GEODOMISI Ltd

GEODOMISI Ltd. - Dr. Costas Sachpazis
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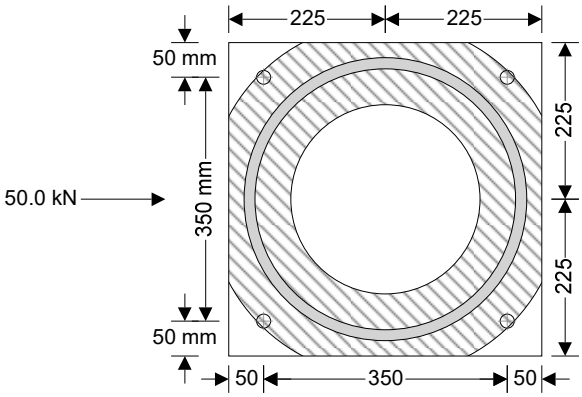
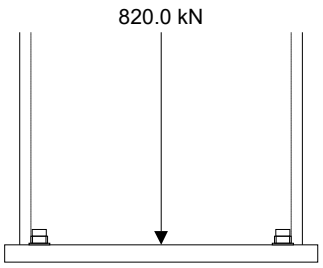
Project: **Column Base Plate Analysis & Design, In accordance with EN1993-1-1:2005 incorporating Corrigenda dated February 2006 and April 2009 and EN1993-1-8:2005 incorporating Corrigenda dated December 2005, September 2006 and July 2009 and the UK National Annexes.**				Job Ref. www.geodomisi.com	
Section: Civil & Geotechnical EngineeringSection				Sheet no./rev. 1	
Calc.Calc. by: Dr. C. Sachpazis	Date: 28/02/2016	Chk'd by	Date	App'd by	Date

CHS COLUMN BASE PLATE

In accordance with EN1993-1-1:2005 incorporating Corrigenda dated February 2006 and April 2009 and EN1993-1-8:2005 incorporating Corrigenda dated December 2005, September 2006 and July 2009 and the UK National Annexes



Plan on baseplate



Elevation on baseplate

Column - CHS 406.4x16.0
Column steel grade - S275H
Plate thickness - 25 mm
Plate steel grade - S275H
Bolt diameter - 20 mm
Bolt grade - 4.6

Design force

Compressive axial force;	$N_{c,Ed}$ = **820.00** kN
Applied shear force;	V_{Ed} = **50.00** kN

Column details

Column section;	CHS 406.4x16.0 (Corus Celsius)
Diameter;	d = **406.4** mm
Thickness;	t = **16.0** mm

Baseplate details

Length;	h_p = **450** mm
Width;	b_p = **450** mm
Depth;	t_p = **25** mm
Column eccentricity x-direction;	e_{bpx} = **0** mm
Column eccentricity ydirection;	e_{bpy}= **0** mm

Foundation details

Dist CL baseplate to edge of concrete (-ve) x-dir;	x_{ce1} = **500**mm

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Dist CL baseplate to edge of concrete (+ve) x-dir;	x_{ce2} = **500**mm
Dist CL baseplate to edge of concrete (-ve) y-dir;	y_{ce1} = **500**mm
Dist CL baseplate to edge of concrete (+ve) y-dir;	y_{ce2} = **500**mm
Length of concrete base;	h_f = **1000** mm
Width of concrete base;	b_f = **1000** mm
Depth of concrete base;	d_f = **1000** mm
Limiting projection edge plate to edge conc x-dir;	$e_h = \min(x_{ce1},x_{ce2}) - (h_p / 2)$ = **275.0** mm
Limiting projection edge plate to edge conc y-dir;	$e_b = \min(y_{ce1},y_{ce2}) - (b_p / 2)$ = **275.0** mm

Concrete foundation details

Concrete strength class of foundation;	C25/30
Characteristic compressive cylinder strength;	f_{ck} = **25.0** N/mm^2
Partial factor for concrete (Table 2.1N);	γ_c = **1.50**
Compressive strength coefficient (cl.3.1.6(1));	α_{cc} = **0.85**
Design compressive concrete strength (exp3.15);	$f_{cd} = \alpha_{cc} \times (f_{ck} / \gamma_c)$ = **14.2** N/mm^2

Steel details

Steel grade baseplate;	S275H
Nominal yield strength baseplate;	f_{yp_plt} = **265** N/mm^2
Nominal ultimate tensile strength baseplate;	f_{u_plt} = **410** N/mm^2
Steel grade column;	S275H
Nominal yield strength column;	f_{yp_col} = **275** N/mm^2
Nominal ultimate tensile strength column;	f_{u_col} = **410** N/mm^2
Partial safety factor resistance of cross sections;	γ_{M0} = **1.00**
Partial safety factor resistance of welds;	γ_{M2} = **1.25**

Foundation bearing strength

Foundation joint material coefficient;	β_j = **0.667**
Projection beyond b'plate for fdn distribution area;	$h_{lim} = \min(2\times e_h, 2\times e_b, 2\times\min(h_p, b_p), d_f)$ = **550.0** mm
Area of base plate;	$A_{c0} = h_p \times b_p$ = **202500** mm^2
Area of distributed foundation area;	$A_{c1} = (h_p + h_{lim}) \times (b_p + h_{lim})$ = **1000000** mm^2
Geometric enhancement coefficient;	$\alpha = \min((A_{c1} / A_{c0})^{0.5}, 1 + d_f / \max(h_p, b_p), 1 + 2 \times (e_h / h_p), 1 + 2 \times (e_b / b_p), 3)$ = **2.222**
Foundation bearing strength;	$f_{jd} = \beta_j \times \alpha \times f_{cd}$ = **21.0** N/mm^2
Area required;	$A_{req} = N_{c,Ed} / f_{jd}$ = **39071** mm^2

Effective area

Additional bearing width (6.2.5(4));	$c = t_p \times (\min(f_{yp\_plt}, f_{yp\_col}) / (3 \times f_{jd} \times \gamma_{M0}))^{0.5}$ = **51.3** mm
Effective area;	A_{eff} = **126503.0** mm^2

PASS - Effective bearing area exceeds required bearing area

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Frictional shear resistance

Steel / concrete friction coefficient; $C_{f,d}$ = **0.2**

Frictional shear resistance; $F_{f,Rd} = C_{f,d} \times N_{c,Ed}$ = **164.00** kN

PASS - Frictional shear resistance exceeds applied shear

Full weld

Assuming the full weld resists the resultant axial and shear loads

Force in weld; $F_{a,Ed} = \sqrt{(N_{c,Ed}^2 + V_{Ed}^2)}$ = **821.5** kN

Weld leg length; s_{wf} = **8.0** mm

Weld throat dimension; $a_{fw} = 1/\sqrt{(2)} \times s_{ww}$ = **5.66** mm

Length of weld; $l_{weld,full} = \pi \times d$ = **1276.7** mm

Correlation factor for fillet welds (Table 4.1); β_w = **0.85**

Design shear strength (4.5.3.3(3)); $f_{vw,d} = \min(f_{u\_col}, f_{u\_plt}) / (\sqrt{(3)} \times \beta_w \times \gamma_{M2})$ = **222.8** N/mm^2

Design resistance per unit length (4.5.3.3(2)); $F_{w,Rd\_f} = f_{vw,d} \times a_{ww}$ = **1260.3** N/mm

Design resistance; $f_{vw,d\_f} = F_{w,Rd\_w} \times l_{weld,full}$ = **1609.1** kN

PASS - Available strength of weld exceeds force in weld

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