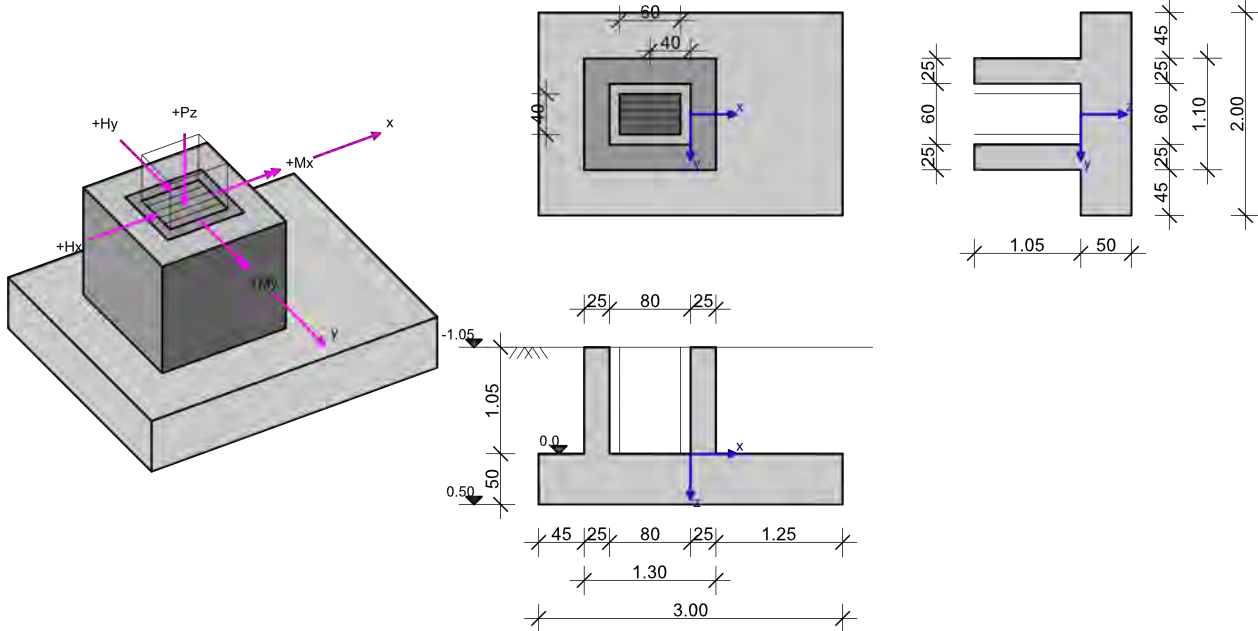


RIB Software SE	Funda V18.0 Build-No. 31102018	Type: Sleeve foundation
File: Köcherfundament_DBV-Bsp12.RTfun		

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/m ³]	f_{ck} [MN/m ²]	f_{cd} [MN/m ²]
C25/30	1.50	1.30	0.85	25.00	25.00	14.17
Reinforcement	γ_s	$\gamma_{s,accid.}$	f_{yd} [MN/m ²]	f_{yk} [MN/m ²]	f_{tk} [MN/m ²]	
B500S	1.15	1.00	434.78	500.00	540.00	

Subsoil geometry and material

h_e [m]	t_w [m]	φ [°]	c [kN/m ²]	$\tan \delta_{s,f}$	γ_1 [kN/m ³]	γ_2 [kN/m ³]
1.050	0.500	30.00	0.00	0.577	20.00	20.00

$\sigma_{Rd} = 200.00$ 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	Typ e	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

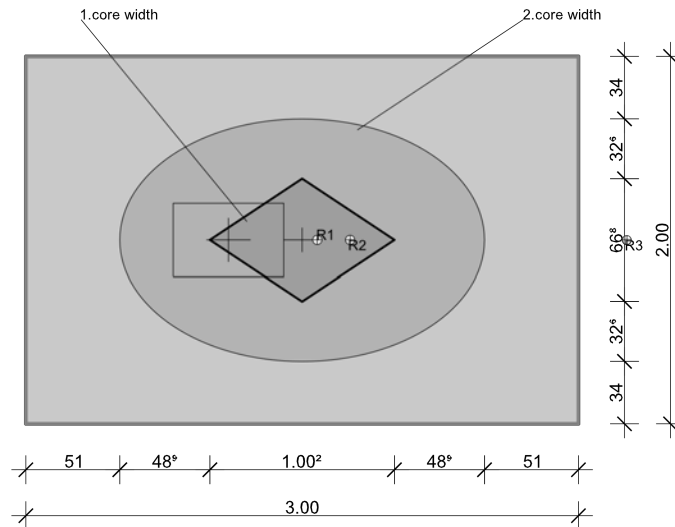
LCC	Load case combination	Crit.	Combination criterion: GK=BasicComb., A=Accidental, LS=SafetyDisplacement, AP=Impact
Type: G	LCC only with permanent loads for core width analysis	Type: G +Q	LCC from permanent and variable loads for core width analysis

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 gapping joint (2nd order theory, characteristic)

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

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.

$e_x / b_x \leq 1/6$ 1. core width in x direction

$e_y / b_y \leq 1/6$ 1. core width in y direction

$(e_x / b_x)^2 + (e_y / b_y)^2 \leq 1/9$ 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, $\eta=0.16$

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

Section	decisi.comb.		M _{max}	M _{min}	h	b	ε _b	ε _s	z _{i,B}	A _{s,b}	A _{s,o}
	A _{s,b}	A _{s,o}	[kNm]	[kNm]	[m]	[m]	[%]	[%]	[m]	[cm ²]	[cm ²]
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

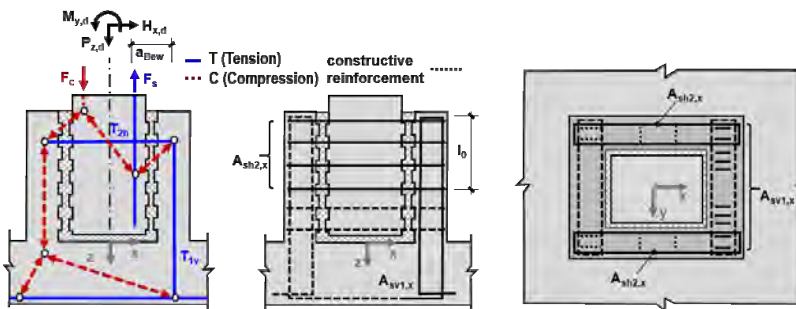
distribute bottom x reinforcement as follows (y_a=-1.000 m)

sb _y [m]	2.000										
A _{Su} [cm ²]	23.98										
A _{Su} [cm ² /m]	11.99										

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

sb _x [m]	0.140	0.585	0.750	0.750	0.775						
A _{Su} [cm ²]	0.52	3.65	4.68	5.42	2.71						
A _{Su} [cm ² /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·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/mm ²]	f _{bd} [N/mm ²]	f _{yd} [N/mm ²]	Composite
Column	45	5.98	435	Composite condition well
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 cm ²	A _{sy,exis} of the vertical reinforcement:	2.26 cm ²
Vertical reinforcement, sleeve d _s :	12 mm	Vertical reinforcement, column d _s :	25 mm

Design

As-direction	LC C	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} [cm ²]	A _{sv1,exis} [cm ²]	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} [cm ²]	A _{sv1,exis} [cm ²]	a _n [m]	l _{bd} [m]	l ₀ [m]	T _{2h} [kN]	A _{sh2} [cm ²]
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
σ _{0,d}	Base pressure inside A _{crit}	β	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 =cotθ	V _{Ed}	related shear force (β·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	a _{sx} /a _{sy}	exis./req. longitudinal reinforcement bottom/top
ρ _l	mean reinforcement ratio	A _{sw,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 on 2nd order theory γ-fold

LCC	V _{Ed} [kN]	σ _{0,d} [kN/m ²]	V _{Ed,red} [kN]	β	a _{crit} [m]	d _m [m]	a _{sx,t} [cm ² /m]	a _{sy,t} [cm ² /m]	V _{Ed} [MN/m ²]	V _{Rd,max} [MN/m ²]
ρ _l [%]	A _{crit} [m ²]	u _{crit} [m]	u _{out} [m]	u ₀ [m]	L _w [m]	a _{crit} /d _m [-]	a _{sx,b} [cm ² /m]	a _{sy,b} [cm ² /m]	V _{Rd,c} [MN/m ²]	V _{Ed} /V _{Rd,c} [-]
2	1356.5	226.1	630.7	1.51	0.31	0.45	0.00	0.00	0.312	1.538
0.166	3.21	6.73	7.58	4.80	0.14	0.68	11.99	4.71	1.098	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]	a _{sx,b} [cm ² /m]	a _{sy,b} [cm ² /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