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2 / 3 Silverless Street
Marlborough, Wilts SN8 1JQ

Project : 30 High Street, Marlborough : Replacement partition wall on first floor, and steel supports.

Client: Knight Frank

Project No S2780

Date : July - August 2025 Additional Calculations

Consent was given to the structural drawings prepared by AMA. Work has started on site again and these calculations relate to the new evidence found. In particular the timber beam supporting the first floor gable was rotten , and was not supported at all at the North East Party Wall.

An new tubular steel column is proposed onto a piled foundation specifically intended by the designers – Target Installation to be installed in confined spaces without damaging adjacent structures.

Probing has been recommended, and testing of the piles is required.

Standards Used

EC1 - Loading

EC3 - Structural Use of Steel.

EC5 – Structural use of timber

EC6 - Structural use Masonry

With appropriate National Application Documents.

All work subject to Listed Building Consent, Building Regulations Approval, Opening Up, Site Conditions and our terms and conditions.

Construction Design and Management Regulations 2015 (CDM 2015) - See drawings and previous CDM documents.

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Calculations:

Rear roofs are tiled. Roof pitch taken from survey drawings at 41 Degrees. The roof

Tiles sarking, battens	0.800
timber	0.150
	0.000
	0.000
Σ on slope	0.950
Σ on plan	1.259

other dead load on plan, kN/m ²		
ceiling joists	0.100	
Plasterboard / Lath and plaster	0.500	max
services	0.050	
Σ on plan & on slope	0.650	
Σ dead	1.909	

Live Load	kN/m ²	
Snow / Roof imposed	0.6	uniform snow
Attic Live	0.000	No access
	0.6	

Total dead + snow / imposed load on plan 2.509

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Drift snow load

$$S_k = [0.2 + 0.1 Z] + \{(A - 100) / 525\}$$

Zone, Z

2

AOD

130 m

Characteristic snow ground load, S_k , kN/m² :=

If >100m AOD $(0.2 + 0.1 * Z) + \{(AOD - 100) / 525\}$

0.457

Else $((0.2 + 0.1Z))$

0.400

Characteristic snow ground load, S_k , kN/m² :=

0.457

Ref

"Structural elements

Design manual

Working with Eurocodes"

Roof Pitch, α_1 , degrees

41

Coefficient, μ_1

0.800

Design Snow Load := $\mu_1 * S_k$, kN/m² <30 deg

0.232

For pitches >60 deg = 0 kN/m²

& $0.8 * (60 - \alpha) / 30$ for 30deg < α < 60deg

Imposed load, Q_k on roof :=, kN/m²

0.380

Imposed Point load =, kN

0.9

h, m

2.11

S_k =

0.457

Case A $2 h / S_k$:=

9.231

B1, m

1.621

B2, m

2.730

B3, m

4.35

Ls1, m

1.621

Ls2, m

2.730

Case B $2 * b_3 / (Ls1 + Ls2)$

2.000

2.000

$S_k * \mu_1$, kN/m²

0.914

Accidental snow load ' := $S_k * \mu_{ew1} * 1.05 / 1.5$ equivalent

0.640 kN/m² SLS $\mu = 1.5$ ULS

Because the drift snow load imposes a triangular load onto part of the roof structure the Drift Snow Load is not critical and the roof snow UDL of 0.6 kN/m² is the design criterion.

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Valley Gutters	kN/m ²	m	
Timber and boarding	0.25		
Code 6 Lead	0.3		
girth of gutter		0.6	
Weight /m valley gutter	0.330		
Water in gutters			
channel width		0.4	
Channel depth		0.05	50mm rain/hr.
Live load of flowing water	0.196		
Total gutter live load	0.526	kN/m SLS	

Partition Loads	kN/m ²	m	kN/m	
Timber frame	0.15			
Plasterboard / lath and plaster	0.36			Side 1
Plasterboard / lath and plaster	0.36			Side 2
Plyshear diaphragm	0.150			Side 1
Plyshear diaphragm	0			Side 2
	1.02			
Height of partition		2.2		
Self weight of partition			2.244	

Roof Dead Load = 1.909 kN/m * 2.7/2 m = 2.577 kN/, SLS

Roof Snow/live Load = 0.6 * 2.7/2 = 0.81 kN/m SLS

Gutter Live Load = 0.526 / 2 = 0.263 kN/m

Total Dead + Live = 3.65 kN/m SLS

Partition Load = 2.244 kN/m

Total onto steel beam = 3.65 + 2.244 = 5.894 kN/m

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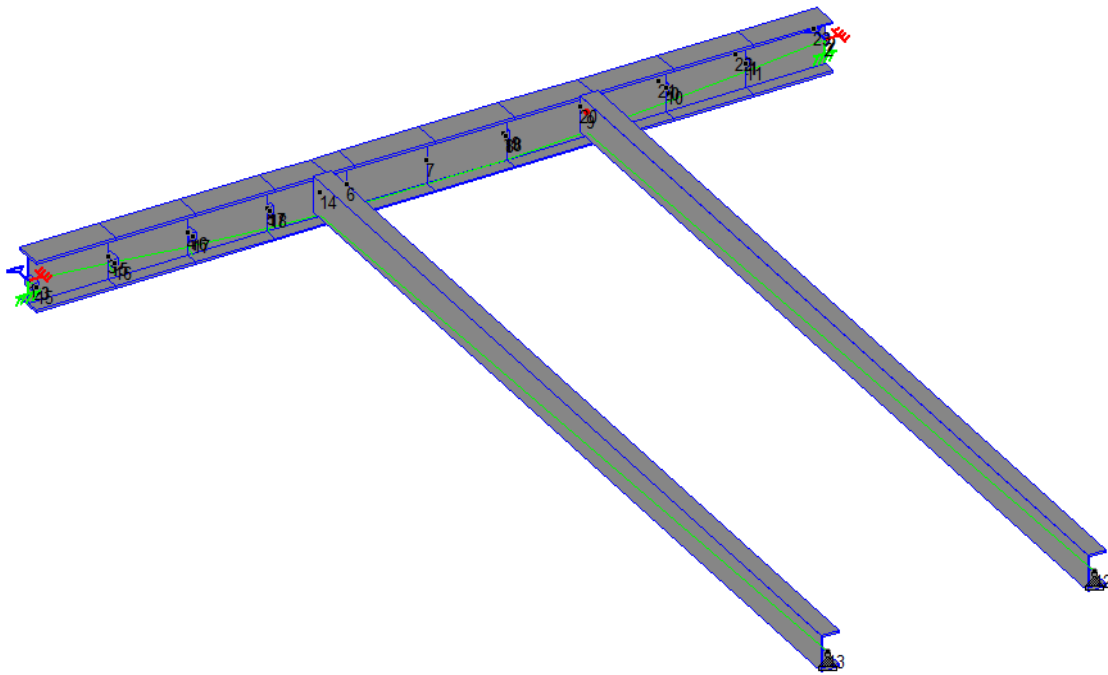
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Torsion onto steel beam .

Nodal Load @ 290mm c/c = $5.894 \text{ kN SLS} \times 0.29 = 1.709 \text{ kN}$ per node.

Eccentricity from the drawing in the range – 75mm to 60mm at the beam ends, more at the gable wall.



Staadpro model

Maximum torsion = 0.008 radians := 0.458 degrees. Max rise of UB = 0.408mm. Torsion is well controlled.

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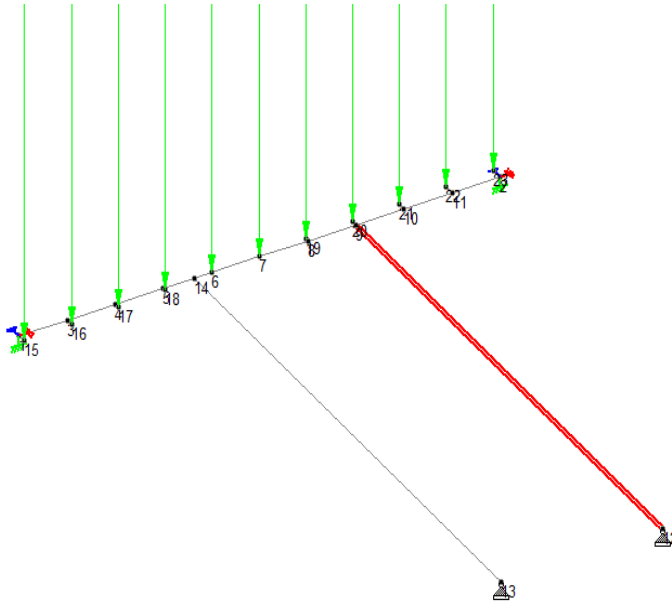
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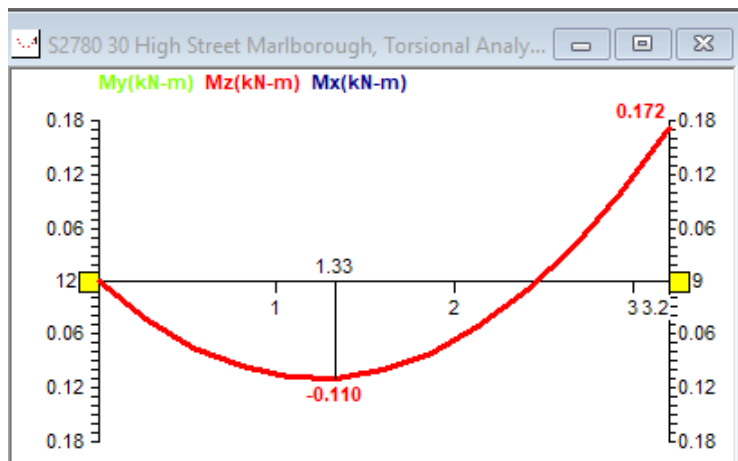
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Connections to existing 178 * 102 UB, and BM, shear in PFC



Max values: 0.172 kN.n SLS into angle includes self weight of the PFC



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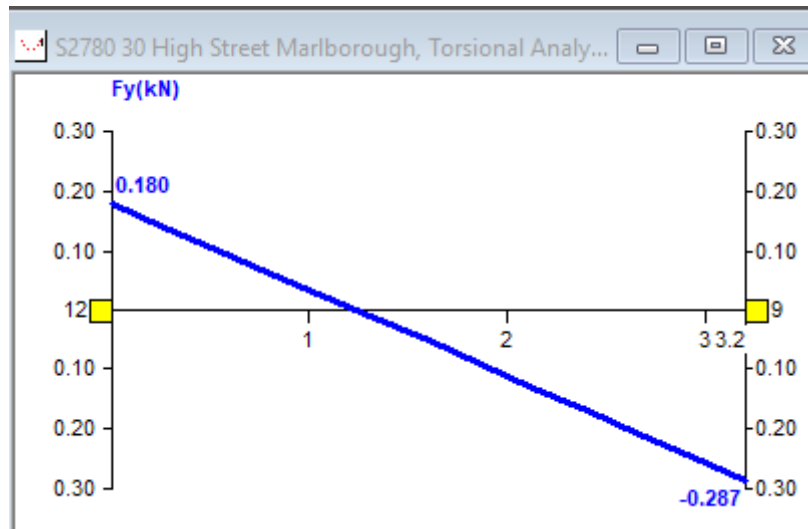
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Shear into connection = 0.287 kN SLS



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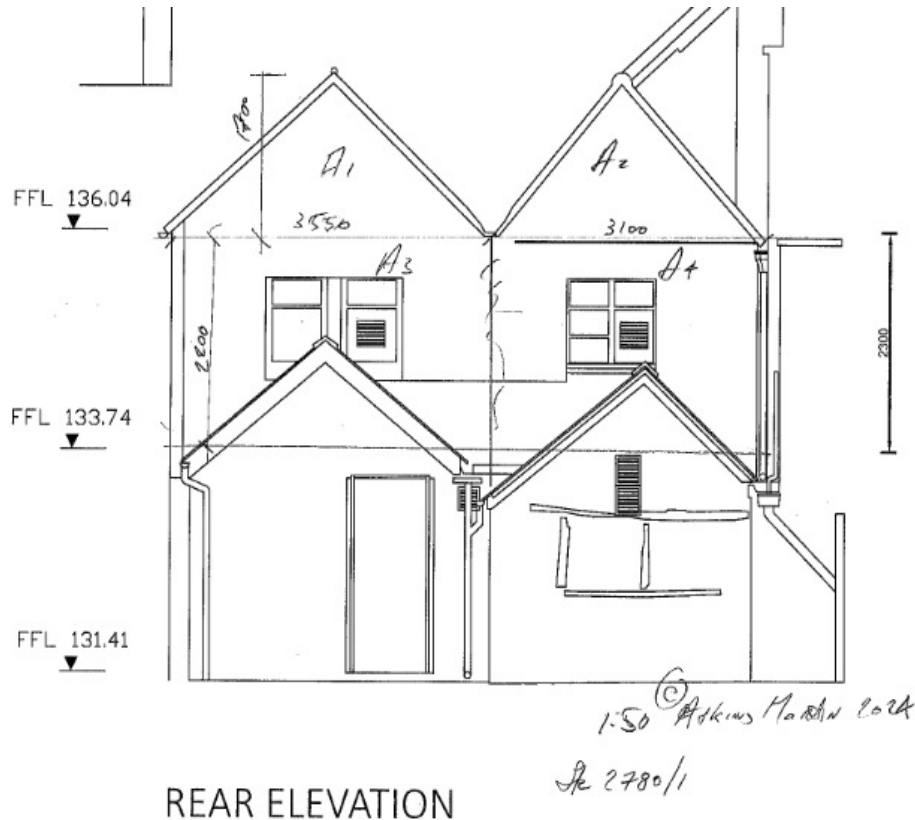
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Weight of roof onto the gable = 0 kN/m SLS

Infill to higher roof taken as block density 19 kN/m³ with tile hanging over the North East portion. Lath and Plaster



Area A2 = $3.1 \times 1.7/2 = 2.635 \text{ m}^2$. Height = 1.7m @ 16 kN/m² Weight = $2.635 \times (16 \times 0.1 + (0.55 + 0.36)) = 2.635 \times 2.51 = 6.614 \text{ kN SLS}$ as a triangular load.

Equivalent to $1.7 \times 2.51 = 4.267 \text{ kN/m}$ Max as a triangular load

Area A4 = $3.1 \times 2.2 = 6.82 \text{ kN/m}^2$. Height = 2.3 @ " " = $6.82 \times 2.51 = 17.118 \text{ kN SLS}$ as a UDL

Equivalent to $2.2 \times 2.51 = 5.522 \text{ kN/m}$ as a UDL

Total load onto steel beam from gable conservatively = $6.614 + 17.118 = 23.732 \text{ kN SLS}$

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First Floor Load:

First floor				
Dead Load:		kN/m2		kN/m2
	deck	0.24		
	Joists self weight	0.15		
	two layers plasterboard / lath and plaster	0.36		
	services	0.05		
		0		
		0		
		0.8	$\gamma=1.35$	1.08
Live Load:				
	Live Load: Offices Class B1	2.5		
	partitions	0.5		
		0		
		3	$\gamma=1.5$	4.5
	Σ	3.8	$\Sigma\gamma$	5.58

Loaded width of floor onto steel beam

Dead = $0.45 / 2 * 0.8 = 0.18$ kN/m SLS

Live = $3 * 0.45 / 2 = 0.675$ kN/m SLS

Self weight of steel in StaadPro analysis.

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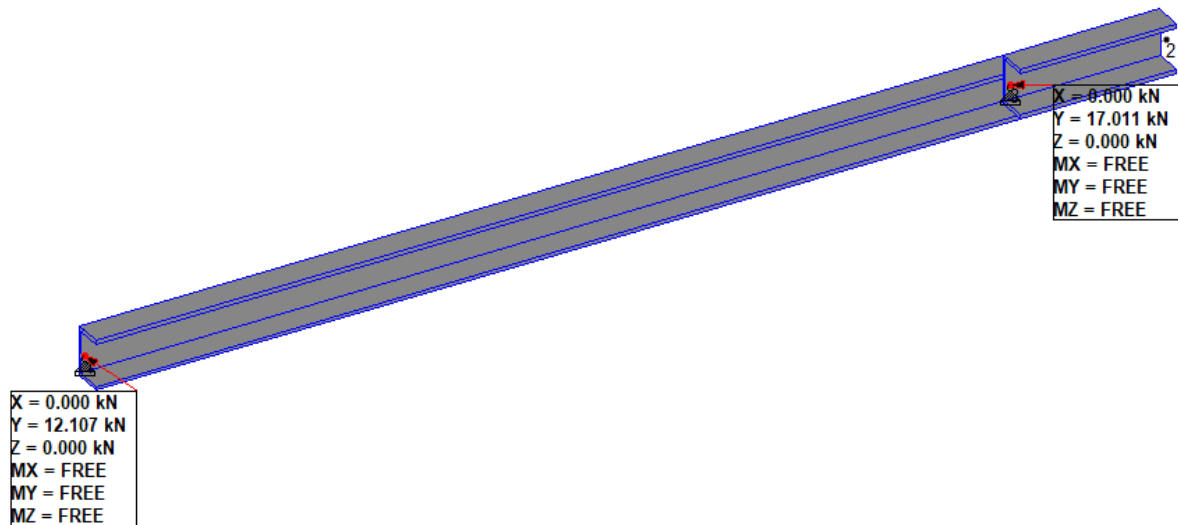
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Column Reaction = 17.0 kN SLS :

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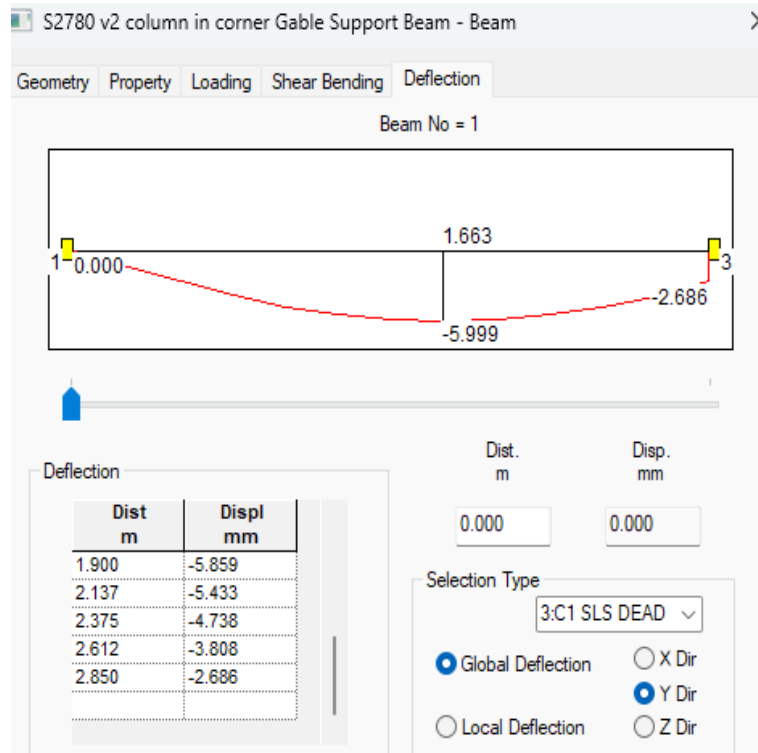
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Column by end of beam – change to 150 * 150 SHS t=8mm

Span of beam = 3.33m.



Max deflection = 5.999mm

Permissible = $3300 / 360 = 9.17\text{mm}$ UF deflection = $0.65 < 1$ OK

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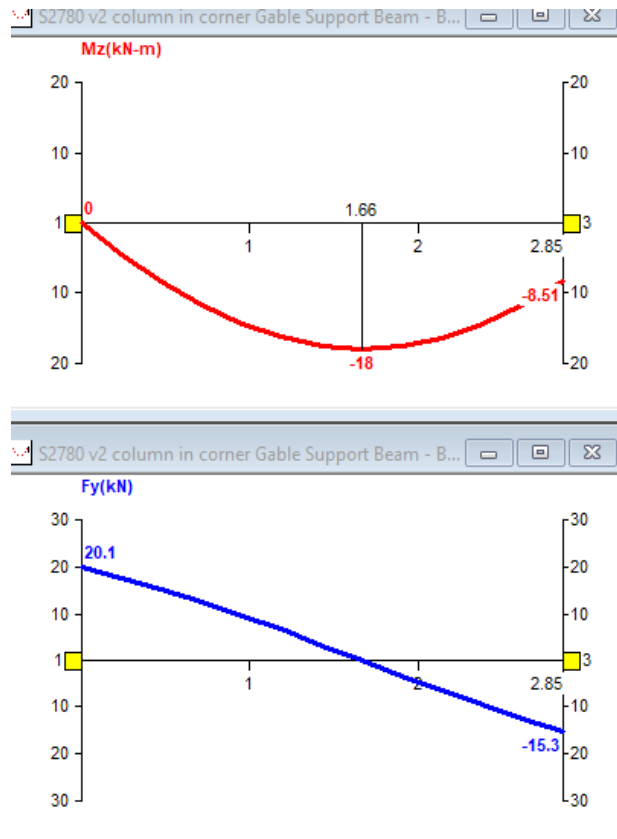
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Max BM = 18 kN.m ULS Max shear = 20.1 kN ULS.



Hot-Finished Square Hollow Sections			Bending resistance with S355			
			Design moment resistance and design shear resistance			
Section designation						
Size	Thickness	Readily available ¹	Mass per metre	Section classification	Moment resistance	Second moment of area
$h \times h$	t		kg/m		$M_{c,Rd}$	I_y
mm	mm				kNm	cm ⁴
150 x 150	4.0		18.2	Class 4	37.6	821
	5.0	✓	22.6	Class 2	55.4	1000
	6.3	✓	28.1	Class 1	68.2	1220
	8.0	✓	35.1	Class 1	84.1	1490
						Shear resistance
						$V_{c,Rd}$
						kN
						238
						294
						367
						459

Use Hot rolled tube to weld plate on top / on side / at bottom to support new joists at any reasonable level.

S355 used to allow welding without lowering the yield stress.

Note with the support column away from the party brick wall than a restraint will be required from the SHS to the wall.

This calculations applies to a cantilever tube with the column set on two number piles at 600mm apart.

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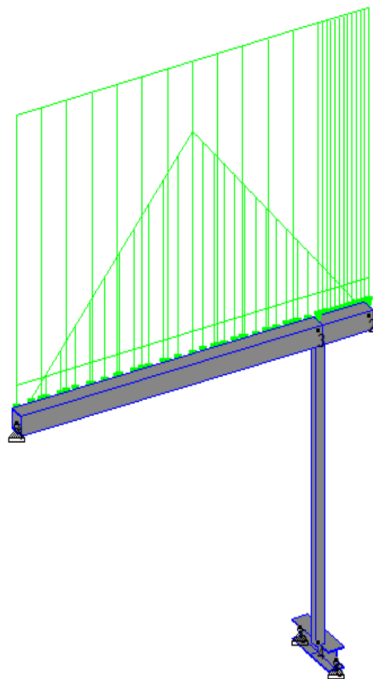
Torsional stiffness is very good

$M_b = 68.2 \text{ kN.m}$ ULS Class 1 section. Permissible shear = 367 kN.

Bending UF = $18 / 68.2 = 0.26 < 1$ Shear UF = $20.1 / 367 = 0.05 \ll 1$ OK

SHS 150 * 150 t=6.3 OK S355 Only Hot rolled with 10mm plate welded 6mm LLFW each side for mid tube position, one side for top or bottom position .- hit and miss.

Case 1 – double piles used because of obstructions in the ground.



Column 80 * 80 SHS Cold rolled S275 min. onto 152 * 152 UC 30 kg/m bridging beam – subject to piling positions.

Column load = 17.7 kN SLS including column and bridging beam self weight.

Moment on column – from capping plate BM's and notional BM

Axial = $17.7 * 1.5 = 26.55 \text{ kN ULS}$. My and Mx from capping plate = $26.55 * (0.08/2.0 + .001) = 26.55 * 0.05 = 1.328 \text{ kN.m SLS}$

Plus $26.55 / 180 * 2.3 = 0.339 \text{ kN.m}$

Total $M_x = M_y = 1.328 + 0.339 = 1.667 \text{ kN.m ULS}$

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Cold Formed Square Hollow Sections ▾ Section properties ▾

 Print design data  Export to excel

Dimensions & properties

Section designation Size h x h mm		Dimensions and properties								
		Mass per metre kg/m 1.102	Area of section A cm ² 1.196	Ratio for local buckling α/t (1) 10.307	Second moment of area I cm ⁴ 20.016	Radius of gyration i cm 4.471	Elastic modulus W _{el} cm ³ 16.716	Plastic modulus W _{pl} cm ³ 20.016	Torsional constants I_T cm ⁴ 1.102 W_t cm ³ 11.196	
Thickness t mm 0.102										
80 x 80	3.0	7.07	9.01	23.7	87.8	3.12	22.0	25.8	140	33.0
	3.5	8.16	10.4	19.9	99.8	3.10	25.0	29.5	161	37.6
	4.0	9.22	11.7	17.0	111	3.07	27.8	33.1	180	41.8
	5.0	11.3	14.4	13.0	131	3.03	32.9	39.7	218	49.7
	6.0	13.2	16.8	10.3	149	2.98	37.3	45.8	252	56.6

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Tubular Sections EC3 – S235 Min Cold Rolled

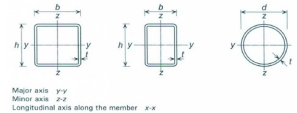
Forces:ULS

	kN.m		kN	
BM Major, M_{yd}	1.667	S Major, V_{yd}	0.00	
BM Minor, M_{zd}	1.67	S Minor, V_{zd}	0.00	
		Axial, Ned,	26.550	kN

Geometry / Parameters

Section : RHS 100 * 60 t=5

h,mm	80	Radius of gyration, major, i_y , cm	3.03
b,mm	80	Radius of gyration, minor, i_z , cm	3.03
Thickness, t, mm	5.0	Elastic modulus , major, $W_{el,y}$, cm ³	32.9
Area, cm ²	14.4	Elastic modulus , minor, $W_{el,z}$, cm ³	32.9
I, major, I_{yy} cm ⁴	131	Plastic Modulus, major, $W_{pl,y}$, cm ³	39.7
I, minor, I_{zz} , cm ⁴	131	Plastic Modulus, minor, $W_{pl,z}$, cm ³	39.7



Actual Member Length, Major axis, mm	2400	c,mm	65	Cold formed
Actual Member Length, Minor axis, mm	2400	c/t	13	α 0.49
Effective length factor	1.5	Class 1 or better		$\chi_{LT}=1.0$
Column effective length major axis, mm	3600			f_y 235 N/mm ²
Column effective length minor axis, mm	3600			ϵ 1.000

Elastic critical buckling load, kN

$$N_{cr} = \Pi^2 \frac{EI}{L^2}$$

Minor axis	204.57	Major axis	204.57
------------	--------	------------	--------

Plastic axial force capacity :

$$f_y A$$

338.4	338.4
-------	-------

Non dimensional slenderness axis:

$$\bar{\lambda} = \sqrt{f_y \frac{A}{N_{cr}}}$$

1.286	1.286
-------	-------

Buckling parameter, axis:

$$\Phi = 0.5 (1 + \alpha(\bar{\lambda} - 0.2) + \bar{\lambda}^2)$$

1.593	1.593
-------	-------

$$X = \frac{1}{\Phi + \sqrt{\Phi^2 - \bar{\lambda}^2}} \text{ but not } > 1.0$$

0.395	0.395
-------	-------

Slenderness Ratio:

$$\lambda_z$$

118.81 OK	λ_y 118.81 OK
-----------	-----------------------

Design Compression resistance:

$$N_{rd} \text{ kN.}$$

133.57	133.57
--------	--------

Smaller value of $N_{rd} \text{ kN.}$

$$133.569$$

Interaction formulae

$$k_{yy} = C_{my} \left[1 + (\bar{\lambda} - 0.2) \left(\frac{N_{Ed}}{\chi_y N_{rk} / \gamma_{M1}} \right) \right]$$

1.216

but:

$$k_{yy} = C_{my} \left[1 + \left(\frac{0.8 N_{Ed}}{\chi_y N_{rk} / \gamma_{M1}} \right) \right]$$

1.159

$$1.159$$

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$$k_{yz} = 0.6 * k_{yy}$$

0.695

$$C_{mz} = 1.000$$

$$k_{zz} = C_{mz} [1 + (\bar{\lambda} - 0.2) \left(\frac{N_{Ed}}{\chi_z N_{Rk} / \gamma_{M1}} \right)] = 1.216$$

but:

$$k_{zz} = C_{mz} \left[1 + \left(\frac{0.8 N_{Ed}}{\chi_z N_{Rk} / \gamma_{M1}} \right) \right] = 1.159$$

$$k_{zz} = 1.159$$

$$k_{zy} = 0.6 * k_{zz} = 0.695$$

$$\frac{N_{Ed}}{(\chi_y N_{Rk} / \gamma_{M1})} + k_{yy} \frac{M_{y,Ed}}{(\chi_{Ly} M_{y,Rk} / \gamma_{M1})} + k_{yz} \frac{M_{z,Ed}}{(M_{z,Rk} / \gamma_{M1})} = \frac{0.199}{0.530} + 0.207 + 0.124$$

$$\frac{N_{Ed}}{(\chi_z N_{Rk} / \gamma_{M1})} + k_{zy} \frac{M_{y,Ed}}{(\chi_{Ly} M_{y,Rk} / \gamma_{M1})} + k_{zz} \frac{M_{z,Ed}}{(M_{z,Rk} / \gamma_{M1})} = \frac{0.2}{0.530} + 0.124 + 0.207$$

Buckling Combined bending and axial compression: 0.530 OK

Cross Section Resistance:

Major axis $M_{pl,y,Rd} = W_{pl,y} f_y / \gamma_{M0} = kN.m \quad 9.33$

Minor axis $M_{pl,z,Rd} = W_{pl,z} f_y / \gamma_{M0} = kN.m \quad 9.33$

$$N_{pl,Rd} = \frac{A f_y}{\gamma_{M0}} = kN. \quad 338.4$$

$$n = \frac{N_{Ed}}{N_{pl,Rd}} = 0.078$$

$$a_w = \frac{(A - 2bt)}{(A)} = 0.444$$

but not ≥ 0.5 $a_w = 0.444$

$$M_{N,y,Rd} = M_{pl,y,Rd} \frac{1-n}{(1-0.5a_w)} = kN.m \quad 11.05$$

$$M_{N,z,Rd} = M_{pl,z,Rd} \frac{1-n}{(1-0.5a_w)} = kN.m \quad 11.05$$

$$M_{N,Rd} = kN.m \quad 11.05$$

if $M_{y,Ed} \wedge M_{z,Ed} < M_{N,Rd}$ **OK**

$$\alpha = \beta \frac{1.66}{(1 - 1.13 n^2)} \text{ but } < 6 \quad 1.672$$

Cross Section Resistance **0.085 OK**

80 * 80 SKS t=5.0mm S235 min. UF combined bending and axial buckling = 0.536 < 1 OK

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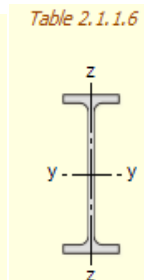
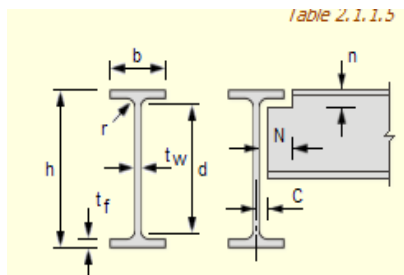
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Bridging beam

$$BM = 2.67 \text{ kN.m} * 1.5 = 4.01 \text{ kN.m}$$

Section 152x152x30



fy, N/mm2	S 275	
€	0.924	
Applied Loads		
Ned, kN	0	
My,ed, kN.m	4.010	Major
Mz, ed	0.000	Minor
Permissible		
Mb,Rd, kN.m	68.200	
UF, buckling	0.059	
N,rd, kN	1015.43	
UF, buckling	0.059	Combined
Cmz	0.6	

mass/m, kg/m	30	Area, A,cm ²	38.3
Depth of section, h,mm	157.6	Rad gyr, iy, major axis, cm	6.76
Width of section,b,mm	152.9	rad gyr, iz, minor axis, cm	3.83
Web thickness, tw,mm	6.5	U	0.849
Flange thickness, tf,mm	9.4	C1	1
Root Radius, r, mm	7.6	Wy,major,cm ³	222
depth between fillets , d, mm	123.6	Wpl,y major,cm ³	248
Local buckling ratio, cf/tf	6.979	βw	1.000
Local buckling ratio, cw/tw	19.015	Le, major,mm	900
		Le, minor	900
Flange classification:		Rolled sections β=	0.75
Class 1 c/tf <=8.0 * ε	:= 7.395	λ lt, 0	0.4
Class 2 c/tf<=9.0 * ε	:= 8.320	α lt minor	0.49
Class 3 c/tf<=12.0 * ε	:= 11.093	h/b	1.0
Section Flange Classification	Class 1	UK γ m1	1.00
Web classification		Destabilising load yes/no	yes
Web c/tw	19.015	Destabilising parameter D	1.2
α= 0.5 * (1 + Ned / Fy * c*tw)	0.500	Wpl,z minor	112
Ψ = 2 * Ned/(A * fy) - 1	-1.000	α z minor	0.49
		I, Major, cm ⁴	1750
Web class 1 cw/tw max	66.000 * ε		61.01
Web class 2 cw/tw max	76.000 * ε		70.26
Web class 3 cw/tw max	114.000 * ε		105.38
Section Web Classification	Class 1		

$$152 * 152 \text{ UC } 30 \text{ OK UF} = 0.059 < 1 \text{ OK}$$

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Addendum:

We have not inspected woodwork or other parts of the structure which are covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect.

This is for the use of our Client only, and shall not be relied upon by a third party.

All work subject to statutory approvals, opening up and site conditions

All work strictly in accordance with our terms and conditions.

The site investigation is a statistical sample only of the ground conditions. Ground conditions may vary between the trial pit / borehole positions, and the geological maps are a guide only to likely ground conditions.

The analysis is a reasonable guide only of the structural performance. Conditions may vary between the assumptions of the analysis and this may alter the actual structural performance