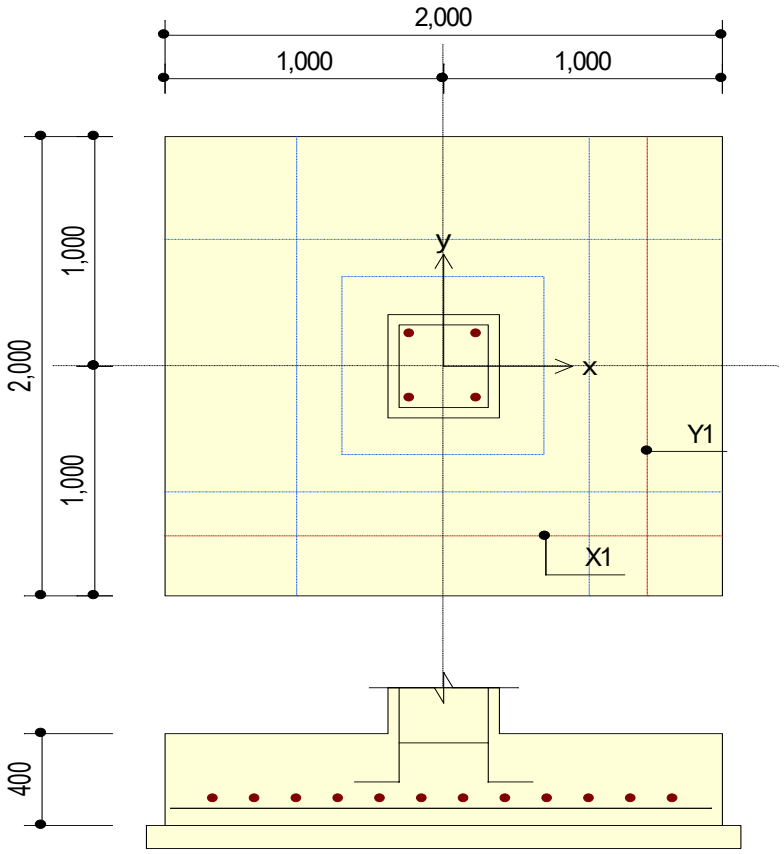
■ ZAPATA : Z-5

1. General Information

(1) Design Code : ACI318M-14
(2) Unit System : N, mm

2. Material

(1) F'_c : 28.00MPa
(2) F_y : 240MPa



3. Section

(1) Section Size
- Depth : 400mm
- Cover : 75.00mm

(2) Column Section
- Shape of Column : Rectangle
- Section : 400x450mm

4. Rebar

(1) Direction Y

- Layer 1 : #4@150 (A_s = 860mm²)

(2) Direction X

- Layer 1 : #4@150 (A_s = 860mm²)

5. Foundation

(1) Foundation Size

- L_x : 2.000m
- L_y : 2.000m
- f_e : 120KPa

6. Design Load

(1) Service Load

- P_s : 317kN
- M_{sx} : 61.00kN·m
- M_{sy} : 56.00kN·m

(2) Factored Load

- P_u : 490kN
- M_{ux} : 90.00kN·m
- M_{uy} : 82.00kN·m

(3) Surcharge Load is not considered.

(4) Self weight is considered.

7. Check Soil Capacity

(1) Calculate actual soil stress (KPa)

- $q_{s.top\text{-}left}$ = 92.11 $q_{s.top\text{-}right}$ = 116
- $q_{s.bot\text{-}left}$ = 0.611 $q_{s.bot\text{-}right}$ = 84.61
- $q_{s.max}$ = 116
- qs.max / fe = 0.97 → O.K

(2) Calculate factored soil stress (KPa)

- $q_{u.top\text{-}left}$ = 139 $q_{u.top\text{-}right}$ = 262
- $q_{u.bot\text{-}left}$ = 4.433 $q_{u.bot\text{-}right}$ = 127
- $q_{u.max}$ = 262 $q_{u.min}$ = 4.433

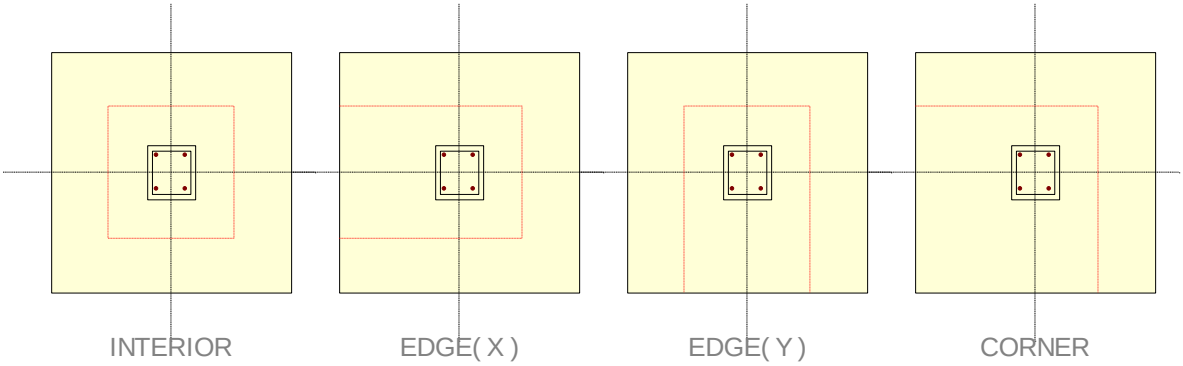
8. Check Shear

(1) Calculate one-way shear

- ø = 0.750
- V_{ux} = 156kN $øV_{cx}$ = 430kN
- V_{ux} / $øV_{cx}$ = 0.363 → O.K
- V_{uy} = 157kN $øV_{cy}$ = 413kN
- V_{uy} / $øV_{cy}$ = 0.380 → O.K

(2) Calculate two-way shear

-	b_0 (mm)	V_{c1} (kN)	V_{c2} (kN)	V_{c3} (kN)	V_c (kN)	V_u (kN)	$øV_c$ (kN)	Ratio
Interior	2,975	2,771	2,616	1,655	1,655	422	1,241	0.340
Edge(X)	3,487	3,249	2,314	1,940	1,940	357	1,455	0.245
Edge(Y)	3,487	3,249	2,314	1,940	1,940	363	1,455	0.250
Corner	2,744	2,556	1,660	1,527	1,527	245	1,145	0.214



- ø = 0.750
- d = 319mm
- $V_{c1} = 0.17\left(1 + \frac{2}{\beta}\right)\sqrt{f'_c}\ b_0\ d$
- $V_{c2} = 0.083\left(\frac{a_s\ d}{b_0} + 2\right)\sqrt{f'_c}\ b_0\ d$
- $V_{c3} = 0.33\sqrt{f'_c}\ b_0\ d$
- $V_c = \min(V_{c1}, V_{c2}, V_{c3})$
- $V_u = 422kN$
- $V_u / øV_c = 0.340 \rightarrow$ O.K

9. Check Moment Capacity

(1) Calculate moment capacity (Direction X)

- ø = 0.900
- $M_{uy} = 53.63kN·m$ $øM_{ny} = 58.40kN·m$
- $M_{uy} / øM_{ny} = 0.918 \rightarrow$ O.K

(2) Calculate moment capacity (Direction Y)

- ø = 0.900
- $M_{ux} = 51.82kN·m$ $øM_{nx} = 56.04kN·m$
- $M_{ux} / øM_{nx} = 0.925 \rightarrow$ O.K

10. Check Rebar

(1) Calculate minimum rebar area required

- $A_{s.min} = 0.00200D = 800mm^2$

(2) Calculate minimum rebar space required (Direction Y)

- $A_s = 129mm^2$ (#4@150)
- $s_{req.} = 161mm$
- $s_x = 150mm < s_{req.} = 161mm \rightarrow$ O.K

(3) Calculate minimum rebar space required (Direction X)

- $A_s = 129mm^2$ (#4@150)
- $s_{req.} = 161mm$
- $s_y = 150mm < s_{req.} = 161mm \rightarrow$ O.K