

1 Spread footing: Foundation97...100 identical elements: 1

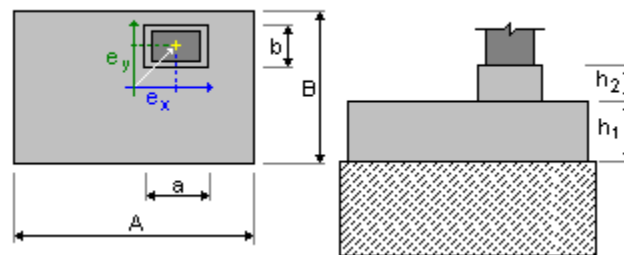
Number of

1.1 Basic data

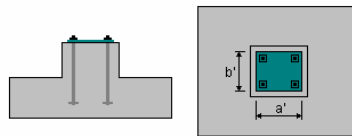
1.1.1 Assumptions

- Geotechnic calculations according to : DTU 13.12
- Concrete calculations according to : BAEL 91 mod. 99
- Foundation with lean concrete
- Shape selection : without limits

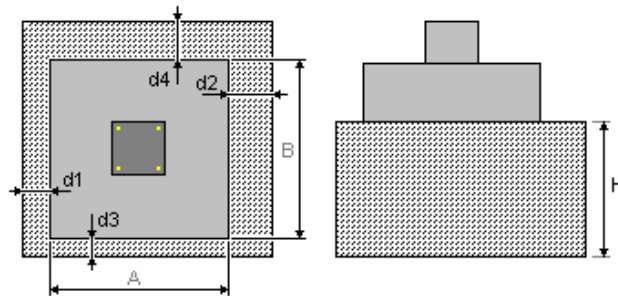
1.1.2 Geometry:



A	= 1.10 (m)	a	= 0.68 (m)
B	= 1.60 (m)	b	= 0.36 (m)
h1	= 0.50 (m)	e_x	= 0.00 (m)
h2	= 0.50 (m)	e_y	= 0.00 (m)



a'	= 40.0 (cm)
b'	= 22.0 (cm)
c1	= 5.0 (cm)
c2	= 3.0 (cm)



H	= 0.10 (m)
d1	= 0.10 (m)
d2	= 0.10 (m)
d3	= 0.10 (m)

$$d4 = 0.10 \text{ (m)}$$

1.1.3 Materials

- Concrete : BETON25; Characteristic strength = 25.00
MPa
Unit weight = 2501.36 (kG/m3)
- Lean concrete : BETON20; Characteristic strength = 20.00
MPa
Unit weight = 2501.36 (kG/m3)
- Longitudinal reinforcement : type HA 400 Characteristic strength = 400.00 MPa
- Transversal reinforcement : type HA 400 Characteristic strength = 400.00 MPa
- Additional reinforcement: : type HA 400 Characteristic strength = 400.00 MPa

1.1.4 Loads:

Foundation loads:

Case	Nature	Group	N (kN)	Fx (kN)	Fy (kN)	Mx (kN*m)	My (kN*m)
DL1	dead load(Structural)	97	8.07	-0.00	0.15	-0.43	-0.00
1	dead load(Structural)	97	2.17	-0.00	0.05	-0.26	-0.00
11	dead load(Structural)	97	0.19	-0.00	0.00	-0.02	-0.00
111	dead load(Structural)	97	5.61	-0.00	0.16	-0.35	-0.00
1111	dead load(Structural)	97	0.00	-0.00	0.00	-0.00	-0.00
11111	dead load(Structural)	97	0.00	0.00	0.00	0.00	0.00
111111	live load(Category A)	97	5.11	-0.00	0.12	-0.62	-0.00
1111111	live load(Category A)	97	0.62	-0.00	0.01	-0.07	-0.00
2	live load(Category A)	97	0.51	-0.00	0.01	-0.06	-0.00
WIND1	wind	97	-4.85	-0.01	6.51	-8.21	-0.05
WIND2	wind	97	-3.26	0.00	-2.29	3.49	0.04
WIND3	wind	97	0.72	-0.08	-4.37	5.99	-0.39
WIND4	wind	97	-8.57	0.14	-4.37	5.99	0.47
WIND5	wind	97	6.74	-0.07	-4.54	5.60	-0.36
WIND6	wind	97	-1.27	0.13	-4.54	5.60	0.45
DL1	dead load(Structural)	98	8.07	0.00	0.15	-0.43	0.00
1	dead load(Structural)	98	2.17	0.00	0.05	-0.26	0.00
11	dead load(Structural)	98	0.19	0.00	0.00	-0.02	0.00
111	dead load(Structural)	98	5.61	0.00	0.16	-0.35	0.00
1111	dead load(Structural)	98	0.00	0.00	0.00	-0.00	0.00
11111	dead load(Structural)	98	0.00	0.00	0.00	0.00	0.00
111111	live load(Category A)	98	5.11	0.00	0.12	-0.62	0.00
1111111	live load(Category A)	98	0.61	0.00	0.01	-0.07	-0.00
2	live load(Category A)	98	0.51	0.00	0.01	-0.06	0.00
WIND1	wind	98	-4.85	0.01	6.50	-8.19	0.05
WIND2	wind	98	-3.26	-0.00	-2.29	3.48	-0.04
WIND3	wind	98	-8.57	-0.14	-4.36	5.98	-0.47
WIND4	wind	98	0.72	0.08	-4.36	5.98	0.39
WIND5	wind	98	-1.27	-0.13	-4.53	5.59	-0.45
WIND6	wind	98	6.74	0.07	-4.53	5.59	0.36
DL1	dead load(Structural)	99	8.07	0.00	-0.15	0.43	0.00
1	dead load(Structural)	99	2.17	0.00	-0.05	0.26	0.00
11	dead load(Structural)	99	0.19	0.00	-0.00	0.02	0.00
111	dead load(Structural)	99	5.61	0.00	-0.16	0.35	0.00
1111	dead load(Structural)	99	0.00	0.00	-0.00	0.00	0.00
11111	dead load(Structural)	99	0.00	0.00	0.00	0.00	0.00
111111	live load(Category A)	99	5.11	0.00	-0.12	0.62	0.00
1111111	live load(Category A)	99	0.07	0.00	0.00	-0.02	0.00
2	live load(Category A)	99	0.51	0.00	-0.01	0.06	0.00
WIND1	wind	99	-3.26	-0.00	2.29	-3.48	-0.04
WIND2	wind	99	-4.85	0.01	-6.50	8.19	0.05
WIND3	wind	99	-8.57	-0.14	4.36	-5.98	-0.47
WIND4	wind	99	0.72	0.08	4.36	-5.98	0.39

WIND5	wind	99	-1.27	-0.13	4.53	-5.59	-0.45
WIND6	wind	99	6.74	0.07	4.53	-5.59	0.36
DL1	dead load(Structural)	100	8.07	-0.00	-0.15	0.43	-0.00
1	dead load(Structural)	100	2.17	-0.00	-0.05	0.26	-0.00
11	dead load(Structural)	100	0.19	-0.00	-0.00	0.02	-0.00
111	dead load(Structural)	100	5.61	-0.00	-0.16	0.35	-0.00
1111	dead load(Structural)	100	0.00	-0.00	-0.00	0.00	-0.00
11111	dead load(Structural)	100	0.00	0.00	0.00	0.00	0.00
111111	live load(Category A)	100	5.11	-0.00	-0.12	0.62	-0.00
1111111	live load(Category A)	100	0.07	-0.00	0.00	-0.02	-0.00
2	live load(Category A)	100	0.51	-0.00	-0.01	0.06	-0.00
WIND1	wind	100	-3.26	0.00	2.29	-3.49	0.04
WIND2	wind	100	-4.85	-0.01	-6.51	8.21	-0.05
WIND3	wind	100	0.72	-0.08	4.37	-5.99	-0.39
WIND4	wind	100	-8.57	0.14	4.37	-5.99	0.47
WIND5	wind	100	6.74	-0.07	4.54	-5.60	-0.36
WIND6	wind	100	-1.27	0.13	4.54	-5.60	0.45

Backfill loads:

Case	Nature	Q1 (kN/m2)
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1.1.5 Combination list

1/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111
2/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111
3/	97_ULS :
1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.50111111+1.501111111+1.502	
4/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.50111111
5/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.50111111
6/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.50111111+1.501111111
7/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.502
8/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.50111111+1.502
9/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.50111111+1.502
10/	97_ULS :
1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.50111111+1.501111111+1.502	
11/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.50111111
12/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.50111111
13/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.50111111+1.501111111
14/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.502
15/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.50111111+1.502
16/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.50111111+1.502
17/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.80WIND1
18/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.80WIND2
19/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.80WIND3
20/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.80WIND4
21/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.80WIND5
22/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.80WIND6
23/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND1
24/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND2
25/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND3
26/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND4
27/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND5
28/	97_ULS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND6
29/	97_ULS :
1.35DL1+1.351+1.3511+1.35111+1.351111+1.50111111+1.501111111+1.502+1.20WIND1	
30/	97_ULS :
1.35DL1+1.351+1.3511+1.35111+1.351111+1.50111111+1.501111111+1.502+1.20WIND2	
31/	97_ULS :
1.35DL1+1.351+1.3511+1.35111+1.351111+1.50111111+1.501111111+1.502+1.20WIND3	
32/	97_ULS :
1.35DL1+1.351+1.3511+1.35111+1.351111+1.50111111+1.501111111+1.502+1.20WIND4	
33/	97_ULS :
1.35DL1+1.351+1.3511+1.35111+1.351111+1.50111111+1.501111111+1.502+1.20WIND5	
34/	97_ULS :
1.35DL1+1.351+1.3511+1.35111+1.351111+1.50111111+1.501111111+1.502+1.20WIND6	
35/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.50111111+1.20WIND1
36/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.50111111+1.20WIND2
37/	97_ULS : 1.35DL1+1.351+1.3511+1.35111+1.351111+1.50111111+1.20WIND3

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2324/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+1.00WIND2
 2325/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+1.00WIND3
 2326/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+1.00WIND4
 2327/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+1.00WIND5
 2328/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+1.00WIND6
 2329/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.771111111+1.00WIND1
 2330/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.771111111+1.00WIND2
 2331/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.771111111+1.00WIND3
 2332/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.771111111+1.00WIND4
 2333/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.771111111+1.00WIND5
 2334/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.771111111+1.00WIND6
 2335/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.772+1.00WIND1
 2336/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.772+1.00WIND2
 2337/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.772+1.00WIND3
 2338/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.772+1.00WIND4
 2339/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.772+1.00WIND5
 2340/* 100_SLS : 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.772+1.00WIND6
 2341/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND1
 2342/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND2
 2343/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND3
 2344/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND4
 2345/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND5
 2346/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND6
 2347/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND1
 2348/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND2
 2349/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND3
 2350/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND4
 2351/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND5
 2352/* 100_SLS :
 1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND6

1.2 Geotechnical design

1.2.1 Assumptions

Foundation design for:

- Capacity
- Sliding
- Rotation
- Uplift

1.2.2 Soil:

Stresses in soil: $\sigma_{ULS} = 0.07 \text{ (MPa)}$ $\sigma_{SLS} = 0.05 \text{ (MPa)}$

Soil level: $N_1 = 0.00 \text{ (m)}$

Column pier level: $N_a = 0.00 \text{ (m)}$

Minimum reference level: $N_f = -1.20$ (m)

Argiles et limons fermes

- Soil level: 0.00 (m)
- Unit weight: 2039.43 (kG/m³)
- Unit weight of solid: 2692.05 (kG/m³)
- Internal friction angle: 30.0 (Deg)
- Cohesion: 0.02 (MPa)

1.2.3 Limit states

Lean concrete stability analysis

Stress calculations

Attention - the selected soil database does not correspond to the geotechnical code. The calculations have been performed based on the default soil types.

Soil type under foundation: not layered

Design combination **97_ULS :**

1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.50111111+1.501111111+1.502+1.20WIND1

Load factors: **1.35** * Foundation weight

1.35 * Soil weight

Calculation results: On the foundation level

Weight of foundation and soil over it: $G_r = 61.40$ (kN)

Design load:

$N_r = 86.63$ (kN)

$M_x = -20.97$ (kN*m)

$M_y = -0.09$ (kN*m)

Equivalent foundation dimensions:

$B' = 1$

$L' = 1$

Foundation depth:

$D_{min} = 1.10$ (m)

Allowable stress calculation method: Stress pressiometric (DTU 13.12, 3.22)

$q_u = 0.15$ (MPa)

Design soil pressure:

$q_{lim} = q_u / \gamma_f = 0.07$ (MPa)

$\gamma_f = 2.00$

Stress in soil:

$q_{ref} = 0.05$ (MPa)

Safety factor: $q_{lim} / q_{ref} = 1.441 > 1$

Uplift

Uplift in ULS

Design combination

97_ULS :

1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND1

Load factors:

1.00 * Foundation weight

1.00 * Soil weight

Weight of foundation and soil over it: $G_r = 45.48$ (kN)

Design load:

$N_r = 52.81$ (kN)

$M_x = -29.15$ (kN*m)

$M_y = -0.12$ (kN*m)

Contact area

$s = 57.98$ (%)

$s_{lim} = 10.00$ (%)

Uplift in SLS

Design combination: **100_SLS :**
1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+0.771111111+0.772+1.00WIND4
Load factors: **1.00** * Foundation weight
1.00 * Soil weight
Weight of foundation and soil over it: Gr = 45.48 (kN)
Design load:
Nr = 53.41 (kN) Mx = -9.28 (kN*m) My = 0.62 (kN*m)
Contact area
s = 100.00 (%)
slim = 100.00 (%)

Sliding

Design combination **97_ULS :**
1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND1
Load factors: **1.00** * Foundation weight
1.00 * Soil weight
Weight of foundation and soil over it: Gr = 45.48 (kN)
Design load:
Nr = 52.81 (kN) Mx = -27.94 (kN*m) My = -0.12 (kN*m)
Equivalent foundation dimensions: A_ = 1.10 (m) B_ = 1.60 (m)
Sliding area: 0.89 (m²)
Cohesion: C = 0.02 (MPa)
Foundation/soil friction coefficient: f = 0.58
Sliding force value F = 12.09 (kN)
Value of force preventing foundation sliding:
- On the foundation level: F(stab) = 44.27 (kN)
Stability for sliding: 3.662 > 1

Rotation

About OX axis

Design combination **97_ULS :**
1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND1
Load factors: **1.00** * Foundation weight
1.00 * Soil weight
Weight of foundation and soil over it: Gr = 45.48 (kN)
Design load:
Nr = 52.81 (kN) Mx = -27.94 (kN*m) My = -0.12 (kN*m)
Stability moment: M_{stab} = 57.96 (kN*m)
Rotation moment: M_{renv} = 29.15 (kN*m)
Stability for rotation: 1.988 > 1

About OY axis

Design combination: **99_ULS :**
1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND3
Load factors: **1.00** * Foundation weight
1.00 * Soil weight
Weight of foundation and soil over it: Gr = 45.48 (kN)
Design load:
Nr = 46.10 (kN) Mx = -17.17 (kN*m) My = -1.09 (kN*m)
Stability moment: M_{stab} = 37.50 (kN*m)
Rotation moment: M_{renv} = 1.12 (kN*m)
Stability for rotation: 33.59 > 1

Foundation stability analysis

Stress calculations

Design combination **97_ULS :**
1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.50111111+1.501111111+1.502+1.20WIND1
Load factors: **1.35** * Foundation weight
1.35 * Soil weight
Weight of foundation and soil over it: Gr = 53.65 (kN)
Design load:
Nr = 78.88 (kN) Mx = -20.97 (kN*m) My = -0.09 (kN*m)
Stress in soil: 0.09 (MPa)
Safety factor: 148.5 > 1

1.3 RC design

1.3.1 Assumptions

- Cracking : limited
- Exposure : mild
- Include element sensitivity condition for fragile failure : yes

1.3.2 Analysis of punching and shear

Shear

Design combination **97_ULS :**
1.00DL1+1.001+1.0011+1.00111+1.001111+1.0011111+1.80WIND1
Load factors: **1.00** * Foundation weight
1.00 * Soil weight
Design load:
Nr = 47.07 (kN) Mx = -27.94 (kN*m) My = -0.12 (kN*m)
Length of critical circumference: 1.10 (m)
Shear force: 18.65 (kN)
Section effective height: heff = 0.44 (m)
Shear area: A = 0.48 (m²)
Shear stress: 0.04 (MPa)
Admissible shear stress: 1.17 (MPa)
Safety factor: 30.27 > 1

1.3.3 Required reinforcement

Spread footing:

bottom:

97_ULS :
1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.00111111+1.001111111+1.002+1.80WIND5
My = 2.02 (kN*m) A_{sx} = 4.84 (cm²/m)

97_ULS :
 1.35DL1+1.351+1.3511+1.35111+1.351111+1.3511111+1.00111111+1.001111111+1.002+1.80WIND1
 $M_x = 15.06 \text{ (kN*m)}$ $A_{sy} = 4.84 \text{ (cm}^2\text{/m)}$

$$A_{s \min} = 4.40 \text{ (cm}^2\text{/m)}$$

top:

$$A'_{sx} = 0.00 \text{ (cm}^2\text{/m)}$$

$$A'_{sy} = 0.00 \text{ (cm}^2\text{/m)}$$

$$A_{s \min} = 0.00 \text{ (cm}^2\text{/m)}$$

$$\text{Maximum code-specified spacing} \quad e_{\max} = 0.25 \text{ (m)}$$

Column pier:

$$\text{Longitudinal reinforcement} \quad A = 10.60 \text{ (cm}^2) \quad A_{\min.} = 8.32 \text{ (cm}^2)$$

$$A = 2 * (A_{sx} + A_{sy})$$

$$A_{sx} = 0.15 \text{ (cm}^2) \quad A_{sy} = 5.15 \text{ (cm}^2)$$

Splice reinforcement (foundation to lean concrete): $A = 11.15 \text{ (cm}^2)$

1.3.4 Provided reinforcement

2.3.1 Spread footing:

Bottom:

Along X axis:

$$10 \text{ HA } 400 \text{ } 10 \quad l = 1.00 \text{ (m)} \quad e = 1 * -0.72 + 9 * 0.16$$

Along Y axis:

$$7 \text{ HA } 400 \text{ } 10 \quad l = 1.50 \text{ (m)} \quad e = 1 * -0.44 + 6 * 0.15$$

Top:

2.3.2 Pier

Longitudinal reinforcement

Along X axis:

$$8 \text{ HA } 400 \text{ } 12 \quad l = 1.08 \text{ (m)} \quad e = 1 * -0.18 + 3 * 0.12$$

Along Y axis:

$$4 \text{ HA } 400 \text{ } 12 \quad l = 1.08 \text{ (m)} \quad e = 1 * -0.13 + 1 * 0.27$$

Transversal reinforcement

$$6 \text{ HA } 400 \text{ } 10 \quad l = 2.04 \text{ (m)} \quad e = 1 * 0.18 + 3 * 0.20 + 2 * 0.09$$

Splice reinforcement

$$12 \text{ HA } 400 \text{ } 12 \quad l = 0.68 \text{ (m)} \quad e_x = 0.39 \quad e_y = 1 * -0.59 + 1 * 0.39 + 1 * 0.40 + 1 * 0.39$$

2 Material survey:

- Concrete volume = 1.00 (m3)
- Lean concrete volume = 0.23 (m3)
- Formwork = 3.74 (m2)

- Steel HA 400
 - Total weight = 38.91 (kG)
 - Density = 38.82 (kG/m³)
 - Average diameter = 10.8 (mm)
 - Survey according to diameters:

Diameter	Length (m)	Weight (kG)
10	32.71	20.18
12	21.09	18.73