# FOUNDATION CALCULATION SHEET

## One-Stop Solution for Foundation


| TITLE | DESCRIPTION |
|---|---|
| PROJECT/JOB NO. | F1-Steel Stack 50 m. Bang Pakong2 |
| 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 |
|---|---|---|---|---|---|---|
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| 50.. AFES | Calculation Sheet of Foundation | Project Na. : Foundation of Steel Stack | |
|---|---|---|---|
| | | Project No. : F1-Steel Stack 50 m. Bang .. | |
| | | Client : DOUBLE A | Page 1 |

# FOUNDATION LISTS

| Group Name | No. | Description | No. | Description |
|---|---|---|---|---|
| F-1 | 1 | F1 | | |

# CONTENTS

# 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 x 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 % |

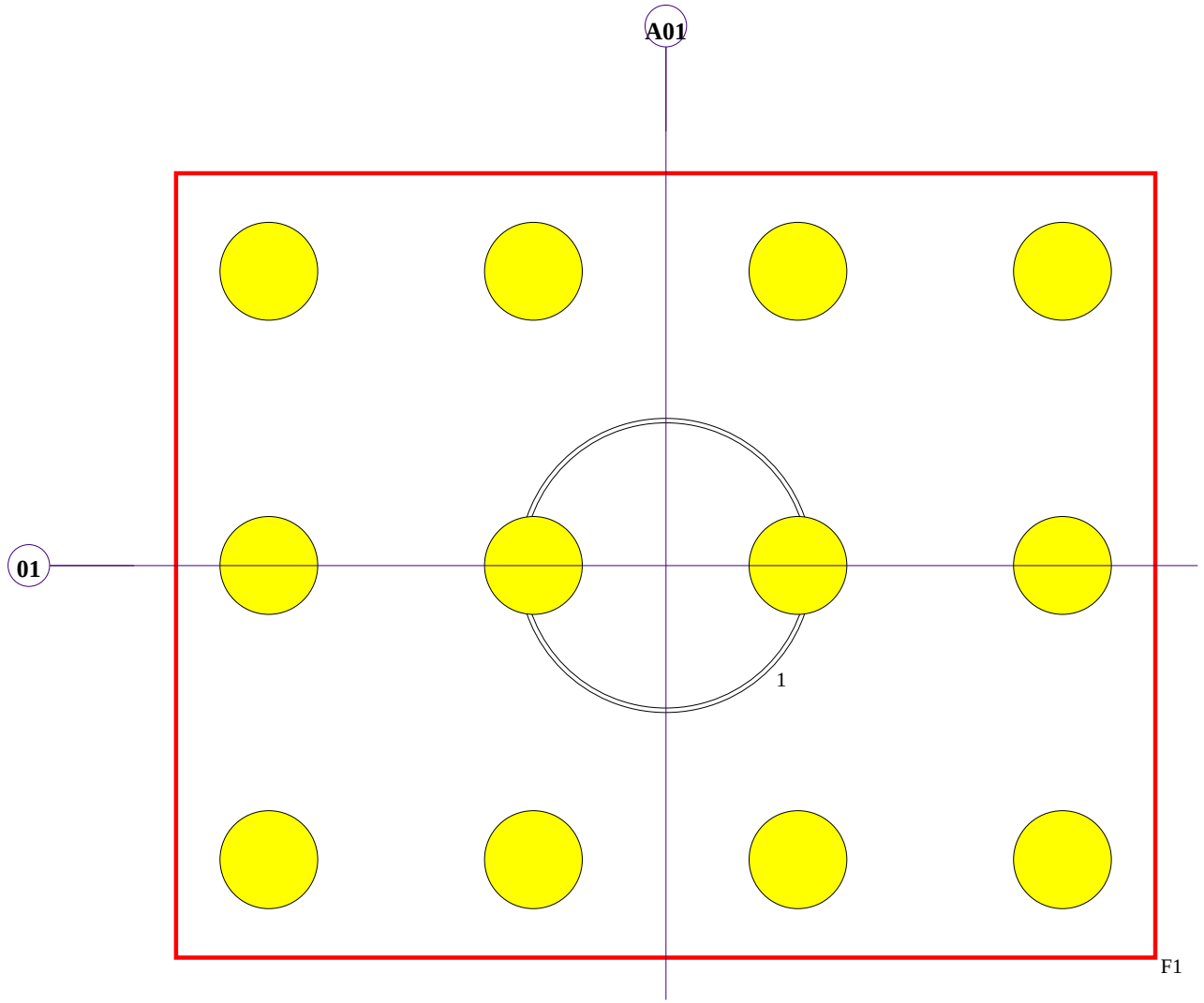
| | |
|---|---|
| Safety factor against overturning for OVM1(FO1) | 1.5 |
| Safety factor against overturning for OVM2(FO2) | 2 |
| Safety factor against overturning for OVM3(FO3) | 1.5 |
| Safety factor against overturning for OVM4(FO4) | 1.9 |
| Safety factor against sliding for the SL1(FS1) | 3 |
| 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 |

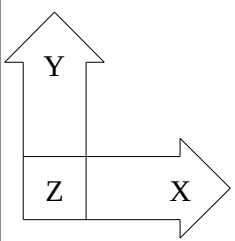
## 1.4 LOAD COMBINATION

| 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 |
|---|---|
| 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 |
| 1 | 1.0 DL + 1.0 LL |

## 2. DRAWING




**REFERENCE DWGS**

| NO. | DWG NO. | DWG TITLE |
|---|---|---|
| | | |
| | | |
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| | | |
| | | |
| | | |

**NOTES**

* OUTPUT UNIT : mm

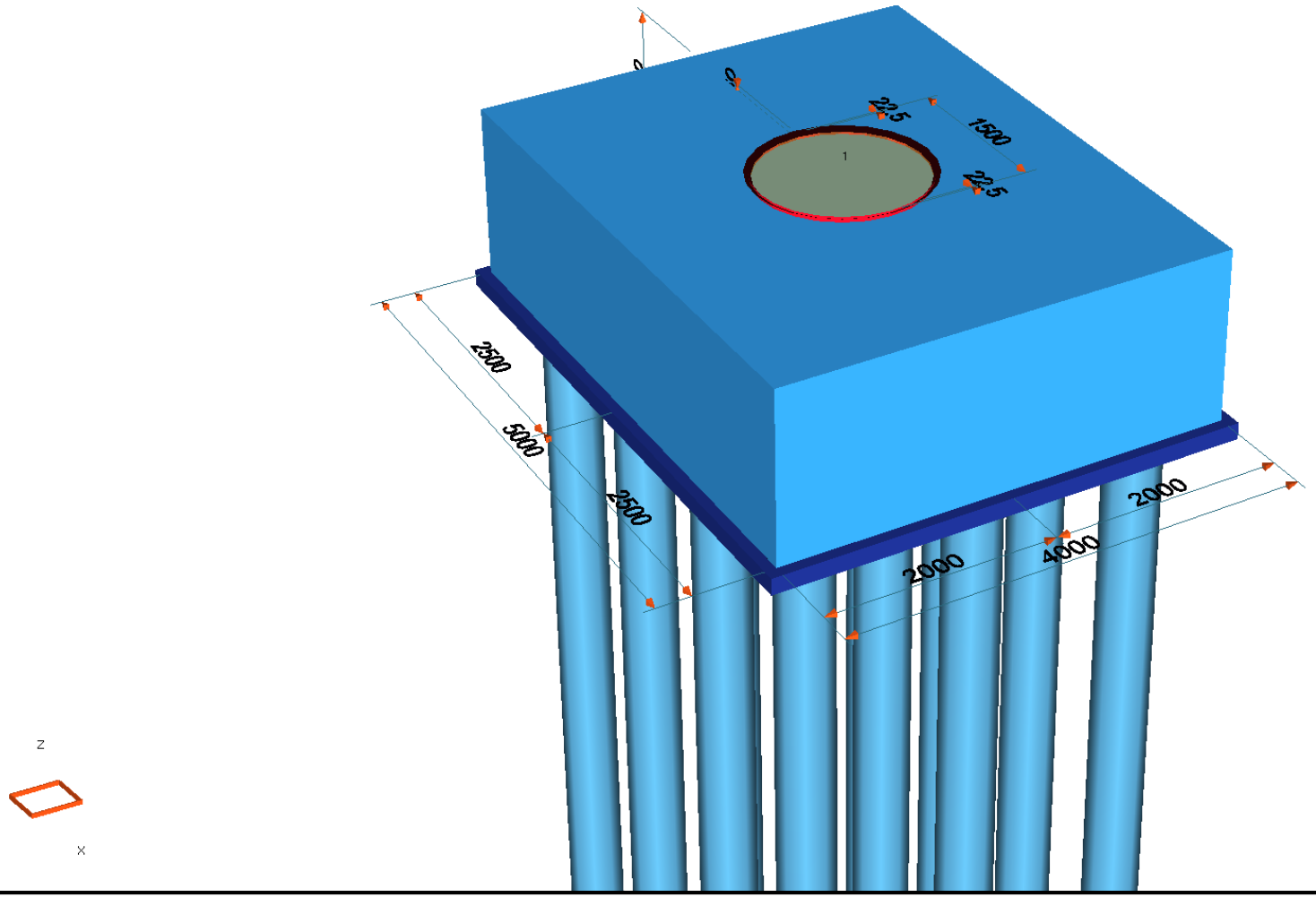
Foundation of Steel Stack 50 m. Bang Pakong-Chachoengsao PROJECT

FOUNDATION LOCATION PLAN

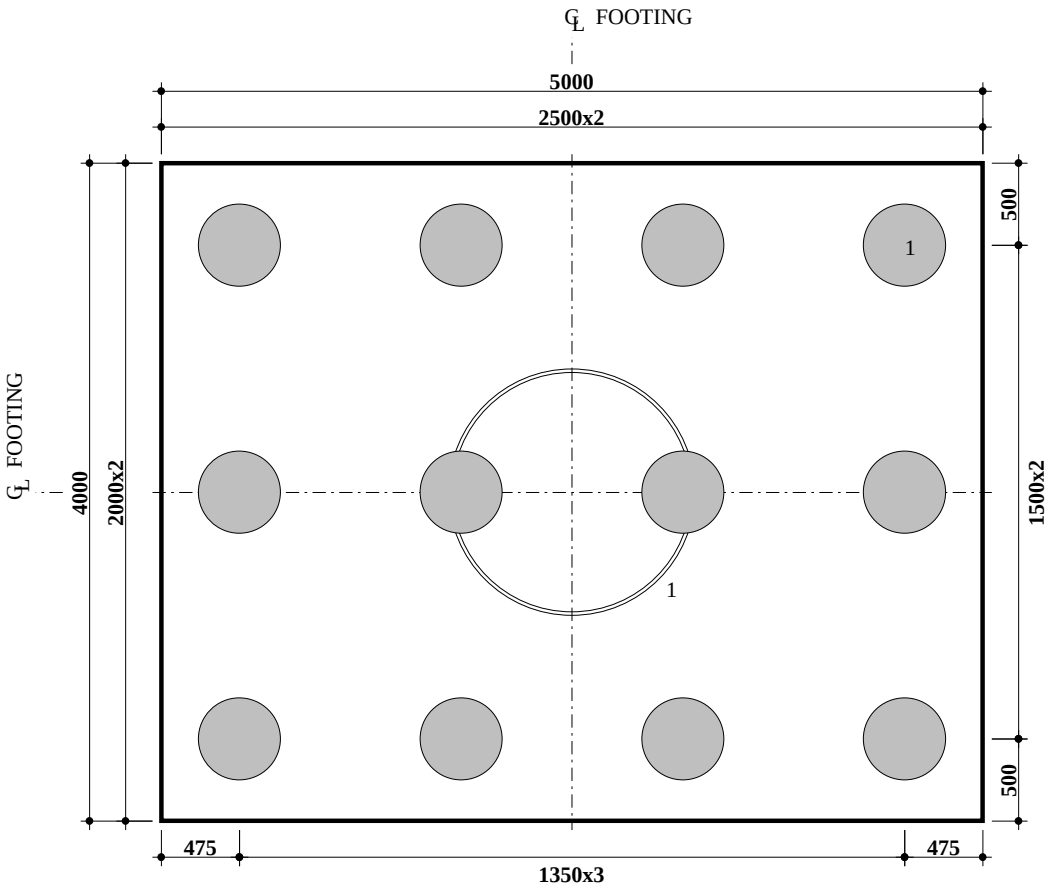
Foundation of Steel Stack 50 m. Bang Pakong

| SQUAD CHECK | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | PROCESS | PIPING | VESSELS | STRUCT. | ELEC. | INST. |

| SCALE | JOB NO. | MICROFILM NO. |
|---|---|---|
| AS SHOWN | DWG Steel Stack 50 m. Bang Pakong2 | |




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**

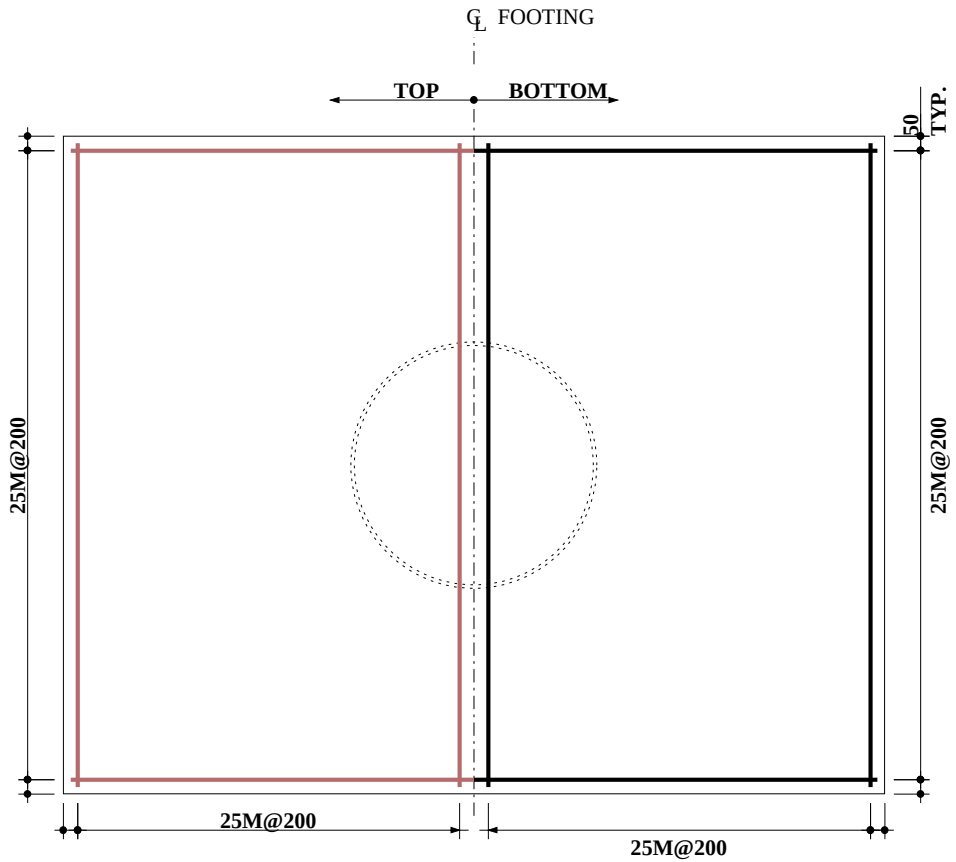
**FOUNDATION DETAIL FOR**

**F1**

| REV. | DATE | DESCRIPTION | DRWN | CHKD | APPD | APPD | APPD |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| SQUAD CHECK | PROCESS | PIPING | VESSELS | STRUCT. | ELEC. | INST. |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| SCALE | JOB NO. | MICROFILM NO. |
|---|---|---|
| AS SHOWN | W-Steel Stack 50 m. Bang Pakong2 | |




REINFORCEMENT PLAN

## REFERENCE DWGS

| NO. | DWG NO. | DWG TITLE |
|---|---|---|
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| | | |
| | | |
| | | |

## NOTES

* PILE
  12-??500 PHC-12
* OUTPUT UNIT : mm

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

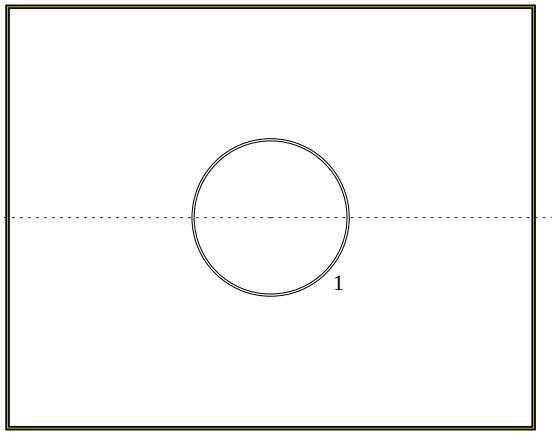
FOUNDATION DETAIL FOR

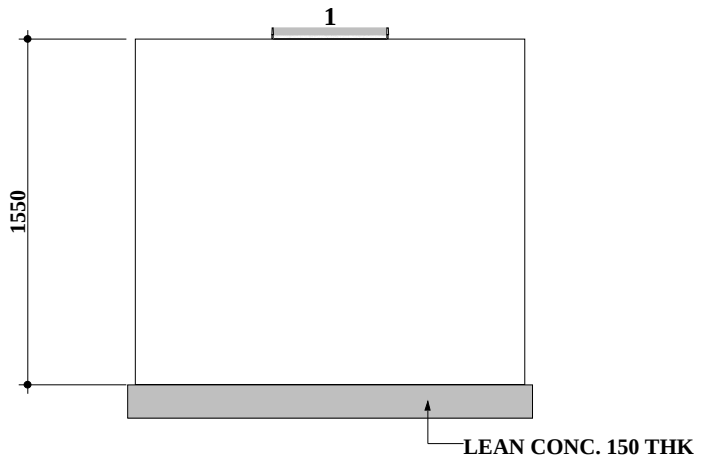
F1

| SQUAD CHECK | PROCESS | PIPING | VESSELS | STRUCT. | ELEC. | INST. |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| REV. | DATE | DESCRIPTION | DRWN | CHKD | APPD | APPD | APPD |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| SCALE | JOB NO. | MICROFILM NO. |
|---|---|---|
| AS SHOWN | W Steel Stack 50 m. Bang Pakong2 | |




ELEVATION (S1) - X

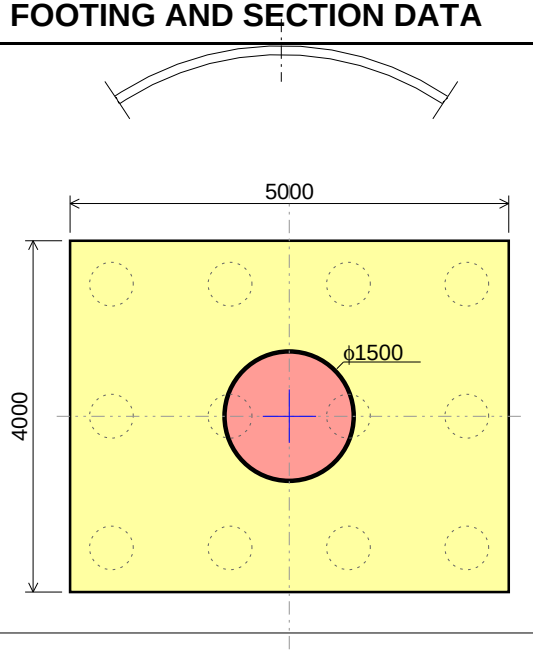
**OUTPUT UNIT : mm**

| Item No. | F1 |
|---|---|

# 13. FOUNDATION DATA

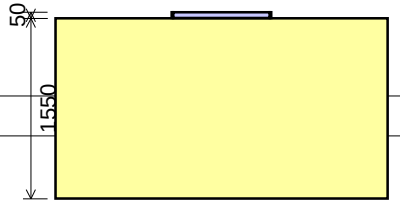
## 3.1 FOOTING AND SECTION DATA

( mm )

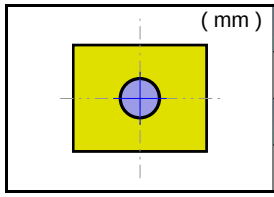



The Origin coordinate
The Center of Gravity & Pile (0,0) mm

| Ft. Name | F1 |
|---|---|
| Ft. Type | MAT |
| Area | 20.000 $m^2$ |
| Ft. Thickness | 1550.00 mm |
| Ft. Volume | 31.000 $m^3$ |
| Ft. Weight | 74.400 tonf |
| Soil Height | 0.00 mm |
| Soil Volume | 0.000 $m^3$ |
| Soil Weight | 0.000 tonf |
| Buoyancy | 0.000 tonf |
| Self Weight (except Pr.SW) | 74.400 tonf |



**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, Pl is a Diameter. and Pw is a Inner Diameter

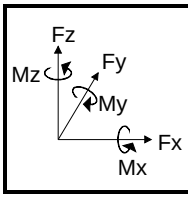
Area is pier concrete area

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

Unit( Length : mm , Weight : tonf , Area : $m^2$ )

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

## 3.3 LOAD CASE



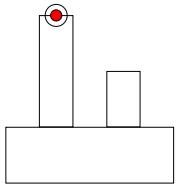
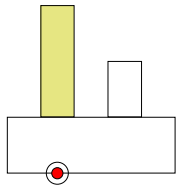
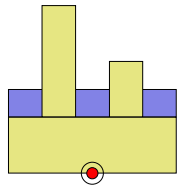

Input the point loads in the global coordinate system direction. Positive directions of moments (shown in the sketch) are based on the right hand rule.

| 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 |

## 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<br>Case NonPileType in centroid of Footing<br>  |

### 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 | 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 |
| | | 1 | 0.000 | 0.000 | -236.440 | 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 | 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 |
| | | 1 | 0.000 | 0.000 | -236.440 | 0.000 | 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

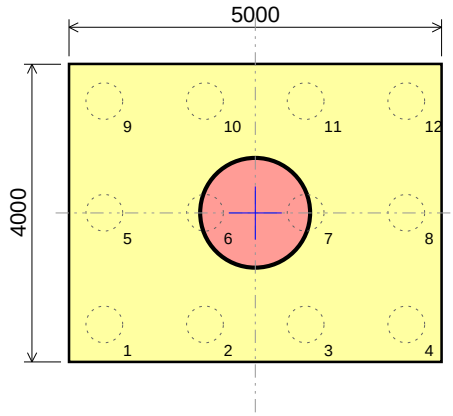
Unit( tonf , tonf-m )

| Ft.Name | L.Comb. | SFx | SFy | SFz | SMx | SMy | C.G. of Loads |
|---|---|---|---|---|---|---|---|
| F1ⓟ | 2 | 0.000 | 4.267 | -177.330 | -6.828 | 0.000 | 2500.0 , 2000.0 |
| | 3 | 0.000 | 5.416 | -177.330 | -8.665 | 0.000 | 2500.0 , 2000.0 |
| | 4 | 0.000 | 0.000 | -391.016 | 0.000 | 0.000 | 2500.0 , 2000.0 |
| | 5 | 0.000 | 7.283 | -294.262 | -11.653 | 0.000 | 2500.0 , 2000.0 |
| | 6 | 0.000 | 10.109 | -294.262 | -16.175 | 0.000 | 2500.0 , 2000.0 |
| | 7 | 0.000 | 7.397 | -32.796 | -11.835 | 0.000 | 2500.0 , 2000.0 |
| | 8 | 0.000 | 10.326 | -32.796 | -16.522 | 0.000 | 2500.0 , 2000.0 |
| | 1 | 0.000 | 0.000 | -236.440 | 0.000 | 0.000 | 2500.0 , 2000.0 |

**Load Combination of Ultimate Condition**

There is no Load Combination

### 3.4.4 Pile Reaction Table




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

Origin Point (0,0) mm

The Center of Gravity & Pile (0,0) mm

**• 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 | 14.21 | .36 | 35.199 | 17.4 | 1.8 |
| 2 | PHC-12 | -675 | -1500 | 14.21 | .36 | 35.199 | 17.4 | 1.8 |
| 3 | PHC-12 | 675 | -1500 | 14.21 | .36 | 35.199 | 17.4 | 1.8 |
| 4 | PHC-12 | 2025 | -1500 | 14.21 | .36 | 35.199 | 17.4 | 1.8 |
| 5 | PHC-12 | -2025 | 0 | 14.78 | .36 | 35.199 | 17.4 | 1.8 |
| 6 | PHC-12 | -675 | 0 | 14.78 | .36 | 35.199 | 17.4 | 1.8 |
| 7 | PHC-12 | 675 | 0 | 14.78 | .36 | 35.199 | 17.4 | 1.8 |
| 8 | PHC-12 | 2025 | 0 | 14.78 | .36 | 35.199 | 17.4 | 1.8 |
| 9 | PHC-12 | -2025 | 1500 | 15.35 | .36 | 35.199 | 17.4 | 1.8 |
| 10 | PHC-12 | -675 | 1500 | 15.35 | .36 | 35.199 | 17.4 | 1.8 |
| 11 | PHC-12 | 675 | 1500 | 15.35 | .36 | 35.199 | 17.4 | 1.8 |
| 12 | PHC-12 | 2025 | 1500 | 15.35 | .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 | 14.06 | .45 | 35.199 | 17.4 | 1.8 |
| 2 | PHC-12 | -675 | -1500 | 14.06 | .45 | 35.199 | 17.4 | 1.8 |
| 3 | PHC-12 | 675 | -1500 | 14.06 | .45 | 35.199 | 17.4 | 1.8 |
| 4 | PHC-12 | 2025 | -1500 | 14.06 | .45 | 35.199 | 17.4 | 1.8 |
| 5 | PHC-12 | -2025 | 0 | 14.78 | .45 | 35.199 | 17.4 | 1.8 |
| 6 | PHC-12 | -675 | 0 | 14.78 | .45 | 35.199 | 17.4 | 1.8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7 | PHC-12 | 675 | 0 | 14.78 | .45 | 35.199 | 17.4 | 1.8 |
| 8 | PHC-12 | 2025 | 0 | 14.78 | .45 | 35.199 | 17.4 | 1.8 |
| 9 | PHC-12 | -2025 | 1500 | 15.5 | .45 | 35.199 | 17.4 | 1.8 |
| 10 | PHC-12 | -675 | 1500 | 15.5 | .45 | 35.199 | 17.4 | 1.8 |
| 11 | PHC-12 | 675 | 1500 | 15.5 | .45 | 35.199 | 17.4 | 1.8 |
| 12 | PHC-12 | 2025 | 1500 | 15.5 | .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 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 2 | PHC-12 | -675 | -1500 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 3 | PHC-12 | 675 | -1500 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 4 | PHC-12 | 2025 | -1500 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 5 | PHC-12 | -2025 | 0 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 6 | PHC-12 | -675 | 0 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 7 | PHC-12 | 675 | 0 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 8 | PHC-12 | 2025 | 0 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 9 | PHC-12 | -2025 | 1500 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 10 | PHC-12 | -675 | 1500 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 11 | PHC-12 | 675 | 1500 | 32.58 | 0 | 35.199 | 17.4 | 1.8 |
| 12 | PHC-12 | 2025 | 1500 | 32.58 | 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 | 23.55 | .61 | 35.199 | 17.4 | 1.8 |
| 2 | PHC-12 | -675 | -1500 | 23.55 | .61 | 35.199 | 17.4 | 1.8 |
| 3 | PHC-12 | 675 | -1500 | 23.55 | .61 | 35.199 | 17.4 | 1.8 |
| 4 | PHC-12 | 2025 | -1500 | 23.55 | .61 | 35.199 | 17.4 | 1.8 |
| 5 | PHC-12 | -2025 | 0 | 24.52 | .61 | 35.199 | 17.4 | 1.8 |
| 6 | PHC-12 | -675 | 0 | 24.52 | .61 | 35.199 | 17.4 | 1.8 |
| 7 | PHC-12 | 675 | 0 | 24.52 | .61 | 35.199 | 17.4 | 1.8 |
| 8 | PHC-12 | 2025 | 0 | 24.52 | .61 | 35.199 | 17.4 | 1.8 |
| 9 | PHC-12 | -2025 | 1500 | 25.49 | .61 | 35.199 | 17.4 | 1.8 |
| 10 | PHC-12 | -675 | 1500 | 25.49 | .61 | 35.199 | 17.4 | 1.8 |
| 11 | PHC-12 | 675 | 1500 | 25.49 | .61 | 35.199 | 17.4 | 1.8 |
| 12 | PHC-12 | 2025 | 1500 | 25.49 | .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 | 23.17 | .84 | 35.199 | 17.4 | 1.8 |
| 2 | PHC-12 | -675 | -1500 | 23.17 | .84 | 35.199 | 17.4 | 1.8 |
| 3 | PHC-12 | 675 | -1500 | 23.17 | .84 | 35.199 | 17.4 | 1.8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4 | PHC-12 | 2025 | -1500 | 23.17 | .84 | 35.199 | 17.4 | 1.8 |
| 5 | PHC-12 | -2025 | 0 | 24.52 | .84 | 35.199 | 17.4 | 1.8 |
| 6 | PHC-12 | -675 | 0 | 24.52 | .84 | 35.199 | 17.4 | 1.8 |
| 7 | PHC-12 | 675 | 0 | 24.52 | .84 | 35.199 | 17.4 | 1.8 |
| 8 | PHC-12 | 2025 | 0 | 24.52 | .84 | 35.199 | 17.4 | 1.8 |
| 9 | PHC-12 | -2025 | 1500 | 25.87 | .84 | 35.199 | 17.4 | 1.8 |
| 10 | PHC-12 | -675 | 1500 | 25.87 | .84 | 35.199 | 17.4 | 1.8 |
| 11 | PHC-12 | 675 | 1500 | 25.87 | .84 | 35.199 | 17.4 | 1.8 |
| 12 | PHC-12 | 2025 | 1500 | 25.87 | .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 | 1.75 | .62 | 35.199 | 17.4 | 1.8 |
| 2 | PHC-12 | -675 | -1500 | 1.75 | .62 | 35.199 | 17.4 | 1.8 |
| 3 | PHC-12 | 675 | -1500 | 1.75 | .62 | 35.199 | 17.4 | 1.8 |
| 4 | PHC-12 | 2025 | -1500 | 1.75 | .62 | 35.199 | 17.4 | 1.8 |
| 5 | PHC-12 | -2025 | 0 | 2.73 | .62 | 35.199 | 17.4 | 1.8 |
| 6 | PHC-12 | -675 | 0 | 2.73 | .62 | 35.199 | 17.4 | 1.8 |
| 7 | PHC-12 | 675 | 0 | 2.73 | .62 | 35.199 | 17.4 | 1.8 |
| 8 | PHC-12 | 2025 | 0 | 2.73 | .62 | 35.199 | 17.4 | 1.8 |
| 9 | PHC-12 | -2025 | 1500 | 3.72 | .62 | 35.199 | 17.4 | 1.8 |
| 10 | PHC-12 | -675 | 1500 | 3.72 | .62 | 35.199 | 17.4 | 1.8 |
| 11 | PHC-12 | 675 | 1500 | 3.72 | .62 | 35.199 | 17.4 | 1.8 |
| 12 | PHC-12 | 2025 | 1500 | 3.72 | .62 | 35.199 | 17.4 | 1.8 |

**• LC : 8, ( .9 DL + 1.43 SL2 )**

Unit (mm,tonf)

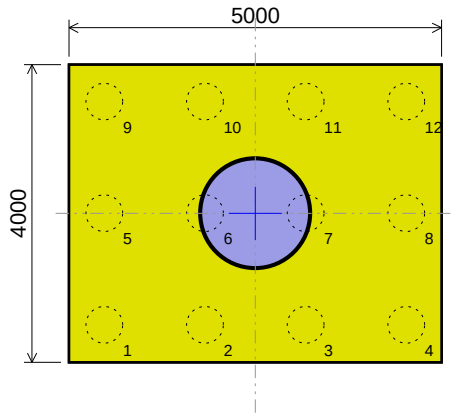
| No. | Name | Pile Geometry | | Bi-Axial | Shear (Hor) | Ra | Ua | Ha |
|---|---|---|---|---|---|---|---|---|
| | | X | Y | XY-Dir. | XY-Dir. | | | |
| 1 | PHC-12 | -2025 | -1500 | 1.36 | .86 | 35.199 | 17.4 | 1.8 |
| 2 | PHC-12 | -675 | -1500 | 1.36 | .86 | 35.199 | 17.4 | 1.8 |
| 3 | PHC-12 | 675 | -1500 | 1.36 | .86 | 35.199 | 17.4 | 1.8 |
| 4 | PHC-12 | 2025 | -1500 | 1.36 | .86 | 35.199 | 17.4 | 1.8 |
| 5 | PHC-12 | -2025 | 0 | 2.73 | .86 | 35.199 | 17.4 | 1.8 |
| 6 | PHC-12 | -675 | 0 | 2.73 | .86 | 35.199 | 17.4 | 1.8 |
| 7 | PHC-12 | 675 | 0 | 2.73 | .86 | 35.199 | 17.4 | 1.8 |
| 8 | PHC-12 | 2025 | 0 | 2.73 | .86 | 35.199 | 17.4 | 1.8 |
| 9 | PHC-12 | -2025 | 1500 | 4.11 | .86 | 35.199 | 17.4 | 1.8 |
| 10 | PHC-12 | -675 | 1500 | 4.11 | .86 | 35.199 | 17.4 | 1.8 |
| 11 | PHC-12 | 675 | 1500 | 4.11 | .86 | 35.199 | 17.4 | 1.8 |
| 12 | PHC-12 | 2025 | 1500 | 4.11 | .86 | 35.199 | 17.4 | 1.8 |

**• 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 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 2 | PHC-12 | -675 | -1500 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 3 | PHC-12 | 675 | -1500 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 4 | PHC-12 | 2025 | -1500 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 5 | PHC-12 | -2025 | 0 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 6 | PHC-12 | -675 | 0 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 7 | PHC-12 | 675 | 0 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 8 | PHC-12 | 2025 | 0 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 9 | PHC-12 | -2025 | 1500 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 10 | PHC-12 | -675 | 1500 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 11 | PHC-12 | 675 | 1500 | 19.7 | 0 | 35.199 | 17.4 | 1.8 |
| 12 | PHC-12 | 2025 | 1500 | 19.7 | 0 | 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

# 4. CHECK OF STABILITY

## 4.1 CHECK OF PILE REACTION (Bi-Axial)

### 4.1.1 Formula

※ if footing is checked in Buoyancy ΣFz means ΣFz - Fb

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

- Ru = $R_{max}$
- Uf = Min[ 0 , $R_{min}$ ]
- Ru < Va -> OK

b. Horizontal - $Hmax = \frac{\sqrt{(\Sigma Hx_i^2 + \Sigma Hy_i^2)}}{Np}$ < Ha -> OK

c. Uplift - Uf < Ua -> OK

Ver. / Uf. = Vertical / Uplift

### 4.1.2 Check of Vertical & Uplift Reaction

| Ft.Name | Np(EA) | Fl (mm) | Fw (mm) | SXi² (m²) | SYi² (m²) |
|---|---|---|---|---|---|
| F1 | 12 | 5000 | 4000 | 27.34 | 18 |

Unit( tonf )

| Ft.Name | L.Comb. | Pile | R Max | R Min | Ru | Uf | Ra | Ua | Result |
|---|---|---|---|---|---|---|---|---|---|
| F1 | 2 | PHC-12 | 15.347 | 14.208 | 15.347 | 0 | 35.199 | 17.4 | OK |
| | 3 | PHC-12 | 15.5 | 14.055 | 15.5 | 0 | 35.199 | 17.4 | OK |
| | 4 | PHC-12 | 32.585 | 32.585 | 32.585 | 0 | 35.199 | 17.4 | OK |
| | 5 | PHC-12 | 25.493 | 23.551 | 25.493 | 0 | 35.199 | 17.4 | OK |
| | 6 | PHC-12 | 25.87 | 23.174 | 25.87 | 0 | 35.199 | 17.4 | OK |
| | 7 | PHC-12 | 3.719 | 1.747 | 3.719 | 0 | 35.199 | 17.4 | OK |
| | 8 | PHC-12 | 4.11 | 1.356 | 4.11 | 0 | 35.199 | 17.4 | OK |
| | **1** | **PHC-12** | **19.703** | **19.703** | **19.703** | **0** | **35.199** | **17.4** | **OK** |

### 4.1.3 Check Of Horizontal Reaction

| Ft.Name | L.Comb. | Pile | Hmax (tonf) | Ha (tonf) | Result |
|---|---|---|---|---|---|
| F1 | 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** |
| | 1 | PHC-12 | 0 | 1.8 | OK |

# 5. DESIGN OF FOOTING

There is no Reinforce LoadCombination