

FOUNDATION CALCULATION SHEET

One-Stop Solution for Foundation



TITLE		DESCRIPTION				
PROJECT/JOB NO.		F1-Steel Stack 50 m. Bang Pakong				
PROJECT/JOB NAME		Foundation of Steel Stack 50 m. Bang Pakong-				
CLIENT NAME		DOUBLE A				
SITE NAME		Chachoengsao				
DOCUMENT NO.						
REFERENCE NO.						
STRUCTURE NAME		Foundation of Steel Stack 50 m. Bang Pakong				
LOAD COMBINATION GROUP						
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APPR'D	APPR'D



Calculation Sheet of Foundation

Project Na. : Foundation of Steel Stack

Project No. : F1-Steel Stack 50 m. Bang ..

Client : DOUBLE A

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Calculation Sheet of Foundation

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1. GENERAL

1.1 CODE & STANDARD

Items	Description
Design Code	American Concrete Institute (ACI 318) [Metric]
Horizontal Force for Wind	UNIFORM BUILDING CODE (UBC-1997)
Horizontal Force for Seismic	UNIFORM BUILDING CODE [UBC-1997]
Unit System	Input : MKS, Output : MKS, Calculation Unit : IMPERIAL

1.2 MATERIALS & UNIT WEIGHT

Items	Value
Concrete (f'c : compressive strength)	206.000 kgf/cm ²
Lean Concrete (Lf'c : compressive strength)	200.000 kgf/cm ²
Reinforcement (10M ~ 16M , yield strength)	40000.000 kgf/cm ²
Reinforcement (19M ~ , yield strength)	40000.000 kgf/cm ²
Rs (Soil unit weight)	2.000 ton/m ³
Rc (Concrete unit weight)	2.400 ton/m ³
Es (Steel Modulus of Elasticity)	2.040 × 10 ⁶ kgf/cm ²
Ec (Concrete Modulus of Elasticity)	216987.800 kgf/cm ²

- Pile Capacity

Items	Value
Pile Name	PHC-12
Footing List	F1
Diameter	500 mm
Length	22 m
Thick	10 mm
Shape	Circle
Capacity (Ha , Ua , Va)	1.4 , 17.4 , 26.4 tonf

1.3 SUBSOIL CONDITION & SAFETY FACTORS

Items	Description
Allowable Increase of Soil (Wind)	33.33 %
Allowable Increase of Soil (Seismic)	33.33 %
Allowable Increase of Soil (Test)	20 %
Allowable Increase of Pile Horizontal (Wind)	33.33 %
Allowable Increase of Pile Horizontal (Seismic)	33.33 %
Allowable Increase of Pile Horizontal (Test)	20 %
Allowable Increase of Pile Vertical (Wind)	33.33 %
Allowable Increase of Pile Vertical (Seismic)	33.33 %
Allowable Increase of Pile Vertical (Test)	20 %
Allowable Increase of Pile Uplift (Wind)	0 %
Allowable Increase of Pile Uplift (Seismic)	0 %
Allowable Increase of Pile Uplift (Test)	0 %



Calculation Sheet of Foundation

Project Na. : Foundation of Steel Stack

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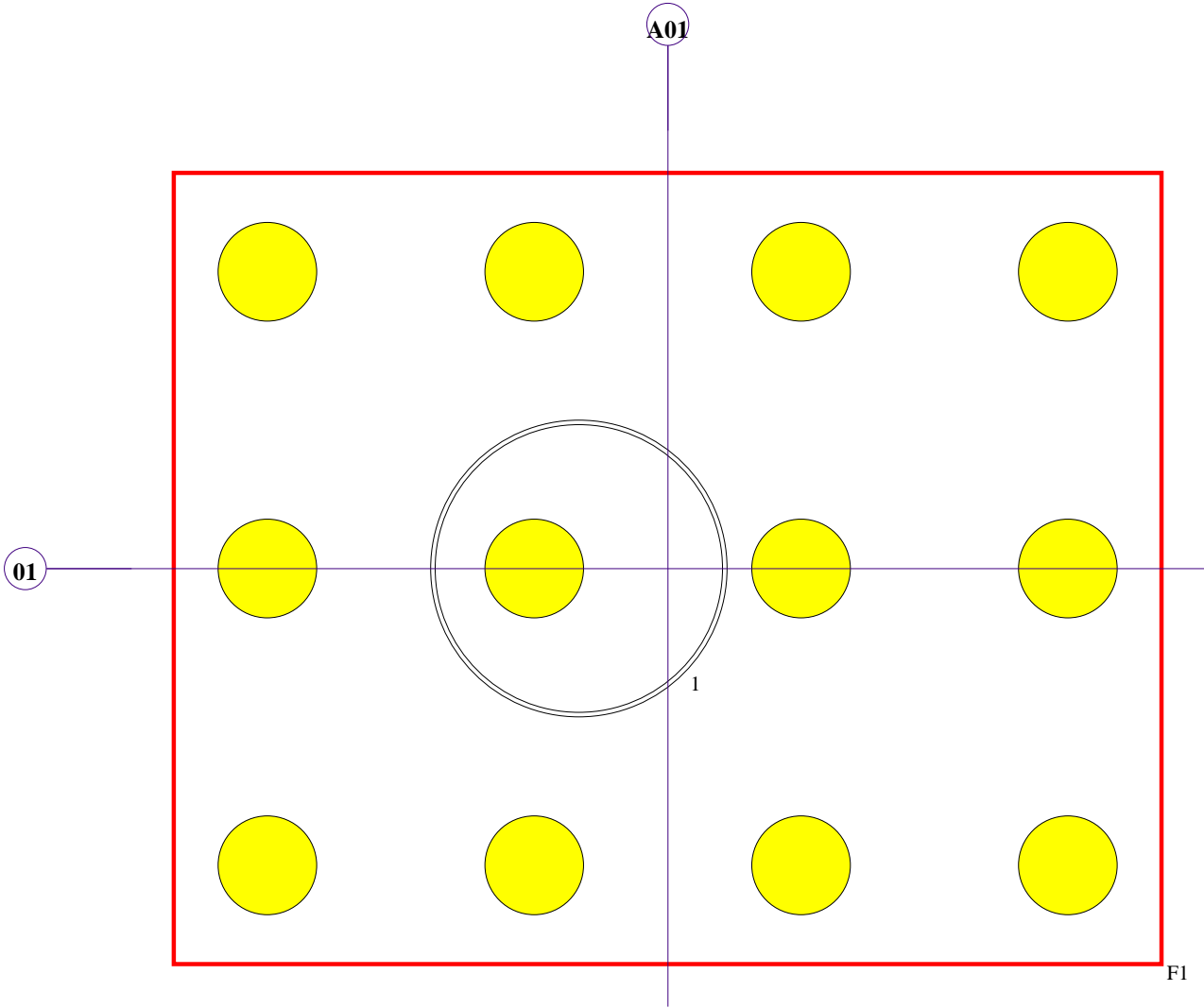
Safety factor against overturning for OVM1(FO1)	1.5
Safety factor against overturning for OVM2(FO2)	2
Safety factor against overturning for OVM3(FO3)	1.5
Safety factor against overturning for OVM4(FO4)	1.9
Safety factor against sliding for the SL1(FS1)	3
Safety factor against sliding for the SL2(FS2)	3
Safety factor against sliding for the SL3(FS3)	1.5
Safety factor against sliding for the SL4(FS4)	1.5
Friction factor (μ)	.35

1.4 LOAD COMBINATION

Index	Load Case Name	Load Case Description
1	DL	DEAD LOAD
2	LL	LIVE LOAD
3	WL	WIND LOAD
4	SL2	SEISMIC LOAD (Operation)

Comb . ID	Load Combination for stability
1	1.0 DL + 1.0 LL
2	.75 DL + .75 LL + .75 WL
3	.75 DL + .75 LL + .75 SL2
4	1.4 DL + 1.7 LL
5	1.05 DL + 1.28 LL + 1.28 WL
6	1.05 DL + 1.28 LL + 1.4 SL2
7	.9 DL + 1.3 WL
8	.9 DL + 1.43 SL2

2. DRAWING



REFERENCE DWGS

NO.	DWG NO.	DWG TITLE

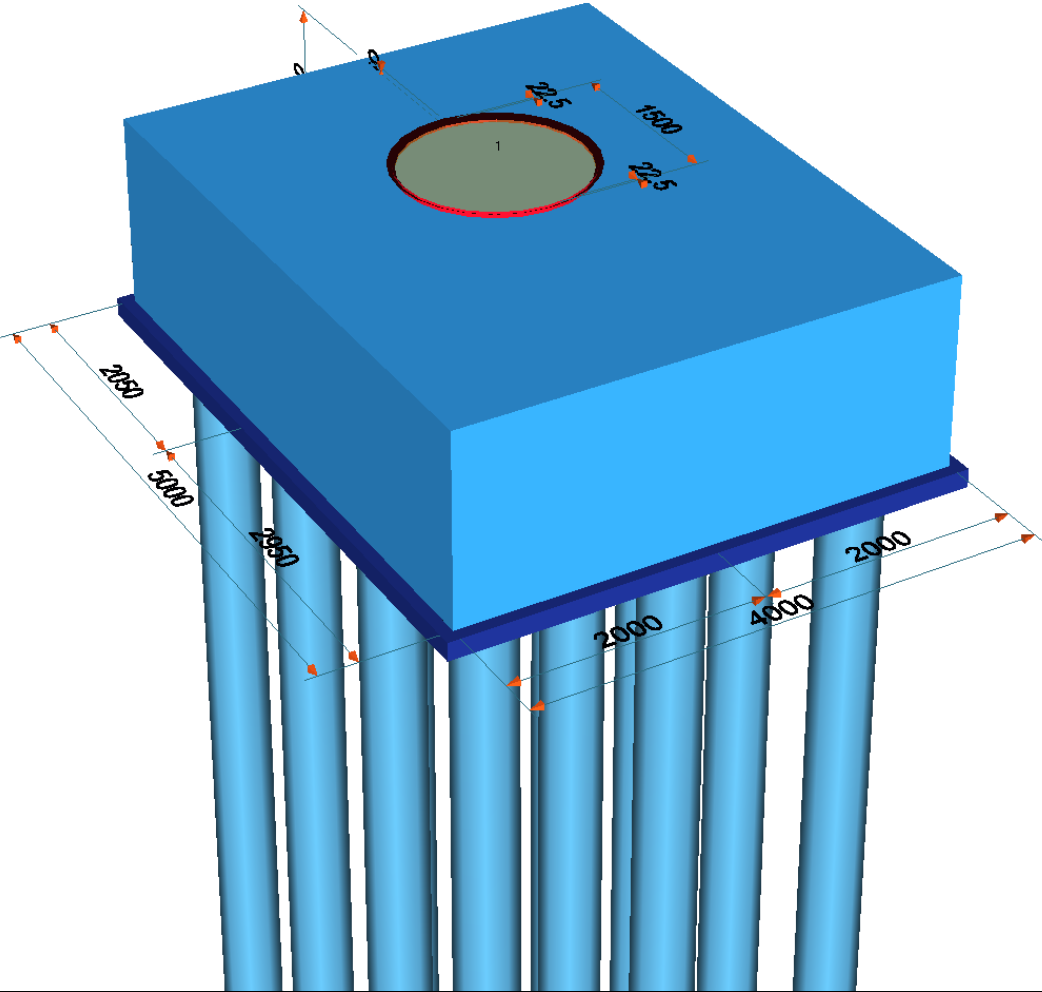
NOTES

* OUTPUT UNIT : mm

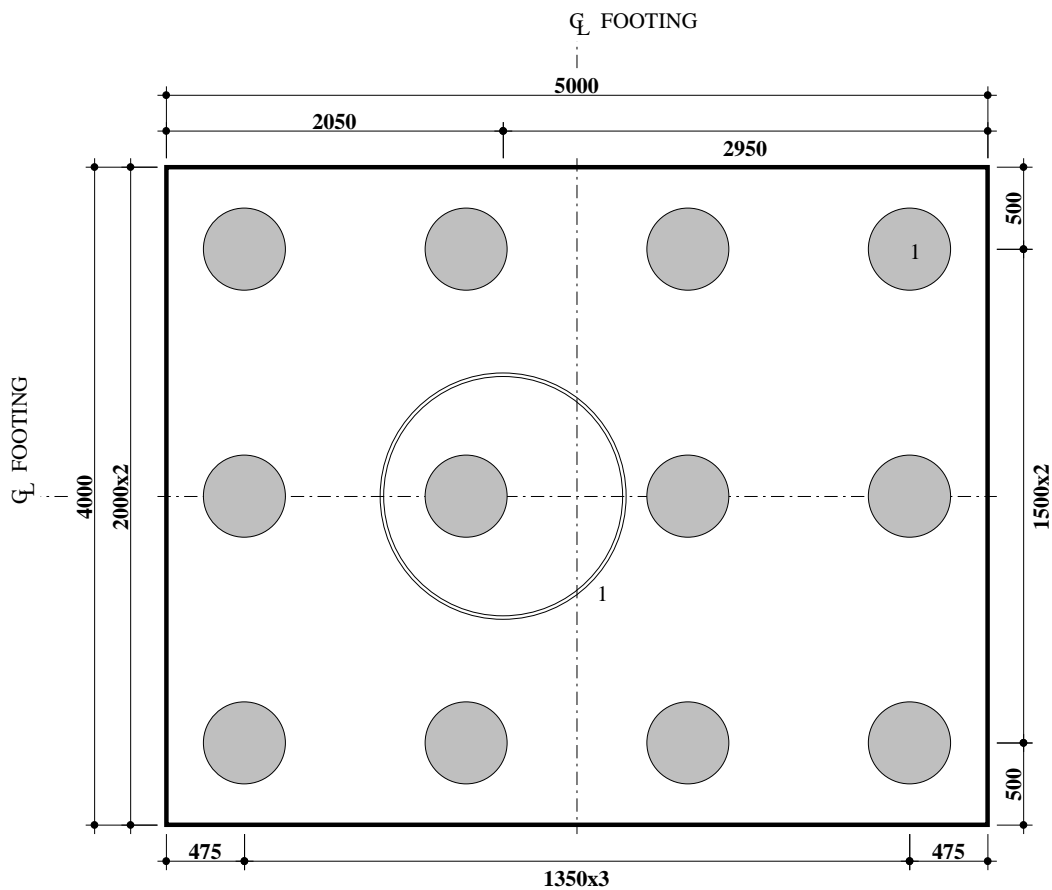
Foundation of Steel Stack 50 m. Bang Pakong-Chachoengsao PROJECT

FOUNDATION LOCATION PLAN
Foundation of Steel Stack 50 m. Bang Pakong

SQUAD CHECK						
	PROCESS	PIPING	VESSELS	STRUCT.	ELEC.	INST.
SCALE		JOB NO.		MICROFILM NO.		
AS SHOWNSteel Stack 50 m. Bang Pakong						



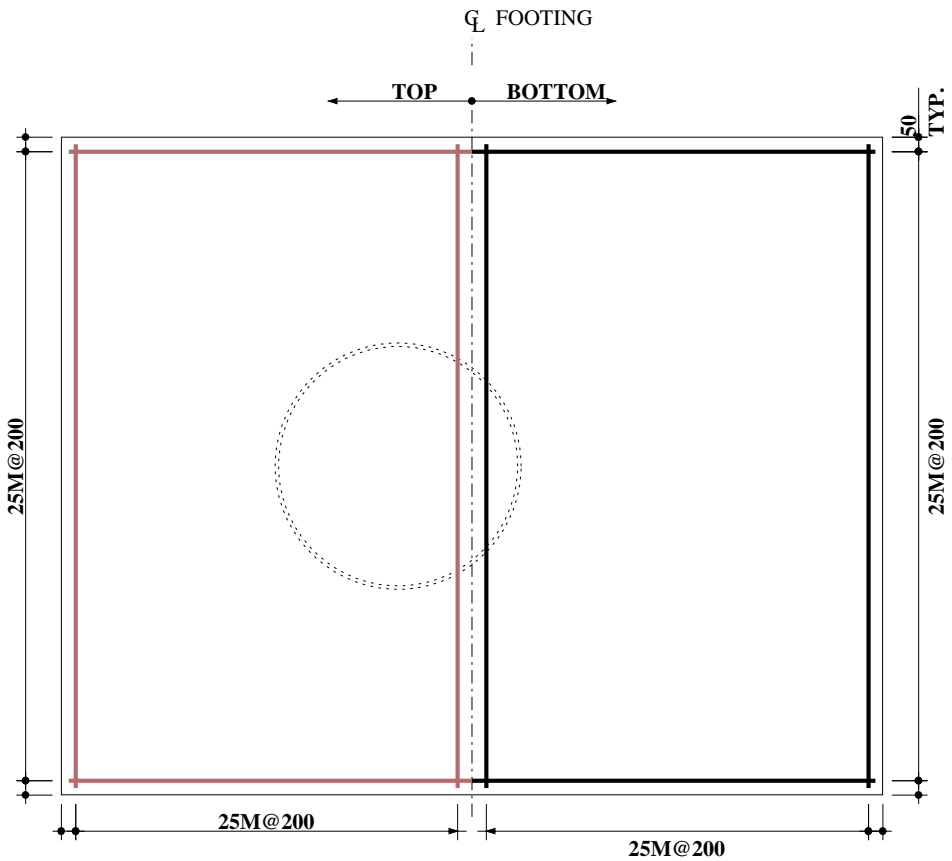
OUTPUT UNIT : mm



FOUNDATION PLAN

REFERENCE DWGS						
NO.	DWG NO.			DWG TITLE		
NOTES						
* PILE 12-??500 PHC-12 * OUTPUT UNIT : mm						
Foundation of Steel Stack 50 m. Bang Pakong-Chachoengsao PROJECT						
FOUNDATION DETAIL FOR F1						
SQUAD CHECK						
	PROCESS	PIPING	VESSELS	STRUCT.	ELEC.	INST.
SCALE		JOB NO.		MICROFILM NO.		
AS SHOWNSteel Stack 50 m. Bang Pakong						

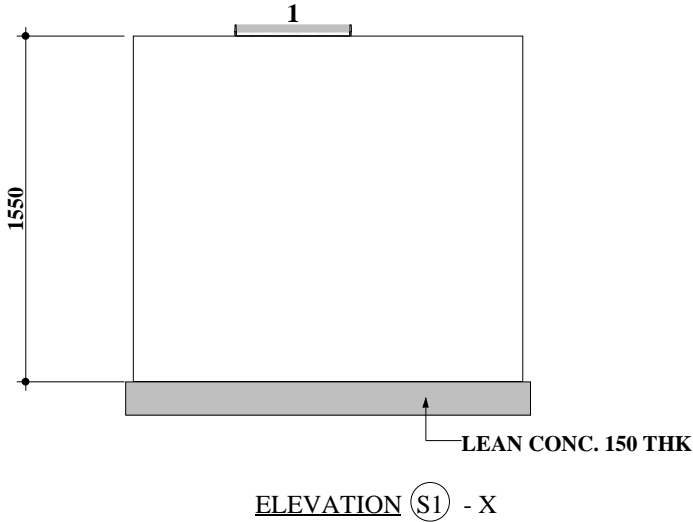
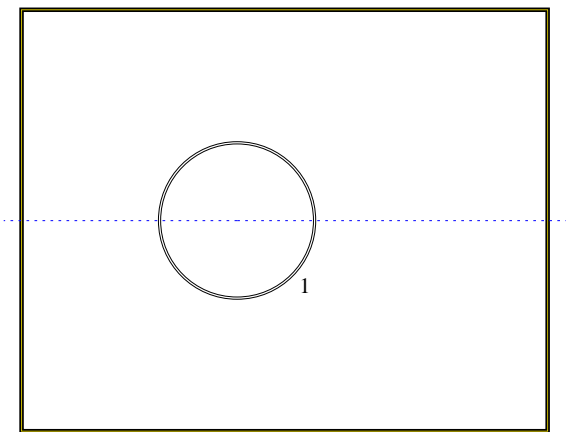
REV.	DATE	DESCRIPTION	DRWN	CHKD	APPD	APPD	APPD		



REINFORCEMENT PLAN

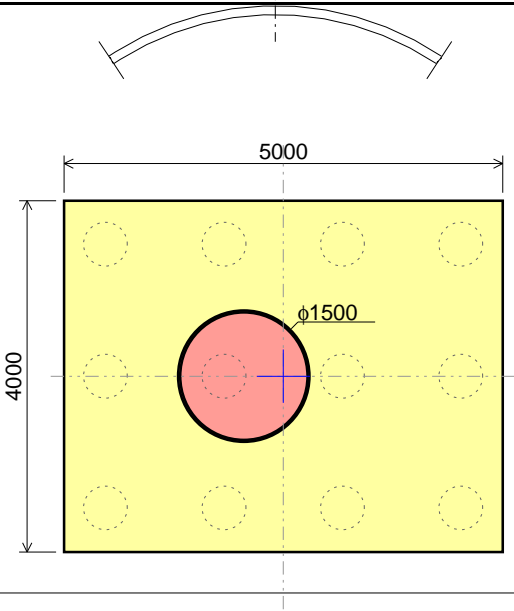
REFERENCE DWGS						
NO.	DWG NO.			DWG TITLE		
NOTES						
* PILE 12-??500 PHC-12 * OUTPUT UNIT : mm						
Foundation of Steel Stack 50 m. Bang Pakong-Chachoengsao PROJECT						
FOUNDATION DETAIL FOR F1						
SQUAD CHECK						
	PROCESS	PIPING	VESSELS	STRUCT.	ELEC.	INST.
SCALE		JOB NO.		MICROFILM NO.		
AS SHOWNSteel Stack 50 m. Bang Pakong						

REV.	DATE	DESCRIPTION	DRWN	CHKD	APPD	APPD	APPD		

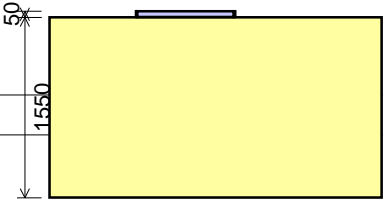


13. FOUNDATION DATA

3.1 FOOTING AND SECTION DATA



Ft. Name	F1
Ft. Type	MAT
Area	20.000 m²
Ft. Thickness	1550.00 mm
Ft. Volume	31.000 m³
Ft. Weight	74.400 tonf
Soil Height	0.00 mm
Soil Volume	0.000 m³
Soil Weight	0.000 tonf
Buoyancy	0.000 tonf
Self Weight (except Pr.SW)	74.400 tonf





Calculation Sheet of Foundation

Project Na. : Foundation of Steel Stack

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► Section Data

	Ft.Name	Direction	Ft. Volume	Soil Volume	Pier Wt
	F1	All Direct	31.000 m ³	0.000 m ³	0.179 tonf
	Sec.Name	Section Area	Ft. Weight	Soil Weight	Total Weight
	S1	20.000 m ²	74.400 tonf	0.000 tonf	74.579 tonf

3.2 PIER DATA

Off X , Off Y is offset position from the Center of the footing

If Pier Shape is Circle or Circle wall, PI is a Diameter. and Pw is a Inner Diameter

Area is pier concrete area

Weight is pier and inner soil weight in case circle wall except Tank1 Type(Circle Ring Footing Shape)

Unit(Length : mm , Weight : tonf , Area : m²)

Ft.Name	Pr.Name	Shape	PI	Pw	Ph	Area	Weight	Off X	Off Y
F1	1	CircleWall	1500.000	1455.000	50.000	0.104	0.179	-450.000	0.000

3.3 LOAD CASE

	Input the point loads in the global coordinate system direction. Positive directions of moments (shown in the sketch) are based on the right hand rule.
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Index	Load Case Name	Load Case Description
1	DL	DEAD LOAD
2	LL	LIVE LOAD
3	WL	WIND LOAD
4	SL2	SEISMIC LOAD (Operation)

Unit(tonf , tonf-m)

Ft.Name	Pr.Name	Load Case	Fx	Fy	Fz	Mx	My
F1	1	1	0	0	-36.44	0	0
		2	0	0	-200	0	0
		3	0	5.69	0	0	0
		4	0	7.22	0	0	0
	Footing SW		0.000	0.000	-74.400	0.000	0.000



Calculation Sheet of Foundation

Project Na. : Foundation of Steel Stack

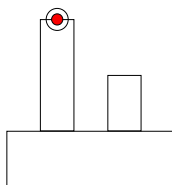
Project No. : F1-Steel Stack 50 m. Bang ..

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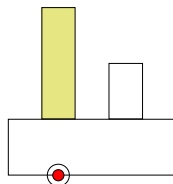
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3.4 LOAD COMBINATION

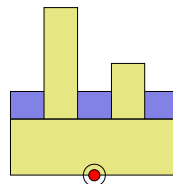
In Pier Top
without Self Weight



In Footing Bottom
with Pier Self Weight,
But without Footing Self Weight,



In Footing Bottom Center
with Pier & Footing Self Weight & Soil Weight,



Case PileType
in centroid of Pile Group
Case NonPileType
in centroid of Footing

3.4.1 Load Combination in Pier Top (Without SW)

Unit(tonf , tonf-m)

Ft.Name	Pr.Name	L.Comb.	SFx	SFy	SFz	SMx	SMy
F1	1	1	0.000	0.000	-236.440	0.000	0.000
		2	0.000	4.267	-177.330	0.000	0.000
		3	0.000	5.416	-177.330	0.000	0.000
		4	0.000	0.000	-391.016	0.000	0.000
		5	0.000	7.283	-294.262	0.000	0.000
		6	0.000	10.109	-294.262	0.000	0.000
		7	0.000	7.397	-32.796	0.000	0.000
		8	0.000	10.326	-32.796	0.000	0.000

3.4.2 Load Combination in Footing Bottom (With Pier SW)

Unit(tonf , tonf-m)

Ft.Name	Pr.Name	L.Comb.	SFx	SFy	SFz	SMx	SMy
F1	1	1	0.000	0.000	-236.440	0.000	0.000
		2	0.000	4.267	-177.330	-6.828	0.000
		3	0.000	5.416	-177.330	-8.665	0.000
		4	0.000	0.000	-391.016	0.000	0.000
		5	0.000	7.283	-294.262	-11.653	0.000
		6	0.000	10.109	-294.262	-16.175	0.000
		7	0.000	7.397	-32.796	-11.835	0.000
		8	0.000	10.326	-32.796	-16.522	0.000

3.4.3 Load Combination in Footing Bottom Center (With Pier & Footing SW)

► Load Combination of Elastic Condition

Ⓢ : PileType

- C.G. of Load is coordinate from left bottom. Unit : mm

Unit(tonf , tonf-m)

Ft.Name	L.Comb.	SFx	SFy	SFz	SMx	SMy	C.G. of Loads
F1 Ⓢ	1	0.000	0.000	-236.440	0.000	-106.398	2157.7 , 2000.0
	2	0.000	4.267	-177.330	-6.828	-79.799	2183.0 , 2000.0
	3	0.000	5.416	-177.330	-8.665	-79.799	2183.0 , 2000.0
	4	0.000	0.000	-391.016	0.000	-175.957	2121.9 , 2000.0
	5	0.000	7.283	-294.262	-11.653	-132.418	2140.8 , 2000.0
	6	0.000	10.109	-294.262	-16.175	-132.418	2140.8 , 2000.0
	7	0.000	7.397	-32.796	-11.835	-14.758	2362.3 , 2000.0
	8	0.000	10.326	-32.796	-16.522	-14.758	2362.3 , 2000.0



Calculation Sheet of Foundation

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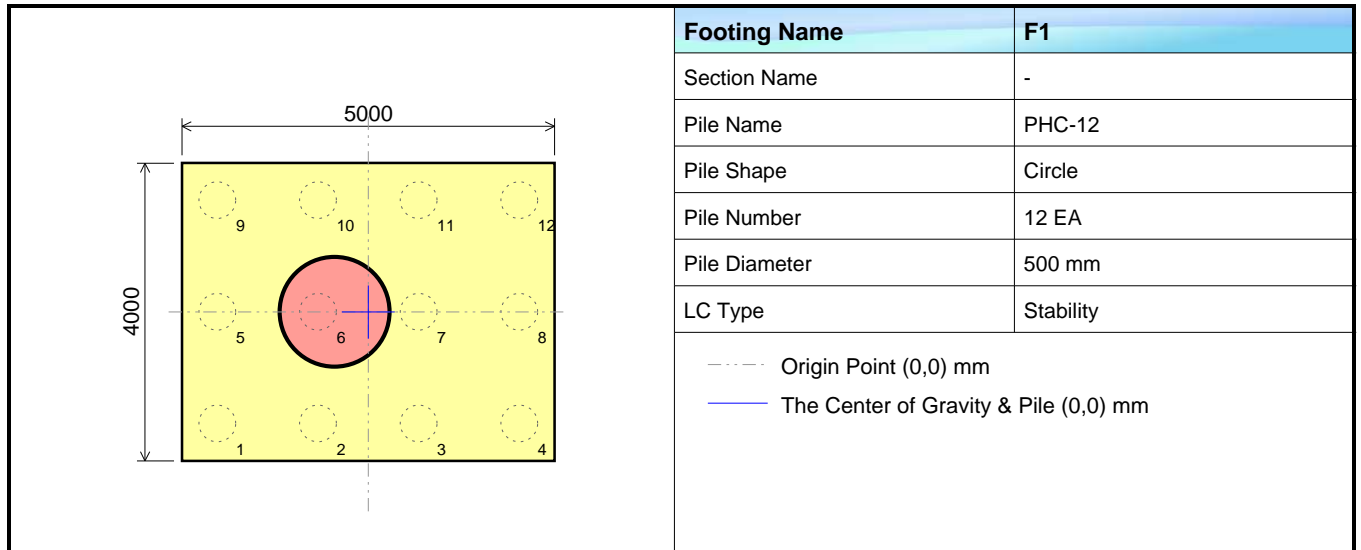
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► Load Combination of Ultimate Condition

There is no Load Combination

3.4.4 Pile Reaction Table



• LC : 1, (1.0 DL + 1.0 LL)

Unit (mm,tonf)

No.	Name	Pile Geometry		Bi-Axial	Shear (Hor)	Ra	Ua	Ha
		X	Y	XY-Dir.	XY-Dir.			
1	PHC-12	-2025	-1500	27.58	0	35.199	17.4	1.8
2	PHC-12	-675	-1500	22.33	0	35.199	17.4	1.8
3	PHC-12	675	-1500	17.08	0	35.199	17.4	1.8
4	PHC-12	2025	-1500	11.82	0	35.199	17.4	1.8
5	PHC-12	-2025	0	27.58	0	35.199	17.4	1.8
6	PHC-12	-675	0	22.33	0	35.199	17.4	1.8
7	PHC-12	675	0	17.08	0	35.199	17.4	1.8
8	PHC-12	2025	0	11.82	0	35.199	17.4	1.8
9	PHC-12	-2025	1500	27.58	0	35.199	17.4	1.8
10	PHC-12	-675	1500	22.33	0	35.199	17.4	1.8
11	PHC-12	675	1500	17.08	0	35.199	17.4	1.8
12	PHC-12	2025	1500	11.82	0	35.199	17.4	1.8

• LC : 2, (.75 DL + .75 LL + .75 WL)

Unit (mm,tonf)

No.	Name	Pile Geometry		Bi-Axial	Shear (Hor)	Ra	Ua	Ha
		X	Y	XY-Dir.	XY-Dir.			
1	PHC-12	-2025	-1500	20.12	.36	35.199	17.4	1.8
2	PHC-12	-675	-1500	16.18	.36	35.199	17.4	1.8
3	PHC-12	675	-1500	12.24	.36	35.199	17.4	1.8
4	PHC-12	2025	-1500	8.3	.36	35.199	17.4	1.8
5	PHC-12	-2025	0	20.69	.36	35.199	17.4	1.8
6	PHC-12	-675	0	16.75	.36	35.199	17.4	1.8



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7	PHC-12	675	0	12.81	.36	35.199	17.4	1.8
8	PHC-12	2025	0	8.87	.36	35.199	17.4	1.8
9	PHC-12	-2025	1500	21.26	.36	35.199	17.4	1.8
10	PHC-12	-675	1500	17.32	.36	35.199	17.4	1.8
11	PHC-12	675	1500	13.38	.36	35.199	17.4	1.8
12	PHC-12	2025	1500	9.44	.36	35.199	17.4	1.8

• LC : 3, (.75 DL + .75 LL + .75 SL2)

Unit (mm,tonf)

No.	Name	Pile Geometry		Bi-Axial	Shear (Hor)	Ra	Ua	Ha
		X	Y	XY-Dir.	XY-Dir.			
1	PHC-12	-2025	-1500	19.97	.45	35.199	17.4	1.8
2	PHC-12	-675	-1500	16.03	.45	35.199	17.4	1.8
3	PHC-12	675	-1500	12.09	.45	35.199	17.4	1.8
4	PHC-12	2025	-1500	8.14	.45	35.199	17.4	1.8
5	PHC-12	-2025	0	20.69	.45	35.199	17.4	1.8
6	PHC-12	-675	0	16.75	.45	35.199	17.4	1.8
7	PHC-12	675	0	12.81	.45	35.199	17.4	1.8
8	PHC-12	2025	0	8.87	.45	35.199	17.4	1.8
9	PHC-12	-2025	1500	21.41	.45	35.199	17.4	1.8
10	PHC-12	-675	1500	17.47	.45	35.199	17.4	1.8
11	PHC-12	675	1500	13.53	.45	35.199	17.4	1.8
12	PHC-12	2025	1500	9.59	.45	35.199	17.4	1.8

• LC : 4, (1.4 DL + 1.7 LL)

Unit (mm,tonf)

No.	Name	Pile Geometry		Bi-Axial	Shear (Hor)	Ra	Ua	Ha
		X	Y	XY-Dir.	XY-Dir.			
1	PHC-12	-2025	-1500	45.62	0	35.199	17.4	1.8
2	PHC-12	-675	-1500	36.93	0	35.199	17.4	1.8
3	PHC-12	675	-1500	28.24	0	35.199	17.4	1.8
4	PHC-12	2025	-1500	19.55	0	35.199	17.4	1.8
5	PHC-12	-2025	0	45.62	0	35.199	17.4	1.8
6	PHC-12	-675	0	36.93	0	35.199	17.4	1.8
7	PHC-12	675	0	28.24	0	35.199	17.4	1.8
8	PHC-12	2025	0	19.55	0	35.199	17.4	1.8
9	PHC-12	-2025	1500	45.62	0	35.199	17.4	1.8
10	PHC-12	-675	1500	36.93	0	35.199	17.4	1.8
11	PHC-12	675	1500	28.24	0	35.199	17.4	1.8
12	PHC-12	2025	1500	19.55	0	35.199	17.4	1.8

• LC : 5, (1.05 DL + 1.28 LL + 1.28 WL)

Unit (mm,tonf)

No.	Name	Pile Geometry		Bi-Axial	Shear (Hor)	Ra	Ua	Ha
		X	Y	XY-Dir.	XY-Dir.			
1	PHC-12	-2025	-1500	33.36	.61	35.199	17.4	1.8
2	PHC-12	-675	-1500	26.82	.61	35.199	17.4	1.8
3	PHC-12	675	-1500	20.28	.61	35.199	17.4	1.8



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4	PHC-12	2025	-1500	13.74	.61	35.199	17.4	1.8
5	PHC-12	-2025	0	34.33	.61	35.199	17.4	1.8
6	PHC-12	-675	0	27.79	.61	35.199	17.4	1.8
7	PHC-12	675	0	21.25	.61	35.199	17.4	1.8
8	PHC-12	2025	0	14.71	.61	35.199	17.4	1.8
9	PHC-12	-2025	1500	35.3	.61	35.199	17.4	1.8
10	PHC-12	-675	1500	28.76	.61	35.199	17.4	1.8
11	PHC-12	675	1500	22.22	.61	35.199	17.4	1.8
12	PHC-12	2025	1500	15.68	.61	35.199	17.4	1.8

• LC : 6, (1.05 DL + 1.28 LL + 1.4 SL2)

Unit (mm,tonf)

No.	Name	Pile Geometry		Bi-Axial	Shear (Hor)	Ra	Ua	Ha
		X	Y	XY-Dir.	XY-Dir.			
1	PHC-12	-2025	-1500	32.98	.84	35.199	17.4	1.8
2	PHC-12	-675	-1500	26.44	.84	35.199	17.4	1.8
3	PHC-12	675	-1500	19.9	.84	35.199	17.4	1.8
4	PHC-12	2025	-1500	13.37	.84	35.199	17.4	1.8
5	PHC-12	-2025	0	34.33	.84	35.199	17.4	1.8
6	PHC-12	-675	0	27.79	.84	35.199	17.4	1.8
7	PHC-12	675	0	21.25	.84	35.199	17.4	1.8
8	PHC-12	2025	0	14.71	.84	35.199	17.4	1.8
9	PHC-12	-2025	1500	35.68	.84	35.199	17.4	1.8
10	PHC-12	-675	1500	29.14	.84	35.199	17.4	1.8
11	PHC-12	675	1500	22.6	.84	35.199	17.4	1.8
12	PHC-12	2025	1500	16.06	.84	35.199	17.4	1.8

• LC : 7, (.9 DL + 1.3 WL)

Unit (mm,tonf)

No.	Name	Pile Geometry		Bi-Axial	Shear (Hor)	Ra	Ua	Ha
		X	Y	XY-Dir.	XY-Dir.			
1	PHC-12	-2025	-1500	2.84	.62	35.199	17.4	1.8
2	PHC-12	-675	-1500	2.11	.62	35.199	17.4	1.8
3	PHC-12	675	-1500	1.38	.62	35.199	17.4	1.8
4	PHC-12	2025	-1500	.65	.62	35.199	17.4	1.8
5	PHC-12	-2025	0	3.83	.62	35.199	17.4	1.8
6	PHC-12	-675	0	3.1	.62	35.199	17.4	1.8
7	PHC-12	675	0	2.37	.62	35.199	17.4	1.8
8	PHC-12	2025	0	1.64	.62	35.199	17.4	1.8
9	PHC-12	-2025	1500	4.81	.62	35.199	17.4	1.8
10	PHC-12	-675	1500	4.08	.62	35.199	17.4	1.8
11	PHC-12	675	1500	3.35	.62	35.199	17.4	1.8
12	PHC-12	2025	1500	2.63	.62	35.199	17.4	1.8

• LC : 8, (.9 DL + 1.43 SL2)

Unit (mm,tonf)

No.	Name	Pile Geometry		Bi-Axial	Shear (Hor)	Ra	Ua	Ha
		X	Y	XY-Dir.	XY-Dir.			

50..



Calculation Sheet
of
Foundation

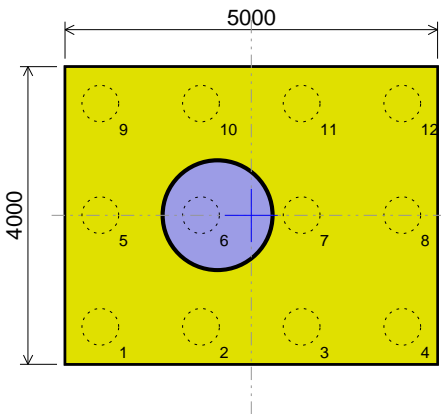
Project Na. : Foundation of Steel Stack

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1	PHC-12	-2025	-1500	2.45	.86	35.199	17.4	1.8
2	PHC-12	-675	-1500	1.72	.86	35.199	17.4	1.8
3	PHC-12	675	-1500	.99	.86	35.199	17.4	1.8
4	PHC-12	2025	-1500	.26	.86	35.199	17.4	1.8
5	PHC-12	-2025	0	3.83	.86	35.199	17.4	1.8
6	PHC-12	-675	0	3.1	.86	35.199	17.4	1.8
7	PHC-12	675	0	2.37	.86	35.199	17.4	1.8
8	PHC-12	2025	0	1.64	.86	35.199	17.4	1.8
9	PHC-12	-2025	1500	5.2	.86	35.199	17.4	1.8
10	PHC-12	-675	1500	4.47	.86	35.199	17.4	1.8
11	PHC-12	675	1500	3.75	.86	35.199	17.4	1.8
12	PHC-12	2025	1500	3.02	.86	35.199	17.4	1.8



Footing Name	F1
Section Name	S1
Pile Name	PHC-12
Pile Shape	Circle
Pile Number	12 EA
Pile Diameter	500 mm
LC Type	Reinforce

- Origin Point (0,0) mm
- The Center of Gravity & Pile (0,0) mm



Calculation Sheet of Foundation

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4. CHECK OF STABILITY

4.1 CHECK OF PILE REACTION (Bi-Axial)

4.1.1 Formula

※ if footing is checked in Buoyancy ΣFz means $\Sigma Fz - Fb$

$$a. \text{ Vertical - Bi Axial : } R = \frac{\Sigma Fz}{N_p} \pm \frac{\Sigma My \times X}{\Sigma Xi^2} \pm \frac{\Sigma Mx \times Y}{\Sigma Yi^2}$$

$$- Ru = R_{\max}$$

$$- Uf = \text{Min}[0, R_{\min}]$$

$$- Ru < Va \rightarrow \text{OK}$$

$$b. \text{ Horizontal - Hmax} = \frac{\sqrt{(\Sigma Hxi^2 + \Sigma Hyi^2)}}{N_p} < Ha \rightarrow \text{OK}$$

$$c. \text{ Uplift - } Uf < Ua \rightarrow \text{OK}$$

Ver. / Uf. = Vertical / Uplift

4.1.2 Check of Vertical & Uplift Reaction

Ft.Name	Np(EA)	FI (mm)	Fw (mm)	SXi ² (m ²)	SYi ² (m ²)
F1	12	5000	4000	27.34	18

Unit(tonf)

Ft.Name	L.Comb.	Pile	R _{Max}	R _{Min}	Ru	Uf	Ra	Ua	Result
F1	1	PHC-12	27.585	11.822	27.585	0	35.199	17.4	OK
	2	PHC-12	21.257	8.298	21.257	0	35.199	17.4	OK
	3	PHC-12	21.411	8.144	21.411	0	35.199	17.4	OK
	4	PHC-12	45.619	19.551	45.619	0	35.199	17.4	NG
	5	PHC-12	35.302	13.742	35.302	0	35.199	17.4	NG
	6	PHC-12	35.678	13.365	35.678	0	35.199	17.4	NG
	7	PHC-12	4.812	.654	4.812	0	35.199	17.4	OK
	8	PHC-12	5.203	.263	5.203	0	35.199	17.4	OK

4.1.3 Check Of Horizontal Reaction

Ft.Name	L.Comb.	Pile	Hmax (tonf)	Ha (tonf)	Result
F1	1	PHC-12	0	1.8	OK
	2	PHC-12	.356	1.8	OK
	3	PHC-12	.451	1.8	OK
	4	PHC-12	0	1.8	OK
	5	PHC-12	.607	1.8	OK
	6	PHC-12	.842	1.8	OK
	7	PHC-12	.616	1.8	OK
	8	PHC-12	.861	1.8	OK

<div>50..</div> <div></div>	<div>Calculation Sheet of Foundation</div>		Project Na. : Foundation of Steel Stack	
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5. DESIGN OF FOOTING

There is no Reinforce LoadCombination