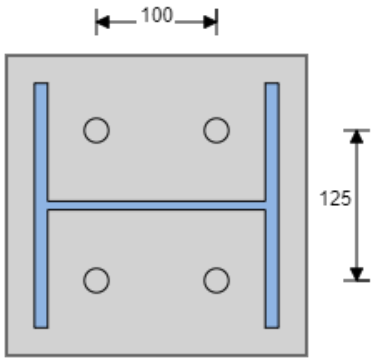
1.0 INPUT

1.1 Column

Type	Type	= **Standard**
Section	Section	= **UC 203x203x46**
Depth	D	= **203.2** mm
Width	B	= **203.6** mm
Flange Thickness	T	= **11** mm
Web Thickness	t	= **7.2** mm

1.1.1 Weld

Column - Base Plate Weld Size	s	= **4** mm



Column : UC 203x203x46
Base Plate : 250x250x10

1.2 Base Plate & Bolts

1.2.1 Base Plate

Depth	D_{pl}	= **250** mm
Width	B_{pl}	= **250** mm
Thickness	t_{pl}	= **10** mm

1.2.2 Holding Down Bolts

Bolt Size	d	= **20** mm
Number of Bolts	N_b	= **4** Nos
Gauge	s_g	= **100** mm
Bolt Spacing	s_b	= **125** mm
Edge Distance	e_x	= **75** mm

1.3 Bolt Anchorage

Bolt Type		**Bolt with Plates**
Embedment	E_b	= **360** mm
Width of Square Plate	b_a	= **80** mm
Thickness	t_a	= **12** mm

1.4 Design Loads

Design Axial Force	A_c	= **300** kN
Design Shear Force	F_{sv}	= **50** kN

1.5 Steel Grade

Column Steel Grade	f_{yc}	= **S 275**
Base Plate Steel Grade	f_{yb}	= **S 275**

Anchor Plate Steel Grade	f_{ya}	= **S 275**

1.6 Bolt Property

Bolt Grade	f_b	= **4.6**
Bolt Pull Out Based on Concrete in		= **Tension**

1.7 Concrete Property

Characteristic Strength of Concrete	f_{cu}	= **25** N/mm^2
Tensile Strength of Concrete	f_s	= **1.15** N/mm^2
Coefficient of Friction	μ	= **0.3**
Electrode Classification	EC	= **35**

2.0 OUTPUT

Ref: BS 5950

2.1 Base Plate Area

Provided Area of Base Plate	A_p	= B_{pl} * D_{pl} = **62500** mm^2
Required Area of Base Plate	A_{Reqd}	= abs(A_c) / 0.6 * f_{cu} = **20000** mm^2

2.2 Base plate thickness

Required Thickness of Base Plate	t_{Reqd}	= **3** mm

2.3 Weld

Weld Length	l_{wew}	= (2 * (B + (2 * T))) + (2 * (B - t)) + (2 * (D - (2 * T)))
		= **1206.4** mm
Design Strength of Weld	p_w	= **220** N/mm^2
Capacity of Weld	P_{weld}	= l_{wew} * p_w * (0.7 * s) = **743.14** kN

2.4 Holding Down Bolts

Force Acting per Bolt	F_b	= **0** kN
Tensile Area of Bolt	A_t	= **245** mm^2
Tensile Strength of Bolt	P_t	= **400** N/mm^2
Tension Capacity of Bolts	P_b	= 0.6 * P_t * 0.875 * A_t = **51.45** kN

2.5 Anchor Plates

2.5.1 Plate Bearing

Force Acting per Anchor Plate	F_a	= **0** kN
Bolt Hole Diameter in Anchor Plate	d_h	= **22** mm
Anchor Plate Bearing Area	A_a	= (b_a^2 - ((π / 4) * d_h^2)) = **6019.87** mm^2
Bearing Capacity of Plate	P_a	= 0.6 * f_{cu} * A_a = **90.3** kN

2.5.2 Plate Bending

Bearing Pressure on Anchor Plate	f_a	= F_a / A_a = **0** N/mm^2
Width of Bolt Head	d_{bh}	= **30** mm

Maximum Cantilever Length	l_{mc}	= $(b_a / 2) * (2)^{0.5} - (d_{bh} / 2)$ = **41.56** mm
Bending Moment in Plate	m_a	= $f_a * l_{mc}^2 / 2$ = **0** Nm/mm
Design Anchor Plate Strength	p_{yap}	= **275** N/mm^2
Bending Capacity of Plate	m_{ac}	= $p_{yap} * t_a^2 / 4$ = **9.9** Nm/mm

2.6 Holding Down Bolt Anchorage

Effective Concrete Plan Area	$A_{planeff}$	= $(s_g * ((N_b / 2) - 1) + b_a) + (b_a + (2 * E_b)) + (\pi * E_b^2) + (2 * b_a * E_b) - ((N_b / 2) * b_a^2)$ = **555950.06** mm^2
Angle from Anchor Plate Corner to Edge of the Overlap	α	= $\cos^{-1}((D_p - (2 * e_x) - b_a) / (2 * E_b)$ = **1.54** deg
Approximate Area of Overlap per Half	A_{lap}	= $E_b^2 * (\alpha - (\sin\alpha * \cos\alpha)) + ((((N_b / 2) - 1) * s_g) + b_a) * (E_b - ((D_{pl} - (2 * e_x) - b_a) / 2))$ = **241876.13** mm^2
Effective Tensile Area	A_{teff}	= $A_{planeff} - A_{lap}$ = **314073.93** mm^2
Total Pullout Capacity of Tension Bolts	P_{pull}	= $2 * f_s * A_{teff}$ = **722.37** kN

2.7 Weld

Design Strength of Weld	p_w	= **220** N/mm^2

2.8 Flange

Design Column Strength	p_{yc}	= **275** N/mm^2
Column Area	A	= $(2 * B * T) + ((D - 2.0 * T) * t)$ = **5783.84** mm^2
Tension Capacity of Flange	F_{cf}	= $B * T * p_{yc}$ = **615.89** kN
Force in Tension Flange	F_{tf}	= $M / (D - T) - A_c * (B * T) / A$ = **-116.17** kN
Flange Weld Design Force	F_f	= $\min(F_{cf}, \max(F_{tf}, 0\ kN))$ = **0** kN
Weld Force per mm	f_{fw}	= $F_f / (2 * B - t)$ = **0** kN/mm
Capacity of Weld	p_{fw}	= **0.77** kN/mm

2.9 Web

Weld Force per mm due to Shear Force	f_{ww}	= $F_{sv} / (2 * (D - (2 * T)))$ = **0.14** kN/mm
Longitudinal Capacity of Weld	p_{ww}	= **0.62** kN/mm
Tension Force in Web	F_{tw}	= **67.67** kN
Weld Force due to Tension	f_{wwt}	= $F_{tw} / (2 * (D - (2 * T)))$ = **0.19** kN/mm
Transverse Capacity of Weld	p_{wwt}	= **0.77** kN/mm

2.10 Shear Capacity

Frictional Resistance	P_{vc}	= $A_c * \mu$ = **90** kN
Individual Bolt Shear Capacity	V_d	= $(\pi / 4.0) * (d * d) * (f_{ub} / (3)^{0.5})$ = **72.55** kN
Design Base Plate Strength	p_{yp}	= **275** N/mm^2
Plate Bearing	P_{be}	= $(d * t_p * p_{yp})$ = **55** kN
Concrete Shear Capacity	V_c	= $(0.4 * f_{cu} * 0.5 * E_b * d)$ = **36** kN
Total Shear Capacity	P_{sc}	= $\min(V_c, P_{be}, V_d) * N_b + P_{vc}$ = **234** kN

2.11 Compression capacity

Maximum Outstand	c	= $t_{pl} / (3.0 * 0.6 * f_{cu} / p_{yp})^{0.5}$ = **24.72** mm
Compression Capacity	C_c	= **647.12** kN

3.0 SUMMARY

Description	Required		Actual		Status
Base Plate					
Base Plate Area (mm^2)	A_{Reqd}	>= **20000**	A_p	= **62500**	**PASS**
Base Plate Thickness (mm)	t_{reqd}	>= **3**	t_{pl}	= **10**	**PASS**
Bolt					
Shear Capacity of Plate Bearing (kN)	F_b	>= **0**	P_{be}	= **55**	**PASS**
Shear Capacity of Bolt (kN)	F_b	>= **0**	V_d	= **72.55**	**PASS**
Shear Capacity of Concrete Bearing (kN)	F_b	>= **0**	V_c	= **36**	**PASS**
Bolt System					
Pullout (kN)	F_t	>= **0**	P_{pull}	= **722.37**	**PASS**
Shear Capacity (kN)	F_{sv}	>= **50**	P_{sc}	= **234**	**PASS**
Anchor Plate					
Bearing Force (kN)	F_a	>= **0**	P_a	= **90.3**	**PASS**
Bending Moment (Nm/mm)	m_a	>= **0**	m_{ac}	= **9.9**	**PASS**
Weld					
Weld Force(kN)	F_{sv}	>= **50**	P_{weld}	= **743.14**	**PASS**
Weld Force in Flange (kN/mm)	f_{fw}	>= **0**	p_{fw}	= **0.77**	**PASS**
Weld Force in Web due to Shear (kN/mm)	f_{ww}	>= **0.14**	p_{ww}	= **0.62**	**PASS**
Weld Force in Web due to Tension (kN/mm)	f_{wwt}	>= **0.19**	p_{wwt}	= **0.77**	**PASS**
Load Capacity					
Compression Capacity (kN)	A_c	>= **300**	C_c	= **647.12**	**PASS**