

MEMBER NAME : Z-T1

1. General Information

- (1) Design Code : NSR-10
(2) Code Unit : N, mm

2. Material

- (1) F'_c : 28.00MPa
(2) F_y : 420MPa

3. Section

- (1) Section Size
 • Depth : 450mm
 • Cover : 75.00mm
 (2) Column Section
 • Shape of Column : Rectangle
 • Section : 400x600mm

4. Rebar

- (1) Direction Y
 • Layer 1 : #4@100 ($A_s = 1,290\text{mm}^2$)
 (2) Direction X
 • Layer 1 : #4@100 ($A_s = 1,290\text{mm}^2$)

5. Foundation

- (1) Foundation Size
 • L_x : 1.000m
 • L_y : 2.200m
 • No. of pile : 2- $\phi 400$
 • Space of pile : 1,200mm
 • $q_{a,comp.}$: 132kN/EA
 • $q_{a,tens.}$: 0.000kN/EA

6. Design Load

- (1) Service Load
 • P_s : 153kN
 • M_{sx} : 29.52kN·m
 • M_{sy} : 11.87kN·m
 (2) Factored Load
 • P_u : 167kN
 • M_{ux} : 30.99kN·m
 • M_{uy} : 14.51kN·m
 (3) Surcharge Load
 • Surface Load : 0.000KPa
 • Weight Density : 18.00kN/m³
 • Soil Height : 0.150m
 (4) Self weight is considered.

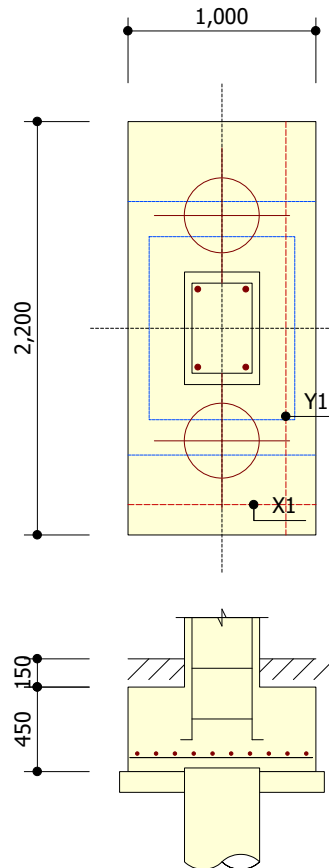
7. Calculation Summary

- (1) Overturning Moment (Service Load)

Category	Value	Criteria	Ratio	Note
Direction X (kN·m)	11.87	14.21	0.835	M_{sy} / M_{rx}
Direction Y (kN·m)	29.52	31.26	0.944	M_{sx} / M_{ry}

- (2) Overturning Moment (Factored Load)

Category	Value	Criteria	Ratio	Note
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Direction X (kN·m)	14.51	17.05	0.851	M_{uy} / M_{rx}
Direction Y (kN·m)	30.99	37.51	0.826	M_{ux} / M_{ry}

(3) Pile Bearing (Compression)

Category	Value	Criteria	Ratio	Note
Compression (kN)	112	132	0.853	
Tension (kN)	0.000	0.000	0.000	
Pile Punching (kN)	123	774	0.158	

(4) One Way Shear

Category	Value	Criteria	Ratio	Note
Direction X (kN)	0.000	547	0.000	$\phi = 0.750$
Direction Y (kN)	39.76	240	0.166	$\phi = 0.750$

(5) Two Way Shear

Category	Value	Criteria	Ratio	Note
Two Way Shear (kN)	155	1,322	0.117	$\phi = 0.750$

(6) Moment Capacity

Category	Value	Criteria	Ratio	Note
Direction Y, M_{ux} (kN·m)	36.79	168	0.219	$\phi = 0.900$
Direction X, M_{uy} (kN·m)	0.000	174	0.000	$\phi = 0.900$

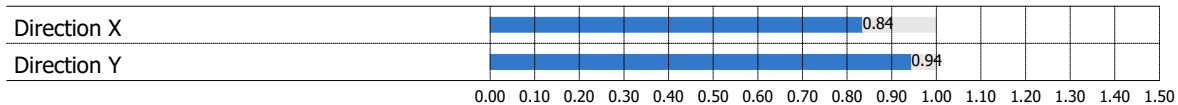
(7) Rebar Space

Category	Value	Criteria	Ratio	Note
Direction Y, M_{ux} (mm)	100	159	0.628	$A_{s,req} = 810\text{mm}^2$
Direction X, M_{uy} (mm)	100	159	0.628	

8. Check overturning moment (Service Load)

Calculation Summary (Overturning Moment (Service Load))

Category	Value	Criteria	Ratio	Note
Direction X (kN·m)	11.87	14.21	0.835	M_{sy} / M_{rx}
Direction Y (kN·m)	29.52	31.26	0.944	M_{sx} / M_{ry}



(1) Calculate resistance Moment

Items	Weight (kN)	Factor	L_x (m)	L_y (m)	R_x (kN·m)	R_y (kN·m)
Self Weight of Concrete	22.48	1.000	0.500	1.100	11.24	24.72
Self Weight of Soil	5.940	1.000	0.500	1.100	2.970	6.534
Surcharge Load	0.000	1.000	0.500	1.100	-	-
Resistance Moment	-	-	-	-	14.21	31.26

(2) Check overturning moment

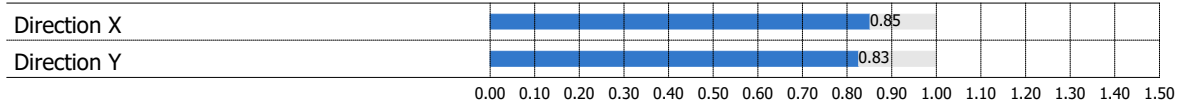
Direction X (M_{sy})			Direction Y (M_{sx})		
M_a	M_R	M_a / M_R	M_a	M_R	M_a / M_R
11.87kN·m	14.21kN·m	0.835	29.52kN·m	31.26kN·m	0.944

9. Check overturning moment (Factored Load)

Calculation Summary (Overturning Moment (Factored Load))

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Category	Value	Criteria	Ratio	Note
Direction X (kN·m)	14.51	17.05	0.851	M_{uy} / M_{rx}
Direction Y (kN·m)	30.99	37.51	0.826	M_{ux} / M_{ry}



(1) Calculate resistance Moment

Items	Weight (kN)	Factor	L_x (m)	L_y (m)	R_x (kN·m)	R_y (kN·m)
Self Weight of Concrete	22.48	1.200	0.500	1.100	13.49	29.67
Self Weight of Soil	5.940	1.200	0.500	1.100	3.564	7.841
Surcharge Load	0.000	1.800	0.500	1.100	-	-
Resistance Moment	-	-	-	-	17.05	37.51

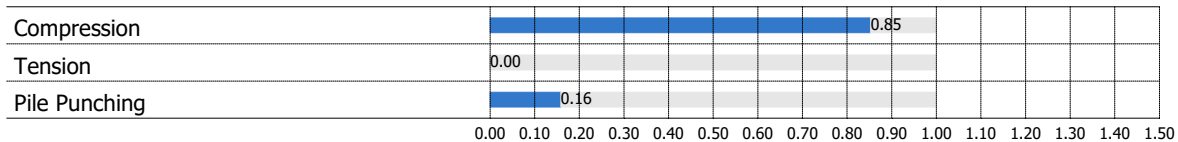
(2) Check overturning moment

Direction X (M_{uy})			Direction Y (M_{ux})		
M_a	M_R	M_a / M_R	M_a	M_R	M_a / M_R
14.51kN·m	17.05kN·m	0.851	30.99kN·m	37.51kN·m	0.826

10. Check Pile Capacity

Calculation Summary (Pile Bearing (Compression))

Category	Value	Criteria	Ratio	Note
Compression (kN)	112	132	0.853	
Tension (kN)	0.000	0.000	0.000	
Pile Punching (kN)	123	774	0.158	



Index	X (mm)	Y (mm)	V_u (kN)	$\phi V_{c,INT}$ (kN)	$\phi V_{c,EDG}$ (kN)	$\phi V_{c,COR}$ (kN)	ϕV_c (kN)	$V_u / \phi V_c$
01	0.000	600	123	1,166	1,066	774	774	0.158
02	0.000	-600	70.97	1,166	1,066	774	774	0.0917

- V_u , V_c : Pile Punching

(1) Calculate actual pile stress (kN)

- $q_{s,max} = 112\text{kN/EA}$
- $q_{s,max} / q_a = 0.853 \rightarrow \text{O.K}$
- $q_{s,min} = 0.000\text{kN/EA}$
- $q_{s,min} / q_a = 0.000 \rightarrow \text{O.K}$

(2) Calculate factored pile stress (kN)

- $q_{u,max} = 123\text{kN/EA}$
- $q_{u,min} = 70.97\text{kN/EA}$

11. Check Shear

Calculation Summary (One Way Shear)

Category	Value	Criteria	Ratio	Note
Direction X (kN)	0.000	547	0.000	$\phi = 0.750$
Direction Y (kN)	39.76	240	0.166	$\phi = 0.750$

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[illegible]

- (1) Calculate one-way shear (Direction X)

- $V_u = 0.000\text{kN}$
- $\phi = 0.750$
- $\phi V_c = 547\text{kN}$
- $V_u / \phi V_c = 0.000 \rightarrow \text{O.K.}$

- (2) Calculate one-way shear (Direction Y)

- $V_u = 39.76 \text{ kN}$
- $\phi = 0.750$
- $\phi V_c = 240 \text{ kN}$
- $V_u / \phi V_c = 0.166 \rightarrow 0. \text{ K}$

- (3) Calculate two-way shear

Calculation Summary (Two Way Shear)

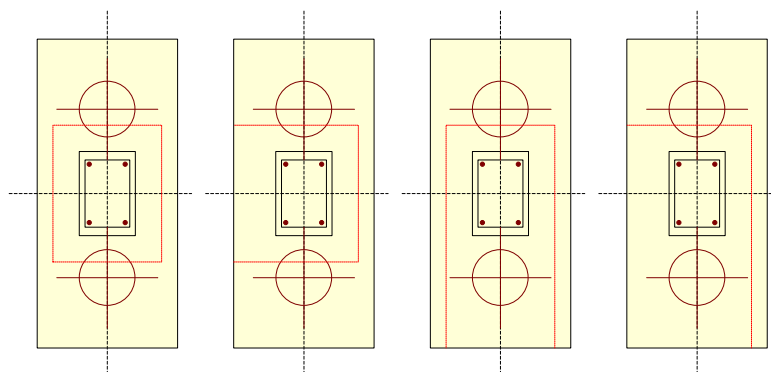
Category	Value	Criteria	Ratio	Note
Two Way Shear (kN)	155	1,322	0.117	$\phi = 0.750$

Two Way Shear



Value
0.12

-	b ₀ (mm)	V _{c1} (kN)	V _{c2} (kN)	V _{c3} (kN)	V _c (kN)	V _u (kN)	øV _c (kN)	Ratio
Interior	3,475	2,689	3,513	2,237	2,237	155	1,678	0.0922
Edge(X)	2,737	2,118	2,677	1,762	1,762	155	1,322	0.117
Edge(Y)	3,937	3,047	3,066	2,535	2,535	50.95	1,901	0.0268
Corner	2,469	1,910	1,993	1,589	1,589	50.95	1,192	0.0427



- $\phi = 0.750$
- $d = 369\text{mm}$
- $V_{c1} = 0.17 \left(1 + \frac{2}{\beta} \right) \sqrt{f'_c} b_o d$
- $V_{c2} = 0.083 \left(\frac{a_s d}{b_o} + 2 \right) \sqrt{f'_c} b_o d$
- $V_{c3} = 0.33 \sqrt{f'_c} b_o d$
- $V_c = \min(V_{c1}, V_{c2}, V_{c3})$
- $V_u = 155\text{kN}$
- **$V_u / \phi V_c = 0.117 \rightarrow \text{O.K.}$**

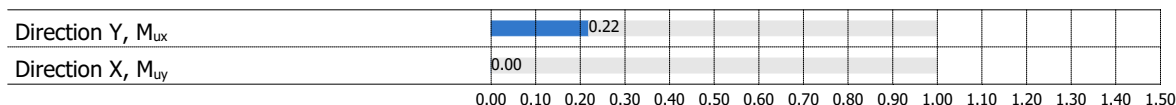
12. Check Moment Capacity

Calculation Summary (Moment Capacity)

Category	Value	Criteria	Ratio	Note
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Direction Y, M_{lux} (kN·m)	36.79	168	0.219	$\varnothing = 0.900$
Direction X, M_{luy} (kN·m)	0.000	174	0.000	$\varnothing = 0.900$

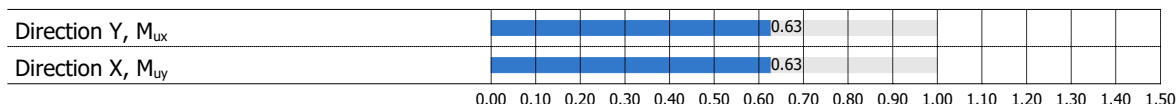


- (1) Calculate moment capacity (Direction X)
 - $\phi = 0.900$
 - $M_{uy} = 0.000 \text{ kN}\cdot\text{m}$ $\phi M_{ny} = 174 \text{ kN}\cdot\text{m}$
 - $M_{uy} / \phi M_{ny} = 0.000 \rightarrow \text{O.K}$
- (2) Calculate moment capacity (Direction Y)
 - $\phi = 0.900$
 - $M_{ux} = 36.79 \text{ kN}\cdot\text{m}$ $\phi M_{nx} = 168 \text{ kN}\cdot\text{m}$
 - $M_{ux} / \phi M_{nx} = 0.219 \rightarrow \text{O.K}$

13. Check Rebar

Calculation Summary (Rebar Space)

Category	Value	Criteria	Ratio	Note
Direction Y, M_{lux} (mm)	100	159	0.628	$A_{ts,req} = 810\text{mm}^2$
Direction X, M_{luy} (mm)	100	159	0.628	



- (1) Calculate minimum rebar area required
 - $A_{s,min} = 0.00180D = 810\text{mm}^2$
- (2) Calculate minimum rebar space required (Direction Y)
 - $A_s = 129\text{mm}^2$ (#4@100)
 - $s_{req.} = 159\text{mm}$
 - $s_x = 100\text{mm} < s_{req.} = 159\text{mm} \rightarrow \text{O.K}$
- (3) Calculate minimum rebar space required (Direction X)
 - $A_s = 129\text{mm}^2$ (#4@100)
 - $s_{req.} = 159\text{mm}$
 - $s_y = 100\text{mm} < s_{req.} = 159\text{mm} \rightarrow \text{O.K}$

MEMBER NAME : Z-T2

1. General Information

- (1) Design Code : NSR-10
(2) Code Unit : N, mm

2. Material

- (1) F'_c : 28.00MPa
(2) F_y : 420MPa

3. Section

- (1) Section Size
 • Depth : 450mm
 • Cover : 75.00mm
 (2) Column Section
 • Shape of Column : Rectangle
 • Section : 400x600mm

4. Rebar

- (1) Direction Y
 • Layer 1 : #4@100 ($A_s = 1,290\text{mm}^2$)
 (2) Direction X
 • Layer 1 : #4@100 ($A_s = 1,290\text{mm}^2$)

5. Foundation

- (1) Foundation Size
 • L_x : 2.700m
 • L_y : 2.700m
 • No. of pile : 5- ϕ 400
 • Space of pile : 1,200mm
 • $q_{a,comp.}$: 131kN/EA
 • $q_{a,tens.}$: 0.000kN/EA

6. Design Load

- (1) Service Load
 • P_s : 325kN
 • M_{sx} : 54.62kN·m
 • M_{sy} : 89.93kN·m
 (2) Factored Load
 • P_u : 482kN
 • M_{ux} : 12.26kN·m
 • M_{uy} : 119kN·m
 (3) Surcharge Load
 • Surface Load : 0.000KPa
 • Weight Density : 18.00kN/m³
 • Soil Height : 0.150m
 (4) Self weight is considered.

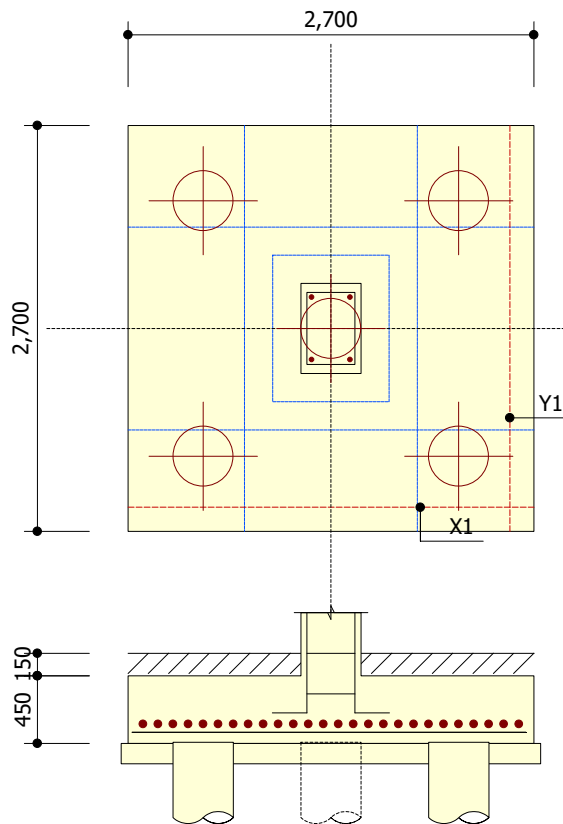
7. Calculation Summary

- (1) Overturning Moment (Service Load)

Category	Value	Criteria	Ratio	Note
Direction X (kN·m)	89.93	127	0.707	M_{sy} / M_{rx}
Direction Y (kN·m)	54.62	127	0.430	M_{sx} / M_{ry}

- (2) Overturning Moment (Factored Load)

Category	Value	Criteria	Ratio	Note
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MEMBER NAME : Z-T2

Direction X (kN·m)	119	153	0.781	M_{uy} / M_{rx}
Direction Y (kN·m)	12.26	153	0.0804	M_{ux} / M_{ry}

(3) Pile Bearing (Compression)

Category	Value	Criteria	Ratio	Note
Compression (kN)	122	131	0.931	
Tension (kN)	0.000	0.000	0.000	
Pile Punching (kN)	153	774	0.198	

(4) One Way Shear

Category	Value	Criteria	Ratio	Note
Direction X (kN)	299	672	0.445	$\phi = 0.750$
Direction Y (kN)	235	648	0.363	$\phi = 0.750$

(5) Two Way Shear

Category	Value	Criteria	Ratio	Note
Two Way Shear (kN)	448	1,678	0.267	$\phi = 0.750$

(6) Moment Capacity

Category	Value	Criteria	Ratio	Note
Direction Y, M_{ux} (kN·m)	48.06	168	0.286	$\phi = 0.900$
Direction X, M_{uy} (kN·m)	71.94	174	0.413	$\phi = 0.900$

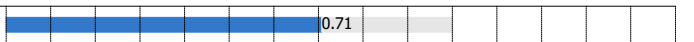
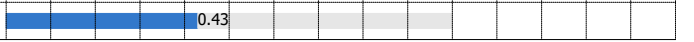
(7) Rebar Space

Category	Value	Criteria	Ratio	Note
Direction Y, M_{ux} (mm)	100	159	0.628	$A_{s,req} = 810\text{mm}^2$
Direction X, M_{uy} (mm)	100	159	0.628	

8. Check overturning moment (Service Load)

Calculation Summary (Overturning Moment (Service Load))

Category	Value	Criteria	Ratio	Note
Direction X (kN·m)	89.93	127	0.707	M_{sy} / M_{rx}
Direction Y (kN·m)	54.62	127	0.430	M_{sx} / M_{ry}

Direction X	
Direction Y	

(1) Calculate resistance Moment

Items	Weight (kN)	Factor	L_x (m)	L_y (m)	R_x (kN·m)	R_y (kN·m)
Self Weight of Concrete	74.48	1.000	1.350	1.350	101	101
Self Weight of Soil	19.68	1.000	1.350	1.350	26.57	26.57
Surcharge Load	0.000	1.000	1.350	1.350	-	-
Resistance Moment	-	-	-	-	127	127

(2) Check overturning moment

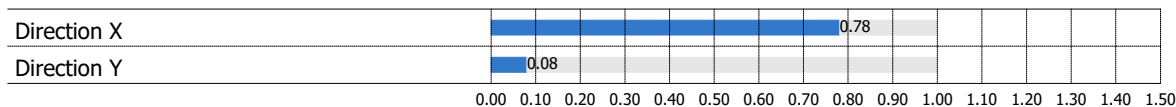
Direction X (M_{sy})			Direction Y (M_{sx})		
M_a	M_R	M_a / M_R	M_a	M_R	M_a / M_R
89.93kN·m	127kN·m	0.707	54.62kN·m	127kN·m	0.430

9. Check overturning moment (Factored Load)

Calculation Summary (Overturning Moment (Factored Load))

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Category	Value	Criteria	Ratio	Note
Direction X (kN·m)	119	153	0.781	M _{uy} / M _{rx}
Direction Y (kN·m)	12.26	153	0.0804	M _{ux} / M _{ry}



(1) Calculate resistance Moment

Items	Weight (kN)	Factor	L _x (m)	L _y (m)	R _x (kN·m)	R _y (kN·m)
Self Weight of Concrete	74.48	1.200	1.350	1.350	121	121
Self Weight of Soil	19.68	1.200	1.350	1.350	31.89	31.89
Surcharge Load	0.000	1.800	1.350	1.350	-	-
Resistance Moment	-	-	-	-	153	153

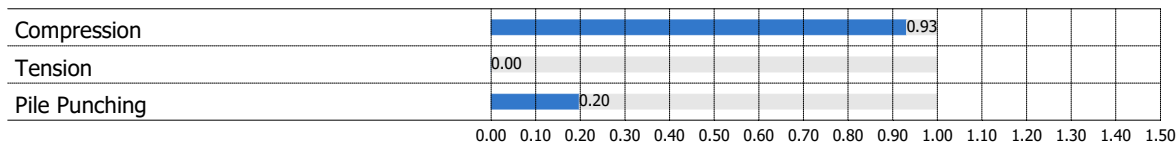
(2) Check overturning moment

Direction X (M_{uy})			Direction Y (M_{ux})		
M_a	M_R	M_a / M_R	M_a	M_R	M_a / M_R
119kN·m	153kN·m	0.781	12.26kN·m	153kN·m	0.0804

10. Check Pile Capacity

Calculation Summary (Pile Bearing (Compression))

Category	Value	Criteria	Ratio	Note
Compression (kN)	122	131	0.931	
Tension (kN)	0.000	0.000	0.000	
Pile Punching (kN)	153	774	0.198	



Index	X (mm)	Y (mm)	V _u (kN)	∅V _{c,INT} (kN)	∅V _{c,EDG} (kN)	∅V _{c,COR} (kN)	∅V _c (kN)	V _u / ∅V _c
01	-850	850	82.93	1,166	1,066	774	774	0.107
02	850	850	153	1,166	1,066	774	774	0.198
03	0.000	0.000	114	1,166	1,886	1,595	1,166	0.0981
04	-850	-850	75.72	1,166	1,066	774	774	0.0978
05	850	-850	146	1,166	1,066	774	774	0.188

- V_u , V_c : Pile Punching

(1) Calculate actual pile stress (kN)

- $q_{s,max} = 122 \text{ kN/EA}$
- $q_{s,max} / q_a = 0.931 \rightarrow \text{O.K.}$
- $q_{s,min} = 0.000 \text{ kN/EA}$
- $q_{s,min} / q_a = 0.000 \rightarrow \text{O.K.}$

(2) Calculate factored pile stress (kN)

- $q_{u,max} = 153 \text{ kN/EA}$
- $q_{u,min} = 75.72 \text{ kN/EA}$

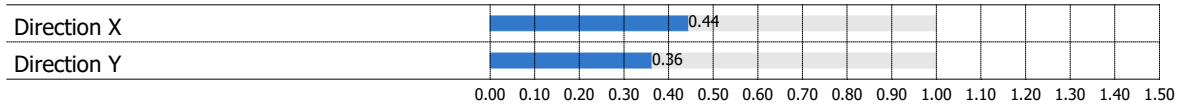
11. Check Shear

Calculation Summary (One Way Shear)

Category	Value	Criteria	Ratio	Note
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Direction X (kN)	299	672	0.445	$\phi = 0.750$
Direction Y (kN)	235	648	0.363	$\phi = 0.750$



(1) Calculate one-way shear (Direction X)

- $V_u = 299\text{kN}$
- $\phi = 0.750$
- $\phi V_c = 672\text{kN}$
- $V_u / \phi V_c = 0.445 \rightarrow \text{O.K}$

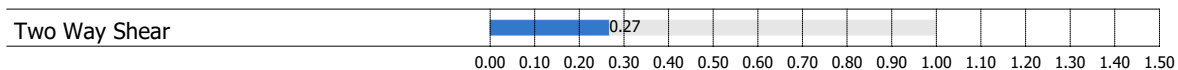
(2) Calculate one-way shear (Direction Y)

- $V_u = 235\text{kN}$
- $\phi = 0.750$
- $\phi V_c = 648\text{kN}$
- $V_u / \phi V_c = 0.363 \rightarrow \text{O.K}$

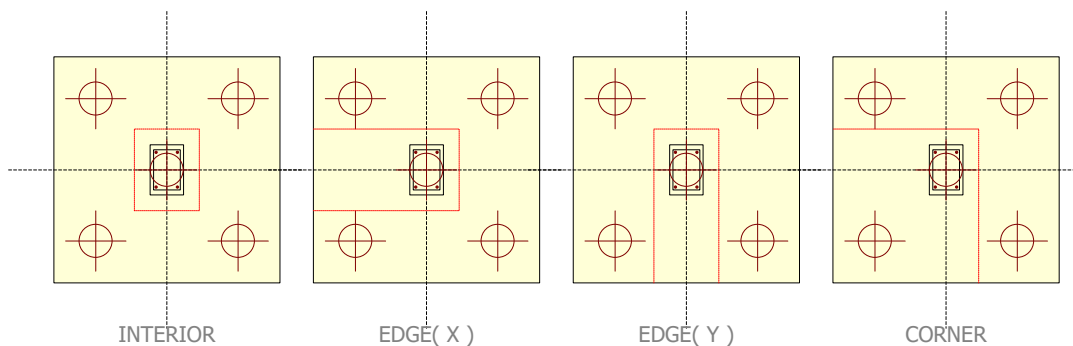
(3) Calculate two-way shear

Calculation Summary (Two Way Shear)

Category	Value	Criteria	Ratio	Note
Two Way Shear (kN)	448	1,678	0.267	$\phi = 0.750$



-	b_0 (mm)	V_{c1} (kN)	V_{c2} (kN)	V_{c3} (kN)	V_c (kN)	V_u (kN)	ϕV_c (kN)	Ratio
Interior	3,475	2,689	3,513	2,237	2,237	448	1,678	0.267
Edge(X)	4,437	3,434	3,228	2,856	2,856	448	2,142	0.209
Edge(Y)	4,437	3,434	3,228	2,856	2,856	448	2,142	0.209
Corner	3,569	2,761	2,349	2,297	2,297	295	1,723	0.171



- $\phi = 0.750$
- $d = 369\text{mm}$
- $V_{c1} = 0.17 \left(1 + \frac{2}{\beta} \right) \sqrt{f_c} b_0 d$
- $V_{c2} = 0.083 \left(\frac{a_s d}{b_0} + 2 \right) \sqrt{f_c} b_0 d$
- $V_{c3} = 0.33 \sqrt{f_c} b_0 d$
- $V_c = \min(V_{c1}, V_{c2}, V_{c3})$
- $V_u = 448\text{kN}$
- $V_u / \phi V_c = 0.267 \rightarrow \text{O.K}$

12. Check Moment Capacity

MEMBER NAME : Z-T3

1. General Information

- (1) Design Code : NSR-10
(2) Code Unit : N, mm

2. Material

- (1) F'_c : 28.00MPa
(2) F_y : 420MPa

3. Section

- (1) Section Size
 • Depth : 450mm
 • Cover : 75.00mm
 (2) Column Section
 • Shape of Column : Rectangle
 • Section : 400x600mm

4. Rebar

- (1) Direction Y
 • Layer 1 : #5@100 ($A_s = 2,000\text{mm}^2$)
 (2) Direction X
 • Layer 1 : #5@100 ($A_s = 2,000\text{mm}^2$)

5. Foundation

- (1) Foundation Size
 • L_x : 2.600m
 • L_y : 4.000m
 • No. of pile : 6- ϕ 400
 • Space of pile : 1,400mm
 • $q_{a,comp.}$: 132kN/EA
 • $q_{a,tens.}$: 0.000kN/EA

6. Design Load

- (1) Service Load
 • P_s : 412kN
 • M_{sx} : 13.04kN·m
 • M_{sy} : -150kN·m
 (2) Factored Load
 • P_u : 602kN
 • M_{ux} : 10.00kN·m
 • M_{uy} : -153kN·m
 (3) Surcharge Load
 • Surface Load : 0.000KPa
 • Weight Density : 18.00kN/m³
 • Soil Height : 0.150m
 (4) Self weight is considered.

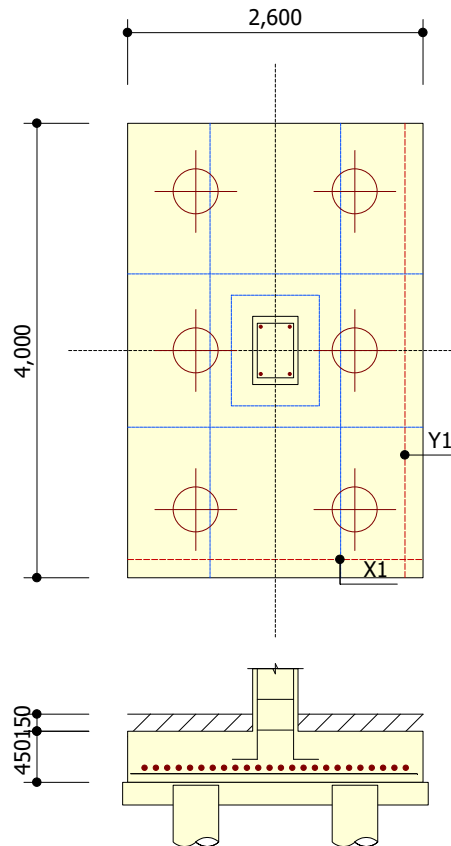
7. Calculation Summary

- (1) Overturning Moment (Service Load)

Category	Value	Criteria	Ratio	Note
Direction X (kN·m)	-150	175	0.860	M_{sy} / M_{rx}
Direction Y (kN·m)	13.04	269	0.0485	M_{sx} / M_{ry}

- (2) Overturning Moment (Factored Load)

Category	Value	Criteria	Ratio	Note
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MEMBER NAME : Z-T3

Direction X (kN·m)	-153	210	0.732	M_{uy} / M_{rx}
Direction Y (kN·m)	10.00	322	0.0310	M_{ux} / M_{ry}

(3) Pile Bearing (Compression)

Category	Value	Criteria	Ratio	Note
Compression (kN)	125	132	0.947	
Tension (kN)	0.000	0.000	0.000	
Pile Punching (kN)	160	866	0.185	

(4) One Way Shear

Category	Value	Criteria	Ratio	Note
Direction X (kN)	422	991	0.426	$\phi = 0.750$
Direction Y (kN)	247	616	0.401	$\phi = 0.750$

(5) Two Way Shear

Category	Value	Criteria	Ratio	Note
Two Way Shear (kN)	721	1,667	0.432	$\phi = 0.750$

(6) Moment Capacity

Category	Value	Criteria	Ratio	Note
Direction Y, M_{ux} (kN·m)	104	252	0.414	$\phi = 0.900$
Direction X, M_{uy} (kN·m)	59.30	264	0.224	$\phi = 0.900$

(7) Rebar Space

Category	Value	Criteria	Ratio	Note
Direction Y, M_{ux} (mm)	100	247	0.405	$A_{s,req} = 810\text{mm}^2$
Direction X, M_{uy} (mm)	100	247	0.405	

8. Check overturning moment (Service Load)

Calculation Summary (Overturning Moment (Service Load))

Category	Value	Criteria	Ratio	Note
Direction X (kN·m)	-150	175	0.860	M_{sy} / M_{rx}
Direction Y (kN·m)	13.04	269	0.0485	M_{sx} / M_{ry}

Direction X	<div><div></div></div>																
Direction Y	<div><div></div></div>																
	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	

(1) Calculate resistance Moment

Items	Weight (kN)	Factor	L_x (m)	L_y (m)	R_x (kN·m)	R_y (kN·m)
Self Weight of Concrete	106	1.000	1.300	2.000	138	212
Self Weight of Soil	28.08	1.000	1.300	2.000	36.50	56.16
Surcharge Load	0.000	1.000	1.300	2.000	-	-
Resistance Moment	-	-	-	-	175	269

(2) Check overturning moment

Direction X (M_{sy})			Direction Y (M_{sx})		
M_a	M_R	M_a / M_R	M_a	M_R	M_a / M_R
-150kN·m	175kN·m	0.860	13.04kN·m	269kN·m	0.0485

9. Check overturning moment (Factored Load)

Calculation Summary (Overturning Moment (Factored Load))

MEMBER NAME : Z-T3

Category	Value	Criteria	Ratio	Note
Direction X (kN·m)	-153	210	0.732	M_{uy} / M_{rx}
Direction Y (kN·m)	10.00	322	0.0310	M_{ux} / M_{ry}
Direction X				
Direction Y				

(1) Calculate resistance Moment

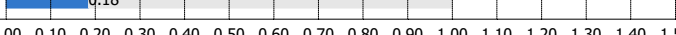
Items	Weight (kN)	Factor	L_x (m)	L_y (m)	R_x (kN·m)	R_y (kN·m)
Self Weight of Concrete	106	1.200	1.300	2.000	166	255
Self Weight of Soil	28.08	1.200	1.300	2.000	43.80	67.39
Surcharge Load	0.000	1.800	1.300	2.000	-	-
Resistance Moment	-	-	-	-	210	322

(2) Check overturning moment

Direction X (M_{uy})			Direction Y (M_{ux})		
M_a	M_R	M_a / M_R	M_a	M_R	M_a / M_R
-153kN·m	210kN·m	0.732	10.00kN·m	322kN·m	0.0310

10. Check Pile Capacity

Calculation Summary (Pile Bearing (Compression))

Category	Value	Criteria	Ratio	Note
Compression (kN)	125	132	0.947	
Tension (kN)	0.000	0.000	0.000	
Pile Punching (kN)	160	866	0.185	
Compression				
Tension				
Pile Punching				

Index	X (mm)	Y (mm)	V_u (kN)	$\phi V_{c,INT}$ (kN)	$\phi V_{c,EDG}$ (kN)	$\phi V_{c,COR}$ (kN)	ϕV_c (kN)	$V_u / \phi V_c$
01	-700	1,400	160	1,158	1,156	866	866	0.185
02	700	1,400	86.87	1,158	1,156	866	866	0.100
03	-700	0.000	158	1,158	1,156	1,539	1,156	0.137
04	700	0.000	85.09	1,158	1,156	1,539	1,156	0.0736
05	-700	-1,400	156	1,158	1,156	866	866	0.180
06	700	-1,400	83.30	1,158	1,156	866	866	0.0961

- V_u , V_c : Pile Punching

(1) Calculate actual pile stress (kN)

- $q_{s,max} = 125\text{kN/EA}$
- $q_{s,max} / q_a = 0.947 \rightarrow \text{O.K}$
- $q_{s,min} = 0.000\text{kN/EA}$
- $q_{s,min} / q_a = 0.000 \rightarrow \text{O.K}$

(2) Calculate factored pile stress (kN)

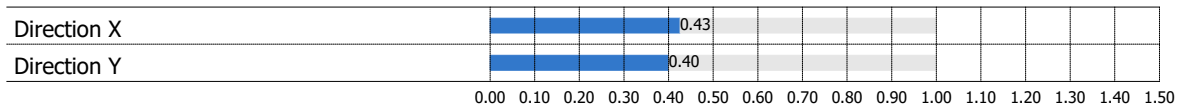
- $q_{u,max} = 160\text{kN/EA}$
- $q_{u,min} = 83.30\text{kN/EA}$

11. Check Shear

Calculation Summary (One Way Shear)

MEMBER NAME : Z-T3

Category	Value	Criteria	Ratio	Note
Direction X (kN)	422	991	0.426	$\phi = 0.750$
Direction Y (kN)	247	616	0.401	$\phi = 0.750$



(1) Calculate one-way shear (Direction X)

- $V_u = 422\text{kN}$
- $\phi = 0.750$
- $\phi V_c = 991\text{kN}$
- $V_u / \phi V_c = 0.426 \rightarrow \text{O.K}$

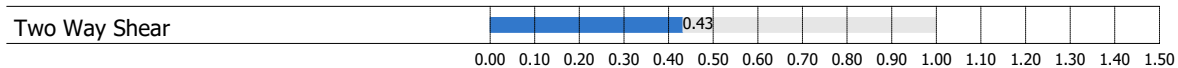
(2) Calculate one-way shear (Direction Y)

- $V_u = 247\text{kN}$
- $\phi = 0.750$
- $\phi V_c = 616\text{kN}$
- $V_u / \phi V_c = 0.401 \rightarrow \text{O.K}$

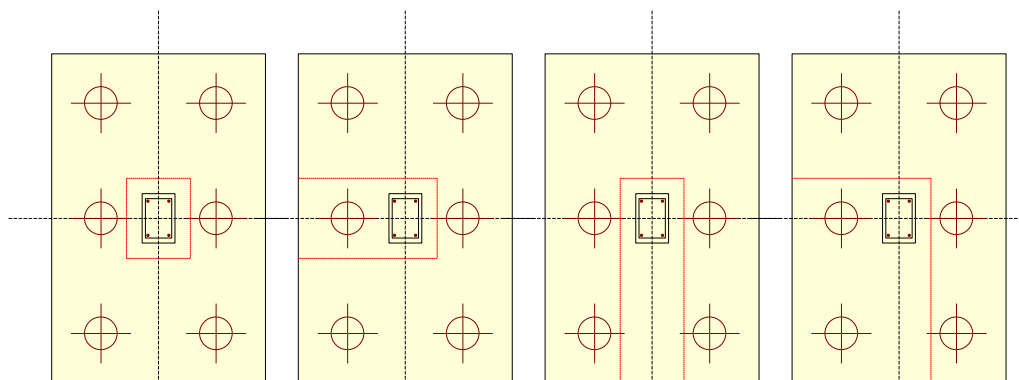
(3) Calculate two-way shear

Calculation Summary (Two Way Shear)

Category	Value	Criteria	Ratio	Note
Two Way Shear (kN)	721	1,667	0.432	$\phi = 0.750$



-	b_0 (mm)	V_{c1} (kN)	V_{c2} (kN)	V_{c3} (kN)	V_c (kN)	V_u (kN)	ϕV_c (kN)	Ratio
Interior	3,468	2,672	3,485	2,223	2,223	721	1,667	0.432
Edge(X)	4,334	3,339	3,173	2,778	2,778	635	2,084	0.305
Edge(Y)	5,734	4,418	3,624	3,675	3,624	721	2,718	0.265
Corner	4,167	3,211	2,527	2,671	2,527	549	1,895	0.289



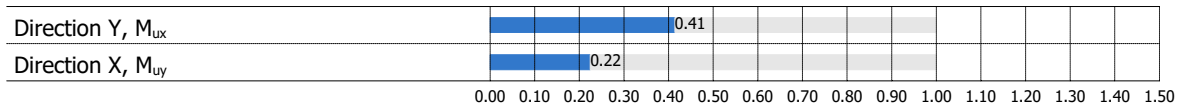
- $\phi = 0.750$
- $d = 367\text{mm}$
- $V_{c1} = 0.17 \left(1 + \frac{2}{\beta} \right) \sqrt{f'_c} b_0 d$
- $V_{c2} = 0.083 \left(\frac{a_s d}{b_0} + 2 \right) \sqrt{f'_c} b_0 d$
- $V_{c3} = 0.33 \sqrt{f'_c} b_0 d$
- $V_c = \min(V_{c1}, V_{c2}, V_{c3})$
- $V_u = 721\text{kN}$
- $V_u / \phi V_c = 0.432 \rightarrow \text{O.K}$

MEMBER NAME : Z-T3

12. Check Moment Capacity

Calculation Summary (Moment Capacity)

Category	Value	Criteria	Ratio	Note
Direction Y, M_{ux} (kN·m)	104	252	0.414	$\phi = 0.900$
Direction X, M_{uy} (kN·m)	59.30	264	0.224	$\phi = 0.900$



(1) Calculate moment capacity (Direction X)

- $\phi = 0.900$
- $M_{uy} = 59.30 \text{ kN}\cdot\text{m}$ $\phi M_{ny} = 264 \text{ kN}\cdot\text{m}$
- $M_{uy} / \phi M_{ny} = 0.224 \rightarrow \text{O.K}$

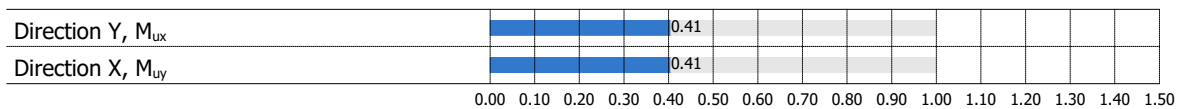
(2) Calculate moment capacity (Direction Y)

- $\phi = 0.900$
- $M_{ux} = 104 \text{ kN}\cdot\text{m}$ $\phi M_{nx} = 252 \text{ kN}\cdot\text{m}$
- $M_{ux} / \phi M_{nx} = 0.414 \rightarrow \text{O.K}$

13. Check Rebar

Calculation Summary (Rebar Space)

Category	Value	Criteria	Ratio	Note
Direction Y, M_{ux} (mm)	100	247	0.405	$A_{s,req} = 810 \text{ mm}^2$
Direction X, M_{uy} (mm)	100	247	0.405	



(1) Calculate minimum rebar area required

- $A_{s,min} = 0.00180D = 810 \text{ mm}^2$

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

- $A_s = 200 \text{ mm}^2$ (#5@100)
- $s_{req.} = 247 \text{ mm}$
- $s_x = 100 \text{ mm} < s_{req.} = 247 \text{ mm} \rightarrow \text{O.K}$

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

- $A_s = 200 \text{ mm}^2$ (#5@100)
- $s_{req.} = 247 \text{ mm}$
- $s_y = 100 \text{ mm} < s_{req.} = 247 \text{ mm} \rightarrow \text{O.K}$