

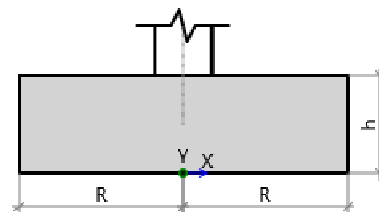
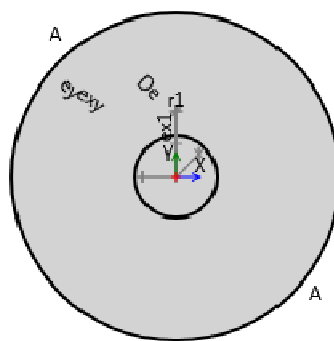
## Geodomisi Ltd

Dr. Costas Sachpazis  
 29 Dionysiou Str., Ilion-Athens  
 Attica 13122 Greece.  
 Web-Site: [www.geodomisi.com](http://www.geodomisi.com)

### Calculation of foundation Reinforcement

Calculation according to EN 1997-1:2008

### Foundation geometry - Circular pad for one column



Radius	R	= 2.00 m
Height of foundation	H	= 1.20 m
Dimensions of column	l1	= 0.50 m
	b1	= 0.50 m
Column position	$e_{x1}$	= 0.00 m
	$e_{xy}$	= 0.00 m
	$e_y$	= 0.00 m

### Soil input

Nr	Name	Z	H	$\gamma_{soil}$	$\gamma_s$	$\gamma_d$	$\varphi'$	C'	$C_u$	$M_{oi}$	$M_i$
		[m]	[m]	[kN/m <sup>3</sup> ]	[kN/m <sup>3</sup> ]	[kN/m <sup>3</sup> ]	[deg]	[kPa]	[kPa]	[kPa]	[kPa]
1	clayey sands	-7.50	7.50	20.00	26.80	20.00	0.40	0.00	74.00	36000.00	36000.00

Foundation formation level  $z_{FL} = -1.00$  m  
 Foundation cast-in-situ

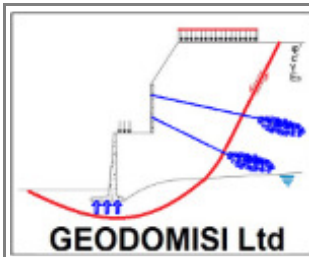
### Bending in direction x - Bottom reinforcement

Critical ULS1

$A_{s,xreq} / A_{s,xprov} = 64\%$  Pass

29-Nov-15

Tel.: +30 (210) 523-8127, +30 (210) 571-1263, Fax: +30 (210) 571-1461, Mbl: +30 6936425722  
[costas@sachpazis.info](mailto:costas@sachpazis.info) & [csachpazis@tee.gr](mailto:csachpazis@tee.gr)



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### Punching shear check

Critical ULS1

$V_{Ed} / V_{Rd.c} = 66\%$   
 &  $V_{Ed} / V_{Rd.c \max} = 38\%$  **Pass**

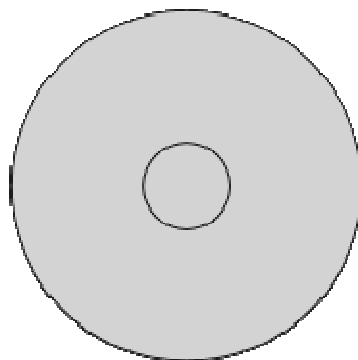
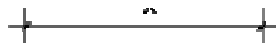
### Loads

Design load combinations:

Name	Limit state	$V_A$ [kN]	$H_{xA}$ [kN]	$H_{yA}$ [kN]	$M_{xA}$ [kNm]	$M_{yA}$ [kNm]	q [kPa]
ULS1	ULS	1500.00	250.00	0.00	0.00	120.00	5.00

### Foundation properties

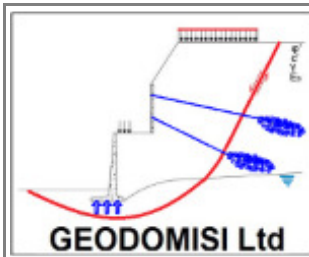
<b>Concrete C20/25</b>	$d_{1x}$	= 0.060 m
	$d_{2x}$	= 0.053 m
<b>Steel B 400 A</b>	$f_{ck}$	= 20.00 MPa
	$\gamma_c$	= 1.50
	$f_{cd}$	= 13.33 MPa
	$f_{yk}$	= 400.00 MPa
	$\gamma_s$	= 1.15
	$f_{yd}$	= 347.83 MPa



minimum reinforcement ratio	$\rho_{min}$	= 0.12 %
maximum reinforcement ratio	$\rho_{max}$	= 4.00 %

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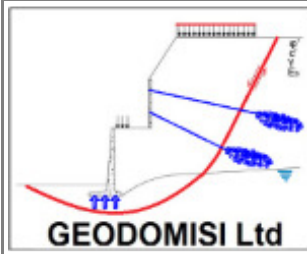
Reinforcement ratio  $\rho = 0.00 \%$

### Bending in direction x - Bottom reinforcement

<b>ULS1</b>	<b><math>A_{s,xreq} / A_{s,xprov} = 64\% \text{ Pass}</math></b>
Design bending moment in direction x	$M_y = 951.12 \text{ kNm}$
Theoretical area of reinforcement in direction x	$A_{s,xreq} = 30.37 \text{ cm}^2/\text{m}$
Provided area of reinforcement in direction x	$A_{s,xprov} = 47.12 \text{ cm}^2/\text{m}$

### Punching shear check

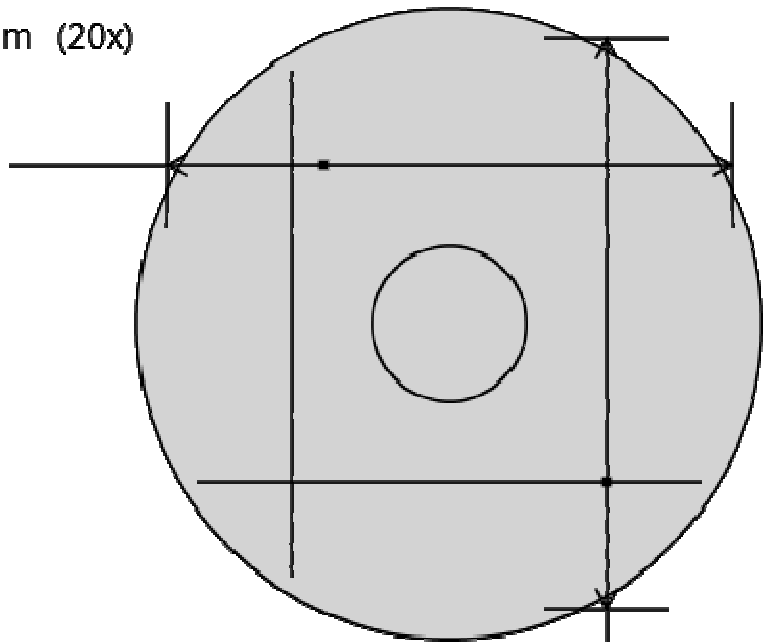
<b>ULS1</b>	<b><math>V_{Ed} \setminus V_{Rd,c} = 66\% \text{ \&amp; } V_{Ed'} \setminus V_{Rd,c \text{ max}} = 38\% \text{ Pass}</math></b>
	$\beta = 1.68$
	$u_1 = \min(4 * \pi * d + 2 * l_1 + 2 * b_1, 2 * (B + L)) = 10.30 \text{ m}$
	$u_0 = 2 * l_1 + 2 * b_1 = 3.14 \text{ m}$
Net applied force	$V_{Ed} = \beta * V_{Ed,red} / (u_1 * d) = 428.54 \text{ kN}$
	$V_{Ed'} = \beta * V_{Ed,red} / (u_0 * d) = 1405.62 \text{ kN}$
	$C_{Rd,c} = 0.18 / \gamma_c = 0.12$
	$k = \min(1 + \sqrt{200 / d}, 2) = 1.59$
	$\rho_L = \min(\sqrt{\rho_x * \rho_y}, 2) = 2.00 \%$
	$V_{min} = 0.035 * k^{3/2} * f_{ck}^{1/2} = 249.24 \text{ kN}$
Punching shear capacity at control perimeter at distance $2*d$ from column edge	$V_{Rd,c} = \min(C_{Rd,c} * k * (100 * \rho_L * f_{ck})^{1/3}, V_{min}) * 2 * d / a = 653.49 \text{ kN}$
	$v = 0.6 * (1 - f_{ck} / 250 \text{ MPa}) = 0.55$
Maximum punching shear capacity column perimeter	$V_{Rd,c \text{ max}} = 0.5 * v * f_{cd} = 3680.00 \text{ kN}$



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Bottom  $\varnothing 30 @ 150\text{mm}$  (20x)



Bottom  $\varnothing 30 @ 150\text{mm}$  (13x)

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