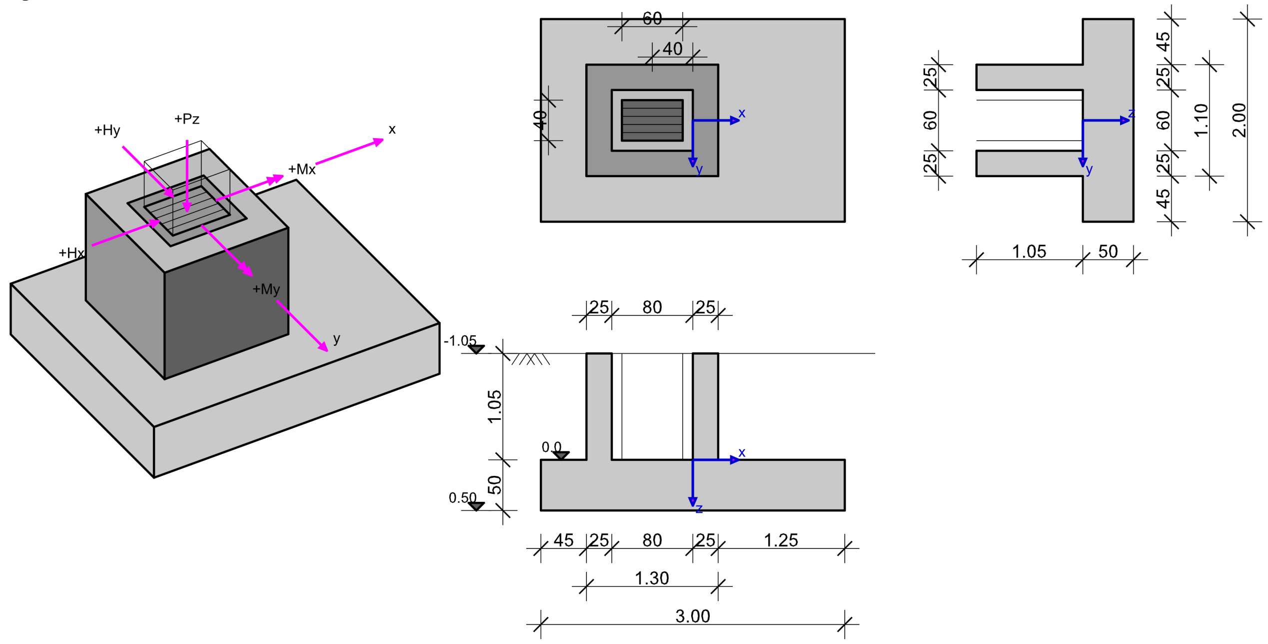
RIB Software SE	Funda V18.0 Build-No. 31102018	Type: Sleeve foundation
File: Köcherfundament_DBV-Bsp12.RTfun		

System information



Soil engineering: DIN EN 1997-1	Design:DIN EN 1992-1-1
Design situation: permanent	

Material coefficient, reinforced concrete (C25/30, B500S)

Concrete	γ_c	$\gamma_{c,accid.}$	α_{cc}	γ_B [kN/m³]	f_{ck} [MN/m²]	f_{cd} [MN/m²]
C25/30	1.50	1.30	0.85	25.00	25.00	14.17

Reinforcement	γ_s	$\gamma_{s,accid.}$	f_{yd} [MN/m²]	f_{yk} [MN/m²]	f_{tk} [MN/m²]
B500S	1.15	1.00	434.78	500.00	540.00

Subsoil geometry and material

h_e [m]	t_w [m]	φ [°]	c [kN/m²]	tan $\delta_{s,f}$	γ_1 [kN/m³]	γ_2 [kN/m³]
1.050	0.500	30.00	0.00	0.577	20.00	20.00
σ_{Rd}= 200.00 kN/m², User-defined						

Loading

Load cases

LC	I	LC_I	Source	Type of action	Name
0				Dead load	
1				Permanent load	
2				Storage rooms (Live load E)	
3				Wind	
4				Snow	

Dead load sum - Load case 0

LC	P_z [kN]
0	208.5

Column loads and imported loads

Type: S = column loads; I = imported loads; c = characteristic; d = design

LC	Type	P_z [kN]	H_x [kN]	H_y [kN]	M_x [kNm]	M_y [kNm]	ΔM_{xII} [kNm]	ΔM_{yII} [kNm]	e_x [m]	e_y [m]
1	S.c	257.0	0.0	0.0	0.0	-96.0	0.0	-48.0	-0.400	0.000
2	S.c	573.0	20.0	0.0	0.0	-180.0	0.0	-106.0	-0.400	0.000
3	S.c	0.0	35.0	0.0	0.0	-90.0	0.0	0.0	-0.400	0.000
4	S.c	100.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.400	0.000

Load case combinations

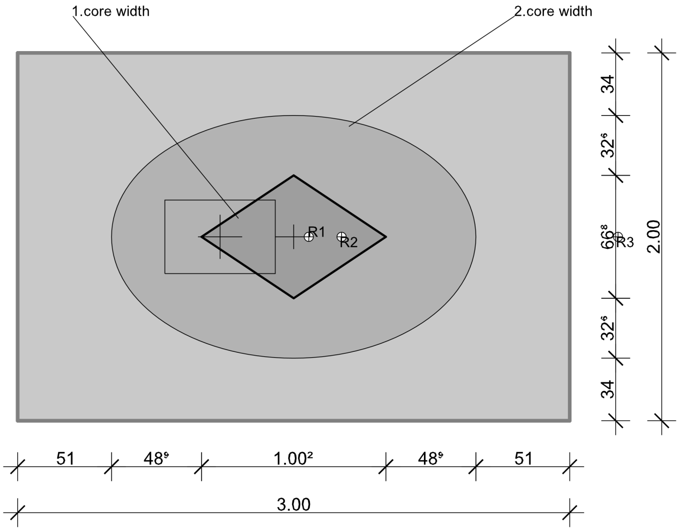
LCC	Load case combination	Crit.	Combination criterion: GK=BasicComb., A=Accidental, LS=SafetyDisplacement, AP=Impact
Type: G	LCC only with permanent loads for core width analysis	Type: G +Q	LCC from permanent and variable loads for core width analysis

decis.= 'yes' ... Combination is decisive in an analysis

LCC	decis.	Type	Crit.	Combination
1	yes	G	GK	1.35*LC1+1.50*LC2+1.50*LC3
2	yes	G	GK	1.35*LC1+1.50*LC2+1.50*LC3+1.50*LC4

Geotechnical analyses

Gaping joint



R1/2: Decisive resultant of the core widths;
R3: Decisive resultant safety against displacement = maximum utilization [%] * foundation width (bx or by)

Foundation rotation and limitation of a gaping joint (2nd order theory, characteristic)

Analysis format: $e_x/b_x \le 1/6$; $e_y/b_y \le 1/6$; $(e_x/b_x)^2+(e_y/b_y)^2 \le 1/9$

It has to be proven, that the resultant from permanent loads is within the 1st core width and the resultant from permanent and variable loads is within the 2nd core width.
$e_x / b_x \le 1/6$ 1. core width in x direction
$e_y / b_y \le 1/6$ 1. core width in y direction
$(e_x / b_x)^2 + (e_y / b_y)^2 \le 1/9$ 2. core width

LCC	$P_{res,G,c}$ [kN]	$e_{x,G}$ [m]	$e_{y,G}$ [m]	$P_{res,P,c}$ [kN]	$e_{x,P}$ [m]	$e_{y,P}$ [m]	$CW1_x$	$CW1_y$	CW2	$1.KW_x$ [%]	$1.KW_y$ [%]	1.CW [%]	2.CW [%]
1	466	0.08	0.00	1039	0.26	0.00	0.03	0.00	**	16.4	0.0	16.4	**
2	466	0.08	0.00	1139	0.20	0.00	0.03	0.00	**	16.4	0.0	16.4	**

1.core width (2.o.th) Decisive LCC1, η=0.16 **Analysis fulfilled**

Reinforced concrete design

Increase due to the punching analysis

Design sections

Section	As-direction	Design section [m]			Design for
		Pos.	Width	Height	
1	y	0.550	3.000	0.500	Bending+Shear
2	x	-1.050	2.000	0.500	Bending+Shear
3	x	0.250	2.000	0.500	Bending+Shear
4	x	0.700	2.000	0.500	Shear

Bending design

Reinforcement layer [cm]

$d_{1,b,x}$	$d_{1,b,y}$	$d_{1,t,x}$	$d_{1,t,y}$	$c_{vl,b,x}$	$c_{vl,b,y}$	$c_{vl,t,x}$	$c_{vl,t,y}$
5.0	4.0	3.0	3.0	6.0	6.0	6.0	6.0

Bending design

	decisi.comb.		Mmax	Mmin	h	b	εb	εs	zi,B	As,b	As,o
Section	As,b	As,o	[kNm]	[kNm]	[m]	[m]	[‰]	[‰]	[m]	[cm²]	[cm²]
1	2	1	69.2	61.6	0.500	3.000	0.00	0.00	0.414	15.5d	0.0
2	2	1	25.5	16.8	0.500	2.000	0.00	0.00	0.405	10.6d	0.0
3	2	1	483.6	467.1	0.500	2.000	0.00	0.00	0.405	24.0	0.0

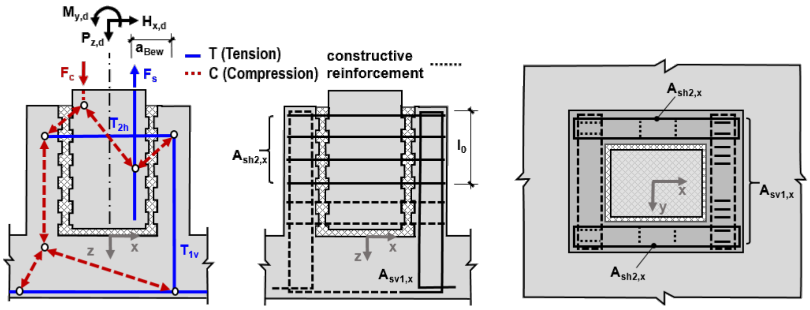
distribute bottom x reinforcement as follows (ya=-1.000 m)

sb_y [m]	2.000									
A_{su} [cm²]	23.98									
A_{su} [cm²/m]	11.99									

distribute bottom y reinforcement as follows (xa=-1.500 m)

sb_x [m]	0.140	0.585	0.750	0.750	0.775					
A_{su} [cm²]	0.52	3.65	4.68	5.42	2.71					
A_{su} [cm²/m]	3.74	6.24	6.24	7.22	3.50					

Sleeve design with profiled joint according to Schlaich/Schäfer



Legend

l_0	required lap length	t_{reco}	suggested embedment depth of the column = $1.50 \cdot b_s$
a_n	clearance column / sleeve reinforcement - min(4*d_s,50mm)	t_{req}	required embedment depth of the column = l_0 +a_n
l_{bd}	required anchorage length	t_{exis}	existing embedment depth of the column
A_{sh}	Horizontal sleeve reinforcement (total)	A_{sv}	Column / sleeve reinforcement vertical (per side)
T_v,T_h	Tensile force of load application column - foundation	a_{Rein}	Distance column / sleeve reinforcement

Composite condition

	f_{ck} [N/mm²]	f_{bd} [N/mm²]	f_{yd} [N/mm²]	Composite
Column	45	5.98	435	Composite conditionwell
Sleeve	25	4.09	435	Composite condition good

Formwork:	profiled	Thickness of mortar d_t:	0.050 m
$A_{sx,exis}$ of the vertical reinforcement:	18.10 cm²	$A_{sy,exis}$ of the vertical reinforcement:	2.26 cm²
Vertical reinforcement, sleeve d_s:	12 mm	Vertical reinforcement, column d_s:	25 mm

Design

As-direction	LCC	$M_{x,d}$ [kNm]	$M_{y,d}$ [kNm]	$P_{z,d}$ [kN]	$H_{x,d}$ [kN]	$H_{y,d}$ [kN]
x A_{sv}	1	-	758.4	1206.5	82.5	-
y A_{sv}	0	0.0	-	0.0	-	0.0
x A_{sh}	1	-	758.4	1206.5	82.5	-
y A_{sh}	0	0.0	-	0.0	-	0.0

Column

t_{exis} [m]	t_{req} [m]	t_{sugg} [m]	$a_{reinf,x}$ [m]	$a_{reinf,y}$ [m]
1.000	0.684	0.900	0.275	0.275

As-direct.	d_s [mm]	T_{1v} [kN]	$A_{sv1,req}$[cm²]	$A_{sv1,exis}$ [cm²]	a_n [m]	l_{bd} [m]	l_0 [m]
x	25	919.13	21.1	29.4	0.206	0.310	0.477
y	25	0.00	0.0	9.8	0.000	0.272	0.000

Sleeve

As-direct.	d_s [mm]	T_{1v} [kN]	$A_{sv1,req}$[cm²]	$A_{sv1,exis}$ [cm²]	a_n [m]	l_{bd} [m]	l_0 [m]	T_{2h} [kN]	A_{sh2} [cm²]
x	12	671.56	15.4	18.1	0.208	0.190	0.266	675.49	15.5
y	12	0.00	0.0	2.3	0.000	0.000	0.000	0.00	0.0

Punching analysis

Legend

V_{Ed}	shear force to bear	$V_{Ed,red}$	reduced shear force
$\sigma_{0,d}$	Base pressure inside A_{crit}	ß	Load increase factor for eccentric loads
A_{crit}	Reduction area within the critical perimeter	a_{crit}	Distance of the critical perimeter to the column edge
u_{crit}	Effective circumference of the critical perimeter	u_{out}	Circumference of the area reinforced for punching
u_0	Effective circumference of the load application area	d_m	mean statically effective depth
a_{crit}/d_m	Inclination of the punching cone$a_{crit}/d_m=\cot_\theta$	v_{Ed}	related shear force(ß·V_{Ed})/(u_{crit}·d_m)
$v_{Rd,c}$	Punching resistance without punching reinforcement	$v_{Rd,max}$	maximum punching resistance
L_w	Distance of the outmost reinforcement layer to the column edge	as_x/as_y	exis./req. longitudinal reinforcement bottom/top
ρ_l	mean reinforcement ratio	$As_{w,j}$	Sum of the punching reinforcement per layer
a_j	Distance of the reinforcement layer to the column edge	u_j	effective circumference of the reinforcement row

Punching analysis - Design values based on2nd order theory γ-fold

LCC ρ_l [%]	V_{Ed} [kN] A_{crit} [m²]	σ_{0d} [kN/m²] u_{crit} [m]	$V_{Ed,red}$ [kN] u_{out} [m]	β [-] u_0 [m]	a_{crit} [m] L_w [m]	d_m [m] a_{crit}/d_m [-]	$as_{x,t}$ [cm²/m] $as_{x,b}$ [cm²/m]	$as_{y,t}$ [cm²/m] $as_{y,b}$ [cm²/m]	v_{Ed} [MN/m²] $v_{Rd,c}$ [MN/m²]	$v_{Rd,max}$ [MN/m²] $v_{Ed}/v_{Rd,c}$ [-]
2 0.166	1356.5 3.21	226.1 6.73	630.7 7.58	1.51 4.80	0.31 0.14	0.45 0.68	0.00 11.99	0.00 4.71	0.312 1.098	1.538 0.284

No punching reinforcement required.

Minimum bending moment for inside columns DIN EN 1992-1-1, 6.4.5 (NA.6)

Distribution width onto at least 0,3*foundation width or critical circumference.						
LCC	V_{Ed} [kN]	$V_{Ed,red}$ [kN]	$m_{Ed,x}$ [kNm/m]	$m_{Ed,y}$ [kNm/m]	$as_{x,b}$ [cm²/m]	$as_{y,b}$ [cm²/m]
2	1356.5	1033.2	129.1	129.1	6.24	6.24

The longitudinal reinforcement has been increased for the punching analysis.

Analysis overview

Analysis	Status	LCC	Utilization
1.core width (2.o.th)	fulfilled	1	0.16