EN 1992-1-1 & EN 1997-1 Pad Footing Design

Footing

Symbol	Description	Value
-	Footing Name	FOOTING 1
B	Footing Width	1.2 m
L	Footing Length	1.2 m
Df	Depth	1.5 m
H	Height	400 mm
c_1	Column Length	300 mm
c_2	Column Width	300 mm
l_c	Column Height	1.2 m
x_{offset}	Column X Offset	0 mm
z_{offset}	Column Z Offset	0 mm
-	Concrete Class	C25/30
$\gamma_{concrete}$	Concrete Unit Weight	25 kN/m^3
d_g	Max. Size of Aggregate	15 mm
-	Type	In situ
-	Cast	Directly against soil

Design Factors

Symbol	Description	Value
-	National Annex	Eurocode Default
-	Design Approach	DA1-Combination 1

Reinforcement

Symbol	Description	Value
c_{nom}	Nominal cover to reinforcement	50 mm
f_{yk}	Characteristic Reinforcement Yield Strength.	500 MPa
$d_{b,x}$	Footing Bar Size (X Direction).	H8
n_x	Number of bars in the X direction of the footing.	15 No.
-	X Bars with standard hooks or bends?	True
$d_{b,z}$	Footing Bar Size (Z Direction).	H8
n_z	Number of bars in the Z direction of the footing.	15 No.
-	Z Bars with standard hooks or bends?	True
$d_{b.col}$	Dowel Bar Size.	H8
$n_{x,col}$	Dowel Bars in X Direction.	2 No.
$n_{z,col}$	Dowel Bars in Z Direction.	2 No.
-	Dowels with Hooks?	True

Geotech Parameters

Symbol	Description	Value
-	Method for design.	Direct
$Drainage$	Type of analysis related to soil behaviour.	Drained
-	Water or air in the foundation-soil interface?	False
c'	Effective soil cohesion.	0 kPa
φ'	Effective Stress Peak Friction Angle	30 °
φ'_{cv}	Critical State Friction Angle	30 °
γs	Soil unit weight.	16 kN/m^3
$\gamma s1$	Saturated unit weight.	17 kN/m^3
D_w	Depth to water table.	1.5 m

REFERENCES	CALCULATIONS	RESULTS

Design Soil Properties

Symbol	Description	Value
φ'_d	Design angle of internal friction	30.00 deg
c'_d	Drained design cohesion	0.0 kPa
δ_{coef}	Due to concrete fabrication type	1.000
$\varphi'_{cv,d}$	Critical State Design Angle	30.00 deg
γ_{ds}	Design soil unit weight	16.00 kN/m3
γ_{ds1}	Design saturated soil unit weight	17.00 kN/m3

Load Cases

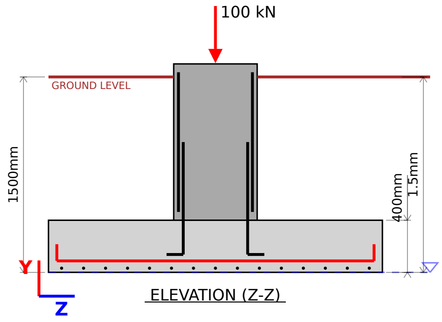
Name	Case	Direction	ψo	P (kN)	Mx (kN-m)	Mz (kN-m)	Hx (kN)	Hz (kN)
Dead	G	vertical	1	100	0	0	0	0
Live	Q	vertical	0.7	50	0	0	0	0

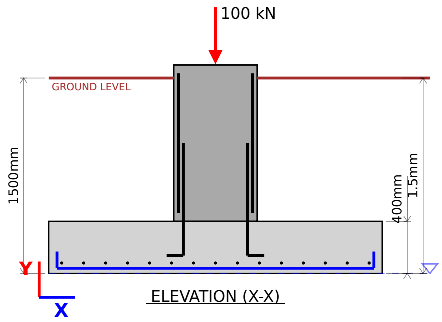
Load Combinations

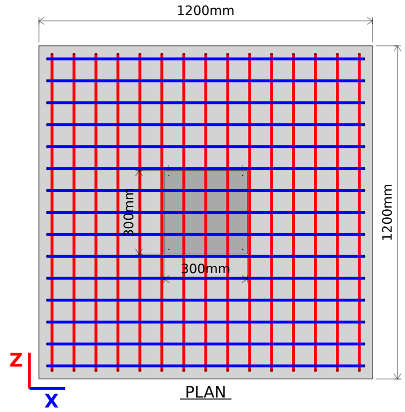
Name	Type	P (kN)	Mx (kN-m)	Mz (kN-m)	Hx (kN)	Hz (kN)
Serv1	SLS	150	0	0	0	0
UU1	GEO	210	0	0	0	0
UF1	GEO	160	0	0	0	0
EQU1	EQU	185	0	0	0	0
EQF1	EQU	165	0	0	0	0

Serv1 = Dead+Live
UU1 = 1.35Dead+1.5Live
UF1 = Dead+1.5Live
EQU1 = 1.1Dead+1.5Live
EQF1 = 0.9Dead+1.5Live

Pad Footing Plan







NAME	LENGTH	WIDTH	HEIGHT	DEPTH	REINF X	REINF Z	COL
FOOTING 1	1200	1200	400	1500	15H8	15H8	4H8

REFERENCES	CALCULATIONS	RESULTS

Footing Stability

Pedestal Weight $G_c =$ 2.70 kN

Overburden soil and footing weight pressure $\Delta q =$ 10.00 kPa

Maximum Eccentricity Check

Critical Load Combination for eccentricity: UU1

Maximum excentricity ratio $ER =$ 0

Eccentricities Summary

LC	P kN	M_z kN-m	M_x kN-m	B_{eff} mm	L_{eff} mm	e_x m	e_z m	ER
UU1	233.09	0	0	1.2	1.2	0	0	0
UF1	177.1	0	0	1.2	1.2	0	0	0

Eccentricity Check

ER <= 1.0

The resultant is within the middle third portion of the base.

PASS

REFERENCES	CALCULATIONS	RESULTS

Footing Bearing Capacity

Critical Load Combination for Bearing Capacity: UU1

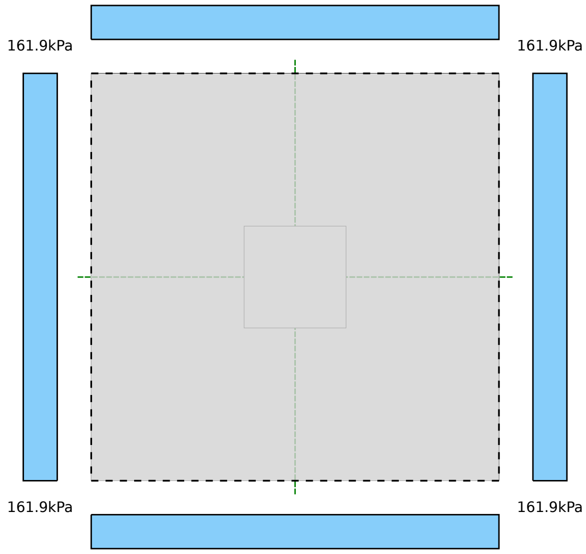
Effective Surcharge	$q' =$	24.00 kPa
Effective Unit Weight	$\gamma' =$	7.20 kN/m3
Rankine Passive Pressure Coeficient	$K_p =$	3.00
Soil Bearing Pressure Coeficient	$N_c =$	30.14
Soil Bearing Pressure Coeficient	$N_q =$	18.40
Soil Bearing Pressure Coeficient	$N_\gamma =$	20.09

Intermediate Results

LC	s_c	s_q	s_γ	m_B	m_L	m	i_c	i_q	i_γ
UU1	1.53	1.5	0.7	1.5	1.5	1.5	1	1	1
UF1	1.53	1.5	0.7	1.5	1.5	1.5	1	1	1

Soil Bearing Summary

LC	L' m	B' m	q_u kPa	R_d kN	E_d kN	SBR
UU1	1.2	1.2	723.2	1041.4	233.1	0.22
UF1	1.2	1.2	723.2	1041.4	177.1	0.17



Soil Bearing Utility Ratio $SBR =$ 0.22

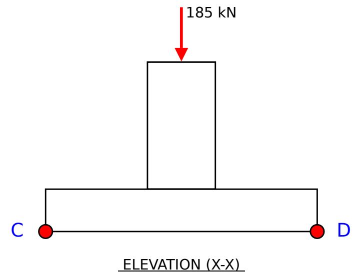
SBR <= 1.0

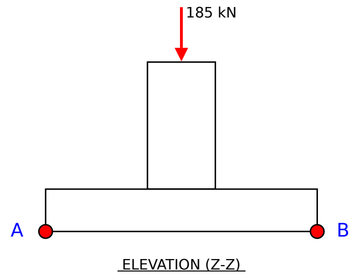
The foundation is safe for bearing capacity.

PASS

REFERENCES	CALCULATIONS	RESULTS

Overturning Check





Overturning Checks Summary

LC	Pt.	$Mres_x$ kN-m	$Mover_x$ kN-m	OR_x	Pt.	$Mres_z$ kN-m	$Mover_z$ kN-m	OR_z
EQU1	A	122.29	0	0	D	122.29	0	0
EQF1	A	108.23	0	0	D	108.23	0	0

Overturning Utility Ratio $OR =$ 0.00

OR <= 1.0

The foundation is safe against overturning.

PASS

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REFERENCES	CALCULATIONS	RESULTS

Sliding Check

Critical load combination for sliding: UU1

Sliding Checks Summary

LC	R_d kN	H_r kN	HSR
UU1	0	134.57	0
UF1	0	102.25	0

Horizontal Actions and Sliding Utility Ratio $HSR =$ 0.00

HSR <= 1.0

The foundation is safe against sliding.

PASS

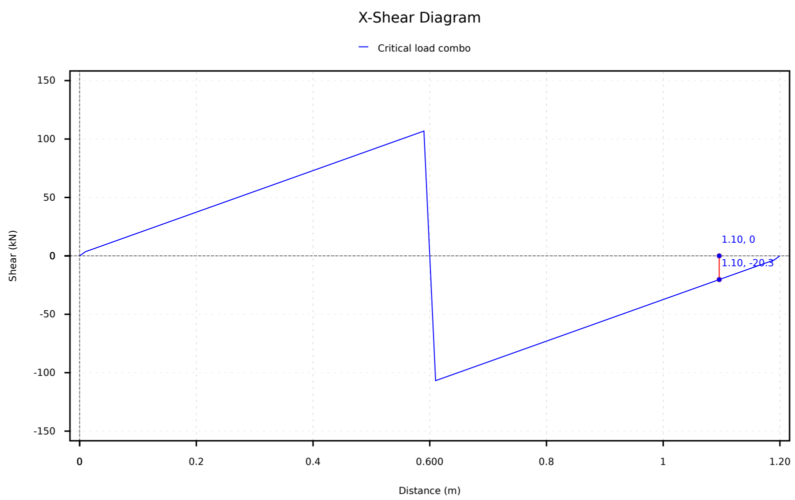
Footing Strength

Effective depth in the x-axis	$d_x =$	346.00 mm
Effective depth in the z-axis	$d_z =$	338.00 mm
Reinforcement Ratio in the x-axis	$\rho_{lx} =$	1.82 /1000
Reinforcement Ratio in the z-axis	$\rho_{lz} =$	1.86 /1000

One Way Shear Check in X

Maximum Shear X-Axis Summary

LC	dist 1 m	Shear 1 kN	dist 2 m	Shear 2 kN
UU1	0.1	20.3	1.1	-20.3
UF1	0.1	15.46	1.1	-15.46



Critical Load Combination: UU1

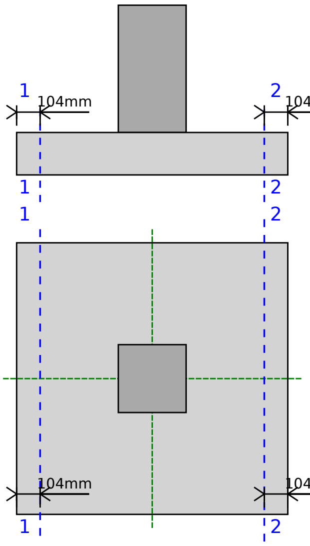
Eq. 6.2.a

Maximum Shear Resistance at the Section	$V_{Rdcx} =$	169.70 kN
Maximum Design Shear Force at the Section	$V_{Ed} =$	-20.30 kN

$$SR_x = \frac{V_{Ed}}{V_{Rdcx}} = \frac{20.30}{169.70}$$

$$SR_x = 0.12$$

UTILITY: 0.12



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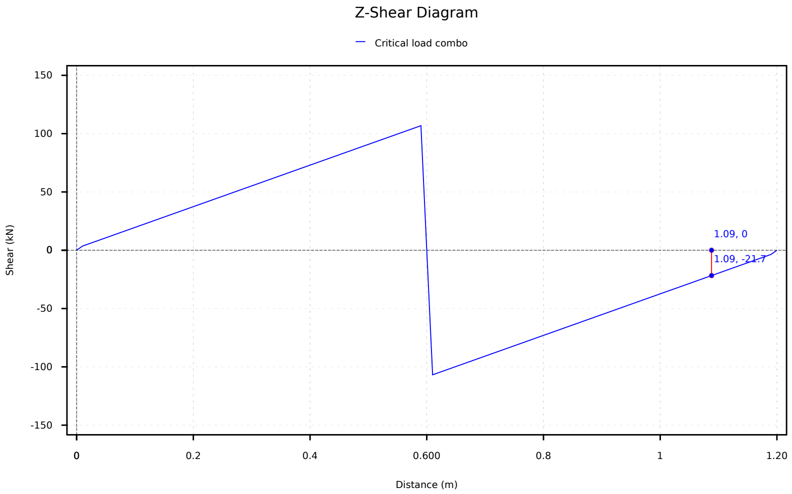
One Way Shear Check in Z

Max Shear Z-Axis Summary

LC	dist 1 m	Shear 1 kN	dist 2 m	Shear 2 kN
UU1	0.11	21.72	1.09	-21.72
UF1	0.11	16.54	1.09	-16.54



Critical Load Combination: UU1

Eq. 6.2.a

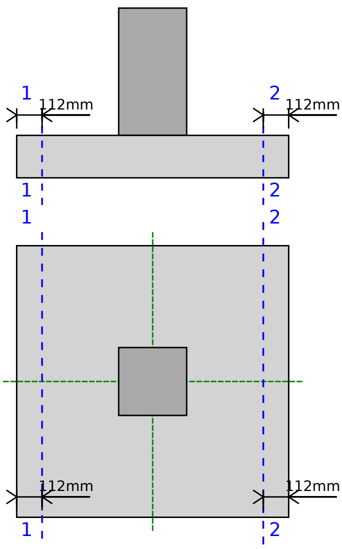
Maximum Shear Resistance at the Section $V_{Rdcz} =$ 167.04 kN

Maximum Design Shear Force at the Section $V_{Ed} =$ -21.72 kN

$$SR_z = \frac{V_{Ed}}{V_{Rdcz}} = \frac{21.72}{167.04}$$

$$SR_z = 0.13$$

UTILITY: 0.13



REFERENCES	CALCULATIONS	RESULTS

Punching Shear Check

Critical Load Combination: UU1

Critical Load Combination for column perimeter: UU1

Maximum punching shear stress at face of column	$\nu_{Rd,max} =$	4500 kPa
Maximum punching shear stress at critical perimeter	$\nu_{Rd} =$	1641 kPa

Punching Check Summary

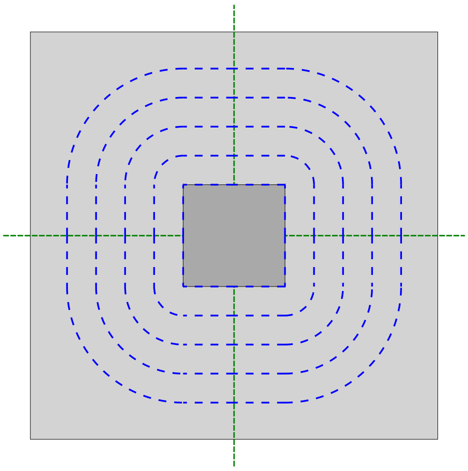
LC	dist a	q_{umean} kPa	β	v_{Ed} kPa	v_{Rd} kPa	PR
UU1	$1.00d_p$	145.83	1	72.85	820.51	0.09
UF1	$1.00d_p$	111.11	1	55.51	820.51	0.07
UU1	$0.75d_p$	145.83	1	126.71	1094.01	0.12
UF1	$0.75d_p$	111.11	1	96.54	1094.01	0.09
UU1	$0.50d_p$	145.83	1	197.41	1641.01	0.12
UF1	$0.50d_p$	111.11	1	150.4	1641.01	0.09
UU1	$0.25d_p$	145.83	1	300.55	3282.02	0.09
UF1	$0.25d_p$	111.11	1	228.99	3282.02	0.07
UU1	$0.00d_p$	145.83	1	479.71	4500	0.11
UF1	$0.00d_p$	111.11	1	365.5	4500	0.08

The control perimeter falls outside the footing slab for the distance 2.00*d.*
*The control perimeter falls outside the footing slab for the distance 1.50*d.

$$PR = \frac{v_{Ed}}{v_{Rd}} = \frac{197.41}{1641.01}$$

$$PR = 0.12$$

UTILITY: 0.12



REFERENCES	CALCULATIONS	RESULTS

EN 1992-1-1: 6.1

Bending Check (X)

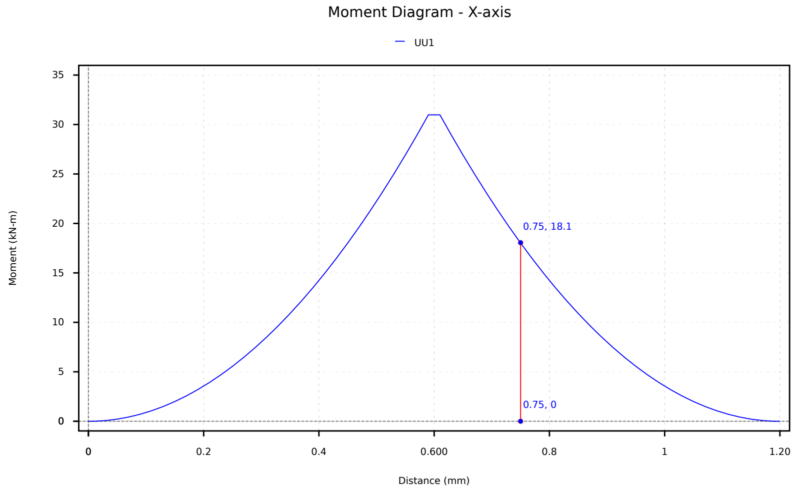
Limiting value for the ratio of the neutral axis depth to the effective depth	$x_{lim} =$	0.45
Long term effects on compression strength factor.	$\alpha_{cc} =$	1.00
Factor defining the effective strength.	$\eta =$	1.00
Limiting factor of the strength coefficient due to ductility	$K_{bal} =$	0.196
Mean tensile strength of concrete	$f_{ctm} =$	2.56 MPa
Factor for the tensile strength of concrete	$\lambda =$	0.80

EN 1992-1-1: 3.1.6(1)

EN 1992-1-1: 3.1.6(2)

Max Moment X-Axis Summary

LC	dist 1 m	Moment 1 kN-m	dist 2 m	Moment 2 kN-m
UU1	0.45	18.02	0.75	18.05
UF1	0.45	13.72	0.75	13.75



Critical Load Combination: undefined

Maximum Design Moment at the Critical Section	$M_{Edz} =$	18.05kN-m
Ratio of the depth of the neutral axis to the effective depth	$K_x =$	0.005
Required reinforcement area	$As_{reqx} =$	126 mm²
Provided reinforcement area	$As_{provx} =$	754 mm²
Minimum reinforcement area	$As_{minx} =$	554 mm²
Maximum reinforcement area	$As_{maxx} =$	19200 mm²

Ductility Check (X)

$K = 0.005 < K_{bal} = 0.196$

$K < k_{bal}$.

PASS

Reinforcement Area (X)

$As_{provx} = 754 > As_{reqx} = 126$

Provided reinforcement area > required reinforcement area.

PASS

Minimum Reinforcement Area (X)

$As_{provx} = 754 > As_{minx} = 553.8$

Provided reinforcement area > minimum reinforcement area.

PASS

Maximum Reinforcement Area (X)

$As_{provx} = 754 < As_{maxx} = 19200$

Provided reinforcement area < maximum reinforcement area due to ductility.

PASS

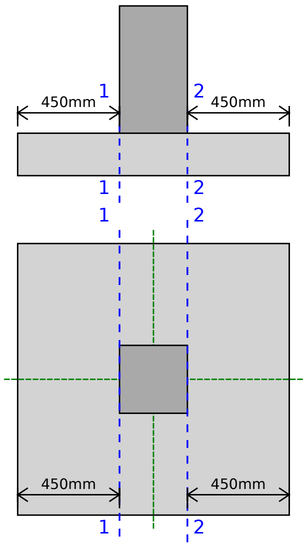
Calculation of the Maximum Resisting Moment (X)

Nominal Flexural Strength $M_{Rdz} =$ 107.75kN-m

$$BR_x = \frac{M_{Edz}}{M_{Rdz}} = \frac{18.05}{107.75}$$

$$BR_x = 0.17$$

UTILITY: 0.17



REFERENCES	CALCULATIONS	RESULTS

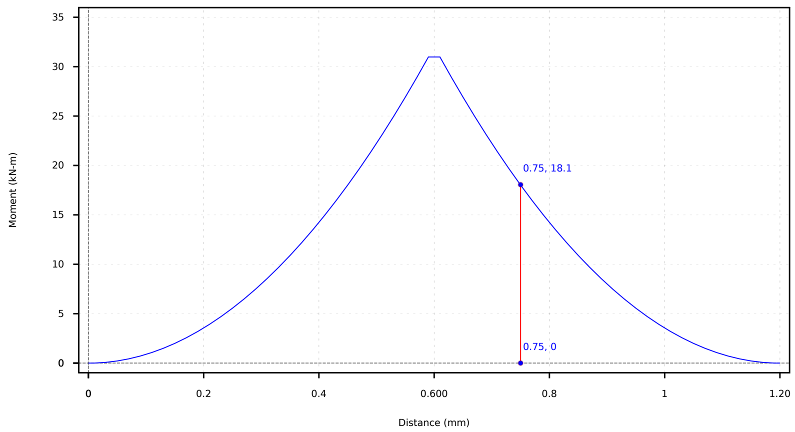
EN 1992-1-1: 6.1

Bending Check Z-Axis

Max Moment Z-Axis Summary

LC	dist 1 m	Moment 1 kN-m	dist 2 m	Moment 2 kN-m
UU1	0.45	18.02	0.75	18.05
UF1	0.45	13.72	0.75	13.75

Moment Diagram - (Z)



Critical Load Combination: undefined

Maximum Moment at the Critical Section	$M_{Edz} =$	18.05kN-m
Ratio of the depth of the neutral axis to the effective depth	$K_z =$	0.005
Required reinforcement area	$As_{reqz} =$	129 mm²
Provided reinforcement area	$As_{provz} =$	754 mm²
Minimum reinforcement area	$As_{minz} =$	541 mm²
Maximum reinforcement area	$As_{maxz} =$	19200 mm²

Ductility Check (Z)

$K = 0.005 < K_{bal} = 0.196$

$K < k_{bal}$.

PASS

Reinforcement Area (Z)

$As_{provz} = 754 > As_{reqz} = 129$

Provided reinforcement area > required reinforcement area.

PASS

Minimum Reinforcement Area (Z)

$As_{provz} = 754 > As_{minz} = 541$

Provided reinforcement area > minimum reinforcement area.

PASS

Maximum Reinforcement Area (Z)

$As_{provz} = 754 < As_{maxz} = 19200$

Provided reinforcement area < maximum reinforcement area due to ductility.

PASS

Calculation of the Maximum Resisting Moment (Z)

Nominal Flexural Strength $M_{Rdz} =$ 105.26 kN-m

$$BR_z = \frac{M_{Edz}}{M_{Rdz}} = \frac{18.05}{105.26}$$

$$BR_z = 0.17$$

UTILITY: 0.17

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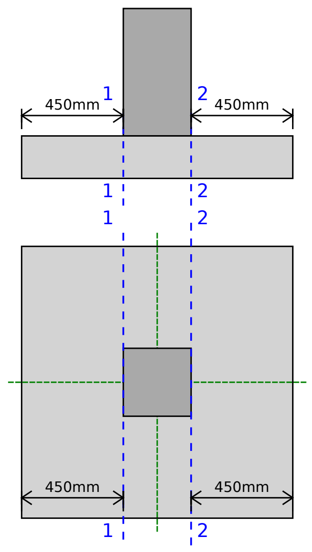
450mm
1
2
450mm
1
2
1
2
450mm
450mm
1
2

REFERENCES	CALCULATIONS	RESULTS
	Footing Details	
EN 1992-1-1: 9.3.1.1(3),8.2.2	Spacing for the Reinforcement along X-Axis	
	$\mathbf{s_{maxx} = 250 > s_x = 78 \;\&\; s_x - \varphi_x = 70 > s_{minx} = 20}$ Provided spacing is O.K.	PASS
EN 1992-1-1: 9.3.1.1(3),8.2.2	Spacing for the Reinforcement along Z-Axis	
	$\mathbf{s_{maxz} = 250 > s_z = 78 \;\&\; s_z - \varphi_z = 70 > s_{minz} = 20}$ Provided spacing is O.K.	PASS

REFERENCES	CALCULATIONS	RESULTS
	Development Length Check (X)	
	Depth of concrete cover $c_d =$ 35.00 mm	
8.4.4	Development Length (X) $l_{bdx} =$ 179.40 mm	
	Available Length (X) $l_{d,availx} =$ 400.00 mm	
	l_{bx} = 179 < $l_{d,availx}$ = 400 Available length > minimum development length.	PASS

REFERENCES	CALCULATIONS	RESULTS

Development Length Check (Z)

	Depth of concrete cover	$c_d =$	35.00 mm
8.4.4	Development Length (Z)	$l_{bdz} =$	179.40 mm
	Available Length (Z)	$l_{d,availz} =$	400.00 mm

$l_{bz} = 179 < l_{d,availz} = 400$

Available length > minimum development length.

PASS

Results Summary

Result Name	Results
EC2 Compliance	PASS
STABILITY CHECKS	
Eccentricity Ratio	PASS
Bearing Capacity	PASS
Overturning	PASS
Sliding	PASS
STRENGTH UTILIZATION	
Shear (X)	0.12
Shear (Z)	0.13
Punching Shear	0.12
Bending Capacity (X)	0.17
Bending Capacity (Z)	0.17
DETAILING	
Min/Max Reinforcement (X)	PASS
Min/Max Reinforcement (Z)	PASS
Bar Spacing (X)	PASS
Bar Spacing (Z)	PASS
Development Length (X)	PASS
Development Length (Z)	PASS

About this Calculator

Calculator Name: EN 1992-1-1 & EN 1997-1 Pad Footing Design
Description: The Eurocode Pad Footing Quick Design allows fast and efficient design of reinforced and mass concrete pad (spread) footings, including column eccentricities in both directions.

Powered by SkyCiv

URL: https://platform.skyciv.com/quick-design?uid=8003-en-2-7-pad-footing-design-calculator&footing_name=FOOTING%201&footing_width=1.2&footing_length=1.2&footing_depth=1.5&footing_height=400&col_c1=300&col_c2=300&col_height=1.2&col_x=0&col_z=0&q=0&annex=eurocode&design_approach=DA1_C1&concrete_strength_class=25&unit_weight=25&max_aggregate_size=15&concrete_type=in_situ&cast=directly&cover=50&f_yk=500&bar_size_x=8&n_x=15&x_bars_with_hooks=true&bar_size_z=8&n_z=15&z_bars_with_hooks=true&col_cover=30&col_bar_size=8&col_nx_bar=2&col_nz_bar=2&dowels_with_hooks=true&bearing_design_method=direct&consider_soil_above_foundation=false&drainage=drained&c=0&phi=30&phi_cv=30&soil_unit_weight=16&sat_unit_weight=17&D_w=1.5&report_detail=false&consider_fprEN_for_punching_beta_factor=false

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