 2no. = 1.06, 3no. = 1.08 & 4+ = 1.10
- M** Allowable bending stress applying K3 . K7 . K8

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MEMBER CHECKS

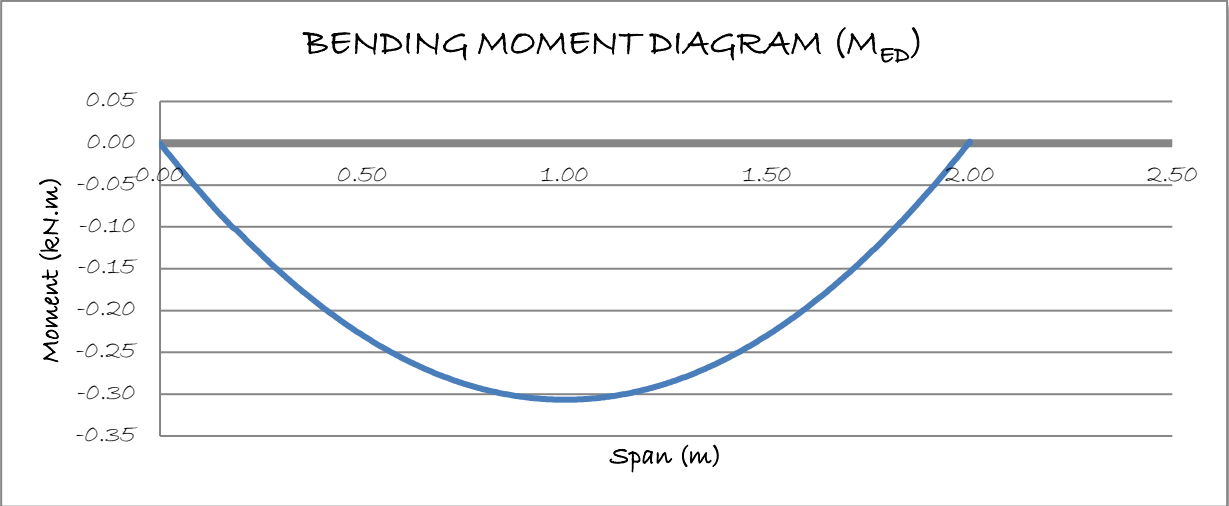
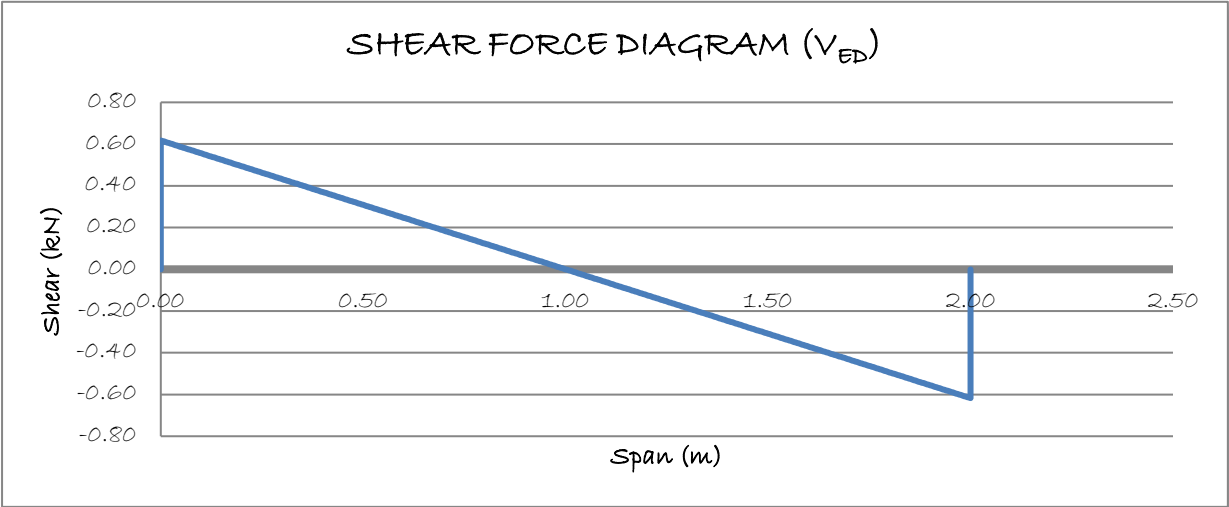
Column

N	The number of timbers used to make up the cross section to derive K9 factor
O	Is the member in a load sharing system, derives K8 Factor
P	Elastic Section Modulus required based on the bending moment and allowable bending Stress. $M / \sigma_{m,g} \cdot K3 \cdot K7 \cdot K8$
Q	Actual Elastic Section Modulus = $bh^2/6$
R	Utilisation Ratio = $Z_{xx} \text{ Required} / Z_{xx} \text{ Provided}$
S	Allowable deflection limit based on $0.003 \times \text{Span}$ limited to 14mm (BS5268-2 Cl.2.7.)
T	Max. Actual member deflections
U	Utilisation Ratio = $d_{\text{actual}} / d_{\text{allowable}}$
V	Permissible h/b ratio taken from BS5268-2 table 19 associated with restraint provided by construction detail.
W	Actual h/b ratio
X	Utilisation Ratio = actual / allowable
Y	Support notch depth. B or T refers to the location of the notch.
Z	Permissible shear stress $\tau_{adm} = \tau_g \cdot K3 \cdot K5 \cdot K8$
AA	Actual shear stress $\tau_a = (3/2) \cdot (V / b \cdot h_e)$
AB	Utilisation Ratio = $\tau_{\text{actual}} / \tau_{\text{allowable}}$
AC	Actual bearing length provided
AD	Permissible compression stress $\sigma_{c,adm,perp} = \sigma_{c,g,perp} \cdot K3 \cdot K8$
AE	Actual compression stress $\sigma_{c,a,perp} = V / b \cdot lb$
AF	Utilisation Ratio = $\sigma_{c,a,perp} / \sigma_{c,adm,perp}$

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REF	Beam Ex. Rafters Loading Input	Output
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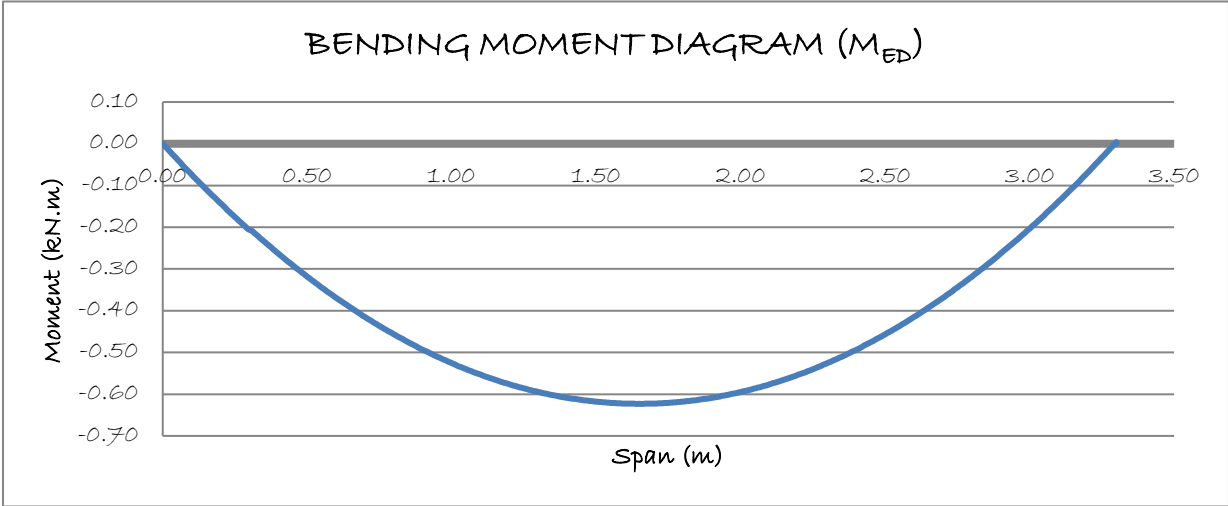
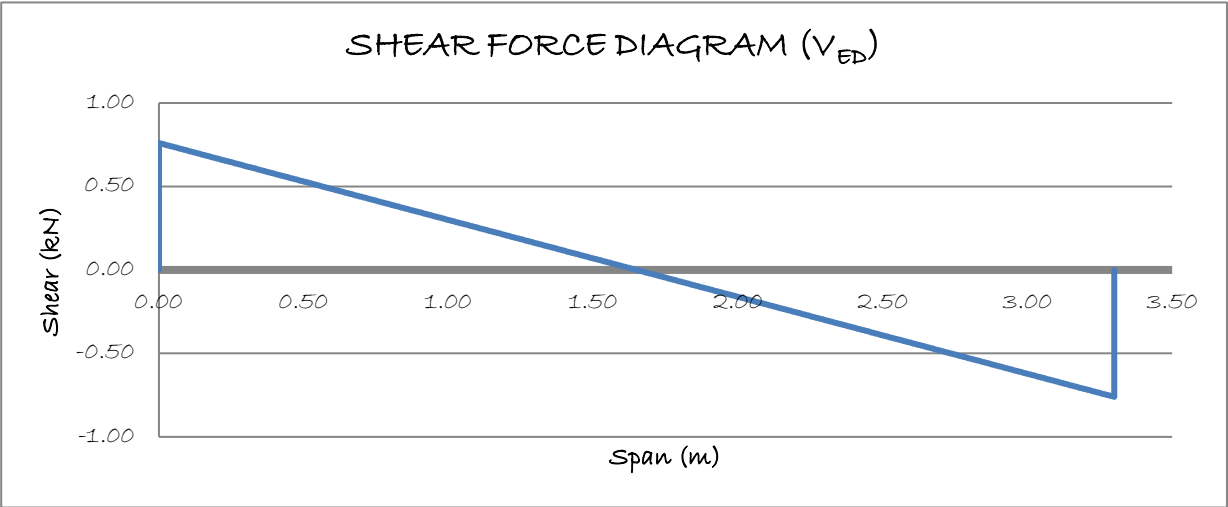
Reference	Action	Load Type	UDL	DL - uniform			PL		TL			
			Intensity (kN/m)	Intensity (kN/m)	Start from RL (m)	Loaded Length (m)	Intensity (kN)	Position from RL (m)	Intensity A (kN/m)	Position from RL (m)	Intensity B (kN/m)	Position from RL (m)
Self Weight Roof Dead Imposed	Gk	UDL	0.0									
	Gk	UDL	0.5									
	Qk	UDL	0.1									



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REF	Beam utility Joists Loading Input	Output
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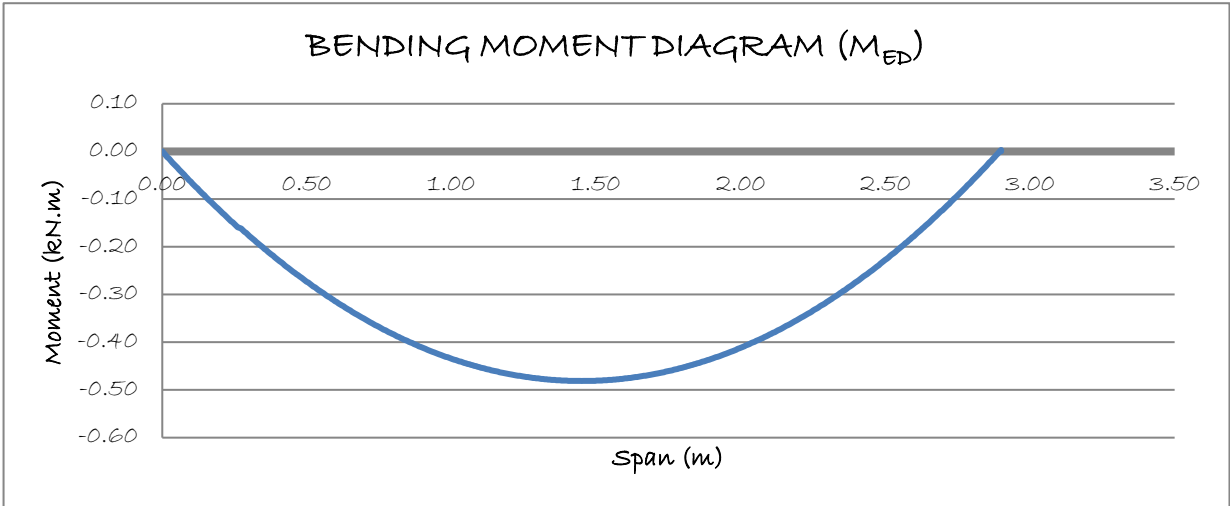
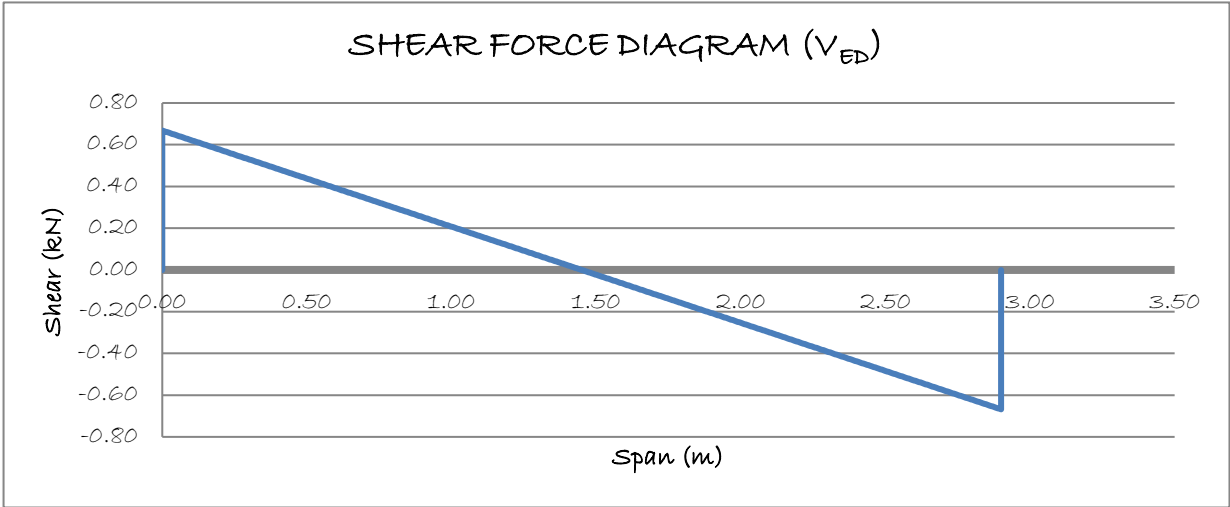
Reference	Action	Load Type	UDL	DL - Uniform			PL		TL			
			Intensity (kN/m)	Intensity (kN/m)	Start from RL (m)	Loaded Length (m)	Intensity (kN)	Position from RL (m)	Intensity A (kN/m)	Position from RL (m)	Intensity B (kN/m)	Position from RL (m)
Self Weight	Gk	UDL	0.0									
Roof Dead	Gk	UDL	0.1									
Imposed	Qk	UDL	0.3									



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REF	Beam Family Rm Joists Loading Input	Output
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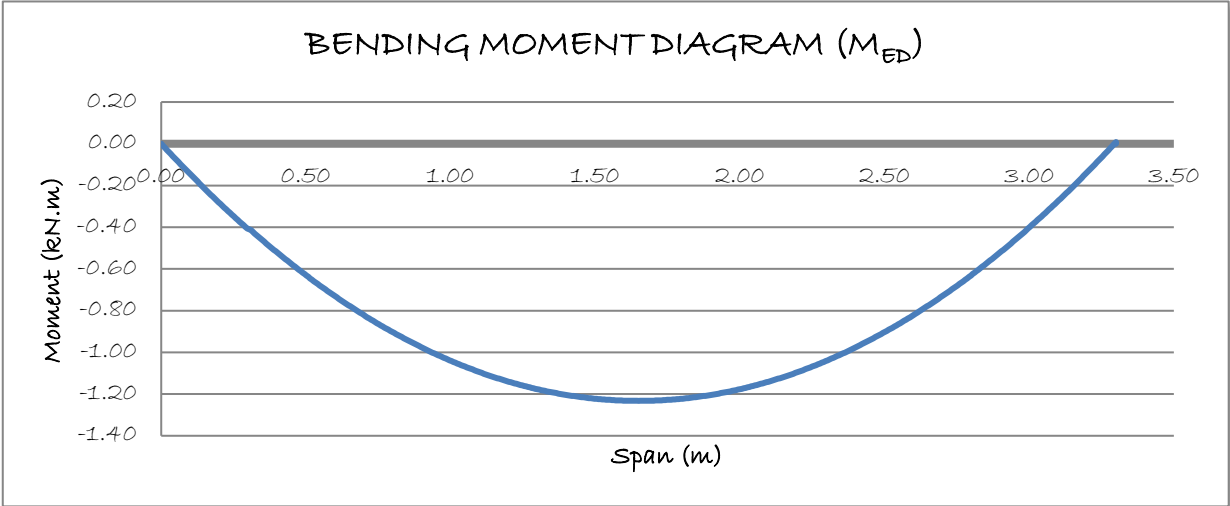
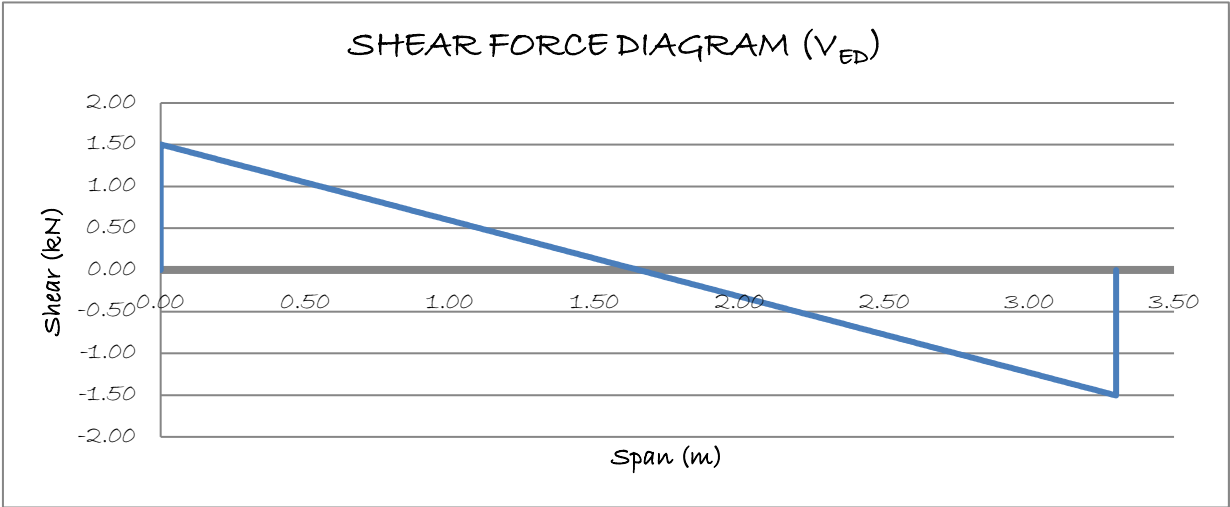
Reference	Action	Load Type	UDL	DL - Uniform			PL		TL			
			Intensity (kN/m)	Intensity (kN/m)	Start from RL (m)	Loaded Length (m)	Intensity (kN)	Position from RL (m)	Intensity A (kN/m)	Position from RL (m)	Intensity B (kN/m)	Position from RL (m)
Self Weight	Gk	UDL	0.0									
Roof Dead	Gk	UDL	0.1									
Imposed	Qk	UDL	0.3									



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REF	Beam WC Trimmer Loading Input	Output
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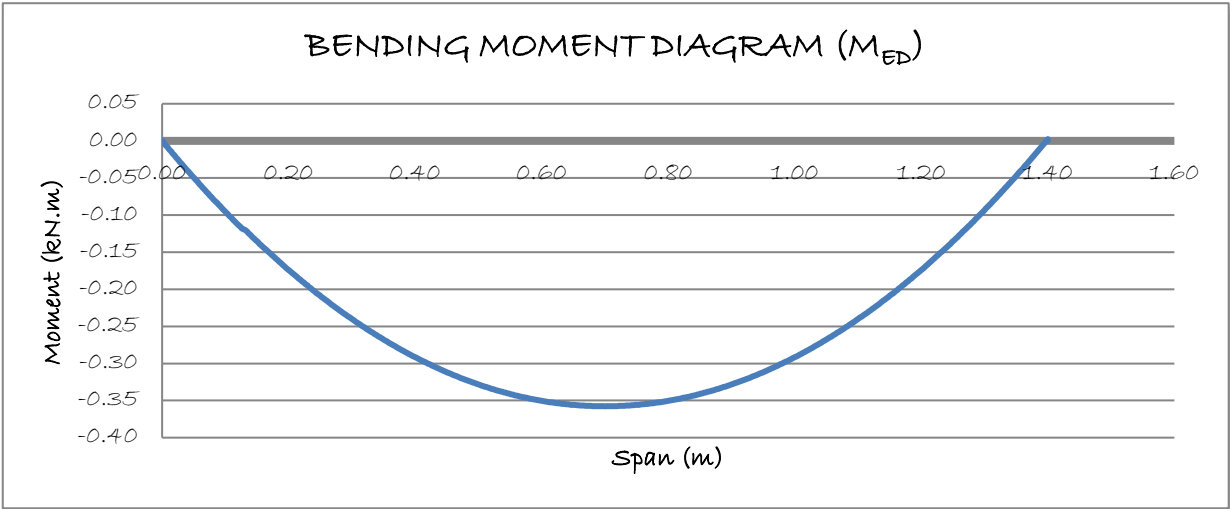
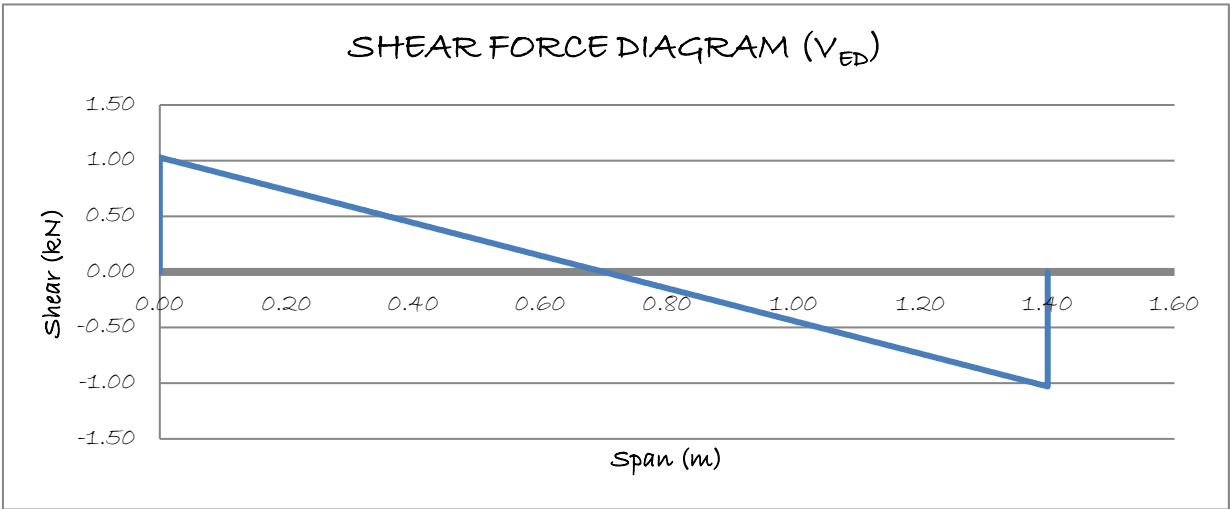
Reference	Action	Load Type	UDL	DL - Uniform			PL		TL			
			Intensity (kN/m)	Intensity (kN/m)	Start from RL (m)	Loaded Length (m)	Intensity (kN)	Position from RL (m)	Intensity A (kN/m)	Position from RL (m)	Intensity B (kN/m)	Position from RL (m)
Self Weight	Gk	UDL	0.0									
Roof Dead	Gk	UDL	0.1									
Imposed	Qk	UDL	0.2									
Roof Dead	Gk	UDL	0.5									
Imposed	Qk	UDL	0.1									



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REF	Beam RL Trimmer 1 Loading Input	Output
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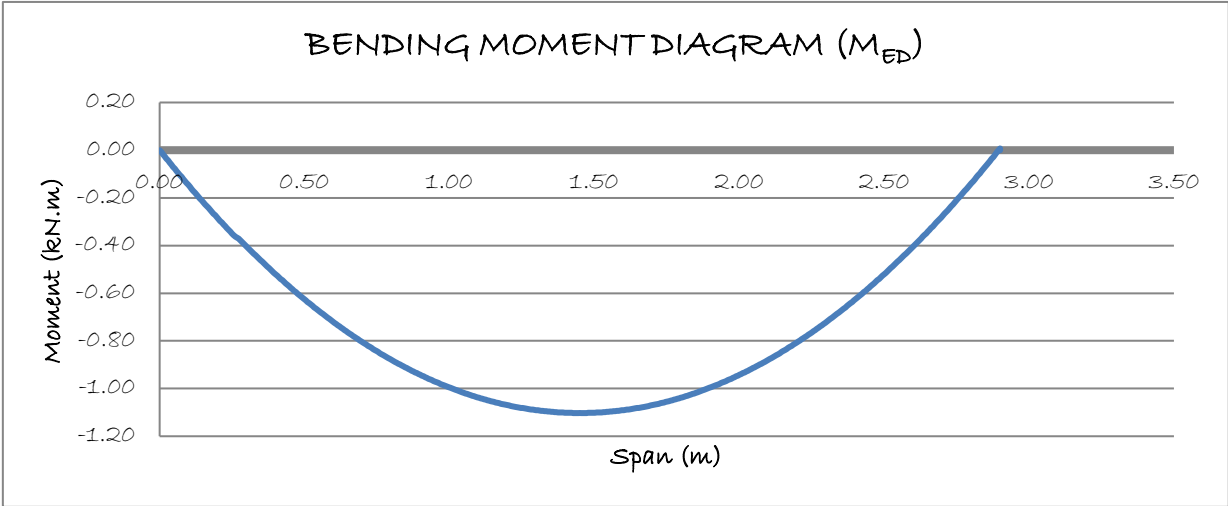
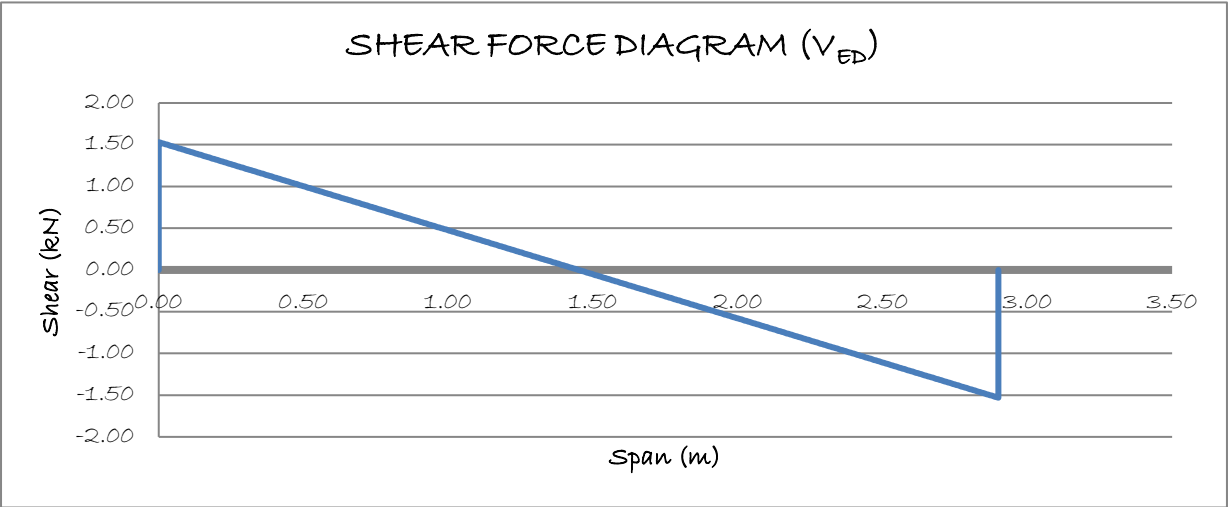
Reference	Action	Load Type	UDL	DL - Uniform			PL		TL			
			Intensity (kN/m)	Intensity (kN/m)	Start from RL (m)	Loaded Length (m)	Intensity (kN)	Position from RL (m)	Intensity A (kN/m)	Position from RL (m)	Intensity B (kN/m)	Position from RL (m)
Self Weight	Gk	UDL	0.0									
Roof Dead	Gk	UDL	0.5									
Imposed	Qk	UDL	0.9									



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REF	Beam RL Trimmer 2 Loading Input	Output
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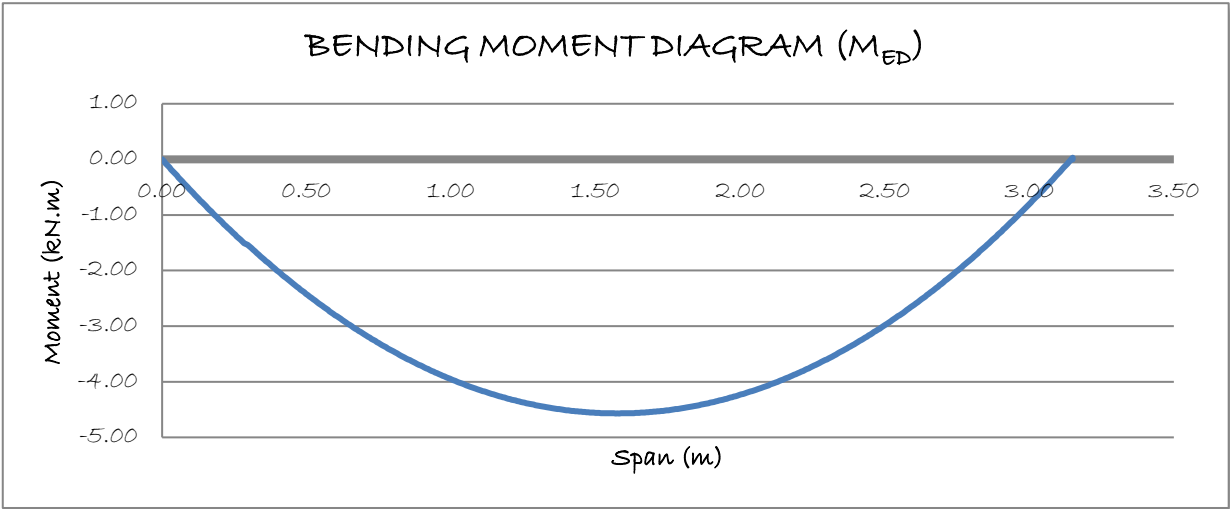
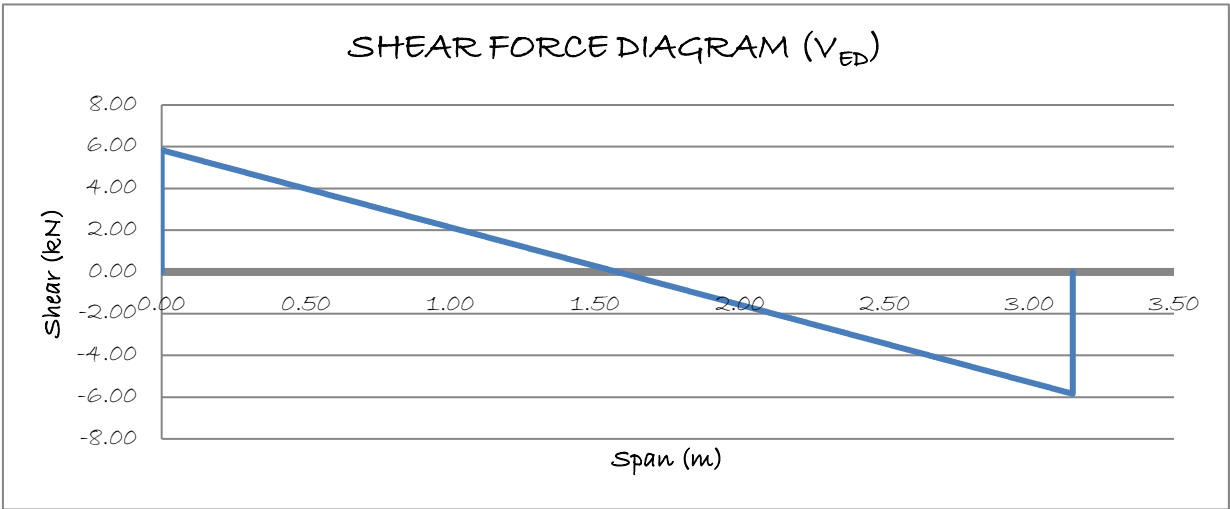
Reference	Action	Load Type	UDL	DL - Uniform			PL		TL			
			Intensity (kN/m)	Intensity (kN/m)	Start from RL (m)	Loaded Length (m)	Intensity (kN)	Position from RL (m)	Intensity A (kN/m)	Position from RL (m)	Intensity B (kN/m)	Position from RL (m)
Self Weight	Gk	UDL	0.0									
Roof Dead	Gk	UDL	0.4									
Imposed	Qk	UDL	0.7									



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REF	Beam Family Rm Eaves Loading Input	Output
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Reference	Action	Load Type	UDL	DL - Uniform			PL		TL			
			Intensity (kN/m)	Intensity (kN/m)	Start from RL (m)	Loaded Length (m)	Intensity (kN)	Position from RL (m)	Intensity A (kN/m)	Position from RL (m)	Intensity B (kN/m)	Position from RL (m)
Self Weight	Gk	UDL	0.1									
Roof Dead	Gk	UDL	1.3									
Imposed	Qk	UDL	2.4									



Timber designs to BS 5268: Part 2

INDIVIDUAL INPUT PARAMETERS

[illegible]

TIMBER PROPERTIES

[illegible]

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MEMBER CHECKS

Table Column Ref	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
	Bending			Deflection			Lateral Buckling			Shear			
Beam Reference	$Z_{required}$	$Z_{provided}$	Utilisation	$d_{allowable}$	d_{actual}	Utilisation	Permissible h/b	Actual h/b	Utilisation	Support Notch Depth	Permissible Stress τ_{adm}	Maximum Stress τ_a	Utilisation
Ex. Rafters	38214	122396	0.31	6.00	4.07	0.68	4.00	2.66	0.66	35 B	0.66	0.22	0.33
Utility Joists	78924	164696	0.48	9.90	6.50	0.66	5.00	3.09	0.62	50 B	0.60	0.26	0.42
Family Rm Joists	60951	164696	0.37	8.70	4.43	0.51	5.00	3.09	0.62	50 B	0.60	0.22	0.37
WC Trimmer	171749	329392	0.52	9.90	9.76	0.99	5.00	1.54	0.31	50 B	0.55	0.25	0.46
RL Trimmer 1	49845	329392	0.15	4.20	1.20	0.29	5.00	1.54	0.31	50 B	0.55	0.17	0.31
RL Trimmer 2	153629	329392	0.47	8.70	7.67	0.88	5.00	1.54	0.31	50 B	0.55	0.26	0.47
Family Rm Eaves	470971	758267	0.62	9.45	7.96	0.84	5.00	2.34	0.47	50 B	0.69	0.55	0.80

BEARING CHECK

Table Column Ref	AC	AD	AE	AF
	Bearing			
Beam Reference	Bearing length l_b	Permissible Stress $\sigma_c, adm, perp$	Actual Stress $\sigma_c, a, perp$	Utilisation
Ex. Rafters	50	2.34	0.26	0.11
Utility Joists	50	2.34	0.32	0.14
Family Rm Joists	50	2.34	0.28	0.12
WC Trimmer	50	2.13	0.32	0.15
RL Trimmer 1	50	2.13	0.22	0.10

Table Column Ref	AC	AD	AE	AF
	Bearing			
Beam Reference	Bearing length l_b	Permissible Stress $\sigma_c, adm, perp$	Actual Stress $\sigma_c, a, perp$	Utilisation
RL Trimmer 2	50	2.13	0.33	0.15
Family Rm Eaves	50	2.38	1.24	0.52

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	Ridge (S1)	Job Ref	
		Designed By	LB
		Checked By	
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		Revision No	
		Calc No	
		Page No	1

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Calculations for strength, stability and stiffness of steel members to BS 5950 Part 1

Member Details

Member profile	Uniform	
Member length	5675	mm
Member type	Beam	
Member slope	-0.0	deg
Section - reference	203x203 UC46	
- type	Rolled I-section	
- axis	Major	
Steel - grade	grade S275	
- ult. tensile strength	410	N/mm2
- yield stress	275	N/mm2
- design strength	275	N/mm2
- Youngs E. modulus	205000	N/mm2

Support Conditions

Degree of Freedom		End 1	End 2
Displacement	- normal	fixed	fixed
	- lateral	fixed	fixed
	- axial	fixed	free
Rotation	- normal	free	free
	- lateral	free	free
	- axial	fixed	fixed

Lateral Restraints

No.	Type	Connection	Offset mm	Start mm	Length mm	Spacing mm
1	End 1	Both flanges				
2	End 2	Both flanges				

Effective Length Factors

Major axis effective length factor on full member length = 1.00

Minor axis effective length factors on division length and member depth

Division Number	Position		Moment				Axial Compression	
	Start	End	Sagging		Hogging		Length	Depth
	mm	mm	Length	Depth	Length	Depth		
1	0	5675	1.00	0.00	1.00	0.00	1.00	0.00

Note: * indicates Destabilising Loads

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	Ridge (S1)	Job Ref	
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Stiffness Criteria (Length/Deflection Ratios)

Member type	Normal			Lateral		
	Length	Ratio	Defl.	Length	Ratio	Defl.
	mm	L/Defl.	mm	mm	L/Defl.	mm
Plaster finish beam	5675	360.00	15.76	5675	360.00	15.76

Load Details (Units: kN and m)

No.	Name	Load No.	Type	Start Pos. mm	Loaded Length mm	Start Value	End Value	Load Description
1	Dead	1	UN			1.95		Self weight Self weight
		2	UN			0.45		
		3	UA			0.00		
2	Imposed	1	UN			0.57		
3	Wind	1	UN			0.63		
		2	UL			1.72		

Load Combinations

Load Case	Safety Factors									
	Comb 1	Comb 2	Comb 3	Comb 4	Comb 5	Comb 6	Comb 7			
	ULS	ULS	ULS	SLS	SLS	SLS	SLS			
1	1.40	1.40	1.20	1.00	0.00	0.00	1.00			
2	1.60	0.00	1.20	0.00	1.00	0.00	0.80			
3	0.00	1.40	1.20	0.00	0.00	1.00	0.80			

Summary of Critical Results for Member (203x203 UC46) - File name: 4. Ridge (S1)

Design Criterion	Utilization Ratio	Load Combination	Position	Status
Local capacity / strength	0.193	2	2838	OK
Lateral buckling	0.355	2	2838	OK
Torsional buckling				n/a
Deflection	0.464	6	2838	OK

End 1 Effects for Member 4. Ridge (S1)

Comb No.	Axial Fz	Shear		Bending		Torsion Mt
		Fvx	Fvy	Mx	My	
1	-0.0	12.1	-0.0	0.0	-0.0	0.0
2	-0.0	12.0	6.8	0.0	-0.0	0.0
3	-0.0	12.3	5.9	0.0	-0.0	0.0
4	-0.0	6.8	-0.0	0.0	-0.0	0.0
5	-0.0	1.6	-0.0	0.0	-0.0	0.0
6	-0.0	1.8	4.9	0.0	-0.0	0.0
7	-0.0	9.5	3.9	0.0	-0.0	0.0

End 2 Effects for Member 4. Ridge (S1)

Comb No.	Axial Fz	Shear		Bending		Torsion Mt
		Fvx	Fvy	Mx	My	
1	-0.0	-12.1	-0.0	-0.0	0.0	0.0
2	-0.0	-12.0	-6.8	-0.0	-0.0	0.0
3	-0.0	-12.3	-5.9	-0.0	-0.0	0.0
4	-0.0	-6.8	-0.0	0.0	0.0	0.0
5	-0.0	-1.6	-0.0	0.0	0.0	0.0
6	-0.0	-1.8	-4.9	0.0	-0.0	0.0
7	-0.0	-9.5	-3.9	-0.0	0.0	0.0

Maximum Effects for Member 4. Ridge (S1)

Comb No.	Axial Fz	Shear		Hogging		Sagging		Torsion Mt
		Fvx	Fvy	Mx	My	Mx	My	
1	0.0	-12.1	0.0	0.0	-0.0	17.2	0.0	0.0
2	0.0	-12.0	-6.8	0.0	0.0	17.1	9.7	0.0
3	0.0	-12.3	-5.9	0.0	0.0	17.4	8.3	0.0
4	0.0	-6.8	0.0	-0.0	-0.0	9.7	0.0	0.0
5	0.0	-1.6	0.0	-0.0	-0.0	2.3	0.0	0.0
6	0.0	-1.8	-4.9	-0.0	0.0	2.5	6.9	0.0
7	0.0	-9.5	-3.9	0.0	0.0	13.5	5.5	0.0

	Stoppers Hill Farm	Job No	7198
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		Checked By	
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Calculations for strength, stability and stiffness of steel members to BS 5950 Part 1

Member Details

Member profile	Uniform	
Member length	5675	mm
Member type	Beam	
Member slope	-0.0	deg
Section - reference	152x152 UC30	
- type	Rolled I-section	
- axis	Major	
Steel - grade	grade S275	
- ult. tensile strength	410	N/mm2
- yield stress	275	N/mm2
- design strength	275	N/mm2
- Youngs E. modulus	205000	N/mm2

Support Conditions

Degree of Freedom		End 1	End 2
Displacement	- normal	fixed	fixed
	- lateral	fixed	fixed
	- axial	fixed	free
Rotation	- normal	free	free
	- lateral	free	free
	- axial	fixed	fixed

Lateral Restraints

No.	Type	Connection	Offset mm	Start mm	Length mm	Spacing mm
1	End 1	Both flanges				
2	End 2	Both flanges				

Effective Length Factors

Major axis effective length factor on full member length = 1.00

Minor axis effective length factors on division length and member depth

Division Number	Position		Moment				Axial Compression	
	Start	End	Sagging		Hogging		Length	Depth
	mm	mm	Length	Depth	Length	Depth		
1	0	5675	1.00	0.00	1.00	0.00	1.00	0.00

Note: * indicates Destabilising Loads

	Stoppers Hill Farm	Job No	7198
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Stiffness Criteria (Length/Deflection Ratios)

Member type	Normal			Lateral		
	Length	Ratio	Defl.	Length	Ratio	Defl.
	mm	L/Defl.	mm	mm	L/Defl.	mm
Plaster finish beam	5675	360.00	15.76	5675	360.00	15.76

Load Details (Units: kN and m)

No.	Name	Load No.	Type	Start Pos. mm	Loaded Length mm	Start Value	End Value	Load Description
1	Dead	1	UN			1.35		Self weight Self weight
		2	UN			0.29		
		3	UA			0.00		
2	Imposed	1	UN			1.28		
3	Wind	1	UN			0.40		
		2	UL			0.96		

Load Combinations

Load Case	Safety Factors										
	Comb 1	Comb 2	Comb 3	Comb 4	Comb 5	Comb 6	Comb 7				
	ULS	ULS	ULS	SLS	SLS	SLS	SLS				
1	1.40	1.40	1.20	1.00	0.00	0.00	1.00				
2	1.60	0.00	1.20	0.00	1.00	0.00	0.80				
3	0.00	1.40	1.20	0.00	0.00	1.00	0.80				

Summary of Critical Results for Member (152x152 UC30) - File name: 5. Purlin (S2)

Design Criterion	Utilization Ratio	Load Combination	Position	Status
Local capacity / strength	0.257	1	2838	OK
Lateral buckling	0.561	3	2838	OK
Torsional buckling				n/a
Deflection	0.716	6	2838	OK

End 1 Effects for Member 5. Purlin (S2)

Comb No.	Axial Fz	Shear		Bending		Torsion Mt
		Fvx	Fvy	Mx	My	
1	-0.0	12.3	-0.0	0.0	-0.0	0.0
2	-0.0	8.1	3.8	0.0	-0.0	0.0
3	-0.0	11.3	3.3	0.0	-0.0	0.0
4	-0.0	4.7	-0.0	0.0	-0.0	0.0
5	-0.0	3.6	-0.0	0.0	-0.0	0.0
6	-0.0	1.1	2.7	0.0	-0.0	0.0
7	-0.0	8.5	2.2	0.0	-0.0	0.0

End 2 Effects for Member 5. Purlin (S2)

Comb No.	Axial Fz	Shear		Bending		Torsion Mt
		Fvx	Fvy	Mx	My	
1	-0.0	-12.3	-0.0	0.0	0.0	0.0
2	-0.0	-8.1	-3.8	-0.0	-0.0	0.0
3	-0.0	-11.3	-3.3	0.0	-0.0	0.0
4	-0.0	-4.7	-0.0	0.0	0.0	0.0
5	-0.0	-3.6	-0.0	0.0	0.0	0.0
6	-0.0	-1.1	-2.7	-0.0	-0.0	0.0
7	-0.0	-8.5	-2.2	0.0	0.0	0.0

Maximum Effects for Member 5. Purlin (S2)

Comb No.	Axial Fz	Shear		Hogging		Sagging		Torsion Mt
		Fvx	Fvy	Mx	My	Mx	My	
1	0.0	-12.3	0.0	-0.0	-0.0	17.5	0.0	0.0
2	0.0	-8.1	-3.8	0.0	0.0	11.5	5.4	0.0
3	0.0	-11.3	-3.3	-0.0	0.0	16.1	4.6	0.0
4	0.0	-4.7	0.0	-0.0	-0.0	6.6	0.0	0.0
5	0.0	-3.6	0.0	-0.0	-0.0	5.2	0.0	0.0
6	0.0	-1.1	-2.7	0.0	0.0	1.6	3.9	0.0
7	0.0	-8.5	-2.2	-0.0	0.0	12.0	3.1	0.0

	Stoppers Hill Farm	Job No	7198
	Purlin (S3)	Job Ref	
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		Checked By	
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Calculations for strength, stability and stiffness of steel members to BS 5950 Part 1

Member Details

Member profile	Uniform	
Member length	5675	mm
Member type	Beam	
Member slope	-0.0	deg
Section - reference	152x152 UC30	
- type	Rolled I-section	
- axis	Major	
Steel - grade	grade S275	
- ult. tensile strength	410	N/mm2
- yield stress	275	N/mm2
- design strength	275	N/mm2
- Youngs E. modulus	205000	N/mm2

Support Conditions

Degree of Freedom		End 1	End 2
Displacement	- normal	fixed	fixed
	- lateral	fixed	fixed
	- axial	fixed	free
Rotation	- normal	free	free
	- lateral	free	free
	- axial	fixed	fixed

Lateral Restraints

No.	Type	Connection	Offset mm	Start mm	Length mm	Spacing mm
1	End 1	Both flanges				
2	End 2	Both flanges				

Effective Length Factors

Major axis effective length factor on full member length = 1.00

Minor axis effective length factors on division length and member depth

Division Number	Position		Moment				Axial Compression	
	Start	End	Sagging		Hogging		Length	Depth
	mm	mm	Length	Depth	Length	Depth		
1	0	5675	1.00	0.00	1.00	0.00	1.00	0.00

Note: * indicates Destabilising Loads

	Stoppers Hill Farm	Job No	7198
	Purlin (S3)	Job Ref	
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Stiffness Criteria (Length/Deflection Ratios)

Member type	Normal			Lateral		
	Length	Ratio	Defl.	Length	Ratio	Defl.
	mm	L/Defl.	mm	mm	L/Defl.	mm
Plaster finish beam	5675	360.00	15.76	5675	360.00	15.76

Load Details (Units: kN and m)

No.	Name	Load No.	Type	Start Pos. mm	Loaded Length mm	Start Value	End Value	Load Description
1	Dead	1	UN			1.20		
		2	UN			0.29		Self weight
		3	UA			0.00		Self weight
2	Imposed	1	UN			2.25		

Load Combinations

Load Case	Safety Factors										
	Comb 1	Comb 2	Comb 3	Comb 4							
	ULS	SLS	SLS	SLS							
1	1.40	1.00	0.00	1.00							
2	1.60	0.00	1.00	1.00							

Summary of Critical Results for Member (152x152 UC30) - File name: 6. Purlin (S3)

Design Criterion	Utilization Ratio	Load Combination	Position	Status
Local capacity / strength	0.336	1	2838	OK
Lateral buckling	0.540	1	2838	OK
Torsional buckling				n/a
Deflection	0.894	4	2838	OK

End 1 Effects for Member 6. Purlin (S3)

Comb No.	Axial Fz	Shear		Bending		Torsion Mt
		Fvx	Fvy	Mx	My	
1	-0.0	16.2	-0.0	0.0	-0.0	0.0
2	-0.0	4.2	-0.0	0.0	-0.0	0.0
3	-0.0	6.4	-0.0	0.0	-0.0	0.0
4	-0.0	10.6	-0.0	0.0	-0.0	0.0

End 2 Effects for Member 6. Purlin (S3)

Comb No.	Axial Fz	Shear		Bending		Torsion Mt
		Fvx	Fvy	Mx	My	
1	-0.0	-16.2	-0.0	-0.0	0.0	0.0
2	-0.0	-4.2	-0.0	0.0	0.0	0.0

	Stoppers Hill Farm	Job No	7198
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End 2 Effects for Member 6. Purlin (S3) (continued)

Comb No.	Axial Fz	Shear		Bending		Torsion Mt
		Fvx	Fvy	Mx	My	
3	-0.0	-6.4	-0.0	-0.0	0.0	0.0
4	-0.0	-10.6	-0.0	-0.0	0.0	0.0

Maximum Effects for Member 6. Purlin (S3)

Comb No.	Axial Fz	Shear		Hogging		Sagging		Torsion Mt
		Fvx	Fvy	Mx	My	Mx	My	
1	0.0	-16.2	0.0	0.0	-0.0	22.9	0.0	0.0
2	0.0	-4.2	0.0	-0.0	-0.0	6.0	0.0	0.0
3	0.0	-6.4	0.0	0.0	-0.0	9.1	0.0	0.0
4	0.0	-10.6	0.0	0.0	-0.0	15.1	0.0	0.0

