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STRUCTURALENGINEER

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COMPUTATIONS

Project:

54 & 54A Beresford Drive
Cape Woolamai
Additions

Project No: ***117.05***

Client:

Grimwade

Codes Used:

AS1170 – Loading code
AS4100 – Steel Structures
AS3600 – Concrete Structures

Description:

Design of post, columns, pad footings and lintels

Computations:

Pages 1 - 7

Job No. 1170S
Page No. 1
Designed PRD

Steel column design V3.00a

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Member:	**(Post P1) 89 x 5.0 SHS (Connection 100mm from face)**	
Compr:	**Nc* = 19.1kN < øNc = 282.7kN**	**OK (0.07)**
Bending:	**Mx* = 2.8kNm < øMb(3000,αm=1.75) = 15.5kNm**	**OK (0.18)**
	No minor bending	
Combined:	**In-plane = 0.25, Out-of-plane = 0.25**	**OK (0.25)**

Geometry

Segment length (L) =	3000 mm	L = Lx = Ly =	Y (Y)es,(N)o
Major axis length (Lx) =	3000 mm		
Minor axis length (Ly) =	3000 mm		
Eff. X factor (kex) =	1.00	αm =	1.75
Eff. Y factor (key) =	1.00		
		Holes =	0 mm^2

Loadings

S.Wt = 0.12 kN/m (excluded)

Dead load comp. (Ndl) =	8.2 kN	Analysis type =	1 (1)st order,(2)nd order
Live load comp. (Nll) =	6.2 kN	Type =	B (B)raced/(S)way
Nc* = 1.2*Ndl+1.5*Nll =	19.1 kN	βm =	0.0 cm = 0.60
		δbx = cm/(1-N*/Nombx) =	1.00 and δby = 1.00
Bending moment =	F (C)ap,(F)ace,(M)anual		
Major axis Mx*=δbx.Nc*(D/2+100) =	2.8 kNm		
Minor axis My*=δby.My* =	0.0 kNm	Minor bending (My*) =	0.0 kNm
D =	89 mm (Bending about the strong axis only)		

Capacity

Description =	89 x 5.0 SHS	Warping constant (Iw) =	0 $x10^9$ mm^6
Flange yield (Fyf) =	350 MPa	Torsional constant (J) =	3060 $x10^3$ mm^4
Area (Ag) =	1590 mm^2	Effective section mod. (Zex) =	49.2 $x10^3$ mm^3
Stiffness (Ix) =	1.82 $x10^6$ mm^4	Effective section mod. (Zey) =	49.2 $x10^3$ mm^3
Shear modulus (G) =	80000 MPa	Elastic modulus (E) =	200000 MPa
rx =	33.8 mm	αb =	-0.5 (Comp.)
ry =	33.8 mm	Nett area (An) =	1590 mm^2
Eff. X Length (Lex) =	3000 mm	Nomx = π^2*E*Ix/(kex*Lx)^2 =	399 kN
Eff. Y Length (Ley) =	3000 mm	Nomy = π^2*E*Iy/(key*Ly)^2 =	399 kN

Bending

Msx =	17.2 kNm		øMsx =	15.5 kNm		øMsy =	15.5 kNm
Moa =	312.6 kNm	αs = 1.000		αm = 1.75		øMbx =	15.5 kNm
						øMbx(αm=1) =	15.5 kNm

Compression

			øNs = 0.9*kf*An*fy =	500.9 kN	
αcx =	0.564		øNcx = øNs*αcx =	282.7 kN	
αcx1 =	0.564		øNcx1 = øNs*αcx1 =	282.7 kN	
αcy =	0.564		øNcy = øNs*αcy =	282.7 kN	
αcy1 =	0.564		øNcy1 = øNs*αcy1 =	282.7 kN	
			øNc =	282.7 kN	

Combined

øMrxc = øMsx*(1-Nc*/øNs) =	14.9 kNm	OK (0.19)
øMixc = øMsx*(1-Nc*/øNcx1) =	14.4 kNm	OK (0.19)
øMoxc = øMbx*(1-Nc*/øNcy) =	14.4 kNm	OK (0.19)
In-plane member ratio = Mx*/øMsx + Nc*/øNcx1 =	0.25	OK (0.25)
Out-of-plane member ratio = Mx*/øMbx + Nc*/øNcy =	0.25	OK (0.25)
øMcx = min(øMoxc & øMixc) =	14.4 kNm	

Steel column design V3.00a

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Member:	**(Column C1) 89 x 5.0 SHS (Connection 100mm from face)**	
Compr:	**Nc* = 43.9kN < øNc = 321.5kN**	**OK (0.14)**
Bending:	**Mx* = 6.3kNm < øMb(2700,αm=1.75) = 15.5kNm**	**OK (0.41)**
	No minor bending	
Combined:	**In-plane = 0.55, Out-of-plane = 0.55**	**OK (0.55)**

Geometry

Segment length (L) =	2700 mm	L = Lx = Ly =	Y (Y)es,(N)o
Major axis length (Lx) =	2700 mm		
Minor axis length (Ly) =	2700 mm		
Eff. X factor (kex) =	1.00	αm =	1.75
Eff. Y factor (key) =	1.00		
		Holes =	0 mm^2

Loadings

S.Wt = 0.12 kN/m (excluded)

Dead load comp. (Ndl) =	17.8 kN	Analysis type =	1 (1)st order,(2)nd order
Live load comp. (Nll) =	15.0 kN	Type =	B (B)raced/(S)way
Nc* = 1.2*Ndl+1.5*Nll =	43.9 kN	βm =	0.0 cm = 0.60
		δbx = cm/(1-N*/Nombx) =	1.00 and δby = 1.00
Bending moment =	F (C)ap,(F)ace,(M)anual		
Major axis Mx*=δbx.Nc*(D/2+100) =	6.3 kNm		
Minor axis My*=δby.My* =	0.0 kNm	Minor bending (My*) =	0.0 kNm
D =	89 mm (Bending about the strong axis only)		

Capacity

Description =	89 x 5.0 SHS	Warping constant (Iw) =	0 $x10^9$ mm^6
Flange yield (Fyf) =	350 MPa	Torsional constant (J) =	3060 $x10^3$ mm^4
Area (Ag) =	1590 mm^2	Effective section mod. (Zex) =	49.2 $x10^3$ mm^3
Stiffness (Ix) =	1.82 $x10^6$ mm^4	Effective section mod. (Zey) =	49.2 $x10^3$ mm^3
Shear modulus (G) =	80000 MPa	Elastic modulus (E) =	200000 MPa
rx =	33.8 mm	αb =	-0.5 (Comp.)
ry =	33.8 mm	Nett area (An) =	1590 mm^2
Eff. X Length (Lex) =	2700 mm	Nomx = π^2*E*Ix/(kex*Lx)^2 =	493 kN
Eff. Y Length (Ley) =	2700 mm	Nomy = π^2*E*Iy/(key*Ly)^2 =	493 kN

Bending

Msx =	17.2 kNm		øMsx =	15.5 kNm		øMsy =	15.5 kNm
Moa =	347.3 kNm	αs = 1.000		αm = 1.75		øMbx =	15.5 kNm
						øMbx(αm=1) =	15.5 kNm

Compression

		øNs = 0.9*kf*An*fy =	500.9 kN
αcx =	0.642	øNcx = øNs*αcx =	321.5 kN
αcx1 =	0.642	øNcx1 = øNs*αcx1 =	321.5 kN
αcy =	0.642	øNcy = øNs*αcy =	321.5 kN
αcy1 =	0.642	øNcy1 = øNs*αcy1 =	321.5 kN
		øNc =	321.5 kN

Combined

øMrxc = øMsx*(1-Nc*/øNs) =	14.1 kNm	OK (0.45)
øMixc = øMsx*(1-Nc*/øNcx1) =	13.4 kNm	OK (0.47)
øMoxc = øMbx*(1-Nc*/øNcy) =	13.4 kNm	OK (0.47)
In-plane member ratio = Mx*/øMsx + Nc*/øNcx1 =	0.55	OK (0.55)
Out-of-plane member ratio = Mx*/øMbx + Nc*/øNcy =	0.55	OK (0.55)
øMcx = min(øMoxc & øMixc) =	13.4 kNm	

Floor beam design V3.00a

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Member: (Floor Beam FB1) 250x90PFC
Bending: M*(max) = 28.7kNm < øMb(6000,αm=1.13) = 50.7kNm — OK (0.57)
Deflection: δdl = L/1173 (5mm), Ψs.δll = L/2221 (3mm), δtot. = L/767 (8mm) — OK
Precamber: Not required
Reactions: (Each end) Rdl = 8.2kN, Rll = 6.2kN, R* = 19.1kN

Geometry

Span (L) =	6000 mm	Effective length (Le) =	6000 mm
Centres (cts) =	1000 mm	αm =	1.13

Design at = M mm from LHS, (M)ax, (S)eg

Effective length (Le) = 6000 mm
αm = 1.13

Loadings

Floor area =	6.0 m²	Load type =	N (N)ormal, (S)torage
Apply reduction =	N (Y)es,(N)o	Short term LL (Ψs) =	0.7
Floor reduction (Ψa) =	1.00 Cl 3.4.2		

Uniform dead loads

Floor dead load (wdl) =	0.40 kPa * Ψa *	1000 mm +		kN/m =	0.40 kN/m
Super. dead load (wdl) =	0.40 kPa *	2700 mm +		kN/m =	1.08 kN/m
Other dead load (wdl) =	0.40 kPa *	2250 mm +		kN/m =	0.90 kN/m
Include S.Wt =	Y (Y)es,(N)o			S.Wt =	0.36 kN/m
				Σwdl =	2.74 kN/m

Uniform live loads

Floor live load (wll) =	1.50 kPa *	1000 mm +		kN/m =	1.50 kN/m
Partitions (wll) =	0.25 kPa *	2250 mm +		kN/m =	0.56 kN/m
				Σwll =	2.06 kN/m

Point loads

Point dead load (pdl) =	kN	Position =	3000 mm from LHS
Point live load (pll) =	kN		

w* = 1.2*wdl + 1.5*wll =	6.38 kN/m	Rdl =	8.2 kN
p* = 1.2*pdl + 1.5*pll =	0.00 kN	Rll =	6.2 kN
Max M* at =	3000 mm	R* =	19.1 kN
M* =	28.7 kNm (Maximum)		

Capacity

Description =	250x90PFC	Warping constant (Iw) =	35.9 x10⁹ mm⁶
Flange yield (fyf) =	300 MPa	Torsional constant (J) =	238 x10³ mm⁴
Area (Ag) =	4520 mm²	Effective section mod. (Zex) =	421 x10³ mm³
Stiffness (Ix) =	45.1 x10⁶ mm⁴	Effective section mod. (Zey) =	88.7 x10³ mm³
Shear modulus (G) =	80000 MPa	Elastic modulus (E) =	200000 MPa

Msx =	126.3 kNm	øMsx =	113.7 kNm		øMsy =	23.9 kNm
Moa =	64.8 kNm	αs = 0.395	αm = 1.13		øMbx =	50.7 kNm

Deflections

Ireq'd DL (L/360) =	13.8 x10⁶ mm⁴		δDL =	5.1 mm	Span / 1173
Ireq'd Ψs.LL (L/360) =	7.3 x10⁶ mm⁴		Ψs.δLL =	2.7 mm	Span / 2221
Ireq'd DL+Ψs.LL (L/250) =	14.7 x10⁶ mm⁴	< Critical	δTotal =	7.8 mm	Span / 767

Max. precamber (0.3%*span) =	18 mm	Min. precamber =	15 mm
Precamber 80% of δDL =	4 mm	Adopted precamber =	0 mm

1kN midspan δ = 0.5 mm

"T" Lintel V3.00b

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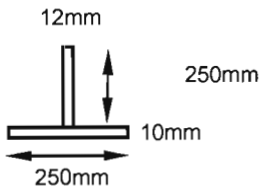
Geometry: (Brickwork Lintel BL1) 250mm x 12mm pl. vertical, 250mm x 10mm pl. horizontal
Design: M* = 28.2kNm < øMb(4700,αm=1.13) = 49.3 kNm — OK (0.57)
Defl'n: δdl = 6.2mm (Span / 756), δll = 0.0mm (Span / -) — OK
Reactions: (Each end) Rdl = 17.8kN, Rll = 0.0kN, R*dn = 24.0kN

Geometry

Span = Le = 4700 mm

αm = 1.13



Vertical web
Thickness = 12 mm
Height = 250 mm
Yield strength = 250 MPa

Horizontal flange
Thickness = 10 mm
Width = 250 mm
Yield strength = 250 MPa

Loading

Uniform dead loads

Roof dead load (wdl) =		kPa *		mm +		kN/m =	0.00 kN/m
Floor dead load (wdl) =		kPa *	1500	mm +		kN/m =	0.00 kN/m
Wall dead load (wdl) =	4.20	kPa *	1700	mm +		kN/m =	7.14 kN/m
Other dead load (wdl) =		kPa *		mm +		kN/m =	0.00 kN/m
Include S.Wt =	Y	(Y)es,(N)o				S.Wt =	0.43 kN/m
						Σwdl =	7.57 kN/m

Uniform live loads

Roof live load (wll) =		kPa *		mm +		kN/m =	0.00 kN/m
Floor live load (wll) =		kPa *	1500	mm +		kN/m =	0.00 kN/m
Other live load (wll) =		kPa *		mm +		kN/m =	0.00 kN/m
Short term LL (Ψs) =	0.7					Σwll =	0.00 kN/m

Point loads
Dead load (Pdl) = kN — Position = 2350 mm from LHS
Live load (Pll) = kN

w* = 1.35*wdl = 10.22 kNm
p* = 1.2*pdl + 1.5*pll = 0.00 kNm
M* = 28.2 kNm
(Max at 2350mm)

Rdl = wdl*L/2 + pdl*(L-pos)/L = 17.8 kN
Rll = wll*L/2 + pll*(L-pos)/L = 0.0 kN
R* = 1.35*Rdl = 24.0 kN

Properties

Area =	5500 mm²	Warping constant (Iw) =	0 mm⁶ (Cl H4)
Stiffness (Ix) =	38.7 x10⁶ mm⁴	Torsional constant (J) =	227 x10³ mm⁴
Stiffness (Iy) =	13.06 x10⁶ mm⁴	Elastic modulus (Zt) =	210 x10³ mm³
Shear modulus (G) =	80000 MPa	Elastic modulus (Zb) =	510 x10³ mm³
Elastic modulus (E) =	200000 MPa	Min. elastic modulus (Zmin) =	210 x10³ mm³
Elastic (y.top) =	184 mm	Plastic modules (S) =	382 x10³ mm³
Plastic (yp.top) =	229 mm	Eff. elastic mod.(Compact) (Zc) =	315 x10³ mm³

Capacity - Cl 5.6.1.2

Web λe =dw/tw*√(fyw/250) = 20.8 < 22, Non-compact — Cl 5.2.2
Zex = Zmin+[(22-Sw)/(22-8)*(Zc-Zmin)] = 219 x10³ mm³

Msx =	54.7 kNm	øMsx =	49.3 kNm	βx =	182.5
Moa =	286.9 kNm	αs =	0.931	αm =	1.13
		øMbx = αm*αs*øMsx ≤ øMsx =	49.3 kNm		

Deflections

Ireq'd DL (L/360) =	18.4 x10⁶ mm⁴	< Critical	δDL =	6.2 mm	Span / 756
Ireq'd LL (L/360) =	0.0 x10⁶ mm⁴		Ψs.δLL =	0.0 mm	Span / -
			1kN midspan δ =	0.3 mm	

"T" Lintel V3.00b

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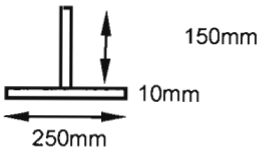
Geometry: (Brickwork Lintel BL2) 150mm x 10mm pl. vertical, 250mm x 10mm pl. horizontal
Design: M* = 10.8kNm < øMb(2800,αm=1.13) = 19.9 kNm — **OK (0.54)**
Defl'n: δdl = 2.5mm (Span / 1135), δll = 1.0mm (Span / 2943) — **OK**
Reactions: (Each end) Rdl = 7.6kN, Rll = 4.2kN, R*dn = 15.4kN

Geometry

Span = Le = 2800 mm

αm = 1.13



Vertical web			Horizontal flange		
Thickness =	10	mm	Thickness =	10	mm
Height =	150	mm	Width =	250	mm
Yield strength =	250	MPa	Yield strength =	250	MPa

Loading

Uniform dead loads

Roof dead load (wdl) =		kPa *		mm +	kN/m =	0.00 kN/m
Floor dead load (wdl) =	0.90	kPa *	1500	mm +	kN/m =	1.35 kN/m
Wall dead load (wdl) =	4.20	kPa *	900	mm +	kN/m =	3.78 kN/m
Other dead load (wdl) =		kPa *		mm +	kN/m =	0.00 kN/m
Include S.Wt =	Y	(Y)es,(N)o			S.Wt =	0.31 kN/m
					Σwdl =	5.44 kN/m

Uniform live loads

Roof live load (wll) =		kPa *		mm +	kN/m =	0.00 kN/m
Floor live load (wll) =	2.00	kPa *	1500	mm +	kN/m =	3.00 kN/m
Other live load (wll) =		kPa *		mm +	kN/m =	0.00 kN/m
Short term LL (Ψs) =	0.7				Σwll =	3.00 kN/m

Point loads

Dead load (Pdl) = kN — Position = 1400 mm from LHS
Live load (Pll) = kN

w* = 1.2*wdl + 1.5*wll = 11.03 kNm
p* = 1.2*pdl + 1.5*pll = 0.00 kNm
M* = 10.8 kNm (Max at 1400mm)

Rdl = wdl*L/2 + pdl*(L-pos)/L = 7.6 kN
Rll = wll*L/2 + pll*(L-pos)/L = 4.2 kN
R* = 1.2*Rdl + 1.5*Rll = 15.4 kN

Properties

Area =	4000 mm²	Warping constant (Iw) =	0 mm⁶ (Cl H4)
Stiffness (Ix) =	8.8 x10⁶ mm⁴	Torsional constant (J) =	133 x10³ mm⁴
Stiffness (Iy) =	13.03 x10⁶ mm⁴	Elastic modulus (Zt) =	71 x10³ mm³
Shear modulus (G) =	80000 MPa	Elastic modulus (Zb) =	252 x10³ mm³
Elastic modulus (E) =	200000 MPa	Min. elastic modulus (Zmin) =	71 x10³ mm³
Elastic (y.top) =	125 mm	Plastic modules (S) =	124 x10³ mm³
Plastic (yp.top) =	152 mm	Eff. elastic mod.(Compact) (Zc) =	106 x10³ mm³

Capacity - Cl 5.6.1.2

Web λe =dw/tw*√(fyw/250) = 15.0 < 22, Non-compact — Cl 5.2.2
Zex = Zmin+[(22-Sw)/(22-8)*(Zc-Zmin)] = 88 x10³ mm³

Msx =	22.1 kNm	øMsx =	19.9 kNm	βx =	77.1
Moa =	352.4 kNm	αs =	1.002	αm =	1.13
		øMbx = αm*αs*øMsx ≤ øMsx =	19.9 kNm		

Deflections

Ireq'd DL (L/360) =	2.8 x10⁶ mm⁴	< Critical	δDL =	2.5 mm	Span / 1135
Ireq'd LL (L/360) =	1.1 x10⁶ mm⁴		Ψs.δLL =	1.0 mm	Span / 2943
			1kN midspan δ =	0.3 mm	

"T" Lintel V3.00b

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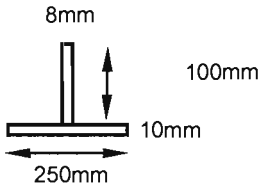
Geometry:	**(Brickwork Lintel BL3) 100mm x 8mm pl. vertical, 250mm x 10mm pl. horizontal**	
Design:	**M* = 4.0kNm < øMb(1700,αm=1.13) = 8.3 kNm**	**OK (0.48)**
Defl'n:	**δdl = 1.2mm (Span / 1462), δll = 0.5mm (Span / 3753)**	**OK**
Reactions:	**(Each end) Rdl = 4.6kN, Rll = 2.6kN, R*dn = 9.3kN**	

Geometry

Span = Le = 1700 mm

αm = 1.13



Vertical web

Thickness = 8 mm
Height = 100 mm
Yield strength = 250 MPa

Horizontal flange

Thickness = 10 mm
Width = 250 mm
Yield strength = 250 MPa

Loading

Uniform dead loads

Roof dead load (wdl) =		kPa *		mm +		kN/m =	0.00 kN/m
Floor dead load (wdl) =	0.90	kPa *	1500	mm +		kN/m =	1.35 kN/m
Wall dead load (wdl) =	4.20	kPa *	900	mm +		kN/m =	3.78 kN/m
Other dead load (wdl) =		kPa *		mm +		kN/m =	0.00 kN/m
Include S.Wt =	Y	(Y)es,(N)o				S.Wt =	0.26 kN/m
						Σwdl =	5.39 kN/m

Uniform live loads

Roof live load (wll) =		kPa *		mm +		kN/m =	0.00 kN/m
Floor live load (wll) =	2.00	kPa *	1500	mm +		kN/m =	3.00 kN/m
Other live load (wll) =		kPa *		mm +		kN/m =	0.00 kN/m
Short term LL (Ψs) =	0.7					Σwll =	3.00 kN/m

Point loads

Dead load (Pdl) = kN
Live load (Pll) = kN
Position = 850 mm from LHS

w* = 1.2*wdl + 1.5*wll = 10.97 kNm
p* = 1.2*pdl + 1.5*pll = 0.00 kNm
M* = 4.0 kNm
(Max at 850mm)

Rdl = wdl*L/2 + pdl*(L-pos)/L = 4.6 kN
Rll = wll*L/2 + pll*(L-pos)/L = 2.6 kN
R* = 1.2*Rdl + 1.5*Rll = 9.3 kN

Properties

Area =	3300 mm^2	Warping constant (Iw) =	0 mm^6 (Cl H4)
Stiffness (Ix) =	2.5 $x10^6$ mm^4	Torsional constant (J) =	100 $x10^3$ mm^4
Stiffness (Iy) =	13.03 $x10^6$ mm^4	Elastic modulus (Zt) =	28 $x10^3$ mm^3
Shear modulus (G) =	80000 MPa	Elastic modulus (Zb) =	138 $x10^3$ mm^3
Elastic modulus (E) =	200000 MPa	Min. elastic modulus (Zmin) =	28 $x10^3$ mm^3
Elastic (y.top) =	92 mm	Plastic modules (S) =	50 $x10^3$ mm^3
Plastic (yp.top) =	103 mm	Eff. elastic mod.(Compact) (Zc) =	41 $x10^3$ mm^3

Capacity - Cl 5.6.1.2

Web λe =dw/tw*√(fyw/250) = 12.5 < 22, Non-compact Cl 5.2.2
Zex = Zmin+[(22-Sw)/(22-8)*(Zc-Zmin)] = 37 $x10^3$ mm^3

Msx =	9.2 kNm	øMsx =	8.3 kNm	βx =	11.5
Moa =	323.1 kNm	αs =	1.022	αm =	1.13
		øMbx = αm*αs*øMsx ≤ øMsx =	8.3 kNm		

Deflections

Ireq'd DL (L/360) =	0.6 $x10^6$ mm^4	< Critical	δDL =	1.2 mm	Span / 1462
Ireq'd LL (L/360) =	0.2 $x10^6$ mm^4		Ψs.δLL =	0.5 mm	Span / 3753
			1kN midspan δ =	0.2 mm	

"T" Lintel V3.00b

Deery Consutling Pty Ltd | Paul Deery

Geometry: (Brickwork Lintel BL4) 100mm x 10mm pl. vertical, 250mm x 10mm pl. horizontal
Design: M* = 5.0kNm < øMb(2500,αm=1.13) = 10.9 kNm — OK (0.46)
Defl'n: δdl = 3.6mm (Span / 700), δll = 0.5mm (Span / 4704) — OK
Reactions: (Each end) Rdl = 5.3kN, Rll = 1.1kN, R*dn = 8.0kN

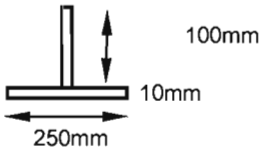
Geometry

Span = Le = 2500 mm

αm = 1.13

Vertical web
Thickness = 10 mm
Height = 100 mm
Yield strength = 250 MPa

Horizontal flange
Thickness = 10 mm
Width = 250 mm
Yield strength = 250 MPa



Loading

Uniform dead loads							
Roof dead load (wdl) =	0.40	kPa *	3600	mm +		kN/m =	1.44 kN/m
Floor dead load (wdl) =		kPa *		mm +		kN/m =	0.00 kN/m
Wall dead load (wdl) =	4.20	kPa *	600	mm +		kN/m =	2.52 kN/m
Other dead load (wdl) =		kPa *		mm +		kN/m =	0.00 kN/m
Include S.Wt =	Y	(Y)es,(N)o				S.Wt =	0.28 kN/m
						Σwdl =	4.24 kN/m
Uniform live loads							
Roof live load (wll) =	0.25	kPa *	3600	mm +		kN/m =	0.90 kN/m
Floor live load (wll) =		kPa *	1500	mm +		kN/m =	0.00 kN/m
Other live load (wll) =		kPa *		mm +		kN/m =	0.00 kN/m
Short term LL (Ψs) =	0.7					Σwll =	0.90 kN/m

Point loads
Dead load (Pdl) = kN — Position = 1250 mm from LHS
Live load (Pll) = kN

w* = 1.2*wdl + 1.5*wll = 6.43 kNm — Rdl = wdl*L/2 + pdl*(L-pos)/L = 5.3 kN
p* = 1.2*pdl + 1.5*pll = 0.00 kNm — Rll = wll*L/2 + pll*(L-pos)/L = 1.1 kN
M* = 5.0 kNm (Max at 1250mm) — R* = 1.2*Rdl + 1.5*Rll = 8.0 kN

Properties

Area =	3500 mm^2	Warping constant (Iw) =	0 mm^6 (Cl H4)
Stiffness (Ix) =	3.0 x10^6 mm^4	Torsional constant (J) =	117 x10^3 mm^4
Stiffness (Iy) =	13.03 x10^6 mm^4	Elastic modulus (Zt) =	34 x10^3 mm^3
Shear modulus (G) =	80000 MPa	Elastic modulus (Zb) =	146 x10^3 mm^3
Elastic modulus (E) =	200000 MPa	Min. elastic modulus (Zmin) =	34 x10^3 mm^3
Elastic (y.top) =	89 mm	Plastic modules (S) =	60 x10^3 mm^3
Plastic (yp.top) =	103 mm	Eff. elastic mod.(Compact) (Zc) =	51 x10^3 mm^3

Capacity - Cl 5.6.1.2

Web λe =dw/tw*√(fyw/250) = 10.0 < 22, Non-compact — Cl 5.2.2
Zex = Zmin+[(22-Sw)/(22-8)*(Zc-Zmin)] = 48 x10^3 mm^3

Msx =	12.1 kNm	øMsx =	10.9 kNm	βx =	13.0
Moa =	224.6 kNm	αs =	1.008	αm =	1.13
		øMbx = αm*αs*øMsx ≤ øMsx =	10.9 kNm		

Deflections

Ireq'd DL (L/360) =	1.6 x10^6 mm^4	< Critical	δDL =	3.6 mm	Span / 700
Ireq'd LL (L/360) =	0.2 x10^6 mm^4		Ψs.δLL =	0.5 mm	Span / 4704
			1kN midspan δ =	0.5 mm	