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Structural Calculations

Project Title

Proposed extension and alterations to
Sonning Cricket Club Pavilion
Pound Lane
Sonning
Berks
RG4 6XE

Project Ref

22-079

Client

Document		**Revision**			
Structural Calculations + Details		A			
Issued to	**Address**	15 09 22			
Enza Architects	By email	e			
Client	By email	e			
Purpose of Issue		C			

P = Preliminary, C = Construction, A = Approval, CT = Comment, T = Tender, I = Information, R = Record
e = e-mail issue, d = CD or DVD issue (e.g. 3/e denotes 3 paper copies + e-mail)

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OMK DESIGN CONSULTANCY	Project Title : Sonning Cricket Club Pavilion	Job Ref :	22-079
		Sheet :	1
		Calc. by :	EV
	Part of structure : LOADINGS	Date :	Sep-22
		Checked :	MM

		SLS		ULS	
PITCHED ROOF - NO CEILING					
ϕ=	39 °				
	Single ply membrane	0.15			
	Battens	0.05			
	OSB board	0.20			
	Rafters	0.15			
	Plasterboard+skim	0.20			
		0.75			
DL		0.97		1.35	
IL		0.53		0.84	
		1.49	kN/m²	2.19	kN/m²
PITCHED ROOF - NO CEILING					
ϕ=	13 °				
	As above	0.75			
DL		0.77		1.08	
IL		0.75		1.20	
		1.52	kN/m²	2.28	kN/m²
FLAT ROOF					
	Single ply membrane	0.15			
	Firrings	0.05			
	OSB board	0.15			
	Joists	0.15			
	Insulation	0.05			
	Plasterboard+skim	0.20			
DL		0.75		1.05	
IL		0.75		1.20	
		1.50	kN/m²	2.25	kN/m²
MASONRY					
100	Block	1.50		2.10	kN/m²
215	Block	3.23		4.52	kN/m²
	Finishes	0.30		0.42	kN/m²

OMK DESIGN CONSULTANCY	Project Title : Sonning Cricket Club Pavilion	Job Ref :	22-079
		Sheet :	2
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	Part of structure : LOADINGS	Date :	Sep-22
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		SLS		ULS	
FLAT CEILING					
	Boards	0.15			
	Joists	0.15			
	Insulation	0.05			
	Plasterboard+skim	0.20			
DL		0.55		0.77	
IL		0.25		0.40	
		0.80	kN/m²	1.17	kN/m²

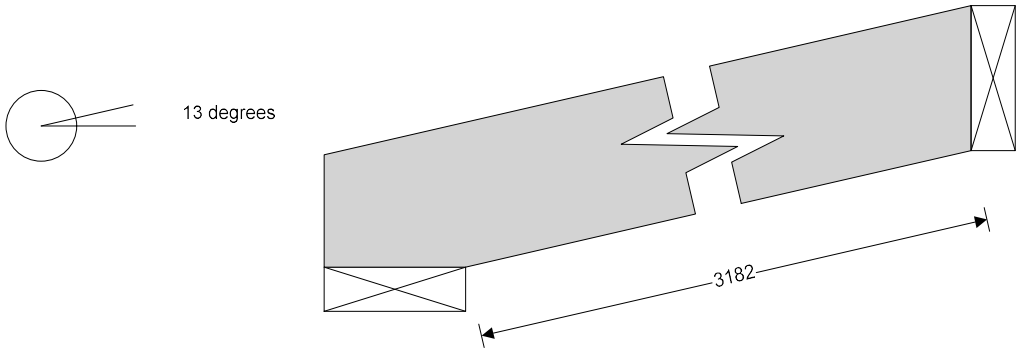
OMK DESIGN CONSULTANCY	Project				Job Ref.	
	Sonning Cricket Club Pavilion				22-079	
	Section				Sheet no./rev.	
					1	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	EV	02/09/2022	MM			

Design span = 3.1 m
Roof pitch = 13^0

TIMBER RAFTER DESIGN (BS5268) - 13DEG

TIMBER RAFTER DESIGN (BS5268-2:2002)

TEDDS calculation version 1.0.03



Rafter details

Breadth of timber sections	b = **47** mm	Depth of timber sections	h = **150** mm
Rafter spacing	s = **400** mm	Rafter span	**Single span**
Clear length of span on slope	L_{cl} = **3182** mm	Rafter slope	α = **13.0** deg
Timber strength class	**C16**		

Section properties

Cross sectional area of rafter	A = **7050** mm^2	Section modulus	Z = **176250** mm^3
Radius of gyration	r = **43** mm	Second moment of area	I = **13218750** mm^4

Loading details

Rafter self weight	F_j = **0.02** kN/m	Dead load on slope	F_d = **0.60** kN/m^2
Imposed snow load on plan	F_u = **0.75** kN/m^2	Imposed point load	F_p = **0.90** kN

Modification factors

Section depth factor	K_7 = **1.08**	Load sharing factor	K_8 = **1.10**

Consider long term load condition

Load duration factor	K_3 = **1.00**	Total UDL perp. to rafter	F = **0.255** kN/m
Notional bearing length	L_b = **4** mm	Effective span	L_{eff} = **3185** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **6.292** N/mm^2 Applied bending stress σ_{m_max} = **1.833** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **4.168** N/mm^2 Applied compressive stress σ_{c_max} = **0.289** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.367 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.737** N/mm^2 Applied shear stress τ_{max} = **0.086** N/mm^2

PASS - Applied shear stress within permissible limits

OMK DESIGN CONSULTANCY	Project: Sonning Cricket Club Pavilion				Job Ref.: 22-079	
	Section:				Sheet no./rev.: 2	
	Calc. by: EV	Date: 02/09/2022	Chk'd by: MM	Date:	App'd by:	Date:

Check deflection

Permissible deflection δ_{adm} = **9.555** mm — Total deflection δ_{max} = **3.035** mm

PASS - Total deflection within permissible limits

Consider medium term load condition

Load duration factor K_3 = **1.25** — Total UDL perp. to rafter F = **0.540** kN/m

Notional bearing length L_b = **8** mm — Effective span L_{eff} = **3189** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **7.865** N/mm^2 — Applied bending stress σ_{m_max} = **3.892** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **4.770** N/mm^2 — Applied compressive stress σ_{c_max} = **0.613** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.646 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.921** N/mm^2 — Applied shear stress τ_{max} = **0.183** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.567** mm — Total deflection δ_{max} = **6.459** mm

PASS - Total deflection within permissible limits

Consider short term load condition

Load duration factor K_3 = **1.50** — Total UDL perp. to rafter F = **0.255** kN/m

Notional bearing length L_b = **7** mm — Effective span L_{eff} = **3189** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **9.438** N/mm^2 — Applied bending stress σ_{m_max} = **5.804** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **5.241** N/mm^2 — Applied compressive stress σ_{c_max} = **0.318** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.689 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **1.106** N/mm^2 — Applied shear stress τ_{max} = **0.273** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.567** mm — Total deflection δ_{max} = **8.359** mm

PASS - Total deflection within permissible limits

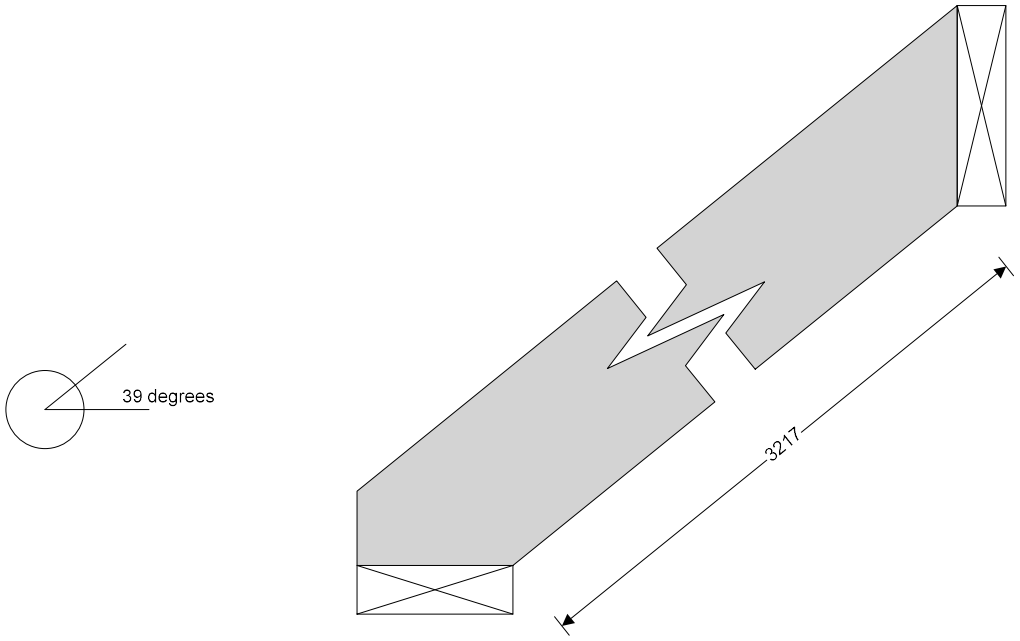
PROVIDE: min. 47w x 150d C16 at 400c/c

Design span = 2.5 m
Roof pitch = 39^0

TIMBER RAFTER DESIGN (BS5268) - 39DEG

TIMBER RAFTER DESIGN (BS5268-2:2002)

TEDDS calculation version 1.0.03



Rafter details

Breadth of timber sections	b = **47** mm	Depth of timber sections	h = **150** mm
Rafter spacing	s = **400** mm	Rafter span	**Single span**
Clear length of span on slope	L_{cl} = **3217** mm	Rafter slope	α = **39.0** deg
Timber strength class	**C16**		

Section properties

Cross sectional area of rafter	A = **7050** mm^2	Section modulus	Z = **176250** mm^3
Radius of gyration	r = **43** mm	Second moment of area	I = **13218750** mm^4

Loading details

Rafter self weight	F_j = **0.02** kN/m	Dead load on slope	F_d = **0.60** kN/m^2
Imposed snow load on plan	F_u = **0.75** kN/m^2	Imposed point load	F_p = **0.90** kN

Modification factors

Section depth factor	K_7 = **1.08**	Load sharing factor	K_8 = **1.10**

Consider long term load condition

Load duration factor	K_3 = **1.00**	Total UDL perp. to rafter	F = **0.203** kN/m
Notional bearing length	L_b = **3** mm	Effective span	L_{eff} = **3220** mm

Check bending stress

Permissible bending stress	σ_{m_adm} = **6.292** N/mm^2	Applied bending stress	σ_{m_max} = **1.494** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **4.124** N/mm^2 Applied compressive stress σ_{c_max} = **0.170** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.282 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.737** N/mm^2 Applied shear stress τ_{max} = **0.070** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.659** mm Total deflection δ_{max} = **2.526** mm

PASS - Total deflection within permissible limits

Consider medium term load condition

Load duration factor K_3 = **1.25** Total UDL perp. to rafter F = **0.384** kN/m

Notional bearing length L_b = **5** mm Effective span L_{eff} = **3222** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **7.865** N/mm^2 Applied bending stress σ_{m_max} = **2.830** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **4.713** N/mm^2 Applied compressive stress σ_{c_max} = **0.322** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.437 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.921** N/mm^2 Applied shear stress τ_{max} = **0.132** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.667** mm Total deflection δ_{max} = **4.793** mm

PASS - Total deflection within permissible limits

Consider short term load condition

Load duration factor K_3 = **1.50** Total UDL perp. to rafter F = **0.203** kN/m

Notional bearing length L_b = **6** mm Effective span L_{eff} = **3223** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **9.438** N/mm^2 Applied bending stress σ_{m_max} = **4.694** N/mm^2

PASS - Applied bending stress within permissible limits

Check compressive stress parallel to grain

Permissible comp. stress σ_{c_adm} = **5.169** N/mm^2 Applied compressive stress σ_{c_max} = **0.251** N/mm^2

PASS - Applied compressive stress within permissible limits

Check combined bending and compressive stress parallel to grain

Combined loading check **0.554 < 1**

PASS - Combined compressive and bending stresses are within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **1.106** N/mm^2 Applied shear stress τ_{max} = **0.218** N/mm^2

PASS - Applied shear stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.669** mm Total deflection δ_{max} = **6.903** mm

PASS - Total deflection within permissible limits

PROVIDE: min. 47w x 150d C16 at 400c/c

Design span = 2.7 m

FLAT ROOF : TIMBER JOIST DESIGN (BS5268)

TIMBER JOIST DESIGN (BS5268-2:2002)

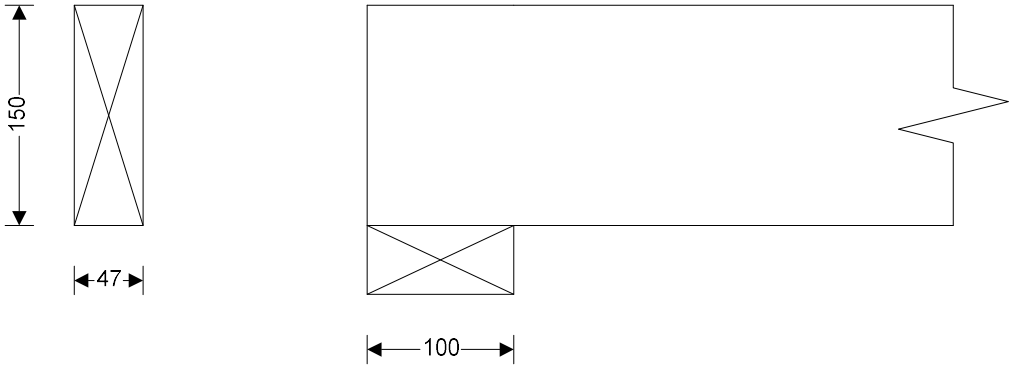
Tedds calculation version 1.1.04

Joist details

Joist breadth	b = **47** mm	Joist depth	h = **150** mm
Joist spacing	s = **400** mm	Service class of timber	**1**
Timber strength class	**C16**		

Span details

Number of spans	N_{span} = **1**	Length of bearing	L_b = **100** mm
Clear length of span	L_{s1} = **2700** mm		



Section properties

Second moment of area	I = **13218750** mm^4	Section modulus	Z = **176250** mm^3

Loading details

Joist self weight	F_{swt} = **0.02** kN/m	Dead load	F_{d_udl} = **0.60** kN/m^2
Imposed UDL(Medium term)	F_{i_udl} = **0.75** kN/m^2		
Imposed point load (Short)	F_{i_pt} = **0.90** kN		

Consider medium term loads

Design bending moment	M = **0.512** kNm	Design shear force	V = **0.758** kN
Design support reaction	R = **0.758** kN	Design deflection	δ = **3.498** mm

Check bending stress

Permissible bending stress	σ_{m_adm} = **7.865** N/mm^2	Applied bending stress	σ_{m_max} = **2.903** N/mm^2

PASS - Applied bending stress within permissible limits

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	Calc. by: EV	Date: 02/09/2022	Chk'd by: MM	Date:	App'd by:	Date:

Check shear stress

Permissible shear stress τ_{adm} = **0.921** N/mm^2 Applied shear stress τ_{max} = **0.161** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **3.025** N/mm^2 Applied bearing stress σ_{c_max} = **0.161** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **8.100** mm Actual deflection δ = **3.498** mm

PASS - Actual deflection within permissible limits

Consider short term loads

Design bending moment M = **0.846** kNm Design shear force V = **1.253** kN

Design support reaction R = **1.253** kN Design deflection δ = **4.990** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **9.438** N/mm^2 Applied bending stress σ_{m_max} = **4.798** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **1.106** N/mm^2 Applied shear stress τ_{max} = **0.267** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **3.630** N/mm^2 Applied bearing stress σ_{c_max} = **0.267** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **8.100** mm Actual deflection δ = **4.990** mm

PASS - Actual deflection within permissible limits

PROVIDE: min. 47w x 150d C16 at 400c/c

Design span = 3.3 m

CEILING : TIMBER JOIST DESIGN (BS5268)

TIMBER JOIST DESIGN (BS5268-2:2002)

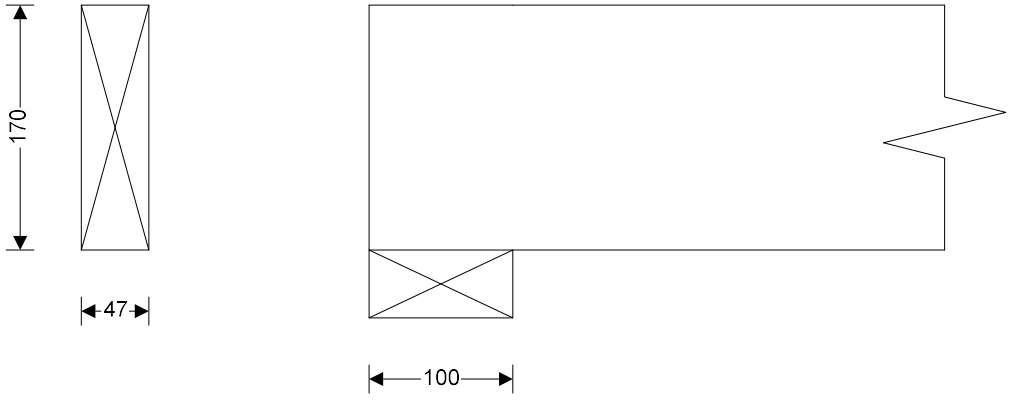
Tedds calculation version 1.1.04

Joist details

Joist breadth	b = **47** mm	Joist depth	h = **170** mm
Joist spacing	s = **400** mm	Service class of timber	**1**
Timber strength class	**C16**		

Span details

Number of spans	N_{span} = **1**	Length of bearing	L_b = **100** mm
Clear length of span	L_{s1} = **3300** mm		



Section properties

Second moment of area	I = **19242583** mm^4	Section modulus	Z = **226383** mm^3

Loading details

Joist self weight	F_{swt} = **0.02** kN/m	Dead load	F_{d_udl} = **0.40** kN/m^2
Imposed UDL(Long term)	F_{i_udl} = **0.25** kN/m^2		
Imposed point load (Medium)	F_{i_pt} = **0.90** kN		

Consider long term loads

Design bending moment	M = **0.387** kNm	Design shear force	V = **0.469** kN
Design support reaction	R = **0.469** kN	Design deflection	δ = **2.698** mm

Check bending stress

Permissible bending stress	σ_{m_adm} = **6.206** N/mm^2	Applied bending stress	σ_{m_max} = **1.709** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.737** N/mm^2 Applied shear stress τ_{max} = **0.088** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **2.420** N/mm^2 Applied bearing stress σ_{c_max} = **0.100** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.900** mm Actual deflection δ = **2.698** mm

PASS - Actual deflection within permissible limits

Consider medium term loads

Design bending moment M = **0.993** kNm Design shear force V = **1.204** kN

Design support reaction R = **1.204** kN Design deflection δ = **5.931** mm

Check bending stress

Permissible bending stress σ_{m_adm} = **7.757** N/mm^2 Applied bending stress σ_{m_max} = **4.388** N/mm^2

PASS - Applied bending stress within permissible limits

Check shear stress

Permissible shear stress τ_{adm} = **0.921** N/mm^2 Applied shear stress τ_{max} = **0.226** N/mm^2

PASS - Applied shear stress within permissible limits

Check bearing stress

Permissible bearing stress σ_{c_adm} = **3.025** N/mm^2 Applied bearing stress σ_{c_max} = **0.256** N/mm^2

PASS - Applied bearing stress within permissible limits

Check deflection

Permissible deflection δ_{adm} = **9.900** mm Actual deflection δ = **5.931** mm

PASS - Actual deflection within permissible limits

PROVIDE: 47w x 170d C16 at 400c/c

LOAD ASSESSMENT – H1-1

a = 2.5 m Ld =√ (a^2 + b^2) = **3.607** m

b = 2.5 m

(Full VDL)

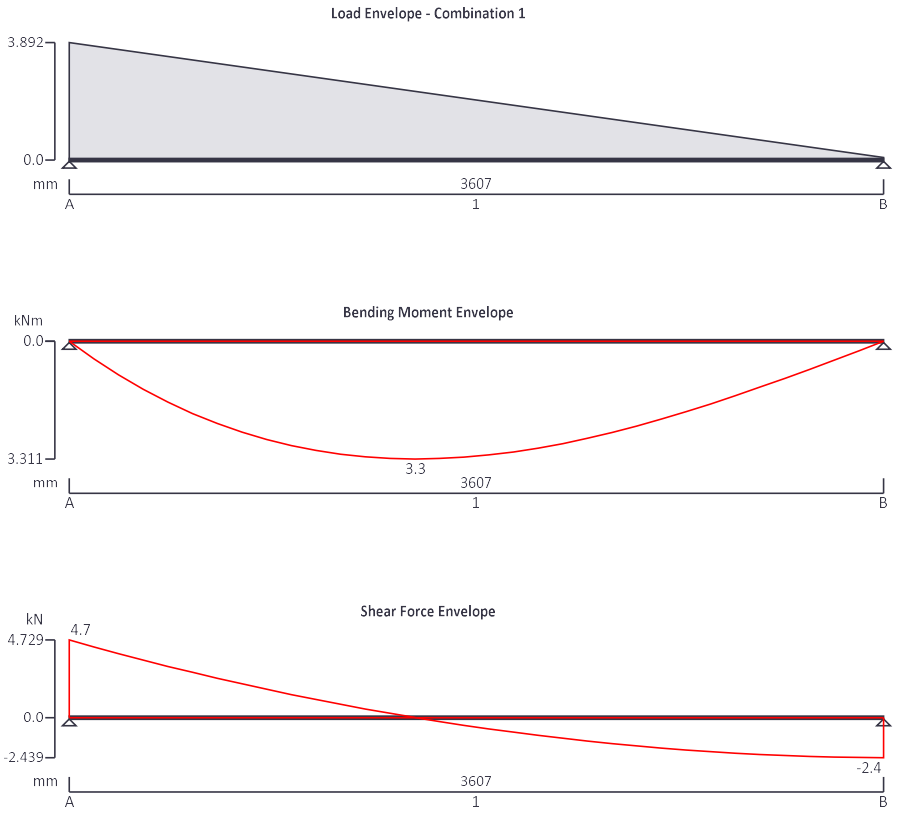
w1 = roof_DL = 0.77 * (a+b) / 2 = **1.925** kN/m

w1= roof_LL = 0.75 * (a+b) /2 = **1.875** kN/m

H1-1 : TIMBER BEAM ANALYSIS & DESIGN (BS5268)

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.02



Applied loading

Beam loads

	Dead self weight of beam × 1
w1	Dead full VDL 1.930 kN/m to 0.000 kN/m
w1	Imposed full VDL 1.880 kN/m to 0.000 kN/m

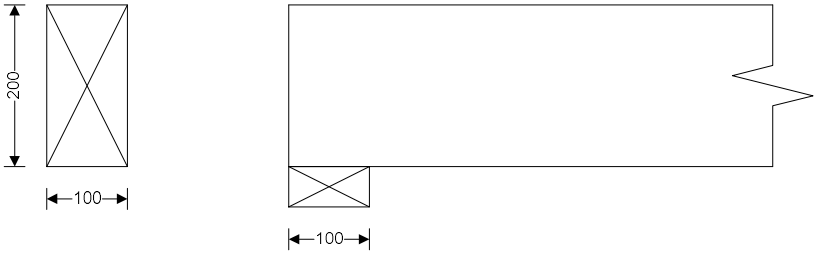
Load combinations

Load combination 1	Support A	Dead × 1.00
		Imposed × 1.00
	Span 1	Dead × 1.00
		Imposed × 1.00

Support B — Dead × 1.00; Imposed × 1.00

Analysis results

Design moment	M = **3.311** kNm	Design shear	F = **4.729** kN
Total load on beam	W_{tot} = **7.168** kN		
Reactions at support A	R_{A_max} = **4.729** kN	R_{A_min} = **4.729** kN	
Unfactored dead load reaction at support A	R_{A_Dead} = **2.469** kN		
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **2.260** kN		
Reactions at support B	R_{B_max} = **2.439** kN	R_{B_min} = **2.439** kN	
Unfactored dead load reaction at support B	R_{B_Dead} = **1.309** kN		
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **1.130** kN		



Timber section details

Breadth of section	b = **100** mm	Depth of section	h = **200** mm
Number of sections	N = **1**	Breadth of beam	b_b = **100** mm
Timber strength class	**C24**		

Member details

Service class of timber	**1**	Load duration	**Long term**
Length of span	L_{s1} = **3607** mm		
Length of bearing	L_b = **100** mm		

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio **4.00** — Actual depth-to-breadth ratio **2.00**

PASS - Lateral support is adequate

Check bearing stress

Permissible bearing stress σ_{c_adm} = **2.400** N/mm^2 — Applied bearing stress σ_{c_a} = **0.473** N/mm^2

PASS - Applied compressive stress is less than permissible compressive stress at bearing

Bending parallel to grain

Permissible bending stress σ_{m_adm} = **7.842** N/mm^2 — Applied bending stress σ_{m_a} = **4.966** N/mm^2

PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress τ_{adm} = **0.710** N/mm^2 — Applied shear stress τ_a = **0.355** N/mm^2

PASS - Applied shear stress is less than permissible shear stress

Deflection

Permissible deflection δ_{adm} = **10.821** mm — Total deflection δ_a = **9.582** mm

PASS - Total deflection is less than permissible deflection

PROVIDE: <u>100w x 200d C24</u>

LOAD ASSESSMENT – B1-1

Design span = 5.7m

(Full UDL)

w1 = $roof_{DL}$ = 0.97 kN/m^2 * 4.7m /2= **2.280** kN/m

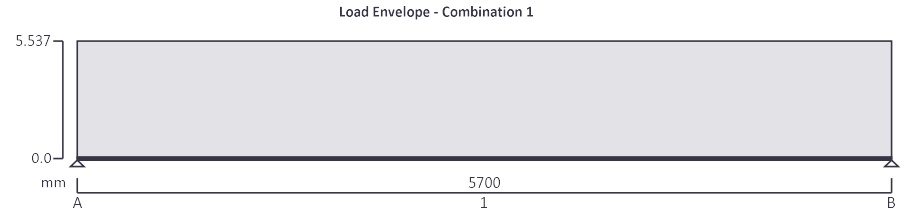
w1= $roof_{LL}$ = 0.53 kN/m^2 * 4.7m /2= **1.246** kN/m

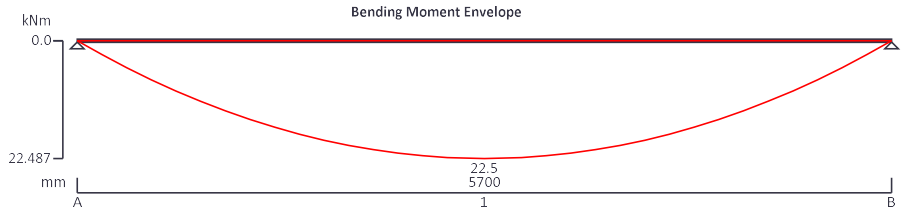
B1-1 : STEEL BEAM ANALYSIS & DESIGN (BS5950)

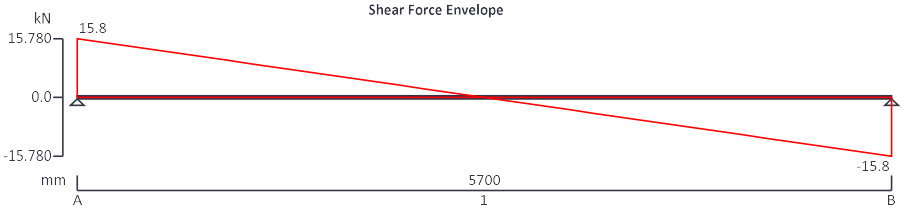
STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.07







Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Applied loading

Beam loads	Dead self weight of beam × 1
	w1 - Dead full UDL 2.3 kN/m
	w1 - Imposed full UDL 1.25 kN/m

Load combinations

Load combination 1 - D + L (ULS)	Support A	Dead × 1.40

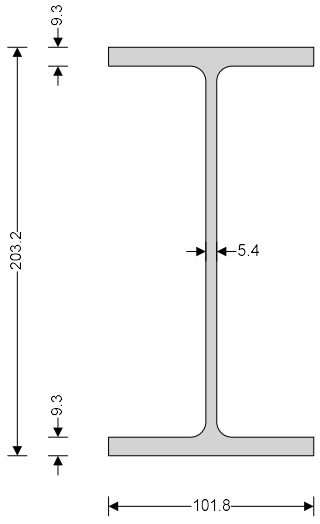
		Imposed × 1.60
		Dead × 1.40
		Imposed × 1.60
	Support B	Dead × 1.40
		Imposed × 1.60

Analysis results

Maximum moment	M_{max} = **22.5** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **15.8** kN	V_{min} = **-15.8** kN
Deflection	δ_{max} = **12** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **15.8** kN	R_{A_min} = **15.8** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **7.2** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **3.6** kN	
Maximum reaction at support B	R_{B_max} = **15.8** kN	R_{B_min} = **15.8** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **7.2** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **3.6** kN	

Section details

Section type **UB 203x102x23 (BS4-1)** Steel grade **S275**



Classification of cross sections - Section 3.5

Tensile strain coefficient ε = **1.00** Section classification **Plastic**

Shear capacity - Section 4.2.3

Design shear force F_v = **15.8** kN Design shear resistance P_v = **181.1** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment M = **22.5** kNm Moment capacity low shear M_c = **64.4** kNm

PASS - Moment capacity exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection δ_{lim} = **15.833** mm Maximum deflection δ = **12.029** mm

PASS - Maximum deflection does not exceed deflection limit

PROVIDE: <u>203 x 133 x 25 UB</u> (to limit deflection)

LOAD ASSESSMENT – B1-2

Design span = 2.6m

(Full UDL)

w1 = roof_DL = 0.97 kN/m^2 * 4.7m /2= **2.280** kN/m

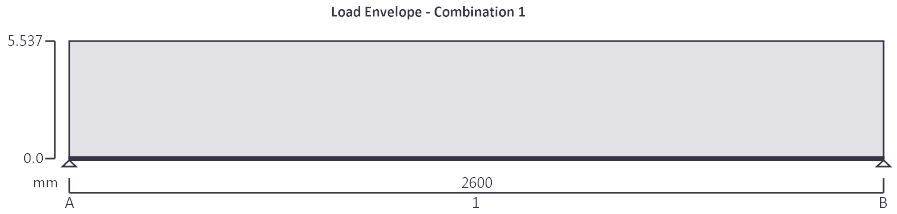
w1= roof_LL = 0.53 kN/m^2 * 4.7m /2= **1.246** kN/m

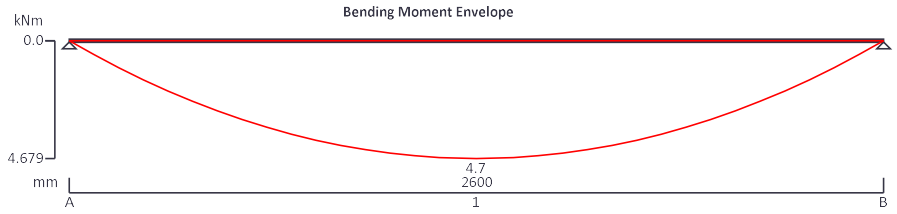
B1-2 : STEEL BEAM ANALYSIS & DESIGN (BS5950)

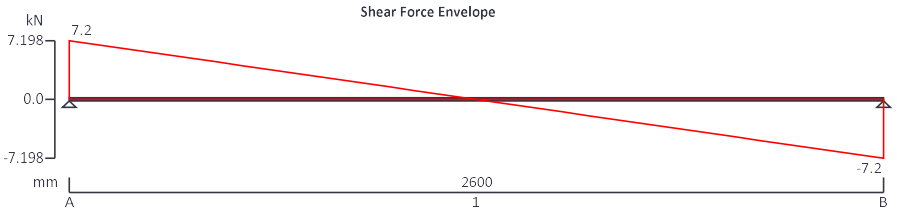
STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.07







Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Applied loading

Beam loads	Dead self weight of beam × 1
	w1 - Dead full UDL 2.3 kN/m
	w1 - Imposed full UDL 1.25 kN/m

Load combinations

Load combination 1 - D + L (ULS)	Support A	Dead × 1.40

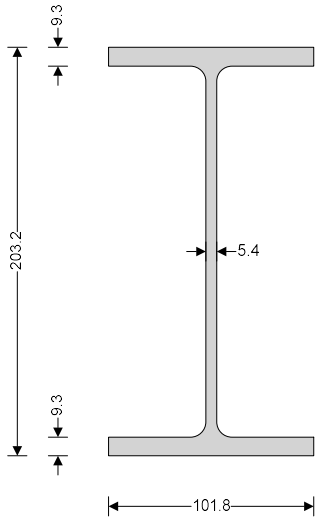
		Imposed × 1.60
		Dead × 1.40
		Imposed × 1.60
	Support B	Dead × 1.40
		Imposed × 1.60

Analysis results

Maximum moment	M_{max} = **4.7** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **7.2** kN	V_{min} = **-7.2** kN
Deflection	δ_{max} = **0.5** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **7.2** kN	R_{A_min} = **7.2** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **3.3** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **1.6** kN	
Maximum reaction at support B	R_{B_max} = **7.2** kN	R_{B_min} = **7.2** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **3.3** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **1.6** kN	

Section details

Section type **UB 203x102x23 (BS4-1)** Steel grade **S275**



Classification of cross sections - Section 3.5

Tensile strain coefficient ε = **1.00** Section classification **Plastic**

Shear capacity - Section 4.2.3

Design shear force F_v = **7.2** kN Design shear resistance P_v = **181.1** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment M = **4.7** kNm Moment capacity low shear M_c = **64.4** kNm

PASS - Moment capacity exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection δ_{lim} = **7.222** mm Maximum deflection δ = **0.521** mm

PASS - Maximum deflection does not exceed deflection limit

PROVIDE: <u>203 x 133 x 25 UB</u>

LOAD ASSESSMENT – B1-3

Design span = 3.4m (Simplified loading)
P1 @ 2.2m :

B1-2_DL = 3.3 kN

B1-2_LL = 1.6 kN

(Full UDL)
w1 = roof_DL = 0.77 * 3.1 / 2 = **1.194** kN/m
w1= roof_LL = 0.75 * 3.1 / 2 = **1.163** kN/m
w2 = ceiling_DL = 0.55 * 3.1 /2 = **0.853** kN/m
w2 = ceiling_LL = 0.25 * 3.1 /2 = **0.388** kN/m

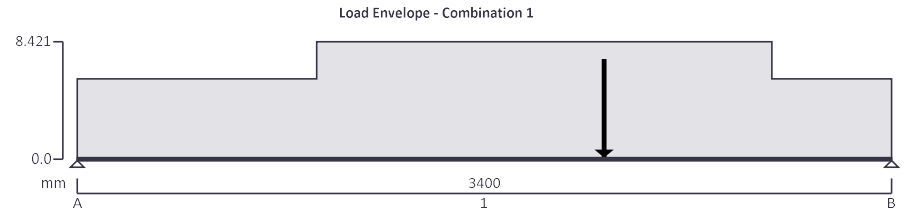
(Partial UDL)
w1 = timber_frame_DL = 1.20 * 1.6 = **1.920** kN/m - Partially from 1.0m to 2.9m

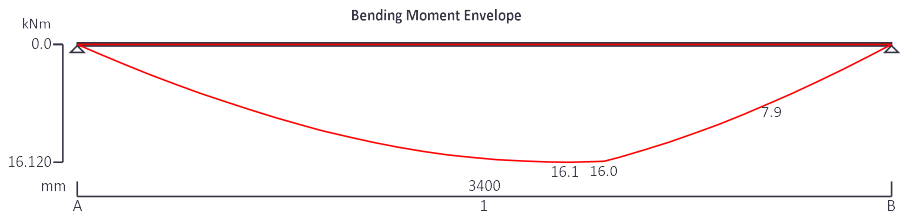
B1-3 : STEEL BEAM ANALYSIS & DESIGN (BS5950)

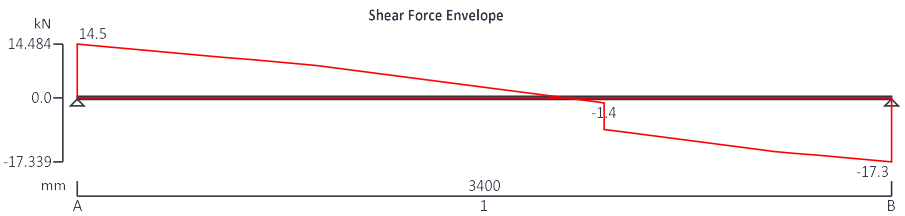
STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.07







Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Applied loading

Beam loads	Dead self weight of beam × 1
	w1 - Dead full UDL 1.2 kN/m
	w1 - Imposed full UDL 1.2 kN/m
	w2 - Dead full UDL 0.9 kN/m
	w2 - Imposed full UDL 0.4 kN/m
	w3 - Dead partial UDL 1.9 kN/m from 1000 mm to 2900 mm
	P1 - Dead point load 3.3 kN at 2200 mm
	P1 - Imposed point load 1.6 kN at 2200 mm

Load combinations

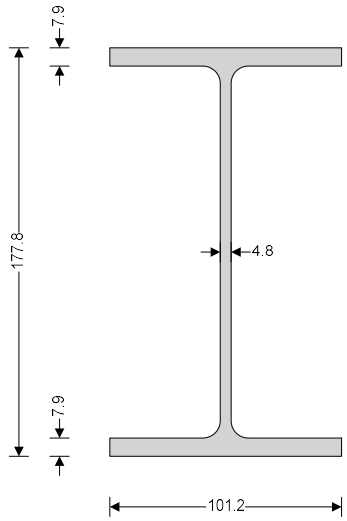
Load combination 1 - D + L (ULS)	Support A	Dead × 1.40
		Imposed × 1.60
		Dead × 1.40
		Imposed × 1.60
	Support B	Dead × 1.40
		Imposed × 1.60

Analysis results

Maximum moment	M_{max} = **16.1** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **14.5** kN	V_{min} = **-17.3** kN
Deflection	δ_{max} = **4.6** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **14.5** kN	R_{A_min} = **14.5** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **6.6** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **3.3** kN	
Maximum reaction at support B	R_{B_max} = **17.3** kN	R_{B_min} = **17.3** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **8.1** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **3.8** kN	

Section details

Section type	**UB 178x102x19 (BS4-1)**	Steel grade	**S275**



Classification of cross sections - Section 3.5

Tensile strain coefficient ε = **1.00** Section classification **Plastic**

Shear capacity - Section 4.2.3

Design shear force F_v = **17.3** kN Design shear resistance P_v = **140.8** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment M = **16.1** kNm Moment capacity low shear M_c = **47.1** kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment M_b = **17.6** kNm M_b / m_{LT} = **19.7** kNm

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection δ_{lim} = **9.444** mm Maximum deflection δ = **4.607** mm

PASS - Maximum deflection does not exceed deflection limit

PROVIDE: <u>178 x 102 x 19 UB</u>

LOAD ASSESSMENT – B1-4

Design span = 4.0m

(Full UDL)

w1 = roof_DL = 0.97 * 2.5 / 2 = **1.213** kN/m

w1= roof_LL = 0.53 * 2.5 / 2 = **0.663** kN/m

w2 = ceiling_DL = 0.55 * 1.3 /2 = **0.358** kN/m

w2 = ceiling_LL = 0.25 * 1.3 /2 = **0.163** kN/m

w3 = flat_roof_DL = 0.75 * 2.7 / 2 = **1.013** kN/m

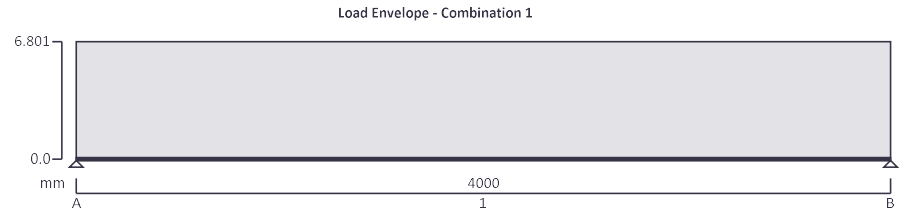
w3= flat_roof_LL = 0.75 * 2.7 / 2 = **1.013** kN/m

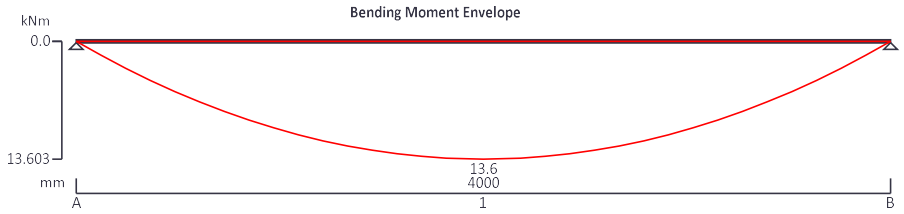
B1-4 : STEEL BEAM ANALYSIS & DESIGN (BS5950)

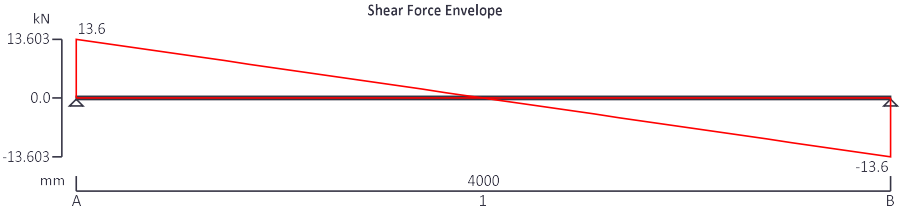
STEEL BEAM ANALYSIS & DESIGN (BS5950)

In accordance with BS5950-1:2000 incorporating Corrigendum No.1

TEDDS calculation version 3.0.07







Support conditions

Support A	Vertically restrained
	Rotationally free
Support B	Vertically restrained
	Rotationally free

Applied loading

Beam loads	Dead self weight of beam × 1
	w1 - Dead full UDL 1.21 kN/m
	w1 - Imposed full UDL 0.66 kN/m
	w2 - Dead full UDL 0.36 kN/m
	w2 - Imposed full UDL 0.16 kN/m
	w3 - Dead full UDL 1.01 kN/m
	w3 - Imposed full UDL 1.01 kN/m

Load combinations

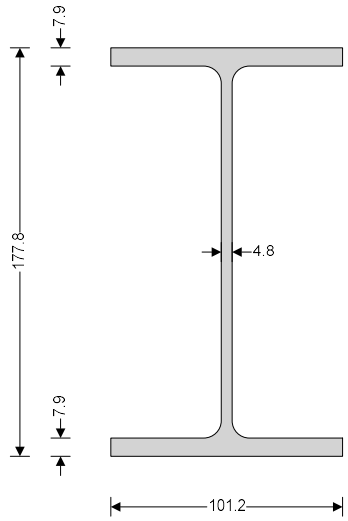
Load combination 1 - D + L (ULS)	Support A	Dead × 1.40
		Imposed × 1.60
		Dead × 1.40
		Imposed × 1.60
	Support B	Dead × 1.40
		Imposed × 1.60

Analysis results

Maximum moment	M_{max} = **13.6** kNm	M_{min} = **0** kNm
Maximum shear	V_{max} = **13.6** kN	V_{min} = **-13.6** kN
Deflection	δ_{max} = **5.5** mm	δ_{min} = **0** mm
Maximum reaction at support A	R_{A_max} = **13.6** kN	R_{A_min} = **13.6** kN
Unfactored dead load reaction at support A	R_{A_Dead} = **5.5** kN	
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **3.7** kN	
Maximum reaction at support B	R_{B_max} = **13.6** kN	R_{B_min} = **13.6** kN
Unfactored dead load reaction at support B	R_{B_Dead} = **5.5** kN	
Unfactored imposed load reaction at support B	$R_{B\_Imposed}$ = **3.7** kN	

Section details

Section type **UB 178x102x19 (BS4-1)** Steel grade **S275**



Classification of cross sections - Section 3.5

Tensile strain coefficient ε = **1.00** Section classification **Plastic**

Shear capacity - Section 4.2.3

Design shear force F_v = **13.6** kN Design shear resistance P_v = **140.8** kN

PASS - Design shear resistance exceeds design shear force

Moment capacity - Section 4.2.5

Design bending moment M = **13.6** kNm Moment capacity low shear M_c = **47.1** kNm

Buckling resistance moment - Section 4.3.6.4

Buckling resistance moment M_b = **15.3** kNm M_b / m_{LT} = **16.6** kNm

PASS - Buckling resistance moment exceeds design bending moment

Check vertical deflection - Section 2.5.2

Consider deflection due to dead and imposed loads

Limiting deflection δ_{lim} = **11.111** mm Maximum deflection δ = **5.512** mm

PASS - Maximum deflection does not exceed deflection limit

PROVIDE: <u>178 x 102 x 19 UB AS B1-4 AND B1-5</u>

OMK DESIGN CONSULTANCY	Project Title: SONNING CRICKET CLUB PAVILION			Job Ref: 22 - 079	
	Part of structure: TERRACE + LINTELS			Calc sheet no.: 22	Revision: A
	Drawing Ref	Calc by: MM	Date: 09/22	Checked by	Date

Ref	Calculations	Output

B1-9 to B1-15 span = 3.0m (max)

Loading
Roof (13) $1.52 \times (2.1/2 + 0.3) =$ 2.1
Ceiling $0.55 \times 2.1/2 =$ 0.6
2.7 kN/m

PROVIDE 100×200 C24 BEAMS (refer to calc sheet)

Lintels

L1-1 to L1-3 span = 0.7m

Loading
215 wall $(3.23 + 0.3 + 0.4) \times 0.2 =$ 0.8
Roof (13) $1.52 \times (2.5/2 + 0.4) =$ 2.5
Ceiling $0.8 \times 2.5/2 =$ 1.0
$4.3 \times 0.7 =$ 3.0 kN

PROVIDE 1No 80×200 AS L1-1 TO L1-3 (SWL = 15 kN)

L1-4/L1-5 span = 1.3m (worst case)

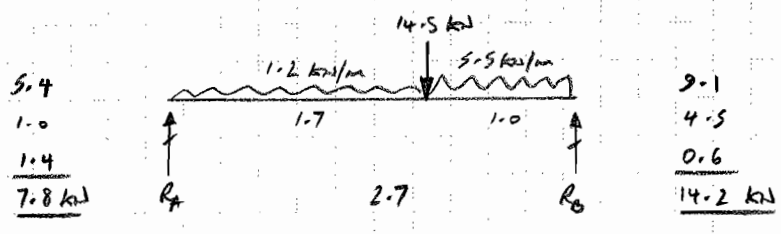
Loading
215 wall As above = 0.8
Roof 13 $1.52 \times (3.1/2 + 0.4) =$ 3.0
Ceiling $0.8 \times 3.1/2 =$ 1.2
$5.0 \times 1.3 =$ 6.5 kN

PROVIDE 1No 80×200 AS L1-4 & L1-5

B1-6/B1-7 span = 2.7m

Loading

Inner	Via B1-3	6.6 + 3.3 =	9.9 kN	14.5 kN
	215 wall	$(3.83 \times 0.35)/2 =$	0.7	0.9
	SW	=	0.2	0.3
			0.9 kN/m	1.2 kN/m
	Roof	$1.49 \times 2.2/2 =$	1.6	2.4
	Ceiling	$0.8 \times 3.3/2 =$	1.3	1.9
			2.9 kN/m	4.3 kN/m



Max BM = $14.2 \times 1.0 - 5.5 \times 1.0^2/2 =$ 11.5 kNm (w = 8.7 kN/m)

OMK DESIGN CONSULTANCY	Project Title: SONNING CRICKET CLUB PAVILION			Job Ref: 22 - 079	
	Part of structure: LINTELS			Calc sheet no.: 23	Revision: A
	Drawing Ref	Calc by: MM	Date: 09/22	Checked by	Date

Ref	Calculations	Output

I_x req = $2.29 \times 8.7 \times 2.7^3$ = 392cm⁴

Try 152×89×16 UB

L_E = $1.2 \times 2.7 + 2 \times 0.15$ = 3.5m

From tables M_b = 15.1 kNm I_x = 834cm⁴ OK

PROVIDE 2 No 152×89×16 UB's AS B1-6/B1-7

B1-8 span = 1.0m

By inspection & for detail

PROVIDE 152×89×16 UB AS B1-8

L1-6 span = 0.95m (clear)

Loading Ceiling $0.8 \times 4.6/2$ = 1.8
100 block $(1.5 + 0.3 \times 2) \times 0.2$ = 0.4
2.2 × 0.95 = 2.1 kN

PROVIDE 100W×65d PCC LINTEL FOR ALL INTERNAL LINTELS UNLESS NOTED OTHERWISE

B1-16 span = 3.4m

Loading Flat Roof $1.5 \times 1.9/2$ = 1.4 2.1
SW = 0.3 0.4
1.7 kN/m 2.5 kN/m

Via Roof $1.49 \times 5.4/2 \times 4.8/2$ = 9.7 kN 14.2 kN

Reactions = $\frac{2.5 \times 3.4}{2} + \frac{14.2}{2}$ = 11.4 kN

Max BM = $\frac{2.5 \times 3.4^2}{8} + \frac{14.2 \times 3.4}{4}$ = 15.7 kNm (Wz 7.5 kN/m)

I_x req = $2.29 \times 7.5 \times 3.4^3$ = 675cm⁴

Try 150×90×24 PFC L_E = $1.2 \times 3.4 + 2 \times 0.15$ = 4.4m

From tables M_b = 27.9 kNm I_x = 1160cm⁴ OK

PROVIDE 150×90×24 PFC AS B1-16

By inspection

PROVIDE 152×89×16 UB AS B1-17 (IF REQUIRED)

OMK DESIGN CONSULTANCY	Project Title: Sonning Cricket Club Pavilion			Job Ref: 22-079	
	Part of structure: Terrace			Calc sheet no. / Revision	
	Drawing Ref	Calc by: MM	Date: 09/22	Checked by	Date

Timber Beam Design

Design Criteria

Design Span	3.00	m
Angle of Incline	0	°

Loadcase 1

Dead & Live UDL

Load w	2.70	kN/m
End Reaction R	4.05	kN
Load w_x	2.70	kN/m
Maximum Moment M_x	3.04	kNm

Member Criteria

Timber Grade	C24	
Grade Stress σ	7.50	N/mm²
Design Stress σ_{adm}	**6.00**	N/mm²
Grade E_{min}	7200	N/mm²
Design $E_{min,adm}$	**5760**	N/mm²

K Factors

K_2 (service class 3)	0.8
K_3 (load duration)	1.0
K_8 (load sharing systems)	1.0
K_9 (multiple members)	1.00

Member Design

Member Quantity	1	No.	Section Modulus Z_{xx}	6.67E+05	mm³
Breadth	100	mm	Second Moment of Area I_{xx}	6.67E+07	mm⁴
Depth	200	mm			

Stress σ_{ma}	**4.56**	N/mm²	76 % capacity
Bending Deflection $\delta_{M,x}$	7.4	mm	
Total Deflection $\delta_{\perp}$	**7.4**	mm	Span x 0.003 = 9.0 mm
End Reaction R	**4.05**	kN	

Provide 1No. 100 x 200 C24