General Construction Notes and Guidance:

1. Calculations are not to be used for the purpose of ordering materials and should only be used for Building Regulations submissions. All dimensions should be checked by the contractor on site.

2. All steelwork to be mechanically wire brushed and painted two coats of red oxide. Steelwork located in the cavity or below DPC to be suitably protected with 2 coats of bituminous paint.

3. All timber to be graded C24 (SC4) unless stated otherwise. Preservative treated to Architect´s details

4. To be read in conjunction with architect's drawings, any inconsistencies should be reported.

5. For details of fire protection to steelwork, see Architects drawings.

6. The contractor is to ensure that all existing construction is adequately supported, using needles and props as required. Where a new beam supports the existing construction adequate pre-load is to be applied and suitable packs such as driven dry-state introduced, then pointed up with mortar.

7. All blockwork to be 7.3 N/mm^2 in class III mortar below DPC in accordance with BS5628:Part3:2005 or suitable 7.0 N/mm^2 foundation quality blocks in class II mortar in accordance with the manufacturer's instructions. All brickwork below DPC to be engineering bricks DPC in accordance with BS 5628: Part 3: 2005.

8. The builder is to take into consideration the placement of the structural elements, ensuring that the method of lifting and placement is safely carried out. Responsibility for this element lies with the Contractor. As the existing walls need to be propped in order to introduce some of the lintels, this should also be considered in relationship to the risk assessment of the Contractor. Safe working procedures must be adopted. Responsibility for this element lies with the Contractor. Splice details for long-span beams can often be accommodated if required.

Party Wall Act 1996

If part of the work is adjacent to the boundary, the adjacent neighbours right to support could be affected; the issues associated with Party Wall Act may need to be considered. This may include providing information to the adjoining owner, giving sufficient notice of works in compliance with the Act. If the following list applies to this project then the Party Wall Act will apply.

1. Installing a new beam into the shared wall between properties
2. Demolishing, building or under-pinning an existing shared wall
3. Building a new wall at or on the boundary or junction of two properties
4. Damp-proofing all the way through a party wall
5. Digging foundations that are within 3m of a Party Wall, where the new foundations are deeper than the existing ones
6. Where the new foundations are within 6m and lower than a 45° line from the bottom of the existing foundations.

Codes

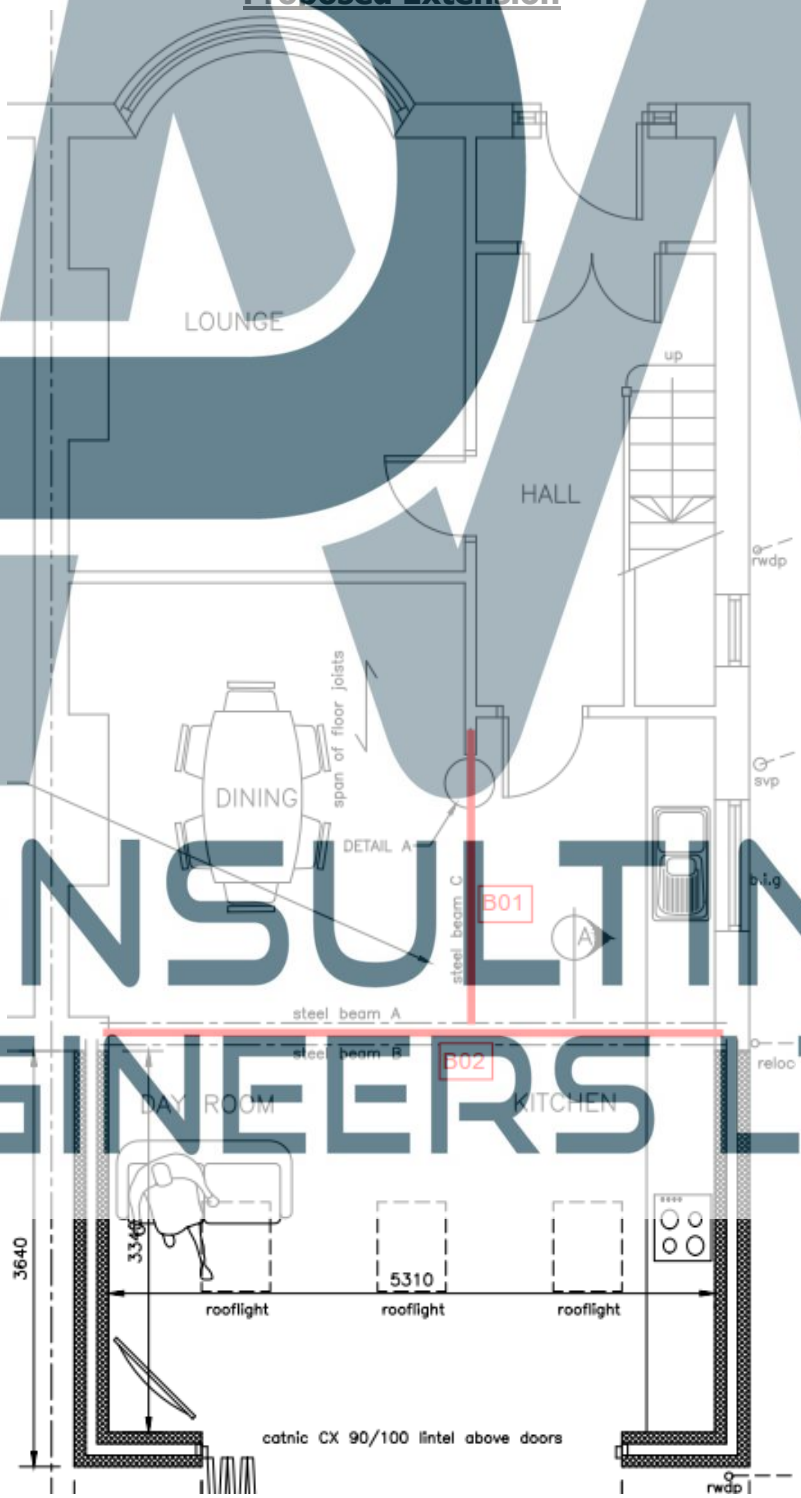
BS EN 1990+A1:2006/NA: 2005-06	Basis of structural design
BS EN 1991-1-1	Part 1-1: General actions - Self-weight, imposed loads for buildings
BS EN 1991-1-3/NA: 2005-12	Part 1-3: General actions - Snow loads
BS EN 1995-1-1+A1:2008/NA: 2006	Part 1-1: General - Common rules and rules for buildings
BS EN 1995-1-2	Part 1-2: General - Structural fire design
BS EN 1991-1-4/NA: 2006	Part 1-4: General actions - Wind loads
BS EN 14080:2013-08	Timber structures - Glued laminated timber and solid timber - Requirements
BS EN 338:2010-03	Structural timber - Strength classes

Loading

					Dead	Live
Roof1c						
	Tiles	g_1=		0.65 kN/m²		
	Rafters,felt,insulation etc	g_2=		0.30 kN/m²		
	Plasterboard	g_3=		0.25 kN/m²		
		g_0=		1.20 kN/m²		
	Roof pitch	a=		35 °		
		g_k=	g_0/COS(a)+g_4		= **1.46 kN/m²**	
	Attic	g_4=		0.25 kN/m²		
	Roof snow loading	q_k=	0,60*((60-a)/30)		=	**0.75 kN/m²**
Floor						
	Joist & boarding,finishes	g_1=		0.25 kN/m²		
	Plasterboard	g_2=		0.25 kN/m²		
		g_k=	g_1+g_2		= **0.50 kN/m²**	
	Imposed	q_k=			=	**1.50 kN/m²**
Walls						
W1	External cavity blockwork	g_1=	2,7*(2,1+1,4)=	9.45 kN/m		
	Plasterboard	g_2=	2,4*0,25	0.60 kN/m		
		g_k=	g_1+g_2		= **10.05 kN/m**	
W5	Internal 100 blockwork	g_1=	2,4*1,40=	3.36 kN/m		
	Plasterboard both sides	g_2=	2,4*0,25*2 =	1.20 kN/m		
		g_k=	g_1+g_2		= **4.56 kN/m**	

	Profile	Padstone
B01	178x102 UB 19 [Grade 43]	215 long x 102.5 wide 1 Course Eng. Bwk Padstone
B02	Use 2No. 254x146 UB 43 Bolted Together.	550 long x 102.5 wide 3 Course Eng. Bwk Padstone

Proposed Extension



Pos: B01

Span length l= 2.40 m

Loading:

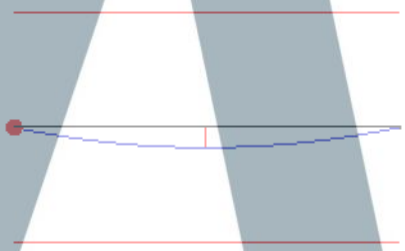
				Dead	Live
Roof 1c	g=	3.90 / 2 * 1.46	=	2.85 kN/m	
Wall Int	g=		=	4.56 kN/m	
				7.41 kN/m	
Roof 1c	q=	3.90 / 2 * 0.75	=		1.46 kN/m
					1.46 kN/m

AXIAL WITH MOMENTS (MEMBER)
B01
Member 3 (N.1-N.3) @ Level 0 in Load Case 1

Member Loading and Member Forces

Loading Combination : 1 UT + 1.25 D1 + 1.5 L1

D1 UDLY -007.410 (kN/m)
L1 UDLY -001.460 (kN/m)



Member Forces in Load Case 1 and Maximum Deflection from Load Case 2						
Member No.	Node End1 End2	Torque Moment (kN.m)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
3	1	0.000	13.743	0.000	8.246	1.377
	3	0.000	-13.743	0.000	@ 1.200	@ 1.200

Classification and Effective Area (EN 1993: 2006)

Section (19.04 kg/m)	178x102 UB 19 [Grade 43]		
Class = Fn(b/T,d/t,f_y,N,M_y,M_z)	6.41, 30.58, 275, 0, 8.25, 0	(Axial: Non-Slender)	Class 1
Auto Design Load Cases	1		

Moment Capacity Check M.c.y.Rd

$V_{y.Ed}/V_{pl.y.Rd}$	0.001 / 156.396 =	0	Low Shear
$M_{c.y.Rd}$ = $f_y.W_{pl.y}/\gamma_{M0}$	275 x 171.3/1	47.108 kN.m	
$M_{y.Ed}/M_{c.y.Rd}$	8.245 / 47.108 =	0.175	OK

Equivalent Uniform Moment Factor C1

C_1= fn(M_1, M_2, M_o, ψ,μ)	0.0, 0.0, 8.2, 0.857, 300.000	1.127	Uniform

Lateral Buckling Check M.b.Rd

Le = 1.2L+2D	1.2 x 2.4 + 2 x 0.178 =	3.236 m	
M_{cr}= Fn(C_1,L_e,I_z,I_t,I_w,E)	1.127, 3.236, 137.6, 4.408, 0.009848, 210000	43.664 kN.m	
λ_{LT}= √ W.f_y/M_{cr}	√ 171.3 x 275 / 43.664	1.039	
χ_{LT}= Fn(λ_{LT}, λ_{LT5950})	1.039, 1.075	0.676	Curve b
χ_{LT}.mod = Fn(χ_{LT},λ_{LT},k_c,f)	0.676, 1.039, 0.942, 0.974	0.694	6.3.2.3
$M_{b.Rd}$ = χ $W_{pl.y}.f_y \leq M_{c.y.Rd}$	0.694 x 171.3 x 275 ≤ 47.108 =	32.684 kN.m	
$M_{y.Ed}/M_{b.Rd}$	8.245 / 32.684	0.252	OK

Deflection Check - Load Case 2

δ ≤ Span/360	1.38 ≤ 2400 / 360	1.38 mm	OK

Section (19.04 kg/m) 178x102 UB 19 [Grade 43]

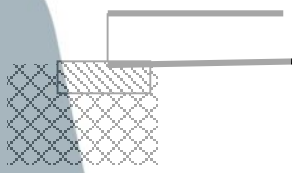
Consider Bearings:

Max Load R_d= 13.74 kN

Assuming γ_m = 3.5 f_k = 3.5

Bearing b = 100 mm

Required Bearing length = Rd*E3*γ_m/(f_k*1,5)/b= **91.6 mm**



Provide 215 long x 102.5 wide 1 Course Eng. Bwk Padstone

Pos: B02

Span length l= 5.30 m

Loading (Inner Leaf):

				Dead	Live
Roof 1c	g=	3.90 / 2 * 1.46	=	2.85 kN/m	
Floor	g=	3.90 / 2 * 0.50	=	0.98 kN/m	
Wall Ext	g=	10.05 / 2	=	5.03 kN/m	
				8.85 kN/m	
Roof 1c	q=	3.90 / 2 * 0.75	=		1.46 kN/m
Floor	q=	3.90 / 2 * 1.50	=		2.93 kN/m
					4.39 kN/m

+ Point load from B01 @ 3.1m automatically assessed in the design software.

AXIAL WITH MOMENTS (MEMBER)
B02
Members 1-2 (N.2-N.4) @ Level 0
Between 0.000 and 3.100 m, in Load Case 1

Member Loading and Member Forces

Loading Combination : 1 UT + 1.25 D1 + 1.5 L1

D1 UDLY -008.850 (kN/m)
L1 UDLY -004.390 (kN/m)

Member Forces in Load Case 1 and Maximum Deflection from Load Case 2

Member No.	Node End1 End2	Torque Moment (kN.m)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
	2	0.000	52.471	0.000	78.004	12.500
	4	0.000	-54.804	0.000	@ 2.976	@ 2.666

Classification and Effective Area (EN 1993: 2006)

Section (42.99 kg/m)	254x146 UB 43 [Grade 43]		
Class = Fn(b/T,d/t,f_y,N,M_y,M_z)	5.8, 30.42, 275, 0, 78, 0	(Axial: Non-Slender)	Class 1
Auto Design Load Cases	1		

Moment Capacity Check M.c.y.Rd

$V_{y.Ed}/V_{pl.y.Rd}$	0.133 / 320.728 =	0	Low Shear
$M_{c.y.Rd} = f_y.W_{pl.y}/ \gamma_{M0}$	275 x 566.3/1	155.733 kN.m	
$M_{y.Ed}/M_{c.y.Rd}$	78.003 / 155.733 =	0.501	OK

Equivalent Uniform Moment Factor C1

C_1= fn(M_1, M_2, M_o, ψ,μ)	0.1, 77.9, -3.6, 0.001, -0.046	1.889	Uniform

Lateral Buckling Check M.b.Rd

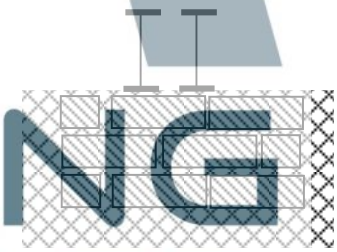
Le = 1.2L+2D	1.2 x 3.1 + 2 x 0.260 =	4.239 m	
M_{cr}= Fn(C_1,L_e,I_z,I_t,I_w,E)	1.889, 4.239, 678.3, 23.88, 0.1031, 210000	295.060 kN.m	
λ_{LT}= √ W.f_y/M_{cr}	√ 566.3 x 275 / 295.06	0.726	
χ_{LT}= Fn(λ_{LT}, λ_{LT5950})	0.726, 0.972	0.856	Curve b
χ_{LT}.mod = Fn(χ_{LT},λ_{LT},k_c,f)	0.856, 0.726, 0.728, 0.865	0.990	6.3.2.3
$M_{b.Rd}$ = χ $W_{pl.y}.f_y \leq M_{c.y.Rd}$	0.990 x 566.3 x 275 ≤ 155.733 =	154.108 kN.m	
$M_{y.Ed}/M_{b.Rd}$	78.004 / 154.108	0.506	OK

Deflection Check - Load Case 2

δ ≤ Span/360	12.5 ≤ 5300 / 360	12.5 mm	OK

Section (42.99 kg/m) 254x146 UB 43 [Grade 43]
For B02 Use 2No. 254x146UB43

Consider Bearings:



Max Load R_d= 54+20= **74 kN**

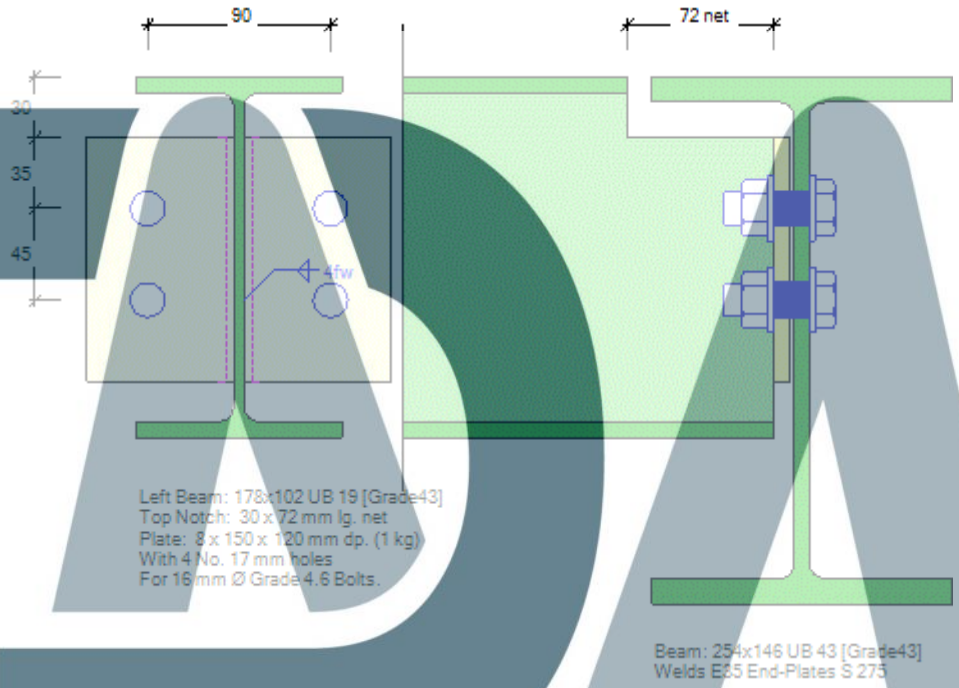
Assuming γ_m = 3.5 f_k = 3.5

Bearing b = 100 mm

Required Bearing length = Rd*E3*γ_m/(f_k*1,5)/b= **493.33 mm**

Provide 550 long x 102.5 wide 3 Course Eng. Bwk Padstone

BEAM TO BEAM: FLEXIBLE END-PLATE CONNECTION AT N.3 - LEVEL 1



Beam to Beam Flexible End-plate Connection to BS 5950

Basic Data

Applied Forces at Interface

Shear Forces	Left = 14.0 kN, Right = 0.0 kN
Tie Force	75.0 k But not less than 100% of the Shear Load. (SCI P341 T5.1)
Design to	BS 5950: Pt 1: 2000 and the SCI Green Book: Joints in Steel Construction: Simple Connections: SCI-P212: 2002

Basic Dimensions

Left-178x102 UB 19 [43]	D=177.8, B=101.2, T=7.9, t=4.8, r=7.6, py=275
Supporting-254x146 UB 43 [43]	D=259.6, B=147.3, T=12.7, t=7.2, r=7.6, py=275
Bolts 16 mm Ø in 17 mm holes	Grade 4.6 Bolts
Plates S 275, Welds E 35	

Summary of Results (Unity Ratios)

Left Hand Beam

Bolt Shear & Bearing	0.14, 0.06	0.14	OK
Plate Bearing		0.06	OK
Plate Shear	0.05, 0.05, 0.05	0.05	OK
Web Shear & Weld	0.16, 0.10	0.16	OK
Web Bending		0.15	OK
Tie force Plate, Web, Weld, Bolts	0.98, 0.49, 0.46, 0.61	0.98	OK

Supporting Beam

Bolt Bearing		0.07	OK
Plate Bearing		0.07	OK
Web Bearing & Shear	0.07, 0.04, 0.03	0.07	OK
Web Tie Force		0.85	OK
Web Tie Force		0.20	OK

Left Hand Beam

Applied Shear Loads	Q = 14.0 kN, fv = 14.0 / 4 =	3.5 kN

Bolt Shear & Bearing

Ps=	16 mm Ø Grade 4.6 Bolts	25.1 kN > fv	OK
Pbb=pb•t•Ø	460 x 8 x 16	58.9 kN > fv	OK

Plate Bearing

Pbs=Fn(pb,t,Ø,edge,kbs)	460, 8, 16, 35, 1.00	58.9 kN > fv	OK

Plate Shear: Check 9(i)

Plane Shear

Av=0.9•D•tk	0.9 x 120 x 8.0	864 mm²	
Avnet=Av-n•Ø•tk	864 - 2 x 17.0 x 8.0	592 mm²	
Pv=0.6•py•Av	0.6 x 275 x 864	142.6 kN > Q/2	OK
Pvnet=0.7•py•Ke•Avnet	0.7 x 275 x 1.2 x 592	136.8 kN > Q/2	OK

Block Shear

Lv=(n-1)•vcc+edge	(2 - 1) x45 + 35	80 mm	
Pr=0.6•py•t•(Lv+Ke(Lt-k•D'))	0.6 x275 x8 x (80 + 1.2 x (30 - 0.5 x 17.0)	139.7 kN > Q/2	OK

Web Weld & Local Shear: Checks 2 & 4

Pweld=Pyw•2•(d-2•tw)•0.7•tw	220 x 2 x (120 - 2 x 4) x 0.7 x 4	138.0 kN > Q	OK
Pv=0.6•Py•(0.9•d•t)	0.6 x 275 x (0.9 x 120 x 4.8)	85.5 kN > Q	OK

Web Bending: Check 5

Mapp=Q•la	14.0 x 82	1.1 kN.m	
Znet Fn(Section, Tnotch, Bnotch)	178x102 UB 19, 30, 0	28.1 cm³	
Shear Capacity Pv=0.6•1•py•t•L	0.6 x 1 x 275.0 x 4.8 x 148	117.2 kN	
Shear Classification Fv/Pv	14.0 / 117.2	0.119 <= 0.75	Low Shear
Mcap=p_y•Z_{net}	275 x 28.1	7.7 kN.m	OK

Single Notched Web Stability (restrained): Check 6

Data	D/tw =37.0, Dc max =89 mm, C max = 178 mm		
Notch Length C =	82 - 8	74 mm	OK
Notch Depth Dc=Max(Dc1, Dc2)	Max (30, 0)	30 mm	OK

Tie force Checks

Basic Data	Tie force = 75.0 kN, g = 90 mm, tw = 5 mm, s = 4 mm		
Tie Force	Tie forces are analysed independently of any vertical loads.		
	The tie force load should not be greater than the vertical shear load		Caution
Lea=2•Eea+(n-1)Pea	2 x 30 + (2-1) x 45)	105.0 mm	
MuA=Pu•Lea•t²/4	328 x 105 x 8²/4	551.0 kN.mm	
Leb=2•Eeb+(n-1)Peb	2 x 35 + (2-1) x 45)	115.0 mm	
MuB=Pu•Leb•t²/4	328 x 115 x 8²/4	603.5 kN.mm	
Plate Cap=2(MuA+MuB)/L	2(551.0 + 603.5) / 30	76.7 kN	OK
Web Cap=Le•tw•py	115 x 5 x 275	151.8 kN	OK
Weld Cap=2•(Le-2s)•a•pw	2(115 - 2 x 4) x 0.7 x 4 x 275	164.8 kN	OK
Prying Ratio Pr=(l1+l2) / l2	(15 + 25) / 25	1.61	
Bolt Cap=Us•Anet/(1.25•Pr)•bolts	393 x 157/(1.25 x 1.61) x 4	122.2 kN	OK

Supporting Beam

Q=Max(Q1,Q2,Q1+Q2)	Max(14.0, 0.0, 14.0 + 0.0)	14.0 kN	
fv =Q1/nb1+Q2/nb2	14.0/4 + 0.0/0	3.5 kN	
Qc =Fn(Q1, Q2, nb1, nb2)	14.0, 0.0, 4, 0	14.0 kN	

Bolt Bearing

Pbb=pb•t•Ø	460 x 7.2 x 16	53.0 kN > fv	OK

Web Bearing & Shear: Check 10

Pbs=Fn(pb,t,Ø,edge,kbs)	460, 7, 16, 36, 1.00	53.0 kN > fv	OK
Av=(et+(n-1)p+eb)•tw	(65 + (2 -1) x 45 + 45) x 7.2	1116 mm²	
Pv=0.6•Py•Av	0.6 x 275 x 1116	184.1 kN > Qc/2	OK
Pv=0.7•p_y•K_e•A_v.net	0.7 x 275 x 1.2 x 871	201.2 kN > Qc/2	OK

Tie force on Supporting Web

h_{proj}(ave)=(D_c-h)/2	(219 - 45) / 2	87 mm
b_{proj}=h_{proj}	87	87 mm
Le_h=d_c		219 mm
Le_b=b+2•b_{proj}	90 + 2 x 87	264 mm
M_u=p_y•t² /4	328 x 7.2² / 4	4250.9 Nmm/mm
$Fcap_h$=Mu•(4•Le_h-2•n•dia) / b_{proj}	4251 x (4x219 - 2x2x17) / 87	39.5 kN
$Fcap_b$=Mu•(4•Le_b-2•n•dia) / h_{proj}	4251x (4x264 - 2x2x17) / 87	48.3 kN

$Fcap=Fcap_h+Fcap_b$	39 + 48.3	87.8 kN	OK
$FVcap=0.6 \bullet P_y \bullet T_k \bullet 2 \bullet (H+B)$	0.6 x 328 x 7.2 x 2 x (45 + 90)	382.6 kN	OK