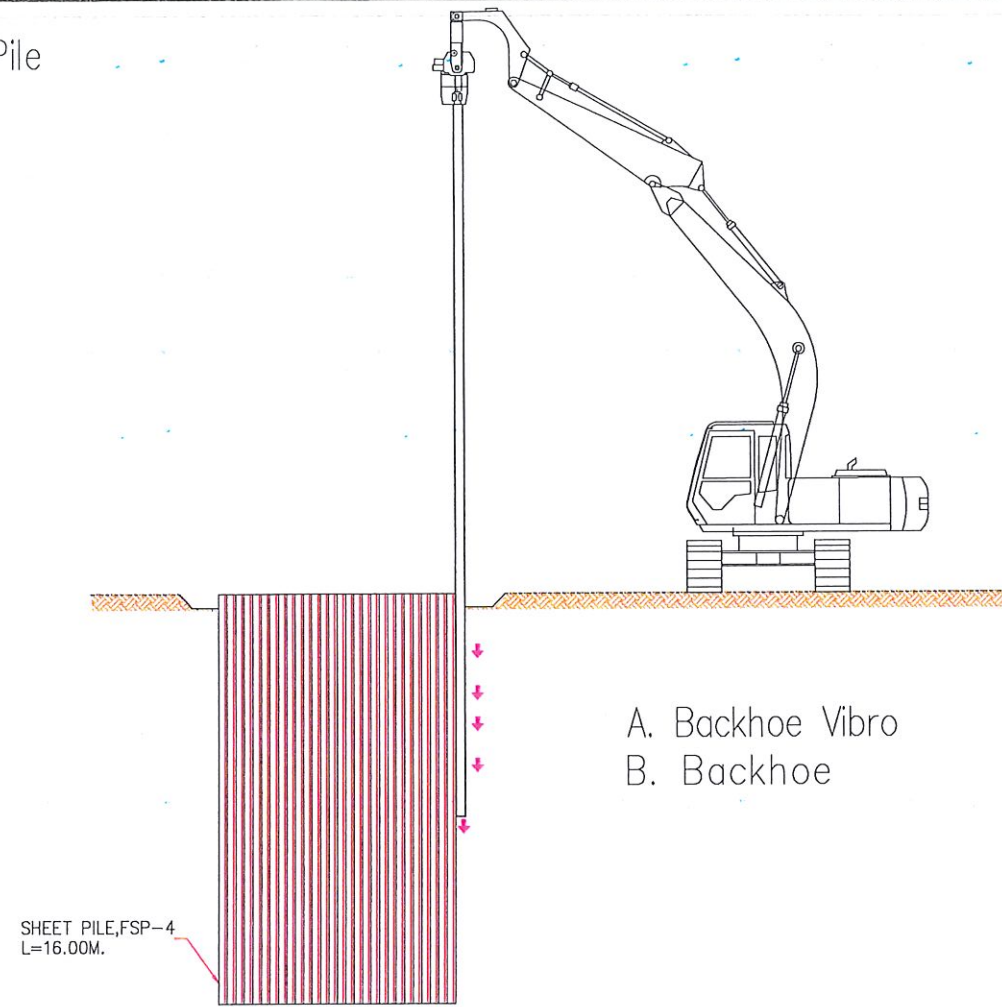


ภาคผนวก ค-15

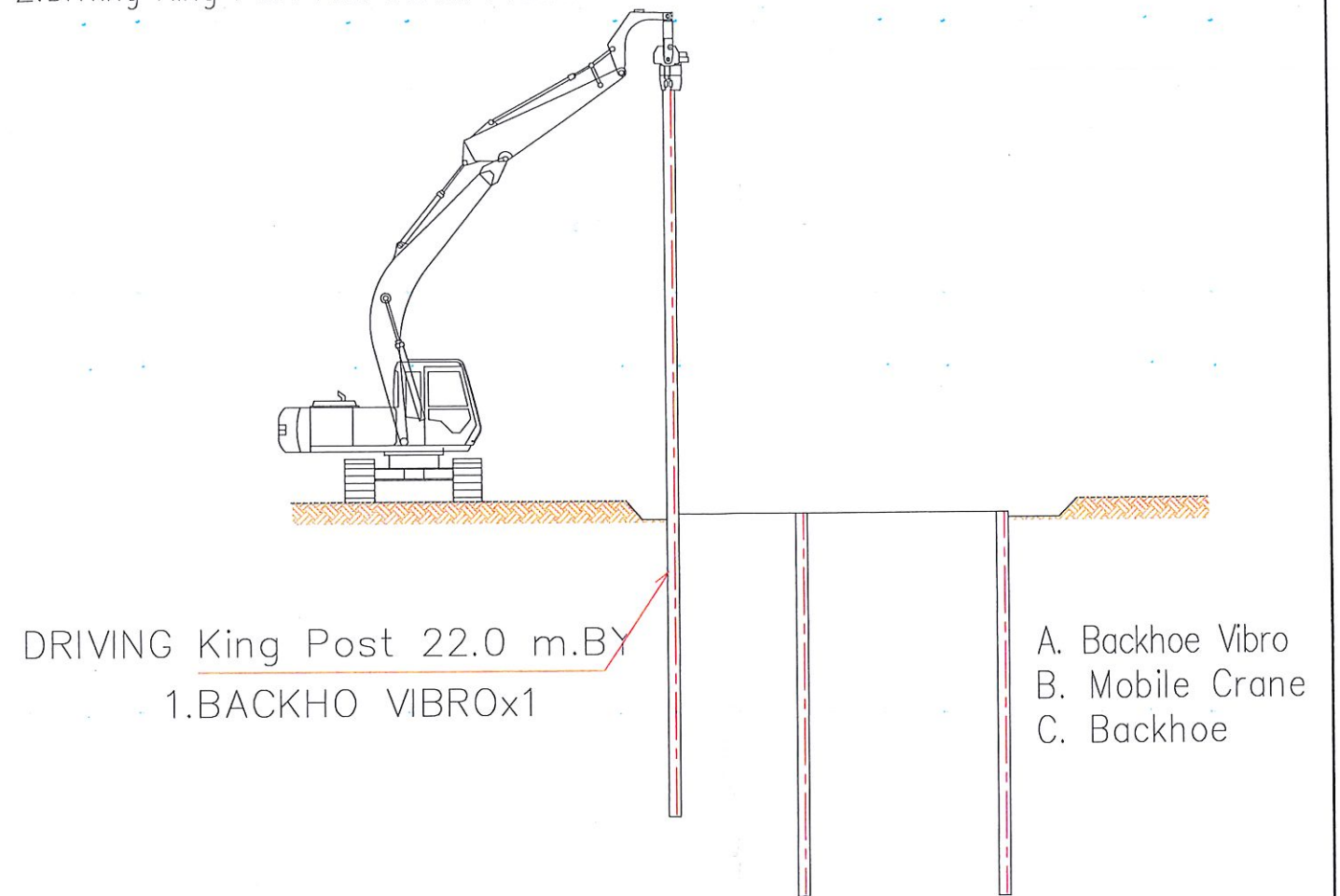
การติดตั้ง Sheet Pile



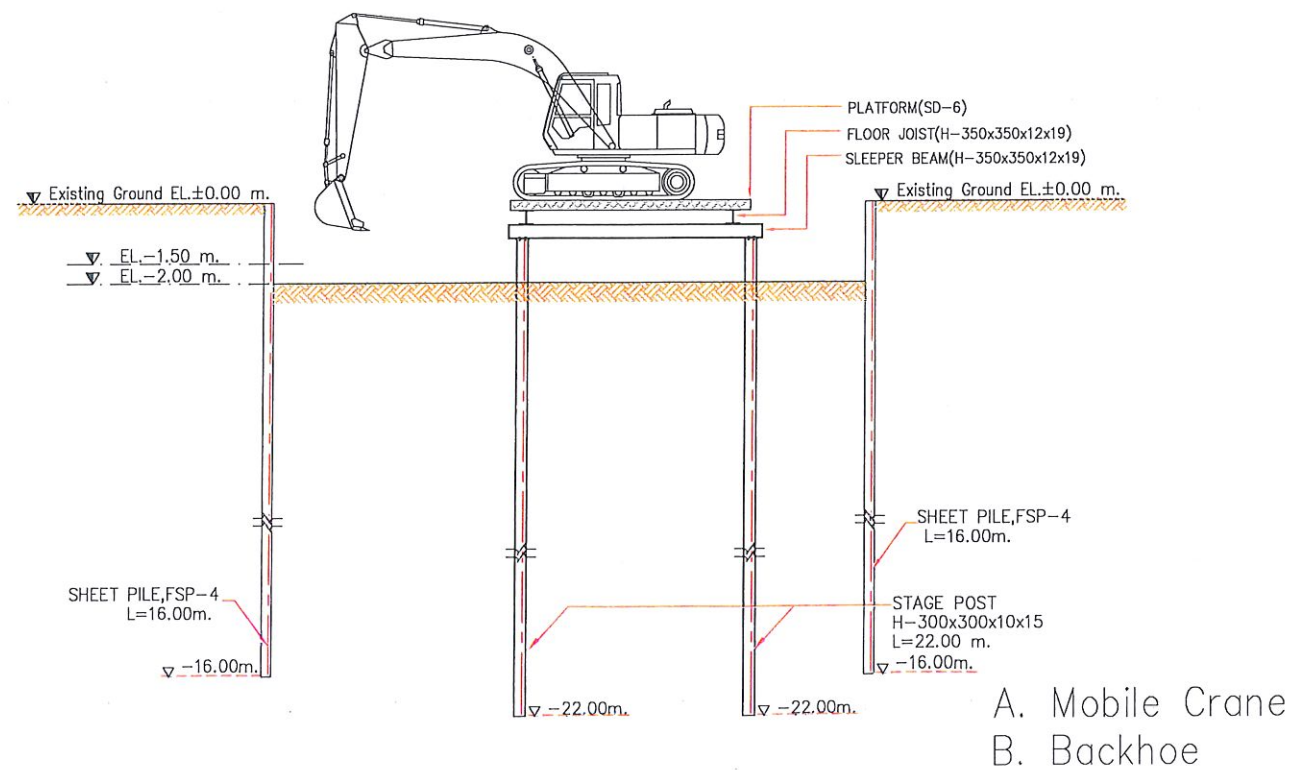
1. Driving Sheet Pile



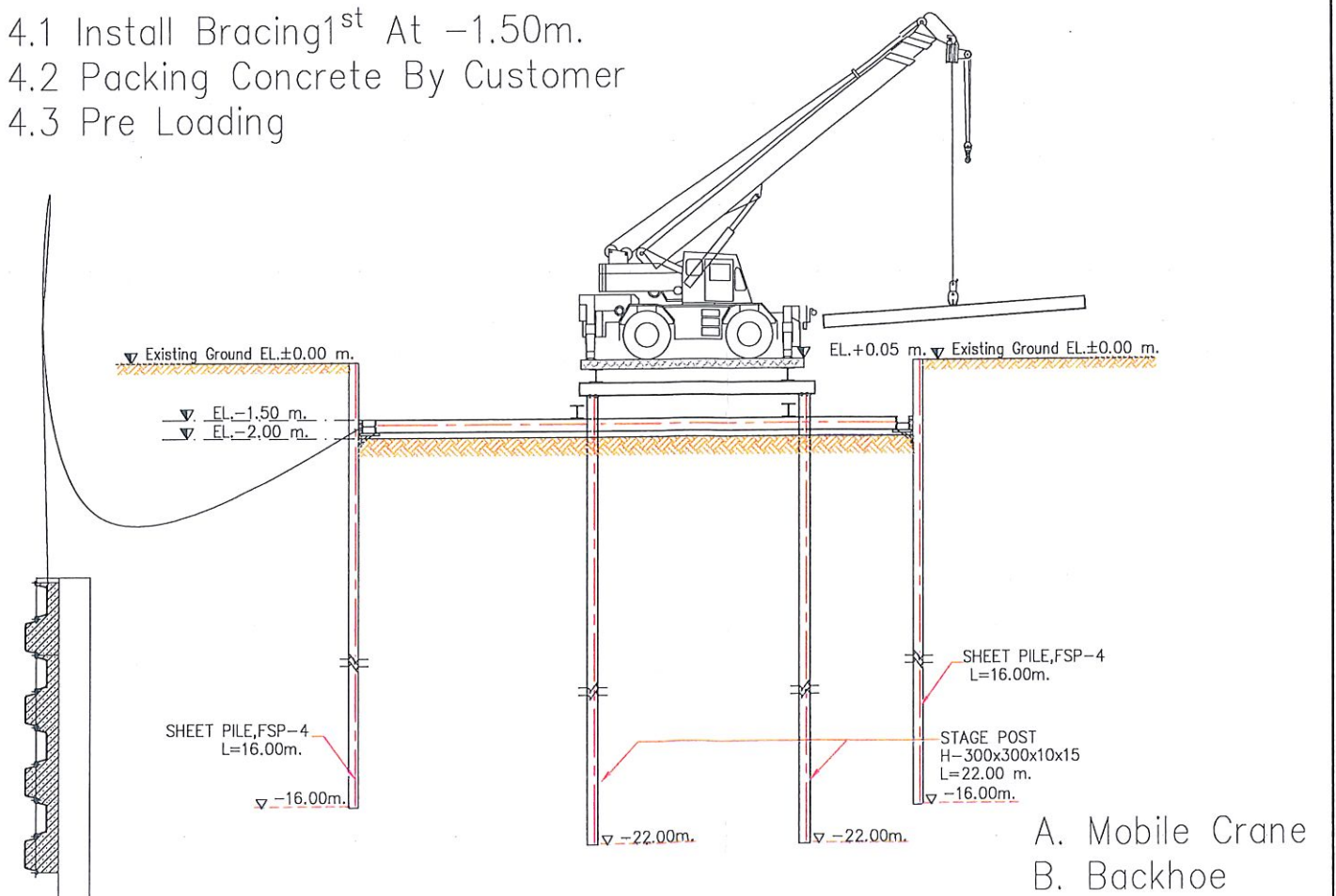
2. Driving King Post And Install Platform



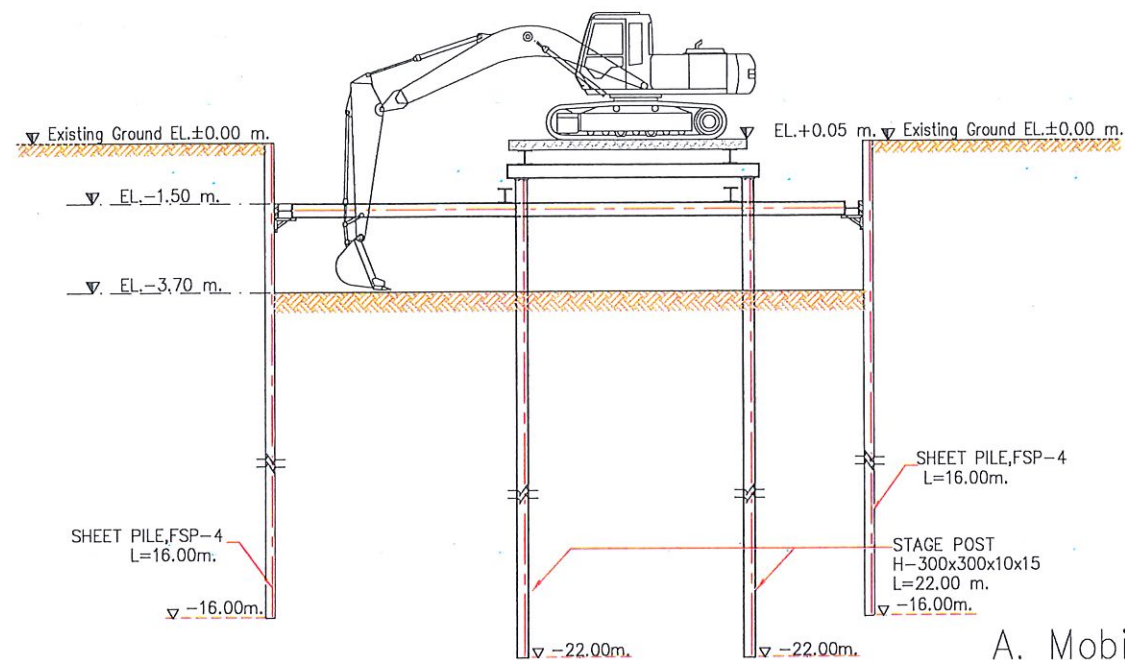
3. Excavate to -1.50m For Installation Platform And Install Bracing^{1st} At -2.00m



4.1 Install Bracing^{1st} At -1.50m. 4.2 Packing Concrete By Customer 4.3 Pre Loading

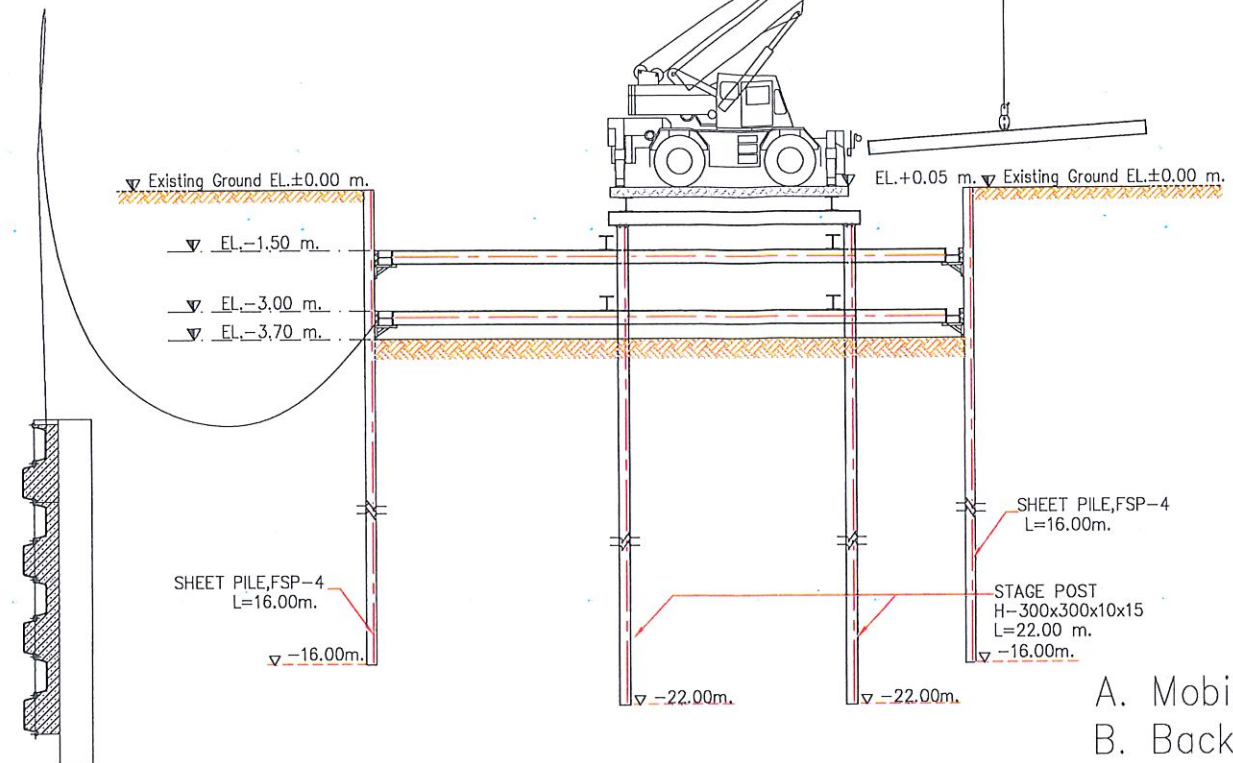


5. Excavate to -3.70m For Install Bracing^{2nd} At -3.00m



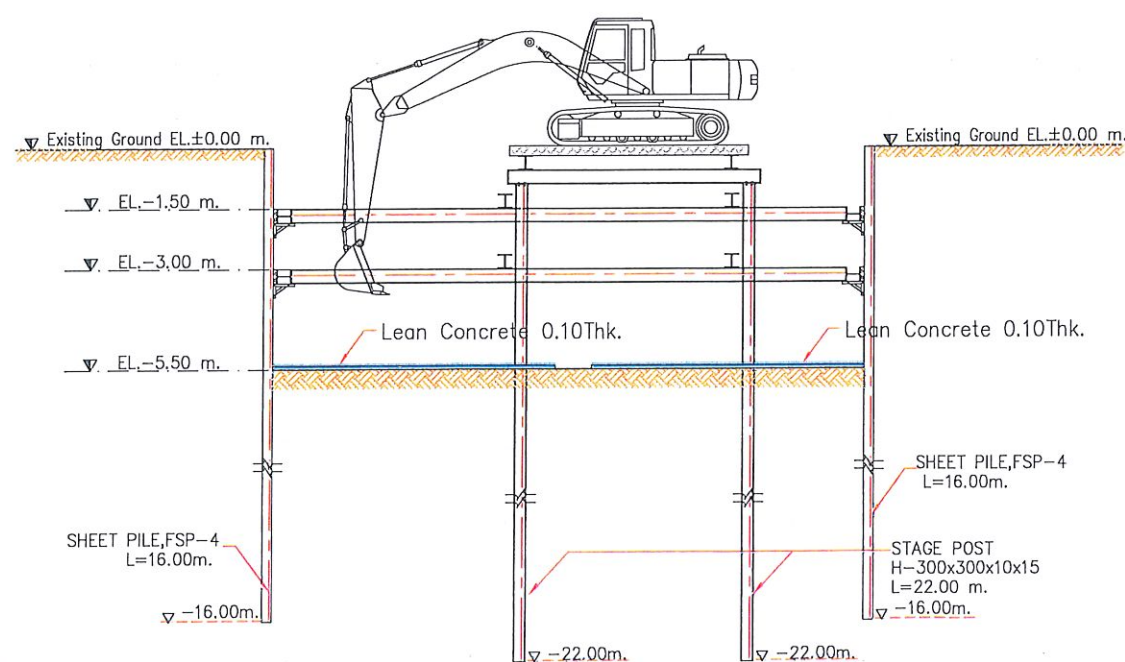
A. Mobile Crane
B. Backhoe

6.1 Install Bracing^{2nd} At -3.00m.
6.2 Packing Concrete By Customer
6.3 Pre Loading



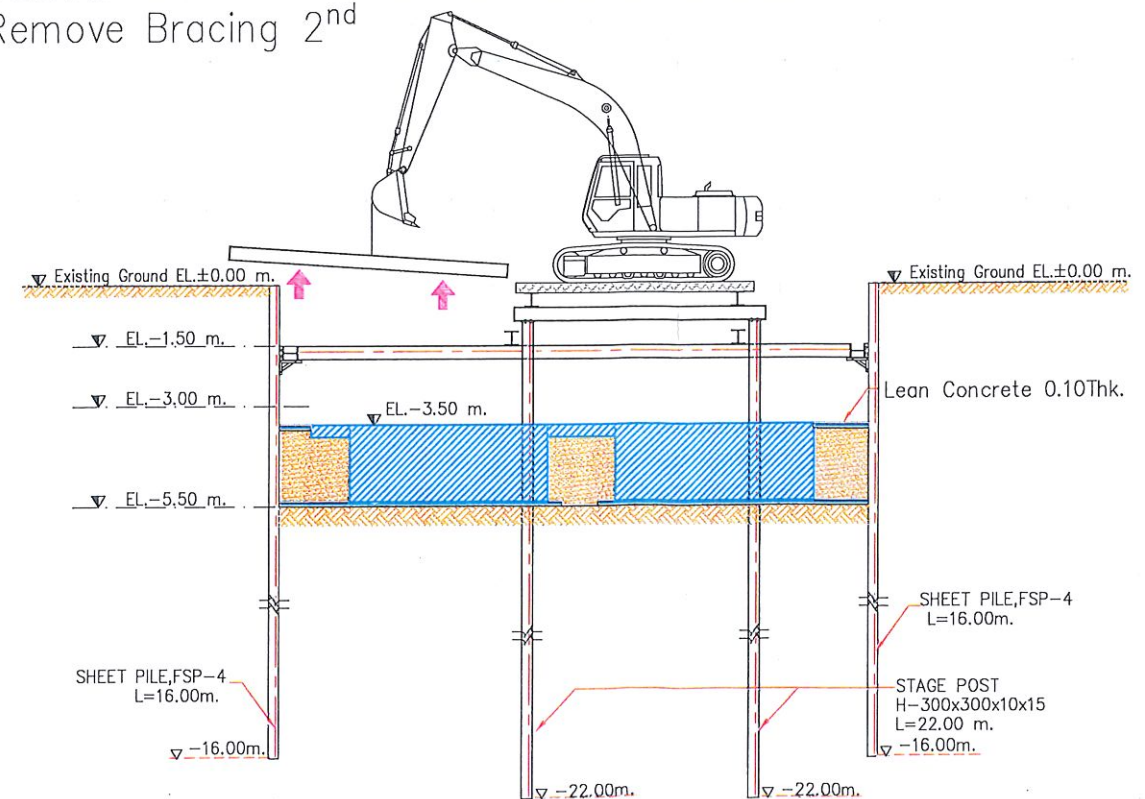
A. Mobile Crane
B. Backhoe

7. Final Excavate to -5.50m. For Making Footing
And Cast Lean Concrete Close Sheet pile immediate By Customer



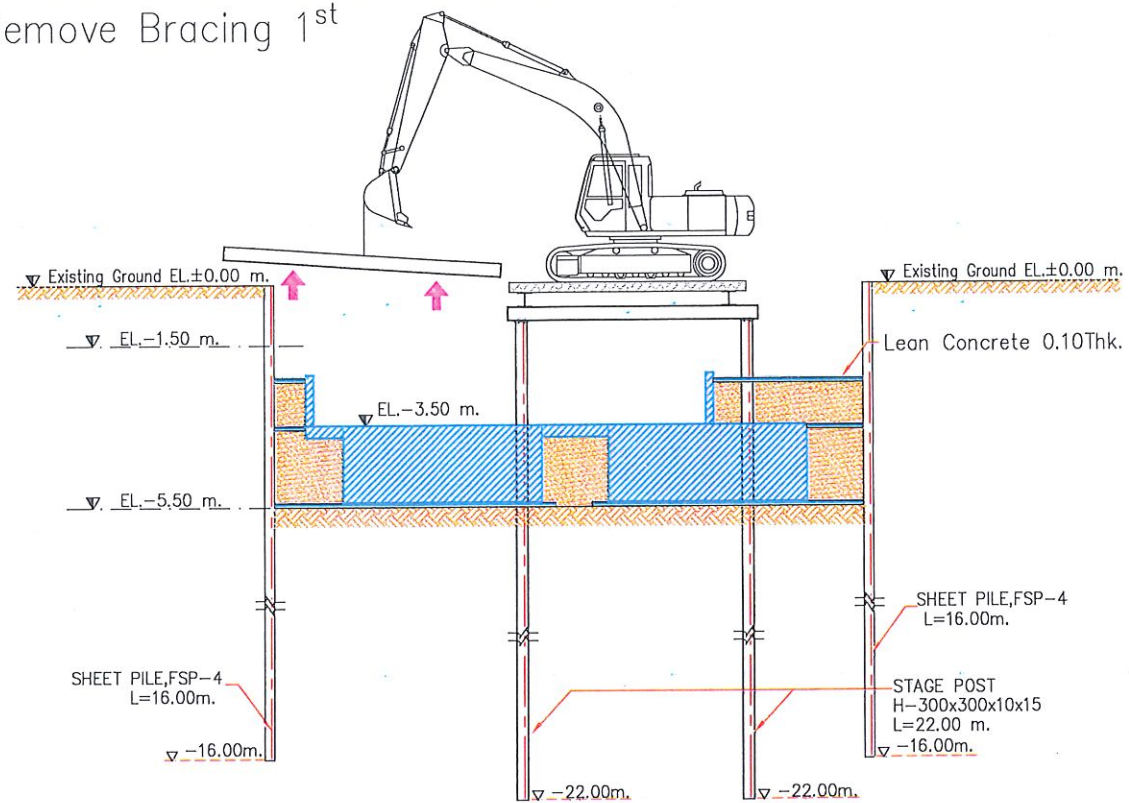
A. Backhoe

8.1 Making Footing And Slab At -3.50m
8.2 Backfill Sand And Cast Lean Concrete Close to Sheet Pile
8.3 Remove Bracing^{2nd}



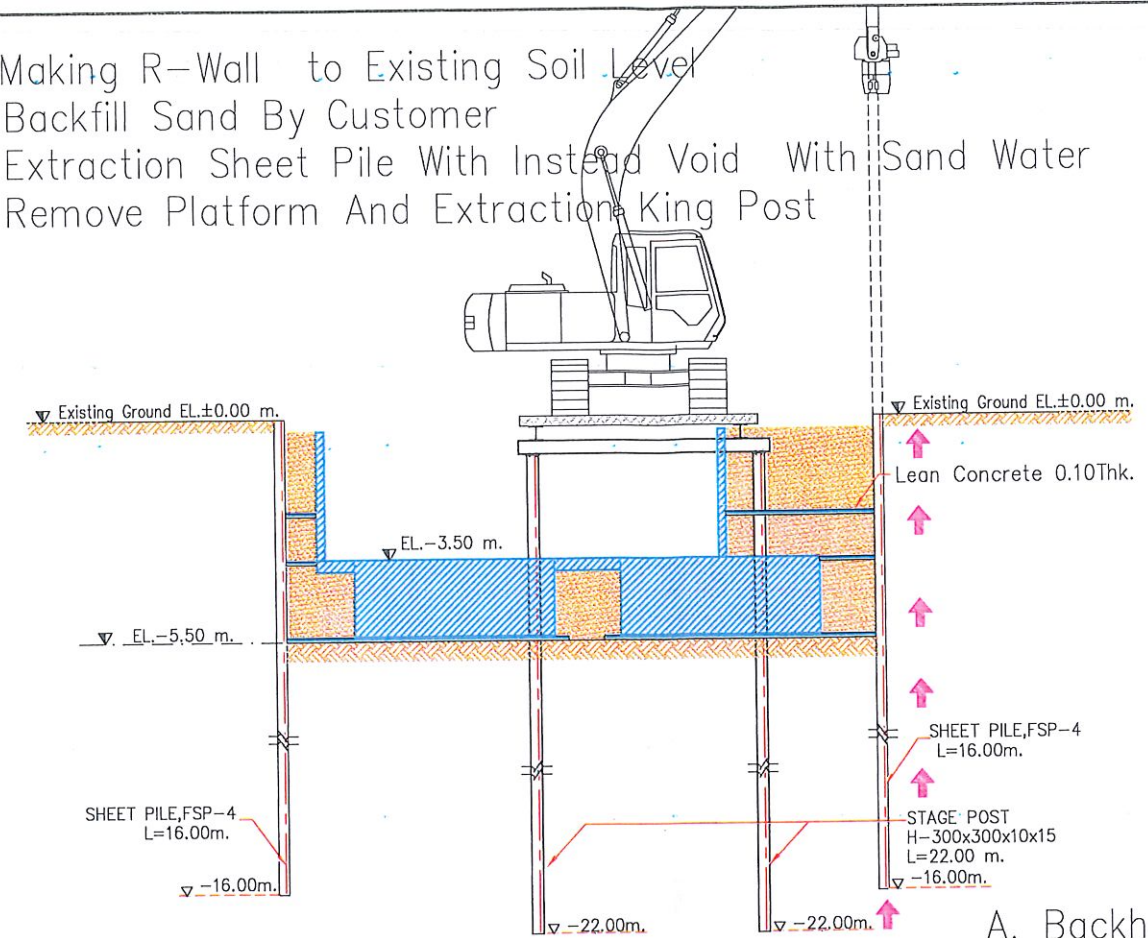
A. Backhoe

- 9.1 Making R-Wall At -2.00m
- 9.2 Backfill Sand And Cast Lean Concrete Close to Sheet Pile
- 9.3 Remove Bracing 1st



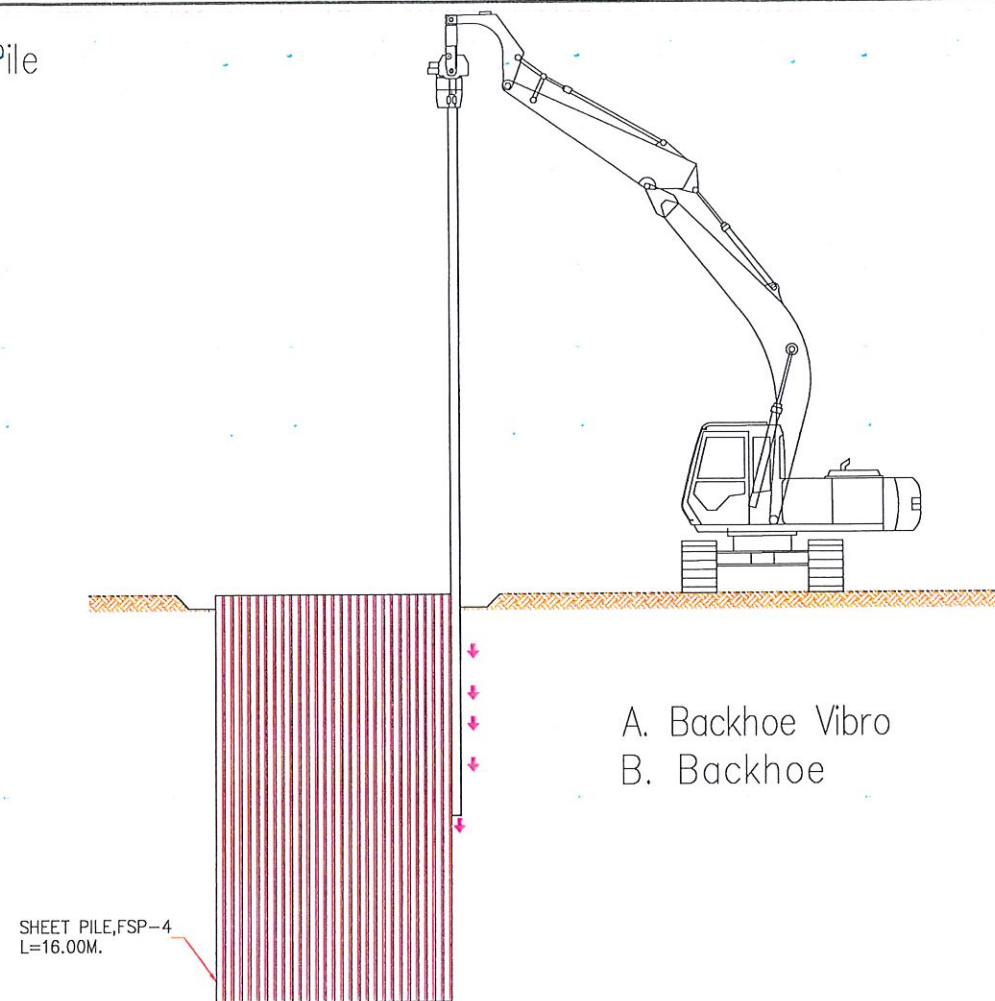
A. Backhoe

- 10.1 Making R-Wall to Existing Soil Level
- 10.2 Backfill Sand By Customer
- 10.3 Extraction Sheet Pile With Instead Void With Sand Water
- 10.4 Remove Platform And Extraction King Post

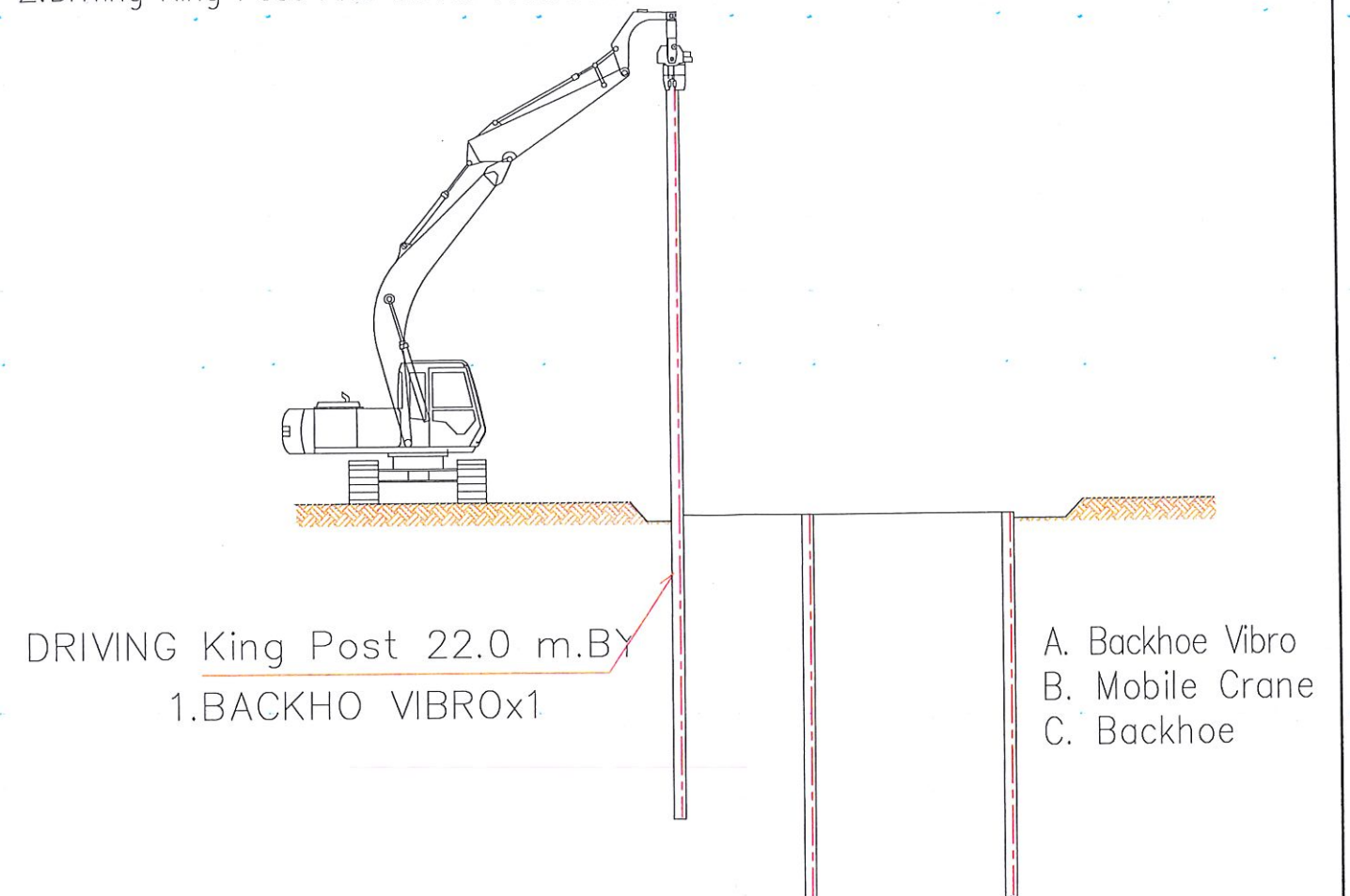


A. Backhoe Vibro
B. Backhoe

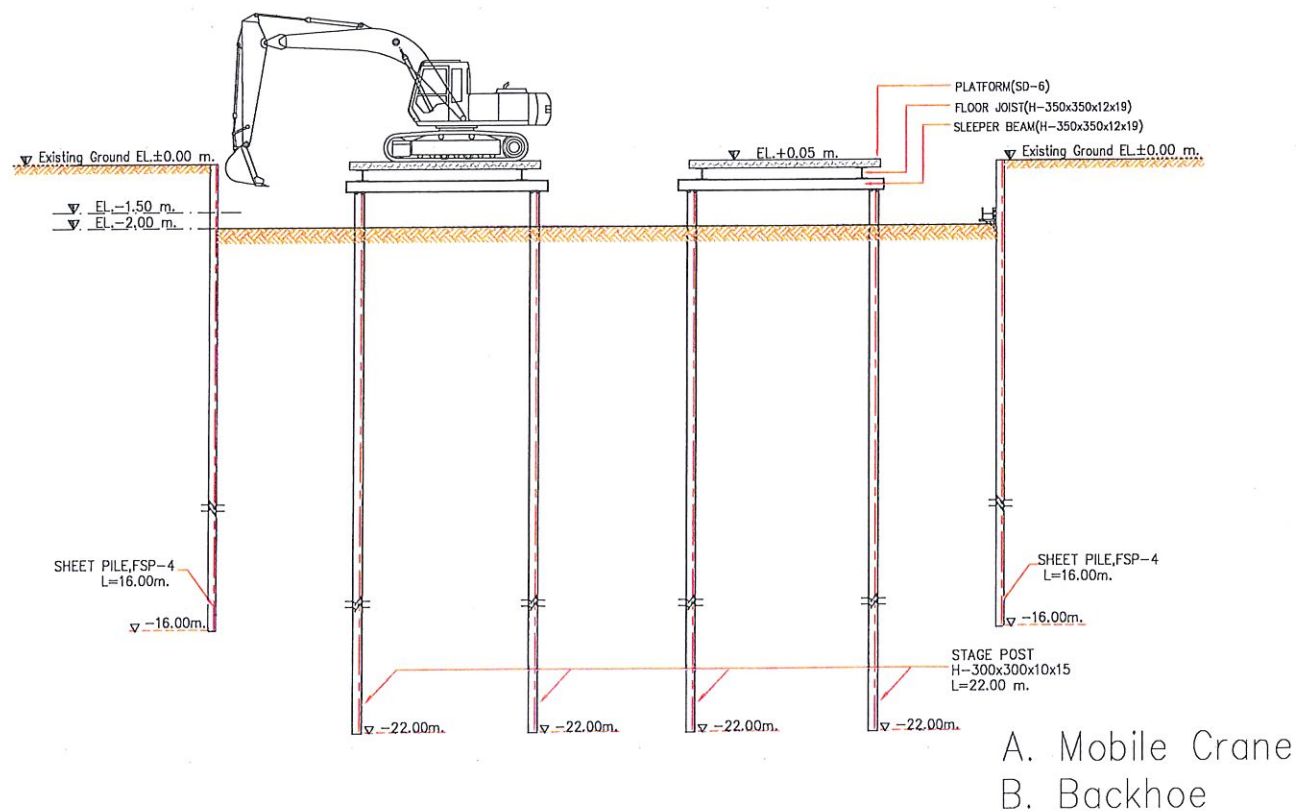
1. Driving Sheet Pile



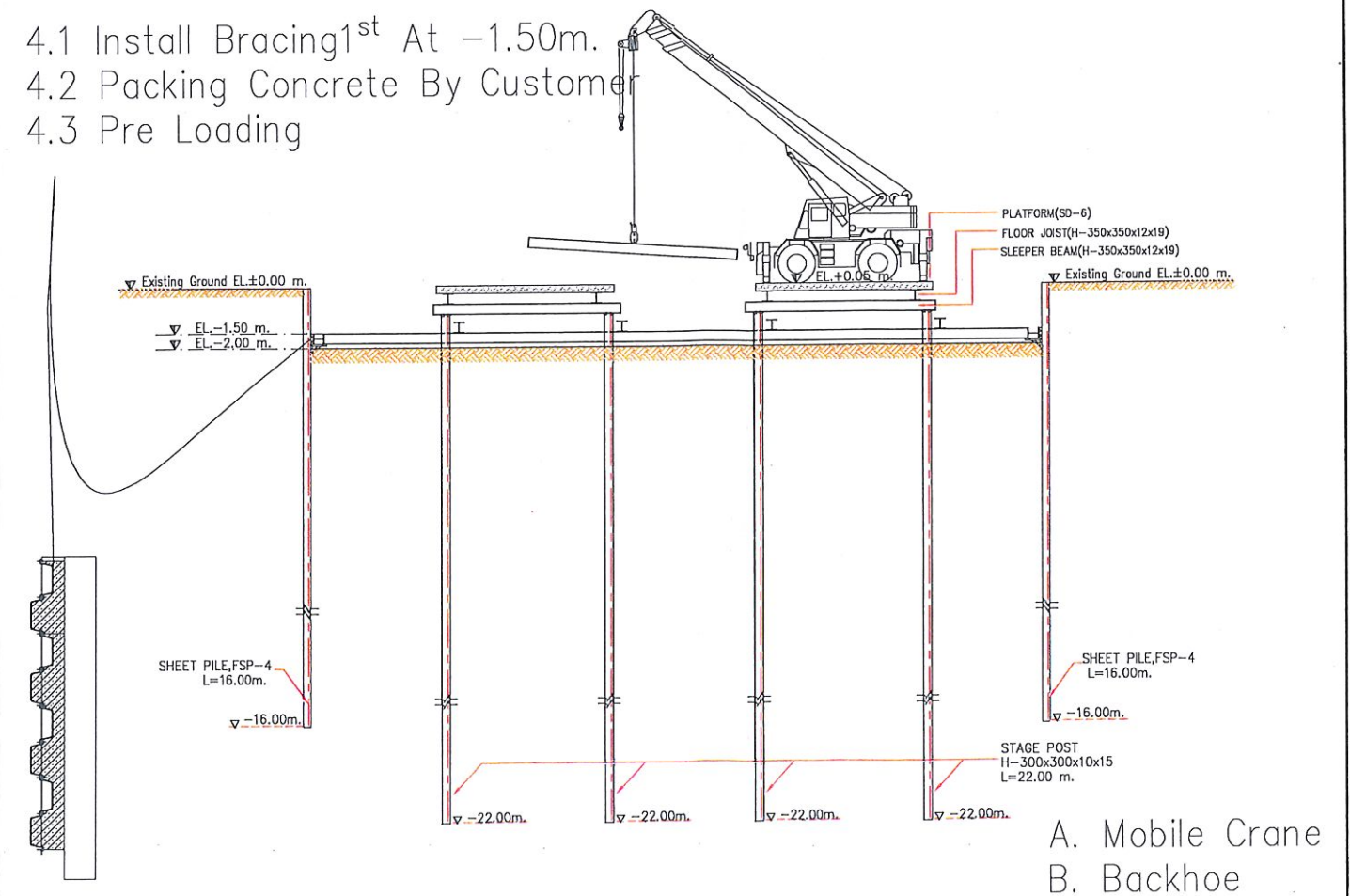
2. Driving King Post And Install Platform



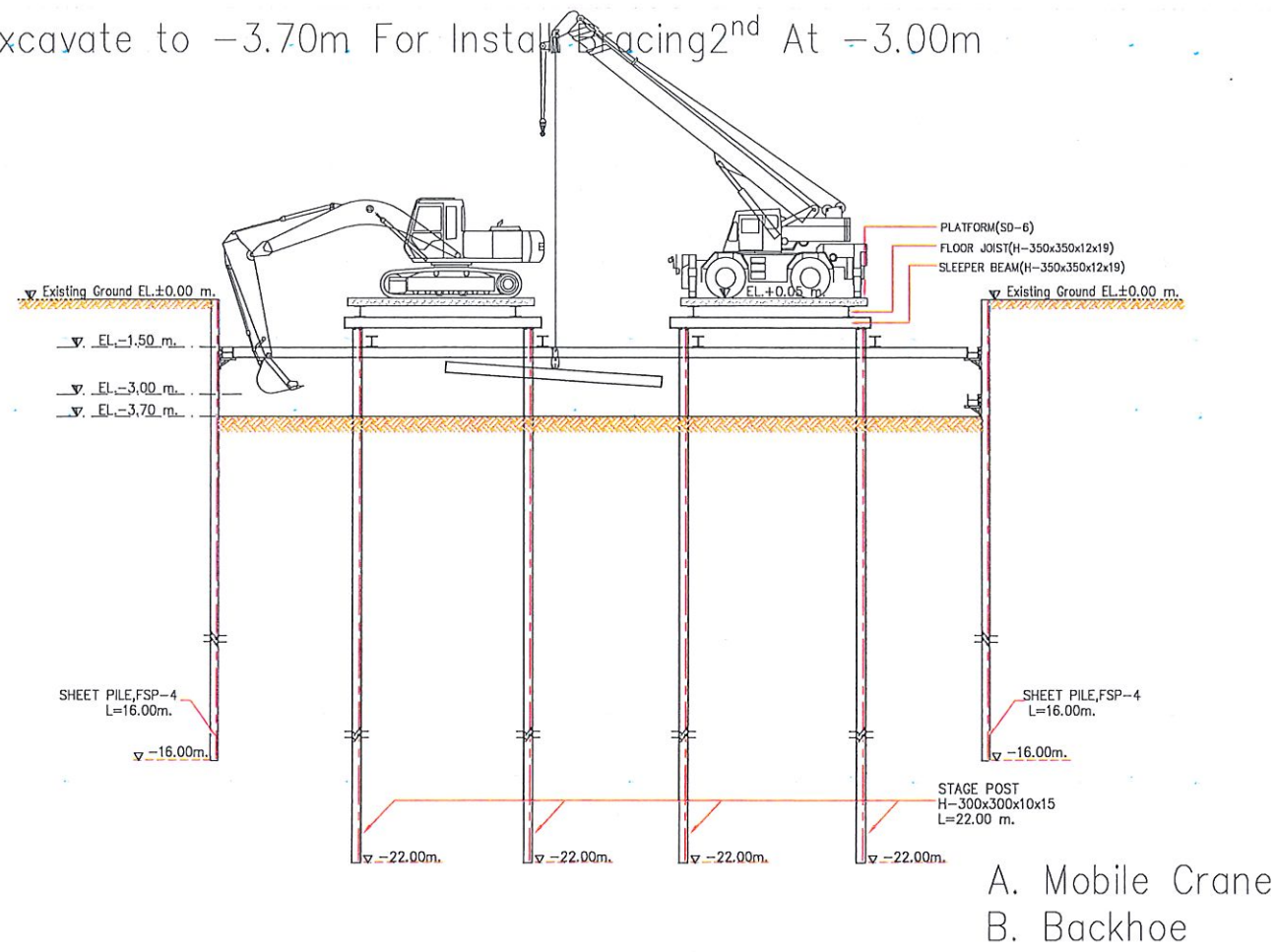
3. Excavate to -1.50m For Installation Platform And Install Bracing^{1st} At -2.00m



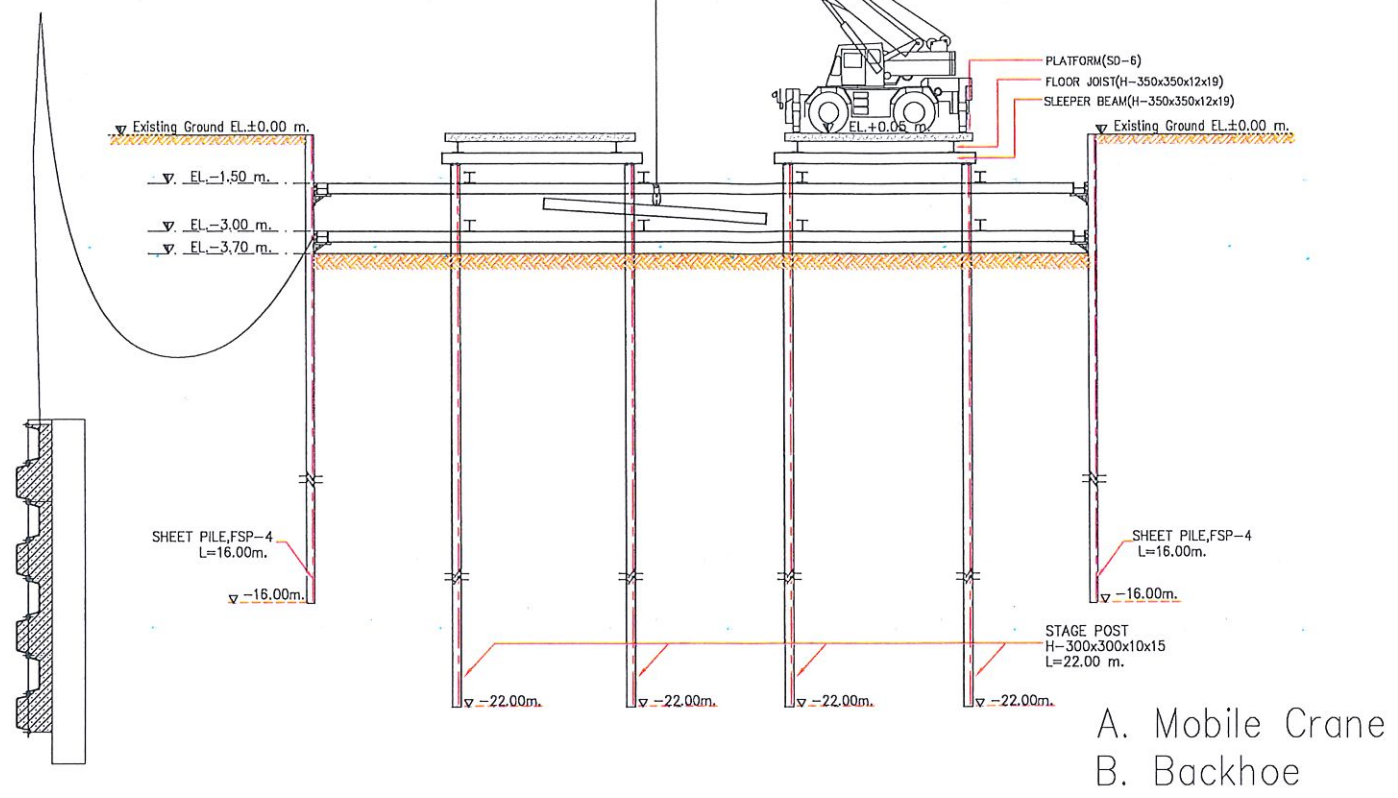
4.1 Install Bracing^{1st} At -1.50m. 4.2 Packing Concrete By Customer 4.3 Pre Loading



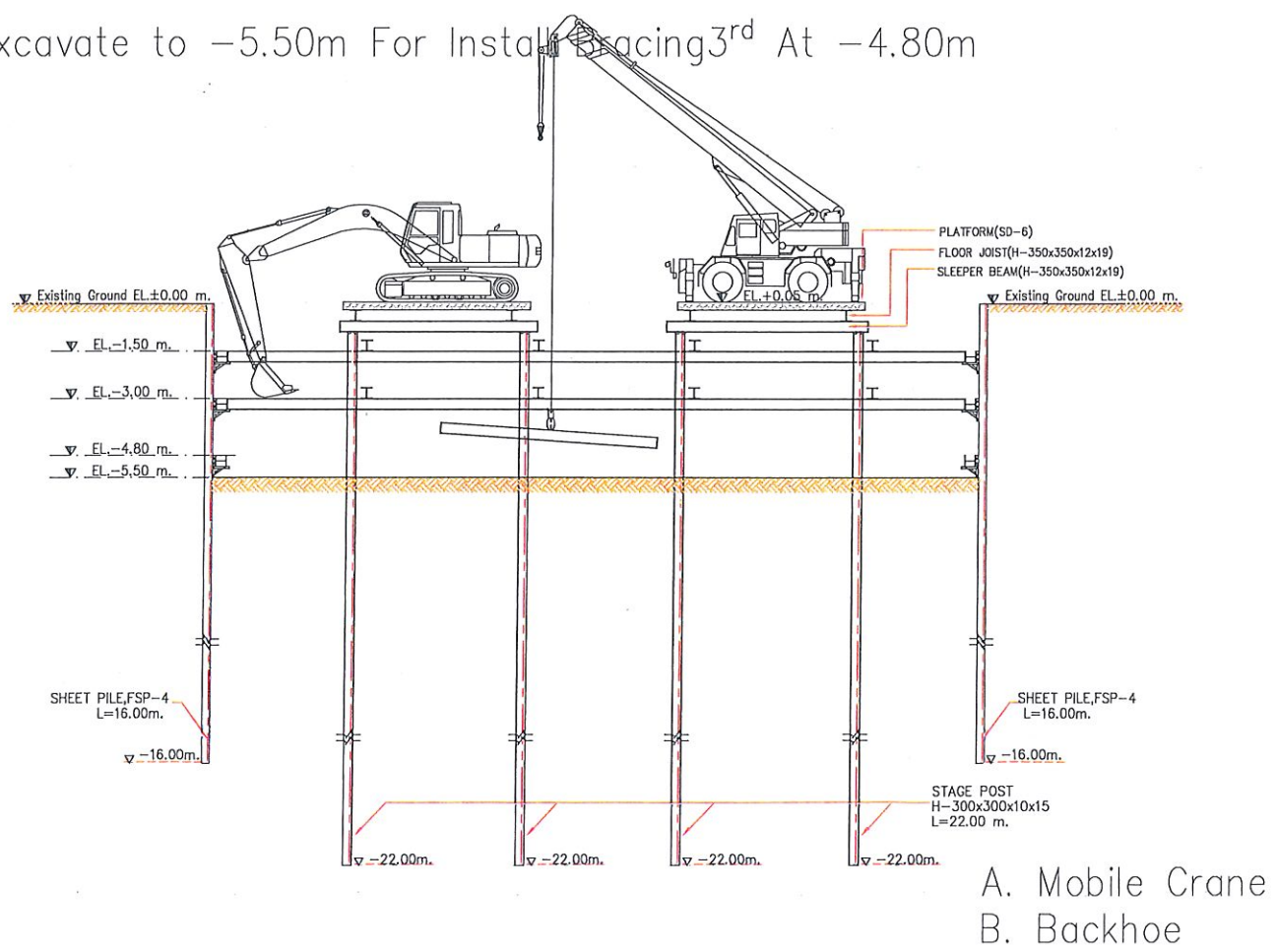
5. Excavate to -3.70m For Install Bracing^{2nd} At -3.00m



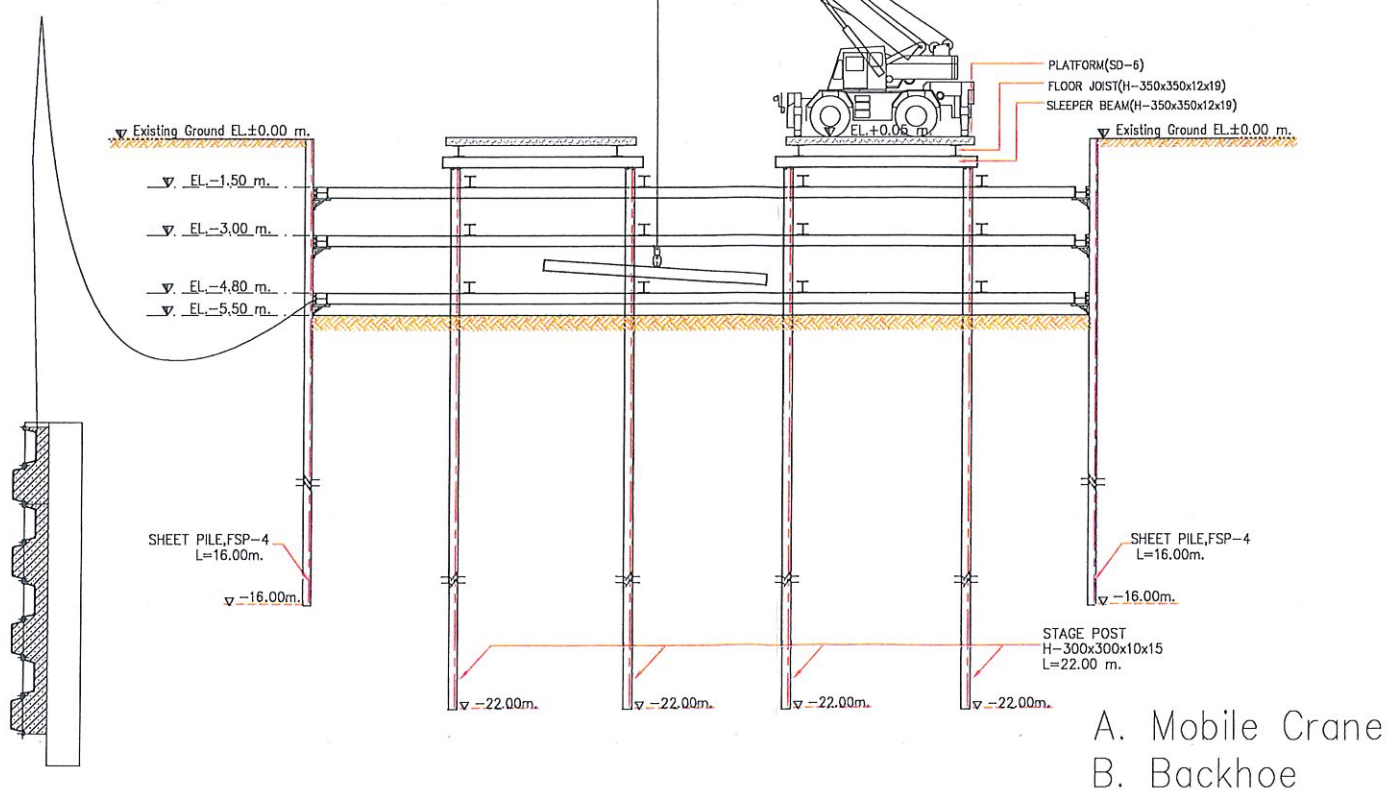
6.1 Install Bracing^{2nd} At -3.00m.
6.2 Packing Concrete By Customer
6.3 Pre Loading



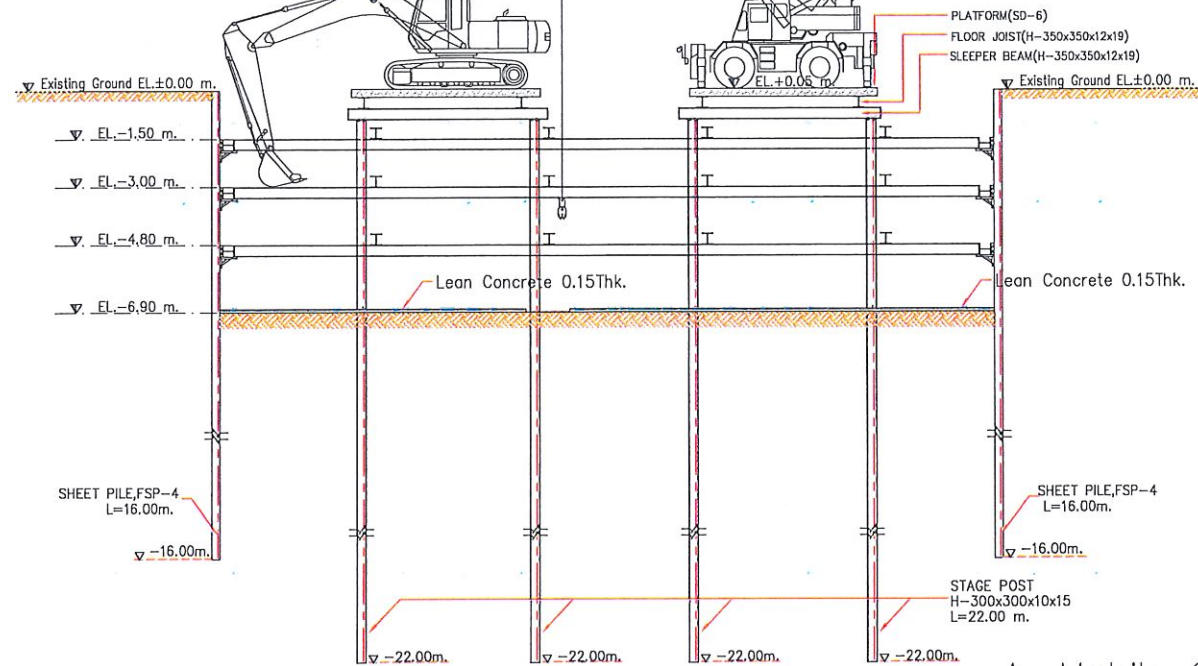
7. Excavate to -5.50m For Install Bracing^{3rd} At -4.80m



8.1 Install Bracing^{3rd} At -4.80m.
8.2 Packing Concrete By Customer
8.3 Pre Loading

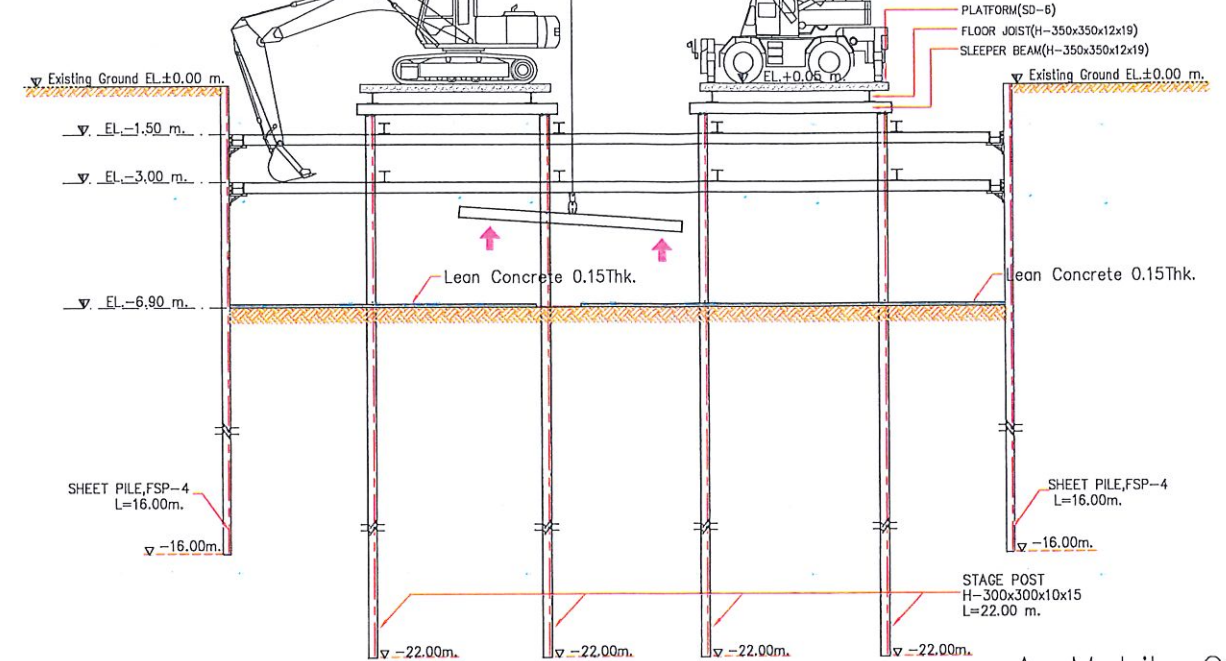


9. Final Excavate to -6.90m. For Making Footing
And Cast Lean Concrete Close Sheet pile immediate By Customer



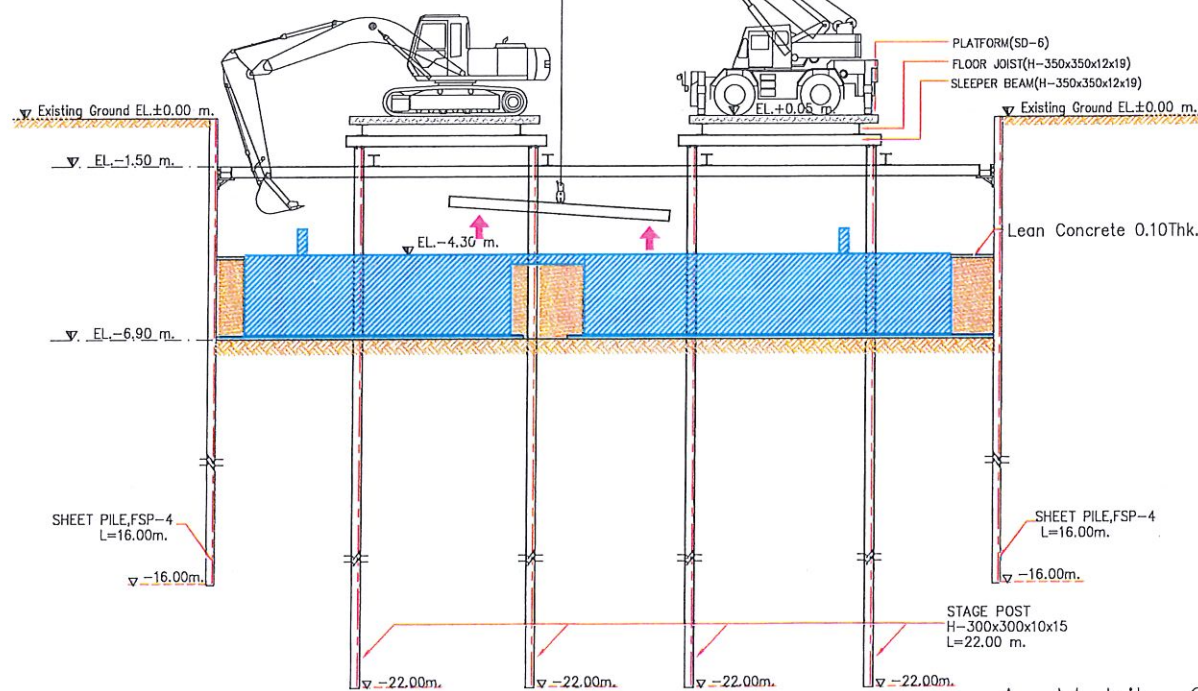
A. Mobile Crane
B. Backhoe

10.1 Making Lean Concrete For Footing At -6.90m
10.2 Backfill Sand And Cast Lean Concrete Close to Sheet Pile
10.3 Remove Bracing 3rd



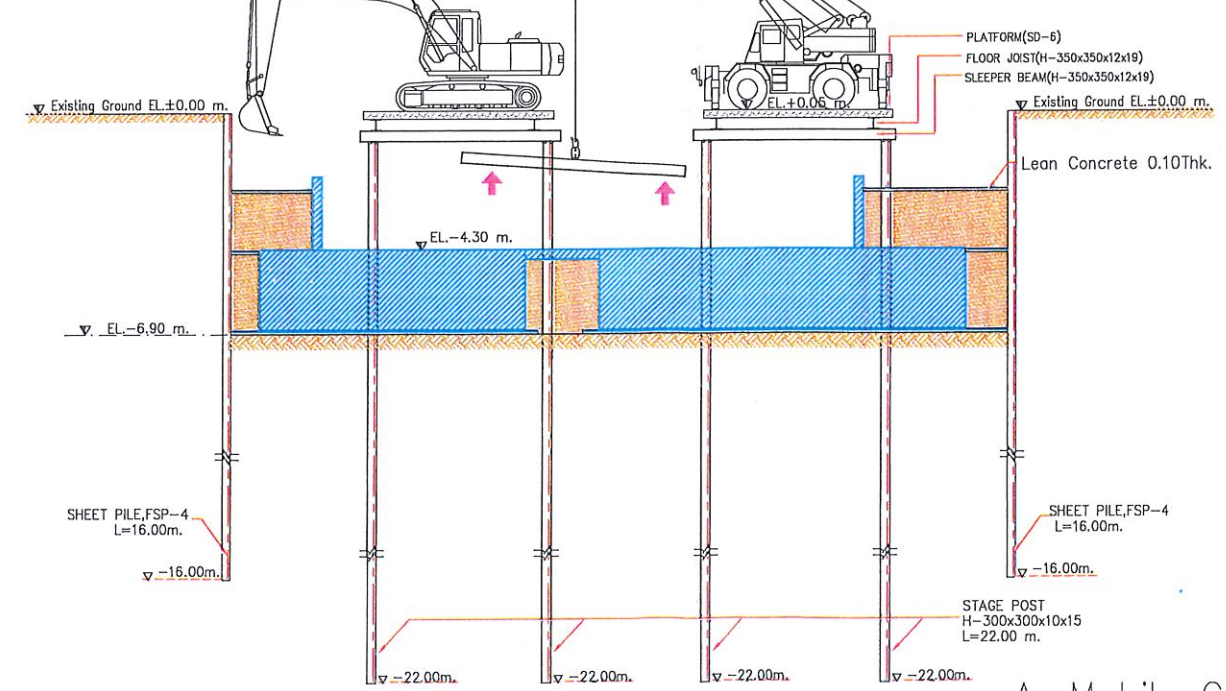
A. Mobile Crane
B. Backhoe

11.1 Making Footing And Slab At -4.30m
11.2 Backfill Sand And Cast Lean Concrete Close to Sheet Pile
11.3 Remove Bracing 2nd



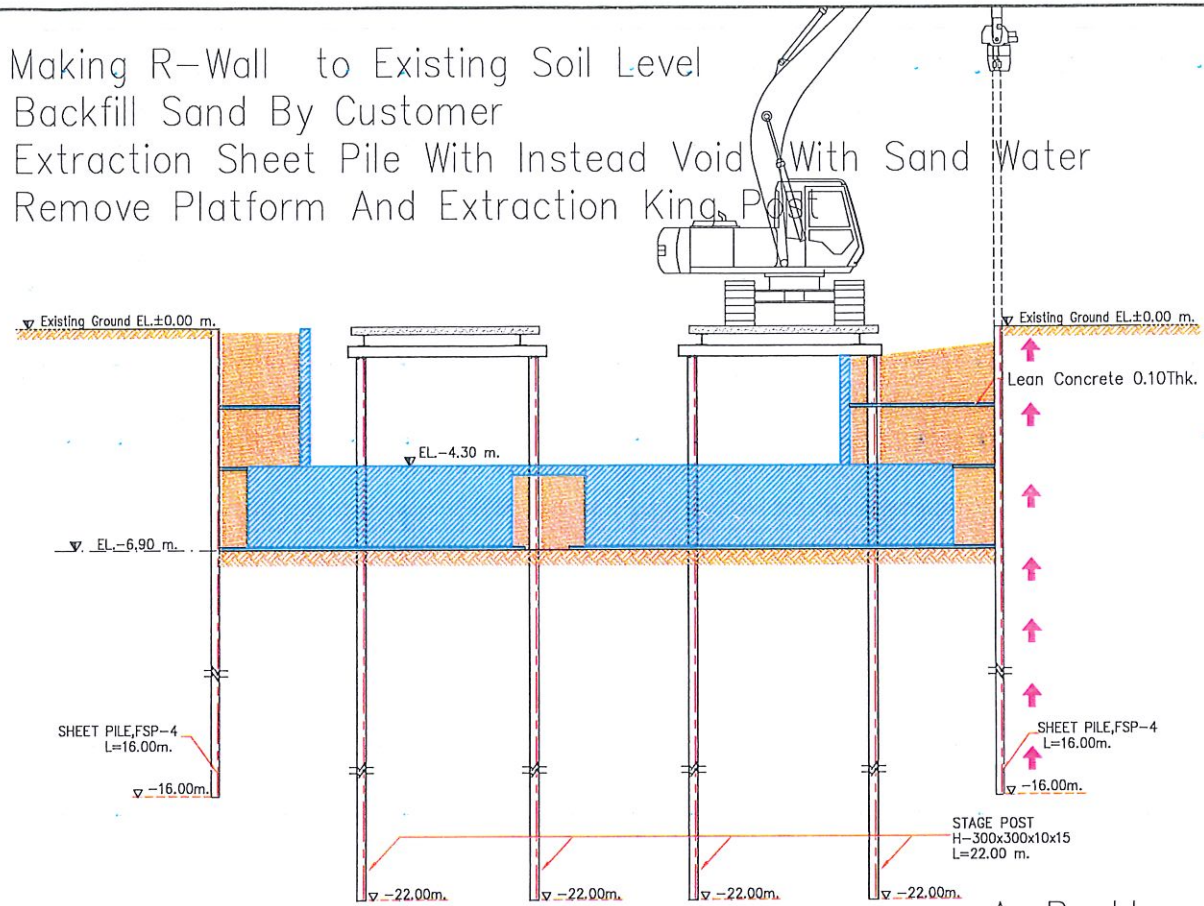
A. Mobile Crane
B. Backhoe

12.1 Making R-Wall At -2.00m
12.2 Backfill Sand And Cast Lean Concrete Close to Sheet Pile
12.3 Remove Bracing 1st

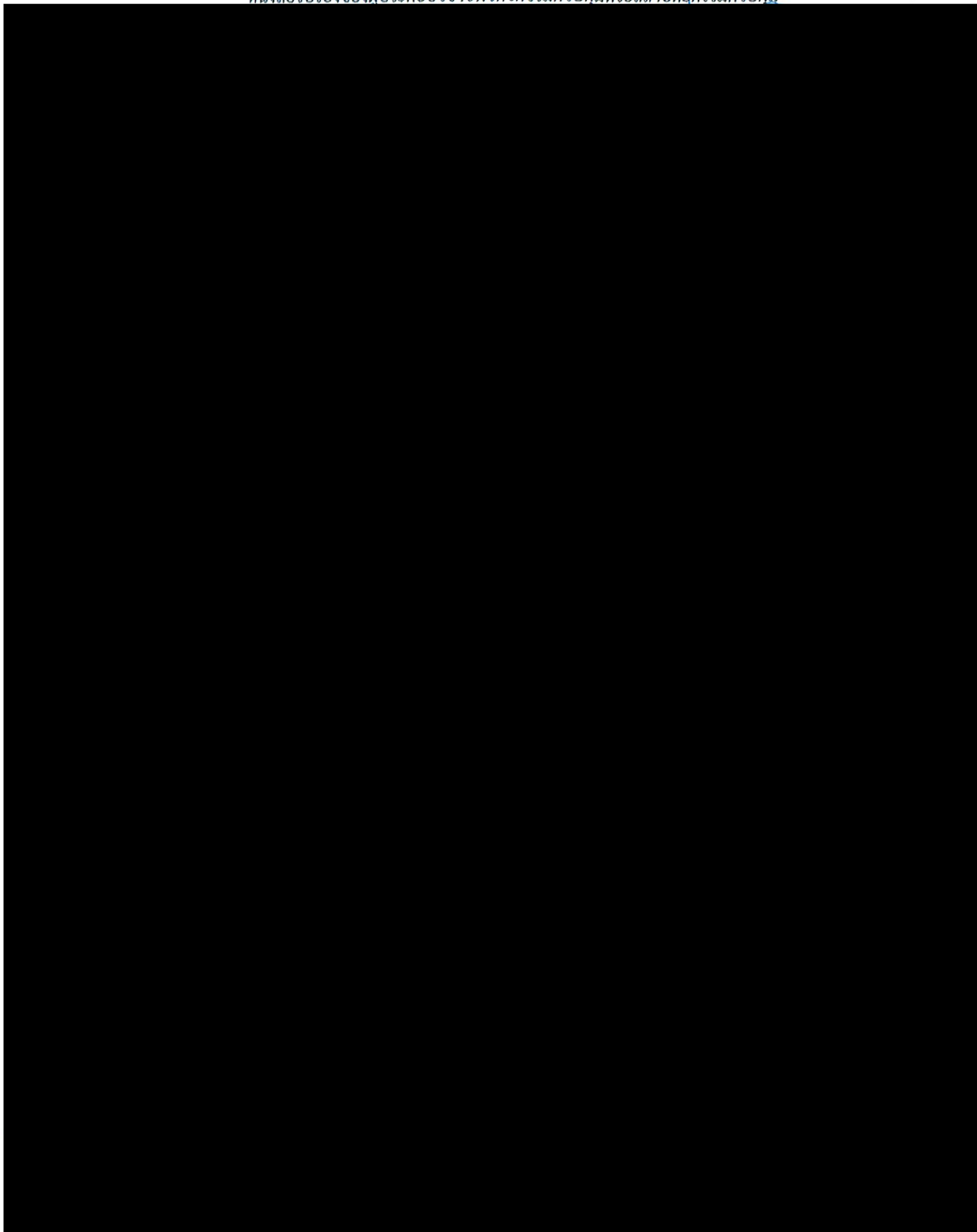


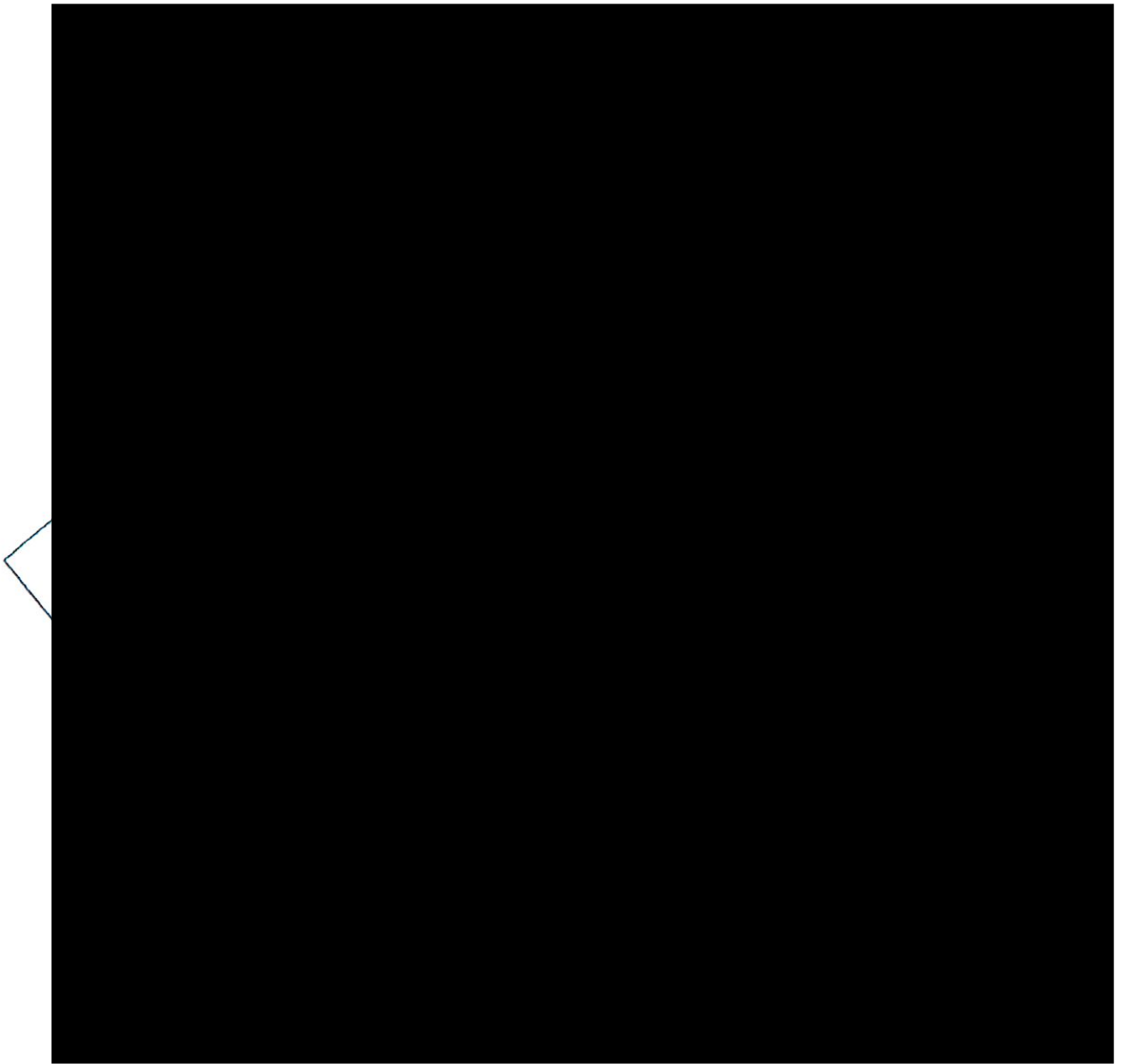
A. Mobile Crane
B. Backhoe

- 13.1 Making R-Wall to Existing Soil Level
- 13.2 Backfill Sand By Customer
- 13.3 Extraction Sheet Pile With Instead Void With Sand Water
- 13.4 Remove Platform And Extraction King Post



หนังสือรับรองของผู้ประกอบวิชาชีพวิศวกรรมควบคุมหรือสถาปัตยกรรมควบคุม

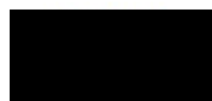


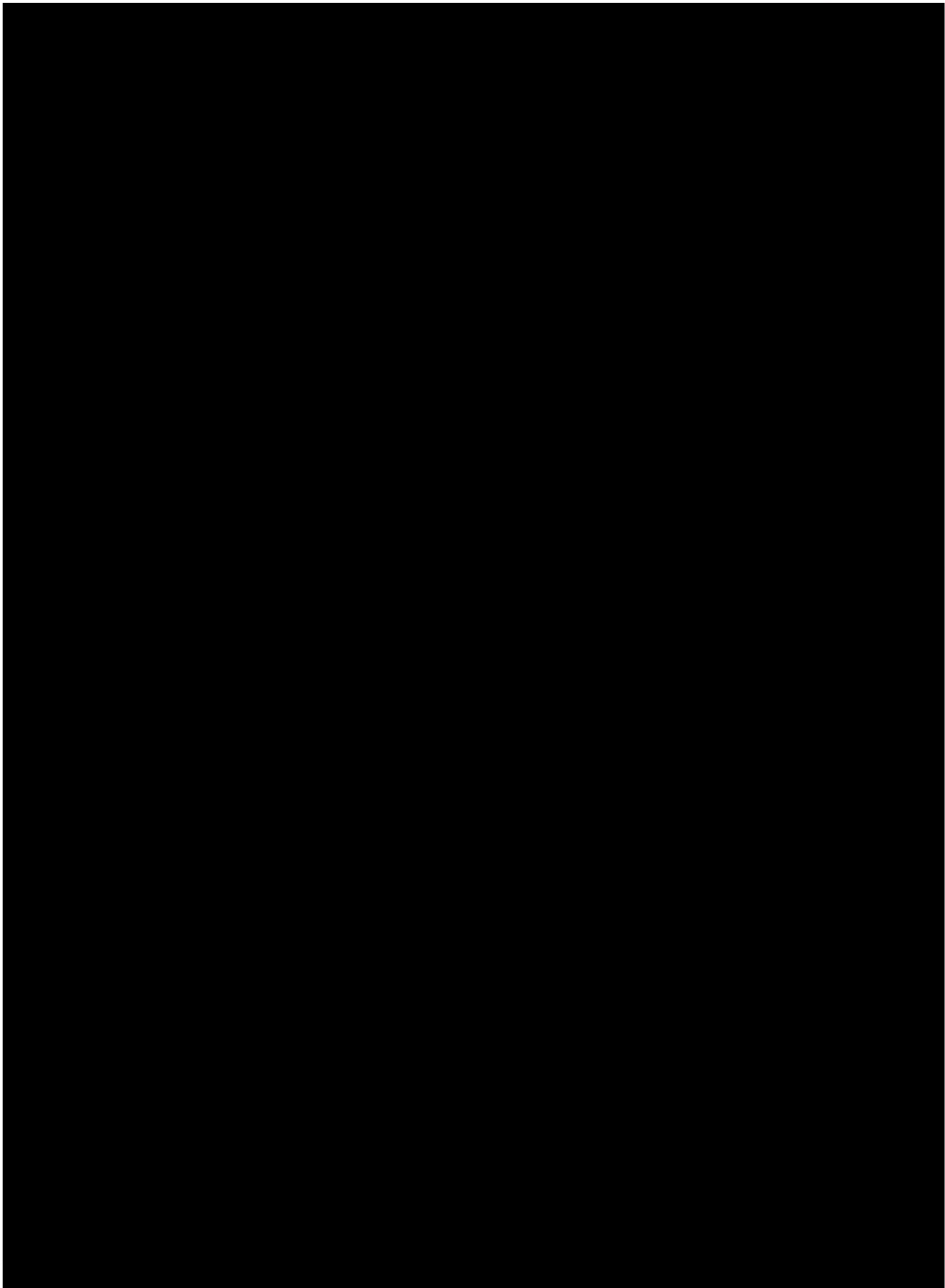


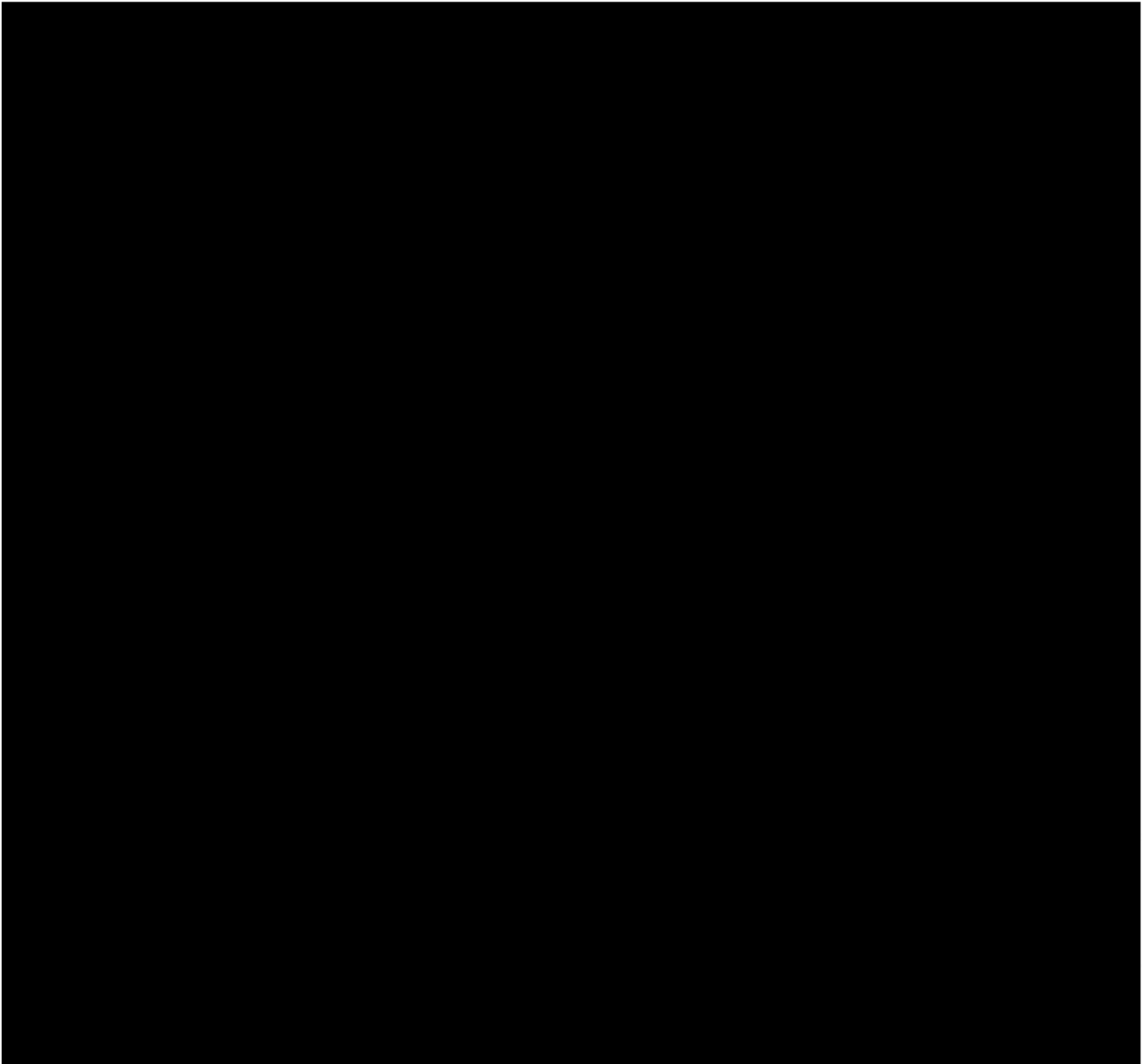
ตำนานถูกต้อง



(นายสุริย์ วัลย์)





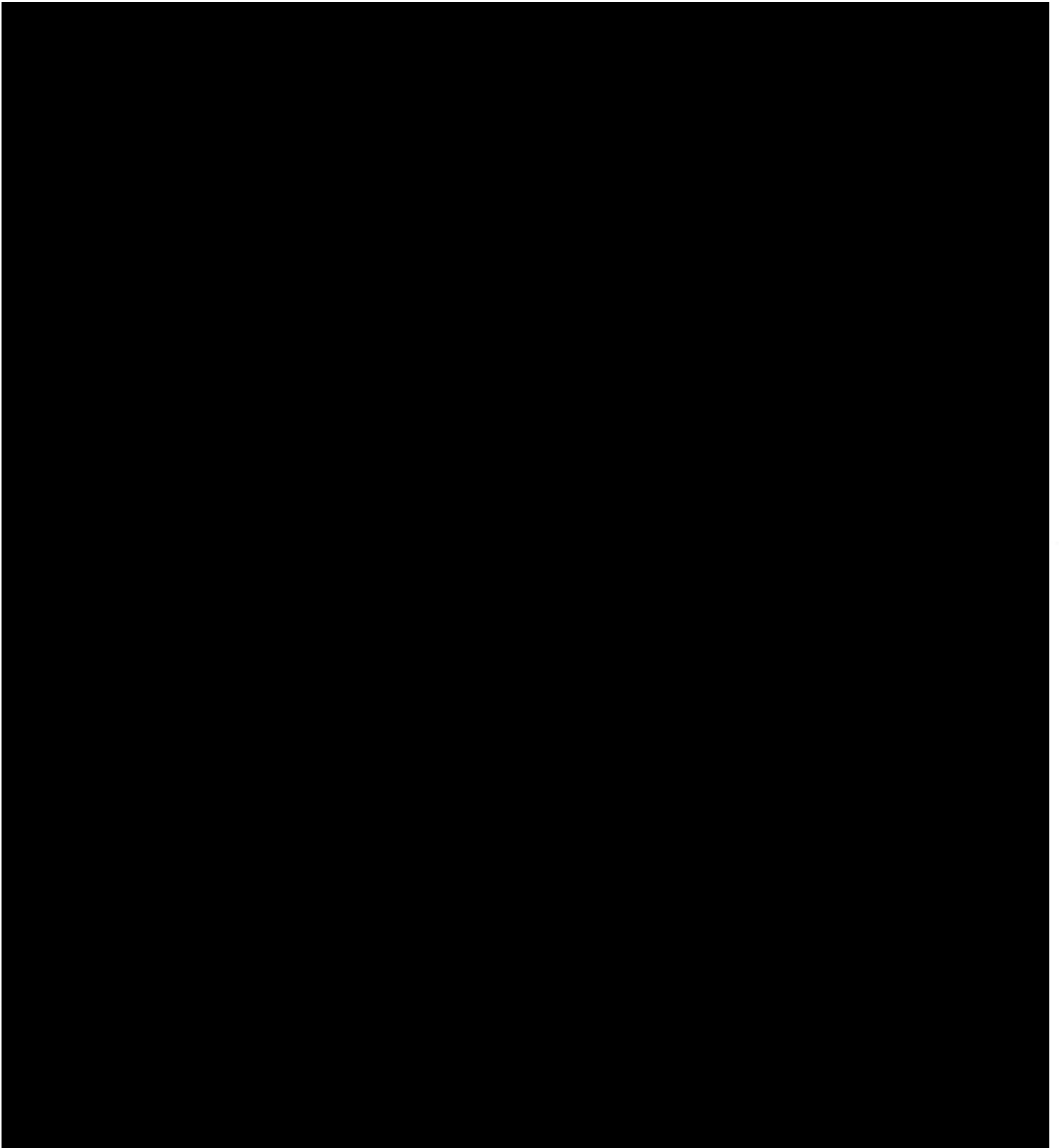


สำเนาถูกต้อง



(นายสุริย์ วิสัย)





(นายสุริย์ วิสัย)



CALCULATION SHEET

FOR

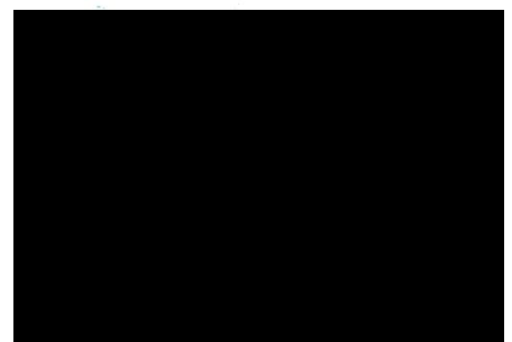
CHECKING OF TEMPORARY SHEET PILE SYSTEM

AT

CUSTOMER: วี.เค. การโยธา (2013) จำกัด

PROJECT: NA REVA CHAROENNAKHON

DATE: 28-เม.ย.-22

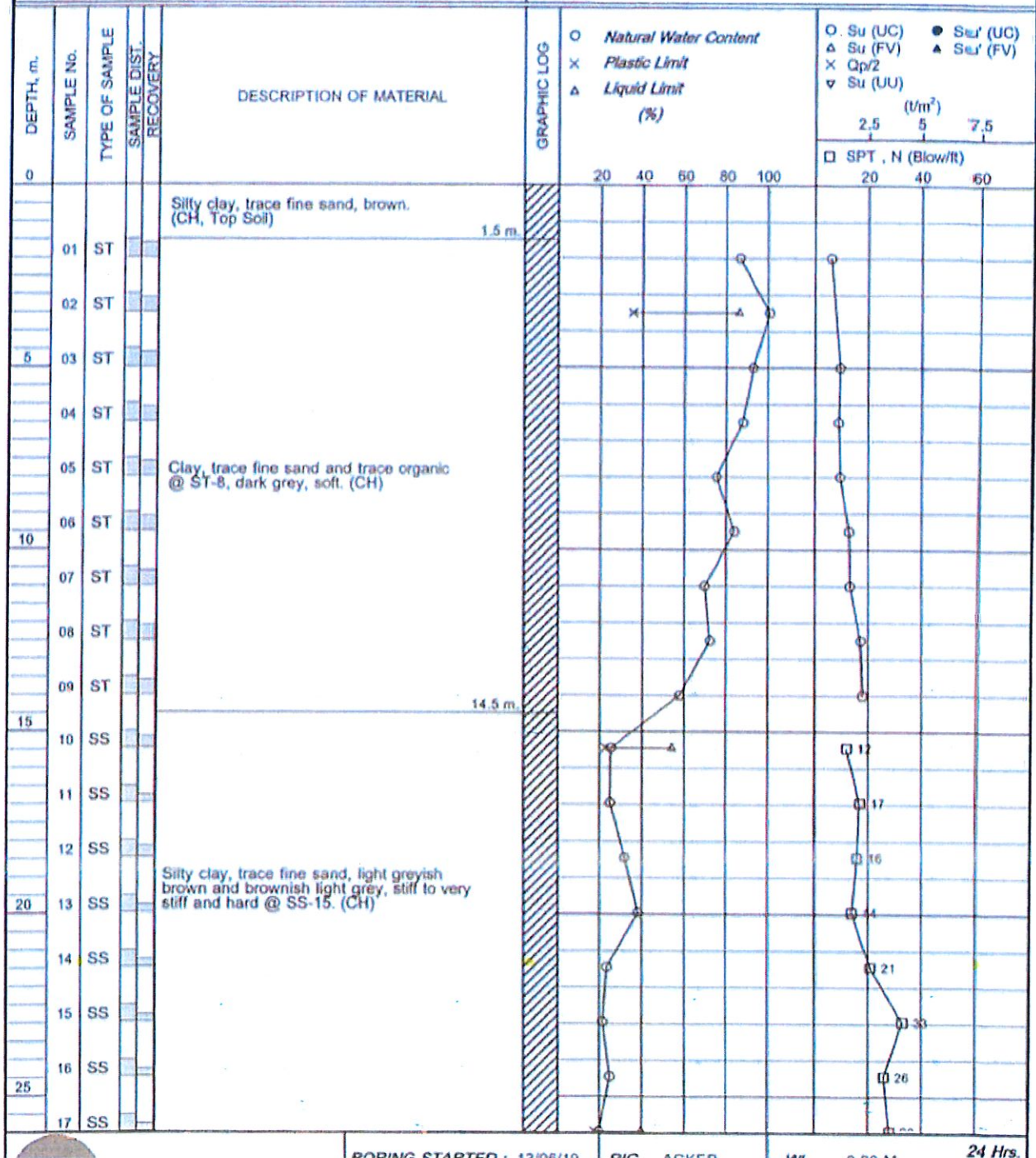


LOG OF BORING No. BH-2

PROJECT : คอนโดมีเนียม 29 ชั้น

LOCATION : ซอยเจริญนคร 58 เขตธนบุรี กรุงเทพมหานคร

CLIENT :



BORING STARTED : 12/05/10

BIC. ACKED

14H 0 30 11

24 Hrs.

PROJECT : NA REVA CHAREONNAKHON
 CUSTOMER : วิ.เค. การโยธา (2013) จำกัด
 LOCATION : CHAREONNAKHON
 DATE : 28-๓.๕.-22

BH2

Summary

F.S. = 2.39

Imaginary bearing point = 6.76 m under excavation level.

Check Length of Sheet pile = 16.00 m

SOIL CONDITION

Design Condition	Level (-m.)
Excavation Level	6.90
Water level	0.30
Lowest strut level	5.00
Existing level	0.00

Load on ground surface, t/m ²	2.00
Pile root depth, m	9.10

	Level (-m.)	Soil	Pp Coef.	Unit weight (t/m ³)		Angle	Cohesion C (t/m ²)	qu	N-Value
				Wet	Dry				
1st. layer	3.00	Soft Clay	1.00	1.60	0.60	0.00	0.7		0.00
2nd. layer	5.50	Soft Clay	1.00	1.55	0.55	0.00	0.9		0.00
3rd. layer	8.50	to medium	1.00	1.60	0.60	0.00	1.2		0.00
4th. layer	12.00	Medium Cla	1.00	1.70	0.70	0.00	1.6		0.00
5th. layer	14.50	silty clay	1.00	1.80	0.80	0.00	2.1		0.00
6th. layer	18.00	silty sand	1.00	2.00	1.00	33.44	5.0		17.00
7th. layer	25.00	silty sand	1.00	2.00	1.00	37.80	0.0		26.00

Su = Undrained Shear strength. = C

qu = Unconfined compressive test.

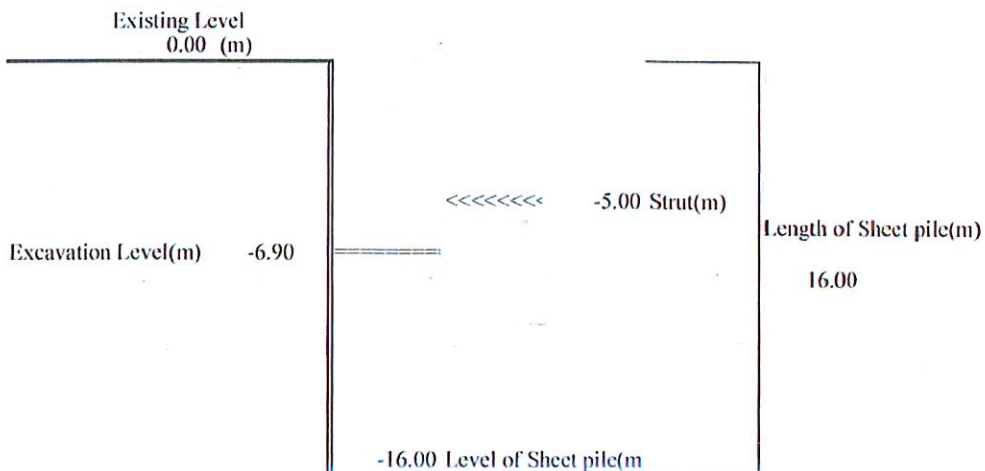
Soil Protection Wall Sheetpile

Pich (m.) 1.00

Width of Pile (m.) = 1.00

0 = SHEETPILE , 1 = H - 200 , 2 = H - 250 , 3 = H - 300 , 4 = H - 350 , 5 = H - 400

Select No 0.00



CHECKING OF BALANCE

Active earth pressure (Rankine & Resal)

	Level (-m.)	TAN 2	q+wh	2C.tan	Pa
Existing level	0.00	1.00	2.00	1.40	0.60
Water level	0.30	1.00	2.18	1.40	0.78
	0.30	1.00	2.18	1.40	0.78
1st. layer	3.00	1.00	3.80	1.40	2.40
	3.00	1.00	3.80	1.40	2.40
Lowest strut level	5.00	1.00	4.90	1.40	3.50
	5.00	1.00	4.90	1.80	3.10
2nd. layer	5.50	1.00	5.18	1.80	3.38
	5.50	1.00	5.18	1.80	3.38
Excavation depth	6.90	1.00	6.02	1.80	4.22
	6.90	1.00	6.02	2.30	3.72
3rd. layer	8.50	1.00	6.98	2.30	4.68
	8.50	1.00	6.98	3.20	3.78
4th. layer	12.00	1.00	9.43	3.20	6.23
	12.00	1.00	9.43	4.20	5.23
5th. layer	14.50	1.00	11.43	4.20	7.23
	14.50	0.29	11.43	5.38	-2.07
Balance Root Depth	16.00	0.29	12.93	5.38	-1.64
	16.00	0.29	12.93	5.38	-1.64
6th. layer	18.00	0.29	14.93	5.38	-1.06
	18.00	0.24	14.93	0.00	3.58
7th. layer	25.00	0.24	21.93	0.00	5.26
	25.00	1.00	21.93	0.00	21.93

Water pressure

Level (-m.)	Pw	Pw
0.00	0.00	0.00
0.30	0.00	0.00
3.00	2.70	2.70
5.00	4.70	4.70
5.50	5.20	5.20
6.90	6.60	6.60
8.50	8.20	5.44
12.00	11.70	2.90
14.50	14.20	1.09
16.00	15.70	0.00
0.00	0.00	0.00
0.00	0.00	0.00

Passive earth pressure (Rankine & Resal)

	Level (-m.)	TAN 2	wh	2C.tan	Pp
Existing level	0.00	1.00	0.00	0.00	0.00
Water level	0.30	1.00	0.00	0.00	0.00
	0.30	1.00	0.00	0.00	0.00
1st. layer	3.00	1.00	0.00	0.00	0.00
	3.00	1.00	0.00	0.00	0.00
Lowest strut level	5.00	1.00	0.00	0.00	0.00
	5.00	1.00	0.00	0.00	0.00
2nd. layer	5.50	1.00	0.00	0.00	0.00
	5.50	1.00	0.00	0.00	0.00
Excavation depth	6.90	1.00	0.00	1.80	1.80
	6.90	1.00	0.00	2.30	2.30
3rd. layer	8.50	1.00	0.96	2.30	3.26
	8.50	1.00	0.96	3.20	4.16
4th. layer	12.00	1.00	3.41	3.20	6.61
	12.00	1.00	3.41	4.20	7.61
5th. layer	14.50	1.00	5.41	4.20	9.61
	14.50	3.45	5.41	18.59	37.28
Balance Root Depth	16.00	3.45	6.91	18.59	42.46
	16.00	3.45	6.91	18.59	42.46
6th. layer	18.00	3.45	8.91	18.59	49.37
	18.00	4.17	8.91	0.00	37.13
7th. layer	25.00	4.17	15.91	0.00	66.30
	25.00	1.00	15.91	0.00	15.91

Balanced earth pressure

[illegible]

CHECKING OF HEAVING

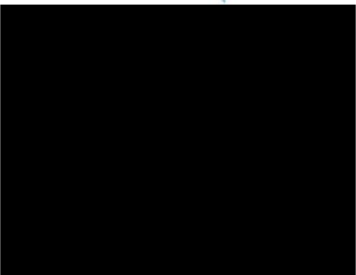
Tip level of sheet pile .	L =	16.00
Checking depth of sheet pile ,	Lo =	16.00
Radius .	X =	11.00
Load on ground surface (t/m ²)	q =	2.00

ROTARY MOMENT (Md)
(Outside pit)

	Level (-m.)	Soil	Unit Weight	Cohesion
	0.00			
Existing level	0.00		1.60	0.7
1st. layer	3.00	Soft Clay	1.60	0.7
Lowest strut level	5.00		1.55	0.9
2nd. layer	5.50	Soft Clay	1.55	0.9
Excavation depth	6.90		1.60	1.2
3rd. layer	8.50	Soft to med	1.60	1.2
4th. layer	12.00	Medium Cl	1.70	1.6
5th. layer	14.50	silty clay	1.80	2.1
Balance root depth	16.00		2.00	5.0
6th. layer	18.00	silty sand	2.00	5.0
7th. layer	25.00	silty sand	2.00	0.0
0.00				

H Outside pit	Unit Weight	w.H
3.00	1.60	4.80
2.00	1.55	3.10
0.50	1.55	0.78
1.40	1.60	2.24
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
Rotary moment (Md)		781.36

Balance L = 16.00 F.S. = 1.31



	Level (-m.)	Soil	Unit Weight	Cohesion
	0.00			
Existing level	0.00		1.60	0.7
1st. layer	3.00	Soft Clay	1.60	0.7
Lowest strut level	5.00		1.55	0.9
2nd. layer	5.50	Soft Clay	1.55	0.9
Excavation depth	6.90		1.60	1.2
3rd. layer	8.50	Soft to med	1.60	1.2
4th. layer	12.00	Medium Cl	1.70	1.6
5th. layer	14.50	silty clay	1.80	2.1
Balance root depth	16.00		2.00	5.0
6th. layer	0.00	silty sand	2.00	5.0
7th. layer	0.00	silty sand	2.00	0.0
0.00	0.00		0.00	0.00
0.00	0.00		0.00	0.00

RESISTING MOMENT (Mr)
(Outside pit)

H Outside pit	Radius	Radius	Mc
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
0.50	0.05	0.05	4.95
1.90	0.17	0.13	17.83
3.50	0.32	0.15	20.90
7.00	0.69	0.37	70.85
9.50	1.04	0.35	89.61
11.00	1.57	0.53	319.66
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
Resisting Moment (Mr) (Outside pit)			523.80

RESISTING MOMENT (Mr)
(Inside pit)

	Level (-m.)	Soil	Unit Weight	Cohesion
	0.00			
Existing level	0.00		1.60	0.7
1st. layer	0.00	Soft Clay	1.60	0.7
Lowest strut level	0.00		1.55	0.9
2nd. layer	0.00	Soft Clay	1.55	0.9
Excavation depth	6.90		1.60	1.2
3rd. layer	8.50	Soft to med	1.60	1.2
4th. layer	12.00	Medium Cl	1.70	1.6
5th. layer	14.50	silty clay	1.80	2.1
Balance root depth	16.00		2.00	5.0
6th. layer	0.00	silty sand	2.00	5.0
7th. layer	0.00	silty sand	2.00	0.0
0.00	0.00		0.00	0.00
0.00	0.00		0.00	0.00

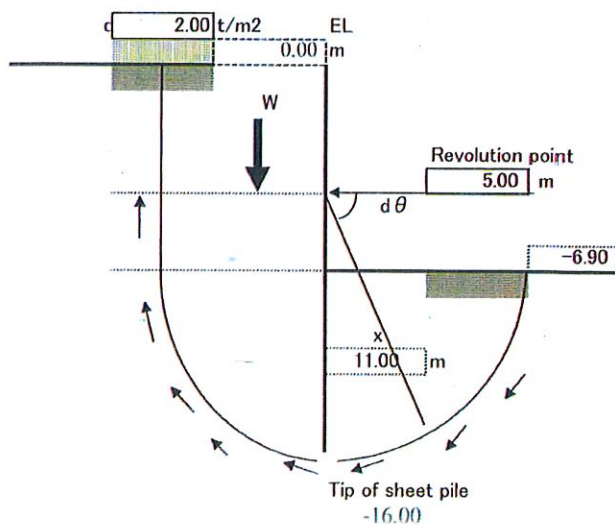
H Inside pit	Radius	Radius	Md
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
1.90	0.17	0.00	0.00
3.50	0.32	0.15	20.90
7.00	0.69	0.37	70.85
9.50	1.04	0.35	89.61
11.00	1.57	0.53	319.66
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
Resisting Moment (Mr) (Inside pit)			501.02

$$F.S. = \frac{Mr \text{ (Outside) } + Mr \text{ (Inside) }}{Md \text{ (Outside) }} = 1.31$$

$$\# \text{ Level of Sheetpile (-m) } = 16.00 \text{ m.}$$

$$\# \text{ Existing ground level (-m) } = 0.00 \text{ m}$$

$$\# \text{ Length of sheet pile to be used } = 16.00 \text{ m}$$



Maximum Bending Moment for Final Excavation

Excavation depth (-m)	-m.	6.90
Lowest strut level (-m)		5.00
Existing level (-m)		0.00
Type of Sheetpile (FSP - 3 , FSP - 4)	FSP -	4
Diminishing of Moment of Inertia	%	20.00
Load on ground surface	t / m ²	2.00
Soil Unit Weight	t / m ³	1.65
Side Pressure Co - Efficient	K =	0.65
Distance Between Lowest Strut and Imaginary Bearing Point		8.66
Side Pressure at Lowest Strut (Ground Level)	P1 =	6.66
Side Pressure at Excavation Depth	P2 =	8.70
Distance Between Lowest Strut and Excavation Depth	H =	1.90

X	Bo	Co	R (A)	R (B)	Xo	Mmax
0.000	8.700	1.900	12.923	1.671	1.706	11.464

Deflection of Maximum Bending Moment Point , cm.

1.38

1.8% of excavation depth.

<

4.75

0.7%

-OK-

Accumulated Deflection , cm.

8.18

12.42

1.2%

-OK-

< Stress check >

$$\sigma_{\max} = M_{\max} / Z_x$$

$$Z_x = 2.270$$

After Diminishing

$$1.816$$

cm³/m

$$M_{\max} = 11.464$$

t/m

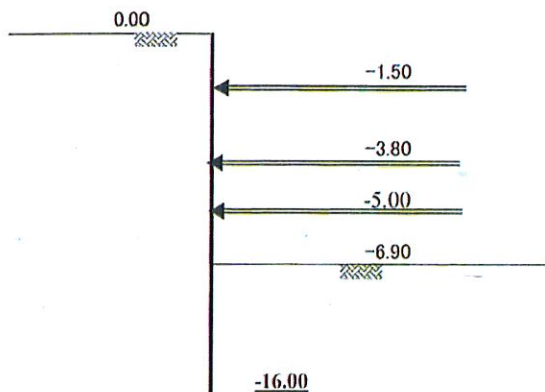
lb

$$\sigma_{\max} = 631 \text{ kgf/cm}^2$$

$$\leq 2,250$$

$$\text{kgf/cm}^2$$

--OK--



CHECKING OF SELF-STANDING METHOD (Y.L.Chang)

Maximum Excavation Depth (m)	H =	2.00	m
Load on the Ground Surface (t/m)	q =	2.00	t/m ²
Side Pressure Co-efficient	k =	0.65	
Unit Weight (t/m ³)	W =	1.65	t/m ³
Co-efficient of Sub-grade Reaction (kg/cm ³)	Kh =	1.00	kg/cm ³
Extra Co-efficient	n =	1.00	
Sheetpile (FSP - 3 , FSP - 4)	FSP =	4	
Pich (Pile)	@ =	1.00	m
Width (Pile)	B =	1.00	m
Moment of Inertia (Pile)	I =	38600.00	cm ⁴
Diminishing of Moment of Inertia		20	%

Earth Pressure	(L = 1 , 2 , 3)	3	
p1 =	1.30	t/m	
p2 =	3.45	t/m	
P =	4.75	t	
h =	0.85	m	
Pile Root Depth	(P1 / B) =	7.09	m
Total Length of Pile		9.09	m

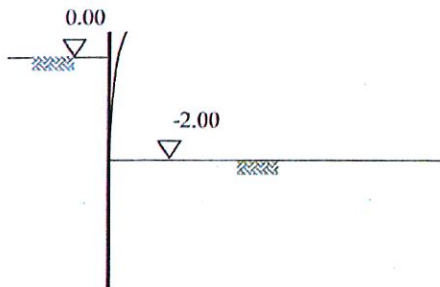
Specific Characteristic of Pile $\beta = \sqrt[3]{(kh * B) / (4 * E * I_x)}$
 $\beta = 0.0044311$ cm-l

Deflection of Pile Head 1.5% of Excavation Depth
D = 1.28 cm < 3.00 cm -OK-

Maximum Bending Moment Under the ground
Mmax = 6.43 t-m

< Stress check >

$\sigma_{max} = M_{max} / Z_x$	$Z_x =$	2,270	After Diminishing	1,816	cm ³ /m
	$M_{max} =$	6.433	t/m		
			fb		
$\sigma_{max} =$	354	kgf/cm ²	\leq	2,250	kgf/cm ² --OK--



PROJECT : NA REVA CHAROENNAKHON
 CUSTOMER : จี.เค. การโยธา (2013) จำกัด
 LOCATION : CHAREONNAKHON
 DATE : 28-๓.๓.-22

BH2

Summary

F.S. = 2.52

Imaginary bearing point = 7.82 m under excavation level.

Check Length of Sheet pile = 16.00 m

SOIL CONDITION

Design Condition	Level (-m.)
Excavation Level	5.50
Water level	0.30
Lowest strut level	3.00
Existing level	0.00
Load on ground surface, t / m ²	2.00
Pile root depth, m	10.50

	Level (-m.)	Soil	Pp Coef.	Unit weight (t/m ³)		Angle	Cohesion C (t/m ²)	qu	N-Value
				Wet	Dry				
1st. layer	3.00	Soft Clay	1.00	1.60	0.60	0.00	0.7		0.00
2nd. layer	5.50	Soft Clay	1.00	1.55	0.55	0.00	0.9		0.00
3rd. layer	8.50	to medium	1.00	1.60	0.60	0.00	1.2		0.00
4th. layer	12.00	Medium Cla	1.00	1.70	0.70	0.00	1.6		0.00
5th. layer	14.50	silty clay	1.00	1.80	0.80	0.00	2.1		0.00
6th. layer	18.00	silty sand	1.00	2.00	1.00	33.44	5.0		17.00
7th. layer	25.00	silty sand	1.00	2.00	1.00	37.80	0.0		26.00

Su = Undrained Shear strength. = C

qu = Unconfined compressive test.

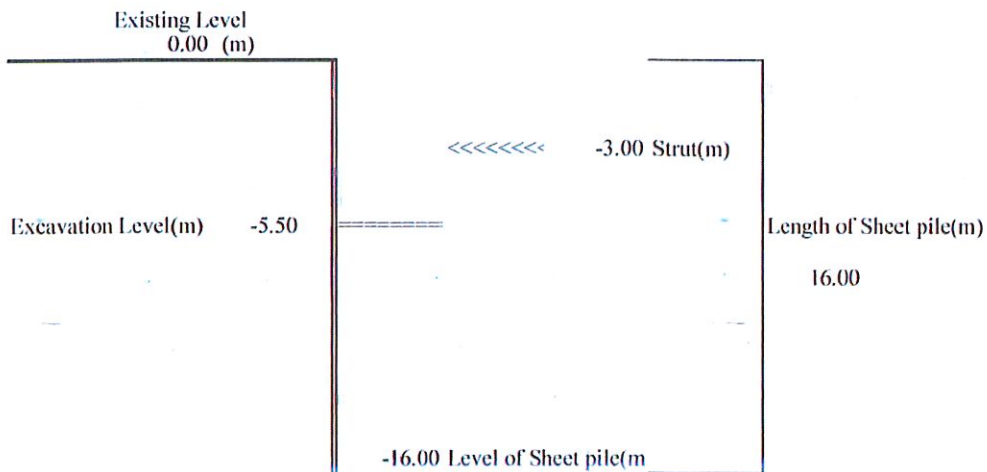
Soil Protection Wall Sheetpile

Pich (m.) 1.00

Width of Pile (m.) : 1.00

0 = SHEETPILE , 1 = H - 200 , 2 = H - 250 , 3 = H - 300 , 4 = H - 350 , 5 = H - 400

Select No 0.00



CHECKING OF BALANCE

Active earth pressure (Rankine & Resal)

	Level (-m.)	TAN 2	q+wh	2C.tan	Pa
Existing level	0.00	1.00	2.00	1.40	0.60
Water level	0.30	1.00	2.18	1.40	0.78
	0.30	1.00	2.18	1.40	0.78
1st. layer	3.00	1.00	3.80	1.40	2.40
	3.00	1.00	3.80	1.40	2.40
Lowest strut level	3.00	1.00	3.80	1.40	2.40
	3.00	1.00	3.80	1.80	2.00
2nd. layer	5.50	1.00	5.18	1.80	3.38
	5.50	1.00	5.18	1.80	3.38
Excavation depth	5.50	1.00	5.18	1.80	3.38
	5.50	1.00	5.18	2.30	2.88
3rd. layer	8.50	1.00	6.98	2.30	4.68
	8.50	1.00	6.98	3.20	3.78
4th. layer	12.00	1.00	9.43	3.20	6.23
	12.00	1.00	9.43	4.20	5.23
5th. layer	14.50	1.00	11.43	4.20	7.23
	14.50	0.29	11.43	5.38	-2.07
Balance Root Depth	16.00	0.29	12.93	5.38	-1.64
	16.00	0.29	12.93	5.38	-1.64
6th. layer	18.00	0.29	14.93	5.38	-1.06
	18.00	0.24	14.93	0.00	3.58
7th. layer	25.00	0.24	21.93	0.00	5.26
	25.00	1.00	21.93	0.00	21.93

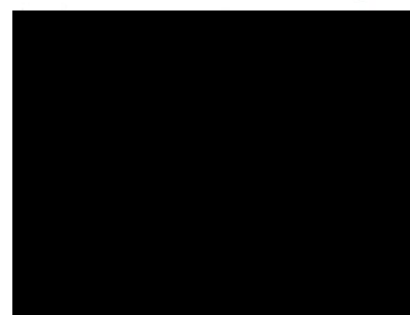
Water pressure

Level (-m.)	Pw	Pw
0.00	0.00	0.00
0.30	0.00	0.00
3.00	2.70	2.70
3.00	2.70	2.70
5.50	5.20	5.20
5.50	5.20	5.20
8.50	8.20	3.71
12.00	11.70	1.98
14.50	14.20	0.74
16.00	15.70	0.00
0.00	0.00	0.00
0.00	0.00	0.00

Passive earth pressure (Rankine & Resal)

	Level (-m.)	TAN 2	wh	2C.tan	Pp
Existing level	0.00	1.00	0.00	0.00	0.00
Water level	0.30	1.00	0.00	0.00	0.00
	0.30	1.00	0.00	0.00	0.00
1st. layer	3.00	1.00	0.00	0.00	0.00
	3.00	1.00	0.00	0.00	0.00
Lowest strut level	3.00	1.00	0.00	0.00	0.00
	3.00	1.00	0.00	0.00	0.00
2nd. layer	5.50	1.00	0.00	1.80	1.80
	5.50	1.00	0.00	1.80	1.80
Excavation depth	5.50	1.00	0.00	1.80	1.80
	5.50	1.00	0.00	2.30	2.30
3rd. layer	8.50	1.00	1.80	2.30	4.10
	8.50	1.00	1.80	3.20	5.00
4th. layer	12.00	1.00	4.25	3.20	7.45
	12.00	1.00	4.25	4.20	8.45
5th. layer	14.50	1.00	6.25	4.20	10.45
	14.50	3.45	6.25	18.59	40.18
Balance Root Depth	16.00	3.45	7.75	18.59	45.36
	16.00	3.45	7.75	18.59	45.36
6th. layer	18.00	3.45	9.75	18.59	52.27
	18.00	4.17	9.75	0.00	40.63
7th. layer	25.00	4.17	16.75	0.00	69.80
	25.00	1.00	16.75	0.00	16.75

Balanced earth pressure

[illegible]

	Level (-m.)	Rotary moment (Mw)			
		Width	Hight	M.arm	Moment
Water Level	0.30				
Lowest Strut Level	3.00	2.70	2.50	0.83	2.81
Final excavation	5.50	5.20	2.50	1.67	10.83
	5.50	5.20	10.50	6.00	163.80
Balance root depth	16.00	0.00	0.00		
Sum of Mw.					177.45

$$F.S. = \frac{M_p}{M_a + M_w}$$

$$F.S. = 2.52$$

Length of Sheetpile (Balance) = 16.00 m.

	Level (-m.)	Risisting moment (Mp)				
		Width	Hight	M.arm	Area	Moment
Existing level	0.00	0.00	0.00	0.00	0.00	0.00
Water level	0.30	0.00	0.00	0.00	0.00	0.00
	0.30	0.00	0.00	0.00	0.00	0.00
1st. layer	3.00	0.00	0.00	0.00	0.00	0.00
	3.00	0.00	0.00	0.00	0.00	0.00
Lowest strut level	3.00	0.00	0.00	0.00	0.00	0.00
	3.00	0.00	0.00	0.00	0.00	0.00
2nd. layer	5.50	1.80	0.00	0.00	0.00	0.00
	5.50	1.80	0.00	0.00	0.00	0.00
Excavation depth	5.50	1.80	0.00	0.00	0.00	0.00
	5.50	2.30	3.00	1.00	3.45	3.45
3rd. layer	8.50	4.10	3.00	2.00	6.15	12.30
	8.50	5.00	3.50	4.17	8.75	36.46
4th. layer	12.00	7.45	3.50	5.33	13.04	69.53
	12.00	8.45	2.50	7.33	10.56	77.46
5th. layer	14.50	10.45	2.50	8.17	13.06	106.68
	14.50	40.18	1.50	9.50	30.13	286.28
Balance Root Depth	16.00	45.36	1.50	10.00	34.02	340.22
	16.00	45.36	0.00	0.00	0.00	0.00
6th. layer	18.00	52.27	0.00	0.00	0.00	0.00
	18.00	40.63	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
					119.17	932.38

Imaginary bearing point	7.82
-------------------------	------

$$F.S. = 2.52 > 1.20 \quad \text{-OK-}$$

CHECKING OF HEAVING

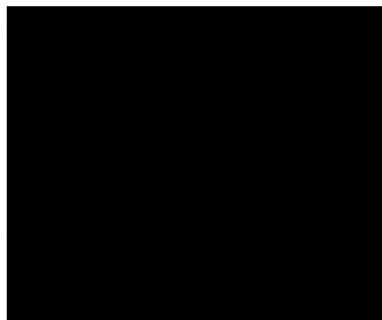
Tip level of sheet pile .	L =	16.00
Checking depth of sheet pile ,	Lo =	16.00
Radius .	X =	13.00
Load on ground surface (t/m ²)	q =	2.00

ROTARY MOMENT (Md)
(Outside pit)

	Level (-m.)	Soil	Unit Weight	Cohesion
	0.00			
Existing level	0.00		1.60	0.7
1st. layer	3.00	Soft Clay	1.60	0.7
Lowest strut level	3.00		1.55	0.9
2nd. layer	5.50	Soft Clay	1.55	0.9
Excavation depth	5.50		1.60	1.2
3rd. layer	8.50	Soft to med	1.60	1.2
4th. layer	12.00	Medium Cl	1.70	1.6
5th. layer	14.50	silty clay	1.80	2.1
Balance root depth	16.00		2.00	5.0
6th. layer	18.00	silty sand	2.00	5.0
7th. layer	25.00	silty sand	2.00	0.0
0.00				

H Outside pit	Unit Weight	w.H
3.00	1.60	4.80
0.00	0.00	0.00
2.50	1.55	3.88
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
Rotary moment (Md)		902.04

Balance L = 16.00 F.S. = 1.50



	Level (-m.)	Soil	Unit Weight	Cohesion
	0.00			
Existing level	0.00		1.60	0.7
1st. layer	3.00	Soft Clay	1.60	0.7
Lowest strut level	3.00		1.55	0.9
2nd. layer	5.50	Soft Clay	1.55	0.9
Excavation depth	5.50		1.60	1.2
3rd. layer	8.50	Soft to med	1.60	1.2
4th. layer	12.00	Medium Cl	1.70	1.6
5th. layer	14.50	silty clay	1.80	2.1
Balance root depth	16.00		2.00	5.0
6th. layer	0.00	silty sand	2.00	5.0
7th. layer	0.00	silty sand	2.00	0.0
	0.00		0.00	0.00
	0.00		0.00	0.00

RESISTING MOMENT (Mr)
(Outside pit)

H Outside pit	Radius	Radius	Mc
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
2.50	0.19	0.19	29.43
2.50	0.19	0.00	0.00
5.50	0.44	0.24	47.29
9.00	0.76	0.33	88.65
11.50	1.09	0.32	113.92
13.00	1.57	0.49	409.93
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
Resisting Moment (Mr) (Outside pit)			689.22

RESISTING MOMENT (Mr)
(Inside pit)

	Level (-m.)	Soil	Unit Weight	Cohesion
	0.00			
Existing level	0.00		1.60	0.7
1st. layer	0.00	Soft Clay	1.60	0.7
Lowest strut level	0.00		1.55	0.9
2nd. layer	5.50	Soft Clay	1.55	0.9
Excavation depth	5.50		1.60	1.2
3rd. layer	8.50	Soft to med	1.60	1.2
4th. layer	12.00	Medium Cl	1.70	1.6
5th. layer	14.50	silty clay	1.80	2.1
Balance root depth	16.00		2.00	5.0
6th. layer	0.00	silty sand	2.00	5.0
7th. layer	0.00	silty sand	2.00	0.0
0.00	0.00		0.00	0.00
0.00	0.00		0.00	0.00

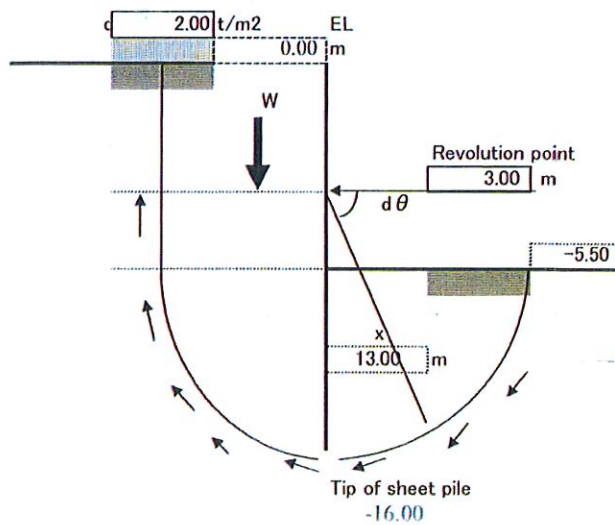
H Inside pit	Radius	Radius	M _d
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
2.50	0.19	0.00	0.00
2.50	0.19	0.00	0.00
5.50	0.44	0.24	47.29
9.00	0.76	0.33	88.65
11.50	1.09	0.32	113.92
13.00	1.57	0.49	409.93
0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00
Resisting Moment (Mr) (Inside pit)			659.79

$$F.S. = \frac{Mr (Outside) + Mr (Inside)}{Md (Outside)} = 1.50$$

$$\# \text{ Level of Sheetpile (-m)} = 16.00 \text{ m.}$$

$$\# \text{ Existing ground level (-m)} = 0.00 \text{ m}$$

$$\# \text{ Length of sheet pile to be used} = 16.00 \text{ m}$$



Maximum Bending Moment for Final Excavation

Excavation depth (-m)	-m.	5.50
Lowest strut level (-m)		3.00
Existing level (-m)		0.00
Type of Sheetpile (FSP - 3, FSP - 4)	FSP -	4
Diminishing of Moment of Inertia	%	20.00
Load on ground surface	t / m2	2.00
Soil Unit Weight	t / m3	1.65
Side Pressure Co - Efficient	K =	0.65
Distance Between Lowest Strut and Imaginary Bearing Point		10.32
Side Pressure at Lowest Strut (Ground Level)	P1 =	4.52
Side Pressure at Excavation Depth	P2 =	7.20
Distance Between Lowest Strut and Excavation Depth	H =	2.50

X	Bo	Co	R (A)	R (B)	Xo	Mmax
0.000	7.199	2.500	12.737	1.908	2.229	15.188

Deflection of Maximum Bending Moment Point , cm.

2.60

1.8% of excavation depth.

<

6.25

-OK-

Accumulated Deflection , cm.

7.60

9.90

-OK-

< Stress check >

$$\sigma_{\max} = M_{\max} / Z_x$$

$$Z_x = 2,270$$

After Diminishing

$$1,816$$

cm³/m

$$M_{\max} = 15.188$$

tf .m

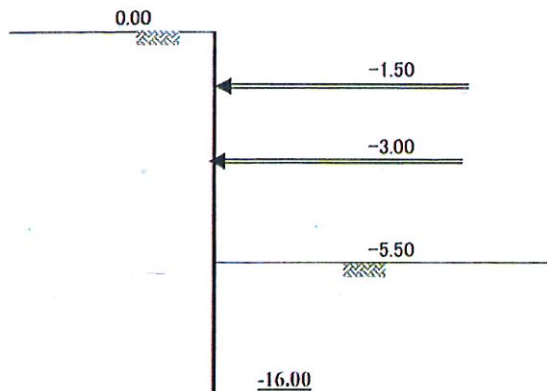
lb

$$\sigma_{\max} = 836 \text{ kgf / cm}^2$$

≤

$$2,250 \text{ kgf / cm}^2$$

--OK--



CALCULATION SHEET

FOR

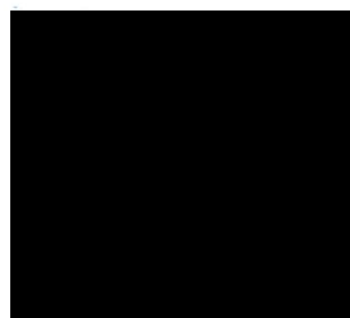
CHECKING OF TEMPORARY STRUT SYSTEM

AT

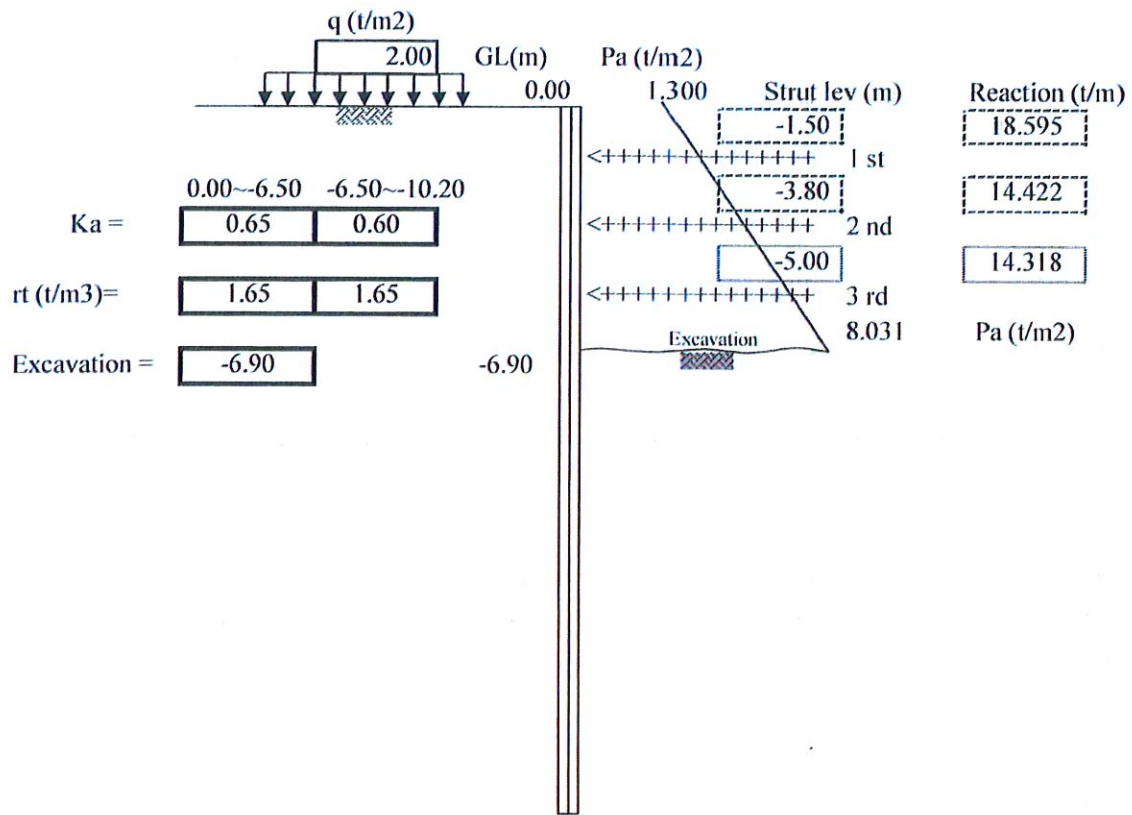
CUSTOMER: วี.เค. การโยธา (2013) จำกัด

PROJECT: NA REVA CHAROENNAKHON

DATE: 28-เม.ย.-22



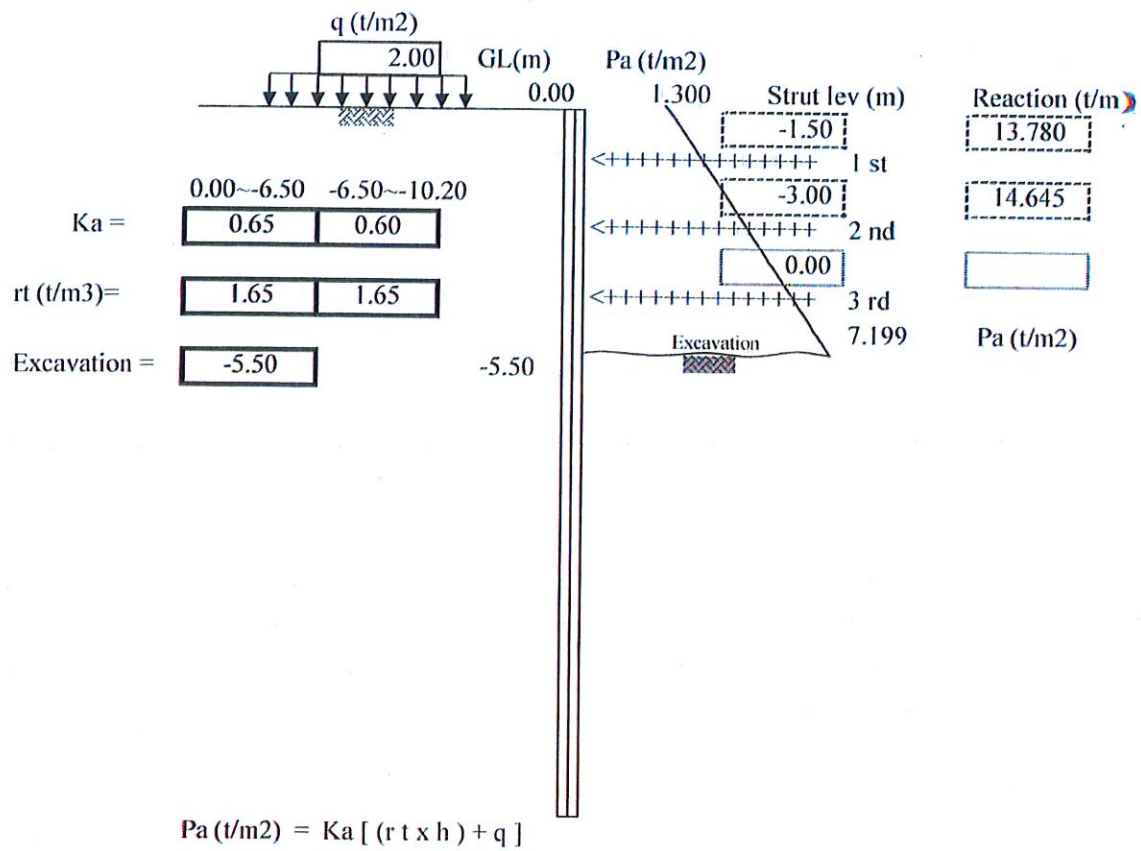
< Checking of Strut Reaction >



$$Pa (t/m^2) = Ka [(r t x h) + q]$$

$$Reaction (t/m) = (Pa 1 + Pa X) x H x 1/2$$

< Checking of Strut Reaction >



$$Pa \text{ (t/m}^2\text{)} = Ka [(rt \times h) + q]$$

$$Reaction \text{ (t/m)} = (Pa \text{ l} + Pa \text{ X}) \times H \times 1/2$$

Check H-Beam		IST Layer (H-350 x 350 x 12 x 19)			Called 35HA		
Level	t/m	Strut span Ls (m)	Wale span Lw (m)	Buckling span Lk (m)	Temperature Nt (t)	Diagonal strut Ld (m)	Diagonal strut span Ds (m)
GL	RI						
-1.50	18.595	6.50	3.00	6.50	5	3.00	2.00
						Diagonal brace Lb (m)	Diagonal brace span Db (m)
						3.00	2.00

Nt	ρ	As (cm ²)	β	t	E (t/cm ²)
5.41485	0.25	171.90	0.000012	5	2100

Nt = $\rho * As * \beta * t * E$

ρ = Coefficient
 As = Sectional area
 β = 0.000012 Coefficient of expansion
 t = Disparity of temperature
 E = 2,100,000 kg/cm²

dl =	$\beta t l$	dl (cm)	β	t	l (cm)
(expansion)		0.04	0.000012	5	650

l = Length of strut

Mdl =	Edl	E (kg/cm ²)	dl/l	Mdl (kg/cm ²)
(moment)		2100000	0.0000600	126

STEEL SS41, SM41, SS400, TIS1227, JIS G3192

F = 2,400 kgf/cm²
 E = 2,100,000 kgf/cm²

T	l	T ₁	T ₂	Weight	Zx
Strut	mm	mm	mm	kg/m	cm ³
H	350	12	19	137	2280

Wale	l	T ₁	T ₂	Weight	Zx
H	mm	mm	mm	kg/m	cm ³
	350	12	19	137	2280

Strut	lk	iy	λ	($\lambda/120$) ²	Aw	As
	cm	cm			cm ²	cm ²
	650	8.89	73.116	0.371	37.44	171.90

Wale	lk	iy	λ	($\lambda/120$) ²	Aw	As
	cm	cm			cm ²	cm ²
	650	8.89	73.116	0.371	37.44	171.90

- 1 f_c , Allowable Compression Stress
($t_{hk} < 40\text{mm}$)

Slenderness ratio

$\lambda = \text{Buckling length}(l_k) / i_y$

$$\lambda = \sqrt{((\pi^2 E) / (0.6 F))} = 120$$

$$\lambda \leq 120$$

Temporary $f_c = 1,462 \text{ kgf/cm}^2$

Temporary

$$f_c = \frac{(1 - 0.4 (\lambda / 120)^2) 2400}{1 + 0.445 * (\lambda / 120)^2} * \frac{5}{6}$$

- 2 f_b , Allowable Bending Stress

Temporary $f_b = 2000 \text{ kgf/cm}^2 \quad 2400 * 5/6$

- 3 f_s , Allowable Shearing Stress

Temporary $f_s = 1167 \text{ kgf/cm}^2 \quad 1400 * 5/6$

4 Checking of wale

4-1	Bending			fb
	$M = R1 * Lw2 / 8 \text{ (tf.m)}$	<input type="text" value="20.920"/>	tf.m	
	$\sigma b = M / Zx \text{ (kgf/cm2)}$	<input type="text" value="918"/>	kgf/cm2	<input type="text" value="2000"/> kgf/cm2
				-OK-
4-2	Shearing			fs
	$S = R1 * Lw / 2 \text{ (tf)}$	<input type="text" value="27.893"/>	tf	
	$\sigma s = S / Aw \text{ (kgf/cm2)}$	<input type="text" value="745"/>	kgf/cm2	<input type="text" value="1167"/> kgf/cm2
				-OK-

Result	Use H - Beam	H	350	(H-350 x 350 x 12 x 19)
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5 Checking of strut

5-1	Bending			fb
	$M = Ws * Lk^2 / 8 \text{ (tf.m)}$	<input type="text" value="2.641"/>	tf.m	
	$Ws = \text{Load on strut} =$	<input type="text" value="0.500"/>	t/m	
	$\sigma b = M / Zx \text{ (kgf/cm2)}$	<input type="text" value="116"/>	kgf/cm2	<input type="text" value="2000"/> kgf/cm2
5-2	Compression			$f_c (\lambda \leq 120)$
	$C = R1 * Ls + Nt$	<input type="text" value="126.284"/>	tf	
	$\sigma c = C / As \text{ (kgf/cm2)}$	<input type="text" value="735"/>	kgf/cm2	<input type="text" value="1,462"/> kgf/cm2
				$f_c (\lambda > 120)$
				<input type="text" value=""/> kgf/cm2
5-3	Combination			
	$Cs = \sigma b / fb + \sigma c / fc \text{ (} \lambda \leq 120 \text{)}$	<input type="text" value="0.56"/>	\leq	1.00 -OK-
	$Cs = \sigma b / fb + \sigma c / fc \text{ (} \lambda > 120 \text{)}$	<input type="text" value=""/>	\leq	

Result	Use H - Beam	H	350	(H-350 x 350 x 12 x 19)
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6 Checking of diagonal strut & diagonal brace

6-1 Bending

	Diagonal strut	Diagonal brace
$M = Wd * Ld(b)^2 / 8 \text{ (tf.m)}$	0.563 tf.m	0.563
$Wd = \text{Load on strut} =$	0.500 t/m	0.500 t/m
$\sigma_b = M / Z_x \text{ (kgf/cm}^2\text{)}$	25 kgf/cm ²	25 kgf/cm ²

6-2 Compression

Size	Ld (m)	As (cm ²)	iy (cm)	λ	$(\lambda/120)^2$	Ds (m)
35HA	3.00	154.90	8.89	33.746	0.079	2.00
	Lb (m)					Db (m)
35HA	3.00	154.90	8.89	33.746	0.079	2.00

	Diagonal strut	Diagonal brace
$C = (R1 * Ds(b))/\sin\theta$	52.595 tf	52.595 tf
$\sigma_c = C / As \text{ (kgf/cm}^2\text{)}$	340 kgf/cm ²	340 kgf/cm ²
$f_c (\lambda \leq 120)$		$f_c (\lambda \leq 120)$
Temporary $f_c =$	1,871 kgf/cm ²	1,871 kgf/cm ²
		$f_c (\lambda > 120)$

6-3 Combination

$$Cs = \sigma_b / f_b + \sigma_c / f_c$$

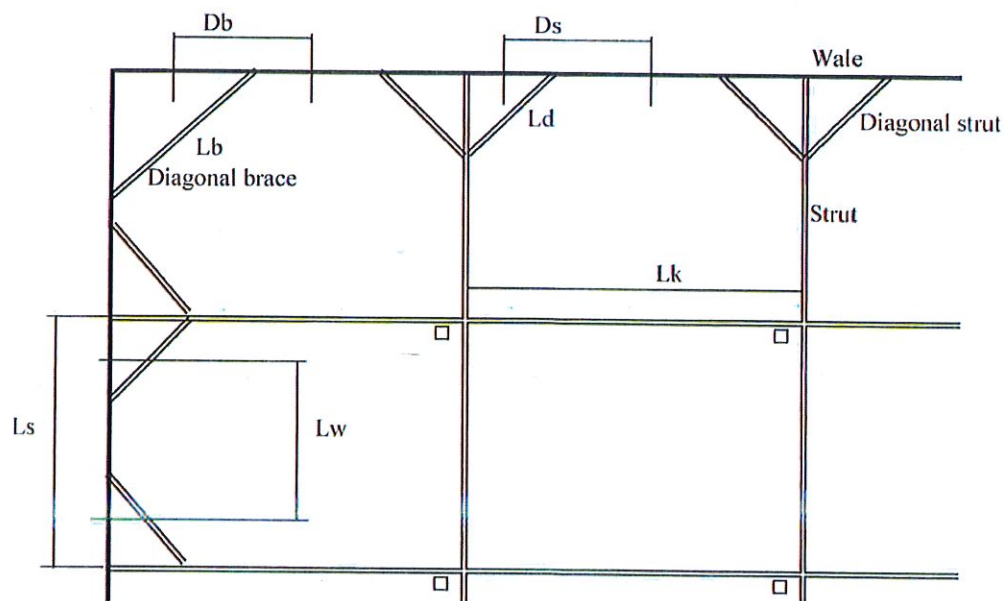
	σ_b	f_b	σ_c	f_c	Cs	
$\lambda \leq 120$	25	2,000	340	1,871	0.19	Diagonal strut
						-OK-
$\lambda \leq 120$	25	2,000	340	1,871	0.19	Diagonal brace
						-OK-

Result	Use H - Beam	Diagonal strut	35HA	(Pre fabricated H-350 x 350 x 12 x 19)
		Diagonal brace	35HA	(Pre fabricated H-350 x 350 x 12 x 19)

6-4 Checking of Bolt

		Diagonal strut	Diagonal brace
	(Wale side)	(Strut side)	
$\theta=45$	$S = R1 * Ds$	$S = R1 * Ds$	$S = R1 * Db$
$\theta=60$	$S = R1 * Ds * 1/\sqrt{3}$	$S = R1 * Ds * 2/\sqrt{3}$	
$\theta=$	$S (tf)$	$S (tf)$	$S (tf)$
45	37.190	37.190	45 37.190
Bolt	F10T 22mm(ϕ)	F10T 22mm(ϕ)	F 10T 22mm(ϕ)
	6	6	6
Q'ty (pc)	6	6	6

Typical plan of strutting system



Check H-Beam		2ND Layer (H-300 x 300 x 10 x 15)			Called 30HA			
Level	t/m	Strut span Ls (m)	Wale span Lw (m)	Buckling span Lk (m)	Temperature Nt (t)	Diagonal strut Ld (m)	Diagonal strut span Ds (m)	
GL	R1							
-3.80	14.422	6.50	3.00	6.50	4	3.00	2.00	
						Diagonal brace span Lb (m)	Diagonal brace span Db (m)	
						3.00	2.00	

Nt	ρ	As (cm ²)	β	t	E (t/cm ²)
3.7296	0.25	118.40	0.000012	5	2100

$$\# Nt = \rho * As * \beta * t * E$$

ρ = Coefficient

As = Sectional area

β = 0.000012 Coefficient of expansion

t = Disparity of temperature

E = 2,100,000 kg/cm²

dl =	β	dl (cm)	β	t	l (cm)
(expansion)	0.04	0.000012	5	650	
				Length of strut	

Mdl =	E	dl/l	Mdl (kg/cm ²)
(moment)	2100000	0.0000600	126

STEEL SS41,SM41,SS400,TIS1227,JIS G3192

$$F = 2,400 \text{ kgf/cm}^2$$

$$E = 2,100,000 \text{ kgf/cm}^2$$

T	l	T1	T2	Weight	Zx
Strut	mm	mm	mm	kg/m	cm ³
H	300	10	15	94	1350

Wale	l	T1	T2	Weight	Zx
H	mm	mm	mm	kg/m	cm ³
	300	10	15	94	1350

Strut	iy	λ	$(\lambda/120)^2$	Aw	As
lk	cm			cm ²	cm ²
650	7.55	86.093	0.515	27.00	118.40

Wale	iy	λ	$(\lambda/120)^2$	Aw	As
lk	cm			cm ²	cm ²
650	7.55	86.093	0.515	27.00	118.40

- 1 f_c , Allowable Compression Stress
($t_{hk} < 40\text{mm}$)

Slenderness ratio

$\lambda = \text{Buckling length}(l_k)/i_y$

$$\lambda = \sqrt{((\pi^2 E) / (0.6 F))} = 120$$

$$\lambda \leq 120$$

Temporary $f_c = 1,292 \text{ kgf/cm}^2$

Temporary

$$f_c = \frac{(1 - 0.4 (\lambda / 120)^2) 2400}{1 + 0.445 (\lambda / 120)^2} * \frac{5}{6}$$

- 2 f_b , Allowable Bending Stress

Temporary $f_b = 2000 \text{ kgf/cm}^2 \quad 2400 * 5/6$

- 3 f_s , Allowable Shearing Stress

Temporary $f_s = 1167 \text{ kgf/cm}^2 \quad 1400 * 5/6$

4 Checking of wale

4-1	Bending			fb
	$M = Rl * Lw^2 / 8$ (tf.m)	<input type="text" value="16.224"/>	tf.m	
	$\sigma_b = M / Zx$ (kgf/cm ²)	<input type="text" value="1,202"/>	kgf/cm ²	<input type="text" value="2000"/> kgf/cm ²
				-OK-
4-2	Shearing			fs
	$S = Rl * Lw / 2$ (tf)	<input type="text" value="21.632"/>	tf.m	
	$\sigma_s = S / Aw$ (kgf/cm ²)	<input type="text" value="801"/>	kgf/cm ²	<input type="text" value="1167"/> kgf/cm ²
				-OK-

Result	Use H - Beam	H	300	(H-300 x 300 x 10 x 15)
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5 Checking of strut

5-1	Bending			fb
	$M = Ws * Lk^2 / 8$ (tf.m)	<input type="text" value="2.641"/>	tf.m	
	$Ws = \text{Load on strut} =$	<input type="text" value="0.500"/>	t/m	
	$\sigma_b = M / Zx$ (kgf/cm ²)	<input type="text" value="196"/>	kgf/cm ²	<input type="text" value="2000"/> kgf/cm ²
5-2	Compression			fc ($\lambda \leq 120$)
	$C = Rl * Ls + Nt$	<input type="text" value="97.470"/>	tf	
	$\sigma_c = C / As$ (kgf/cm ²)	<input type="text" value="823"/>	kgf/cm ²	<input type="text" value="1,292"/> kgf/cm ²
				fc ($\lambda > 120$)
				<input type="text" value=""/> kgf/cm ²
5-3	Combination			
	$Cs = \sigma_b / fb + \sigma_c / fc$ fc ($\lambda \leq 120$)	<input type="text" value="0.73"/>	\leq	1.00 -OK-
	$Cs = \sigma_b / fb + \sigma_c / fc$ fc ($\lambda > 120$)	<input type="text" value=""/>	\leq	

Result	Use H - Beam	H	300	(H-300 x 300 x 10 x 15)
--------	--------------	---	-----	-------------------------

6 Checking of diagonal strut & diagonal brace

6-1 Bending

	Diagonal strut	Diagonal brace
$M = Wd * Ld(b)^2 / 8 \text{ (tf.m)}$	0.563 tf.m	0.563
$Wd = \text{Load on strut} =$	0.500 t/m	0.500 t/m
$\sigma_b = M / Z_x \text{ (kgf/cm}^2\text{)}$	42 kgf/cm ²	42 kgf/cm ²

6-2 Compression

Size	Ld (m)	As (cm ²)	iy (cm)	λ	$(\lambda/120)^2$	Ds (m)
35HA	3.00	154.90	8.89	33.746	0.079	2.00
	Lb (m)					Db (m)
35HA	3.00	154.90	8.89	33.746	0.079	2.00

	Diagonal strut	Diagonal brace
$C = (R1 * Ds(b))/\sin\theta$	40.790 tf	40.790 tf
$\sigma_c = C / As \text{ (kgf/cm}^2\text{)}$	263 kgf/cm ²	263 kgf/cm ²
$f_c (\lambda \leq 120)$		$f_c (\lambda \leq 120)$
Temporary $f_c =$	1,871 kgf/cm ²	1,871 kgf/cm ²
		$f_c (\lambda > 120)$

6-3 Combination

$$C_s = \sigma_b / f_b + \sigma_c / f_c$$

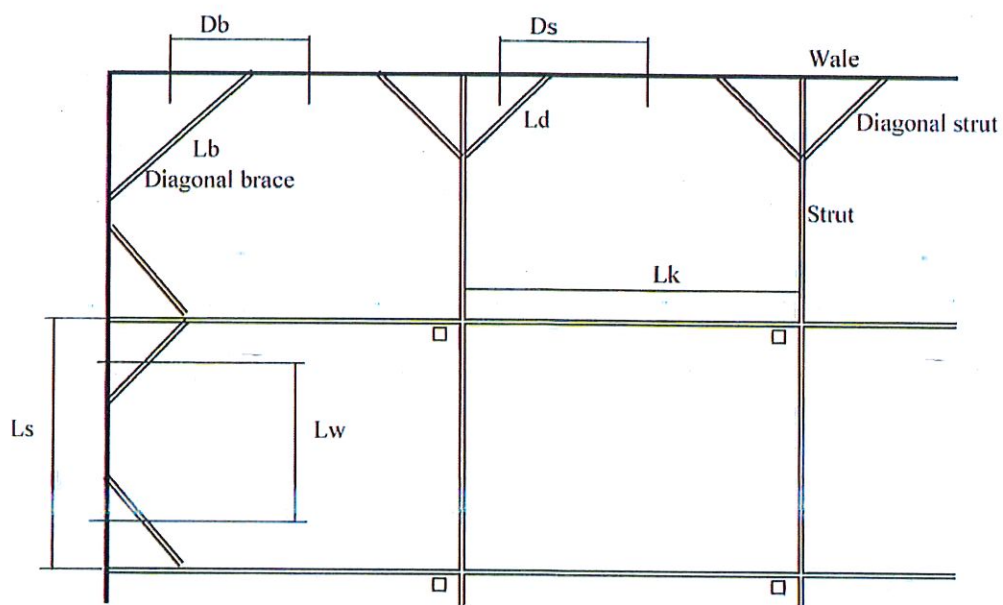
	σ_b	f_b	σ_c	f_c	C_s	
$\lambda \leq 120$	42	2,000	263	1,871	0.16	Diagonal strut -OK-
$\lambda \leq 120$	42	2,000	263	1,871	0.16	Diagonal brace -OK-

Result	Use H - Beam	Diagonal strut	35HA	(Pre fabricated H-350 x 350 x 12 x 19)
		Diagonal brace	35HA	(Pre fabricated H-350 x 350 x 12 x 19)

6-4 Checking of Bolt

	Diagonal strut		Diagonal brace
	(Wale side)	(Strut side)	
$\theta=45$	$S = R1 * Ds$	$S = R1 * Ds$	$S = R1 * Db$
$\theta=60$	$S = R1 * Ds * 1/\sqrt{3}$	$S = R1 * Ds * 2/\sqrt{3}$	
$\theta=$	$S (tf)$	$S (tf)$	$S (tf)$
45	28.843	28.843	45 28.843
Bolt	F10T 22mm(ϕ)	F10T 22mm(ϕ)	F10T 22mm(ϕ)
	6	6	6
Q'ty (pc)	5	5	5

Typical plan of strutting system



CALCULATION SHEET

FOR

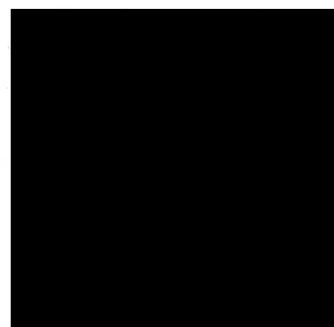
CHECKING OF TEMPORARY WORKING PLATFORM SYSTEM

AT

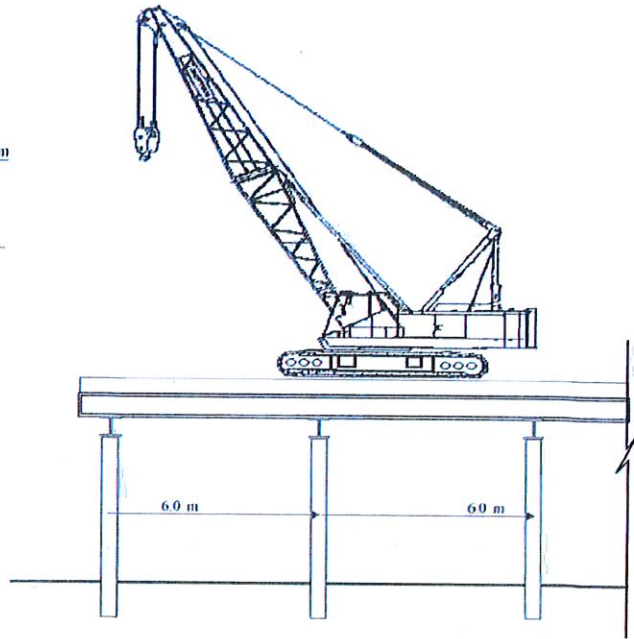
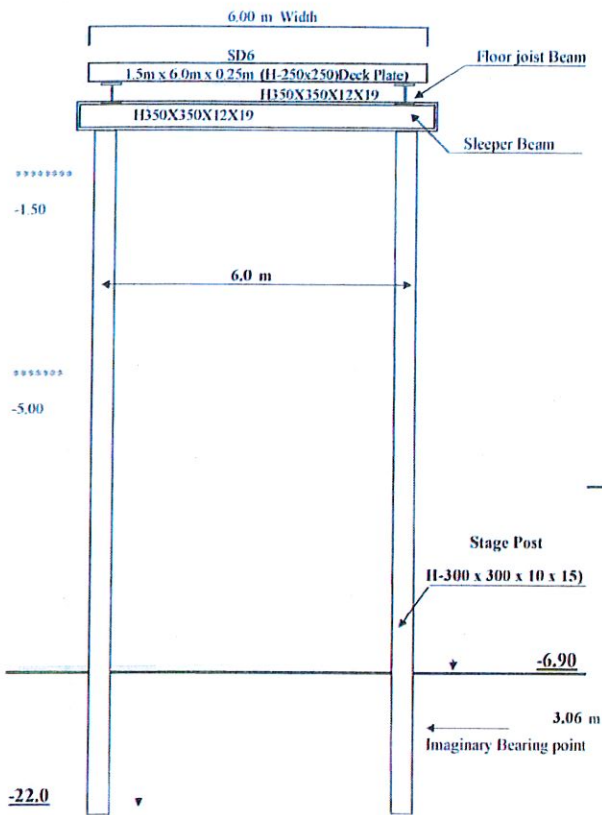
CUSTOMER: วี.เค. การโยธา (2013) จำกัด

PROJECT: NA REVA CHAROENNAKHON

DATE: 28-เม.ย.-22



Lay out of Platform



Size of Stage Post H-Beam

Kh =

Length of Stage post

Excavation

Span of stage post (m x m)

Cover area of Stage post

Span of Floor joist

Span of Sleeper

Level of Strut & Tying Brace

	300	(H-300 x 300 x 10 x 15)
	0.649	
	22.0 m	
	-6.90 m	
	6 m	Width
	6 m	Length
	36	m ² /span
	6 m	
	5.5 m	
	-1.5 m	
	Highest	

$\beta =$	0.0033
Imaginary Bearing point	3.06 m

	2	pc/span
	2	pc/span
	2	Line/span
	2	pc/span
	-5	m
	Lowest	

Dead Load

	Material	Platform	Floor joist	Sleeper	Stage post
Platform	SD6	300	300	300	300
Floor joist	H350		46	46	46
Sleeper	H350			21	21
Others	50	50	50	50	50
Total Dead Load (kg/m ²)		350	396	417	417

Live load (t)

Car Weight (t)	Carriage Weight (t)	Impact (20%)	Live load (t)
40.000	5.000	9.000	54.000

Crane size

Lc (Width, m)

Hc (Length, m)

B (Wheel width, m)

40ton crawler
4.50 m
5.50 m
0.76 m

Wheel Contact Area (m²)

Front Lifting	$H_c \times 0.6 \times B$	2.508 m ²
Side Lifting	$H_c \times B$	4.180 m ²
Slant Lifting	$H_c \times 0.9 \times B \times 1/2$	1.881 m ²

Stress on Contact per wheel (t/m²)

	Pca
Live Load * 100%	
Live Load * 80%	
Live Load * 70%	

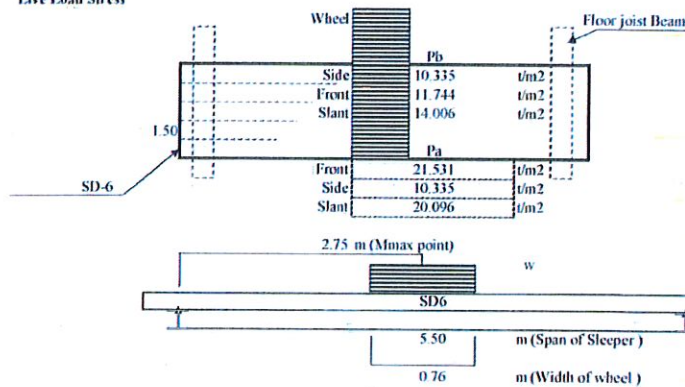
1 Checking of Platform

	Size	Component	Zx (cm ³ /pc)	Ac (cm ² /pc)	fb (kg/cm ²)	fs (kg/cm ²)
SD6	1.5m x 6.0m x 0.25m	11250 x 5pc	860	19.98	2,400	1350

1-1 Dead Load Stress

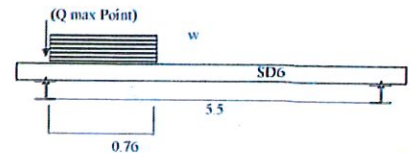
w	SD6
	5.50
w	0.105
Bending Md	0.397
Shearing Qd	0.289

1-2 Live Load Stress



w	24.957
	15.502
	25.576

Max Bending Moment	
M max = (wB (2l - B)) / 8	
Front Lifting	24.278
Side Lifting	15.081
Slant Lifting	24.881



w	24.957
	15.502
	25.576

Max Shearing	
Q max = wB - w * B2 / (2l)	
Front Lifting	17.656
Side Lifting	10.968
Slant Lifting	18.095

1-3 Combination of Bending Moment for Dead & Live Load

$$M' \text{ max} = M \text{ max} + M_d * 1.50 / 0.25$$

Front Lifting	26.660
Side Lifting	17.463
Slant Lifting	27.263

σ_b (kg/cm ²) = M' max / Zx' (511-250x250x9x14)	fb = 2400 kg/cm ²
(Zx = 5*860 = 4300cm ³)	
Front Lifting	620
Side Lifting	406
Slant Lifting	634

-OK-
-OK-
-OK-

Combination of Shearing stress for Dead & Live Load

$$Q' \text{ max} = Q \text{ max} + Q_d * 1.5 / 0.25$$

Front Lifting	19.389
Side Lifting	12.700
Slant Lifting	19.828

$$\sigma_q \text{ (kg/cm}^2\text{)} = Q' \text{ max} / A_e' \quad fs = 1350 \text{ kg/cm}^2$$

Front Lifting	194
Side Lifting	127
Slant Lifting	198

-OK-
-OK-
-OK-

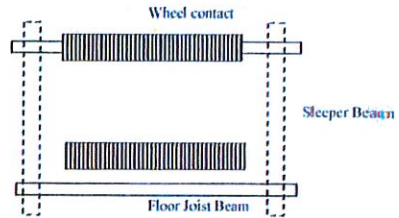
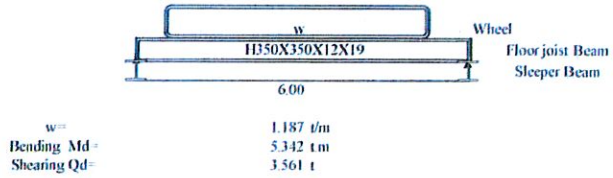
Result	USE	SD6	1.5m x 6.0m x 0.25m	Platform
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2 Checking of Floor joist Beam

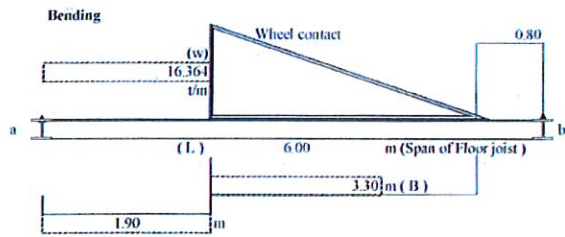
Use H-Beam	H350		1 pc	fb (kg/cm ²)	fs (kg/cm ²)	
				2,400	1,350	

Ae (cm ²)	Ix (cm ⁴)	Zx (cm ³)	Al' (cm ²) Flange	iy (cm)	h (cm)	As (cm ²)
37.44	39800	2280	66.5	8.89	35	171.9

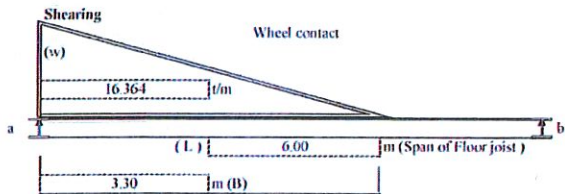
2-1 Dead Load Stress



2-2 Live Load Stress for Front Lifting (Floor Joist)



Ra =	13,500	t
Rb =	13,500	t
Check	13,500	t
Bending Ml =	31,700	t m



$$QI = 22,050$$

Combination for Live load & Dead load

Bending

$M_d + M_l =$	37.042	tm
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$$\sigma_b \text{ (kg/cm}^2\text{)} = M'_{\max} / Z_{x'}$$

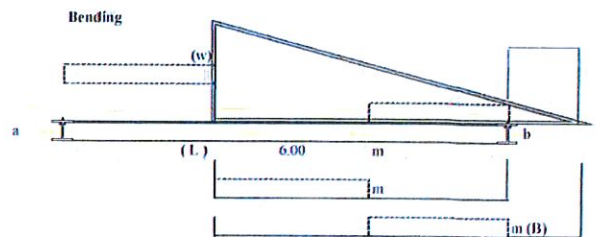
Front Lifting	1,625	0.68	-OK-	Front Lifting		
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Shearing

$$Q_I + Q_d = 25,611$$

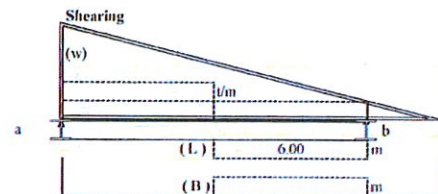
$$\sigma_s \text{ (kg/cm}^2\text{)} = Q'_{\text{max}} / A_{e'}$$

Front Lifting	684	0.51	-OK-	Front Lifting		
---------------	-----	------	------	---------------	--	--



Ra	t
Rb	t
Check	t

MI	t _m
----	----------------


$$QI = \dots t$$

Bending

$$Md + Ml = \quad t, m$$

$$\sigma_b \text{ (kg/cm}^2\text{)} = M'_{\text{max}} / Z_{x'}$$

From Lifting			
--------------	--	--	--

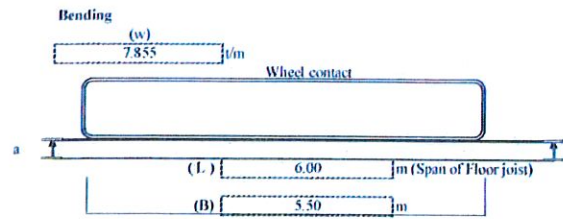
Shearing

$$Q_l + Q_d =$$

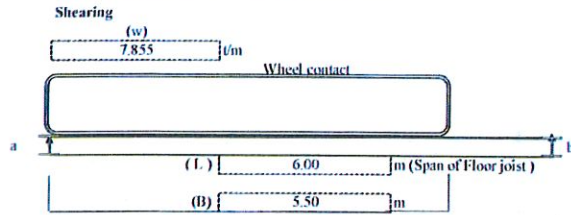
$$\sigma_s \text{ (kg/cm}^2\text{)} = Q'_{\text{max}} / A_{e'}$$

Front Lifting			
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2-3 Live Load Stress for Side Lifting (Floor Joist)



Bending $M_l = 35.100$ t.m



$Q_l = 23.4$ t

Combination for Live load & Dead load

Bending $M_d + M_l = 40.442$ t.m

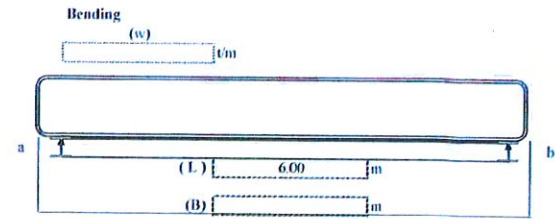
$\sigma_b \text{ (kg/cm}^2\text{)} = M' \text{ max} / Z_n'$ $f_b = 2400 \text{ kg/cm}^2$

Side Lifting 1.774 0.74 -OK-

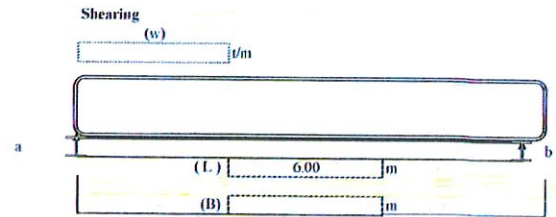
Shearing $Q_l + Q_d = 26.961$ t

$\sigma_s \text{ (kg/cm}^2\text{)} = Q' \text{ max} / A_e'$ $f_s = 1350 \text{ kg/cm}^2$

Side Lifting 720 0.53 -OK-



Bending $M_l =$ t.m



$Q_l =$ t

Bending $M_d + M_l =$ t.m

$\sigma_b \text{ (kg/cm}^2\text{)} = M' \text{ max} / Z_n'$ $f_b = 2400 \text{ kg/cm}^2$

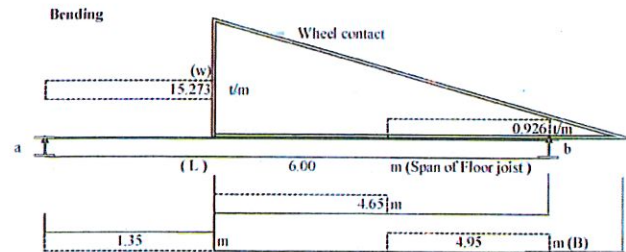
Side Lifting -OK-

Shearing $Q_l + Q_d =$ t

$\sigma_s \text{ (kg/cm}^2\text{)} = Q' \text{ max} / A_e'$ $f_s = 1350 \text{ kg/cm}^2$

Side Lifting -OK-

2-4 Live Load Stress for Slant Lifting (Floor Joist)

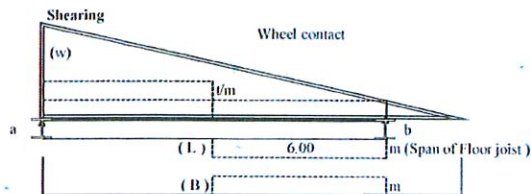


$R_a = 18.759$ t

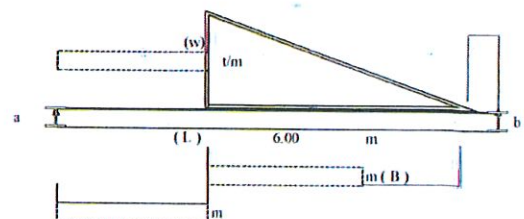
$R_b = 18.902$ t

Check 18.902 t

$M_l = 38.227$ t.m



$Q_l =$ t

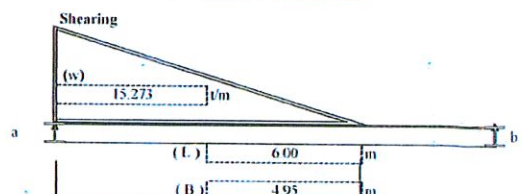


$R_a =$ t

$R_b =$ t

Check

Bending $M_l =$ t.m



$Q_l = 27.405$ t

Combination for Live load & Dead load

Bending				Bending			
$M_d + M_l =$	43.568	t.m		$M_d + M_l =$		t.m	
$\sigma_b \text{ (kg/cm}^2\text{)} = M' \text{ max} / Z_x'$	$f_b = 2400 \text{ kg/cm}^2$			$\sigma_b \text{ (kg/cm}^2\text{)} = M' \text{ max} / Z_x'$	$f_b = 2400 \text{ kg/cm}^2$		
Slant Lifting	1.911	0.80	-OK	Slant Lifting			
Shearing				Shearing			
$Q_l + Q_d =$	11	t		$Q_l + Q_d =$	30.966	t	
$\sigma_s \text{ (kg/cm}^2\text{)} = Q' \text{ max} / A_e'$	$f_s = 1350 \text{ kg/cm}^2$			$\sigma_s \text{ (kg/cm}^2\text{)} = Q' \text{ max} / A_e'$	$f_s = 1350 \text{ kg/cm}^2$		
Slant Lifting				Slant Lifting	827	0.61	-OK-
Result	USE	H-Beam	H350X350X12X19				

3 Checking of Sleeper Beam

Use H-Beam				H350		1 pc		fb (kg/cm ²)		fs (kg/cm ²)	
								2,400		1,350	
Ae (cm ²)		fx (cm ⁴)		Zx (cm ³)		Af (cm ²) Flange		fy (cm)		h (cm)	
37.44		39800		2280		66.5		8.89		35	
										As (cm ²)	
										171.9	

3-1 **Dead Load Stress**

Wheel contact

H350X350X12X19

5.50 m (Span of Sleeper)

Sleeper Beam

Stage post

W

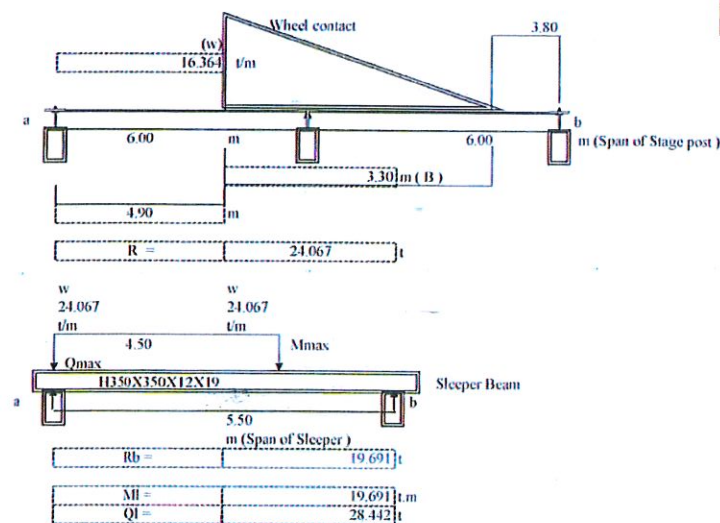
Bending $M_d =$ 8.664 t.m

Shearing $Q_d =$ 6.301 t

Wheel contact

Sleeper Beam

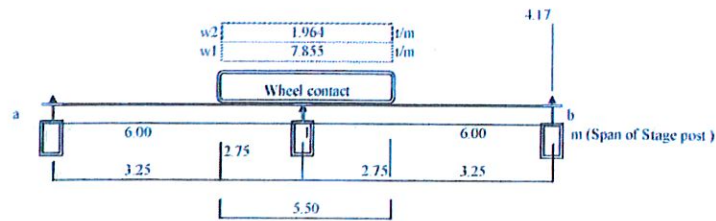
3-2 Live Load Stress for Front Lifting (Sleeper Beam)



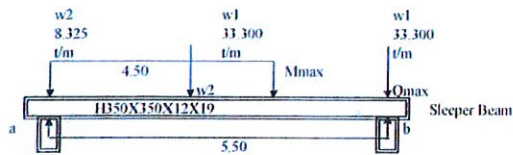
Combination for Live load & Dead load

Bending			
$M_d + M_l =$	28.355	t.m	
$\sigma_b \text{ (kg/cm}^2\text{)} = M' \text{ max} / Z_x'$	$f_b = 2400 \text{ kg/cm}^2$		
Front Lifting	1.244	0.52	-OK
Shearing			
$Q_l + Q_d =$	34.743	t	
$\sigma_s \text{ (kg/cm}^2\text{)} = Q' \text{ max} / A_e'$	$f_s = 1350 \text{ kg/cm}^2$		
Front Lifting	928	0.69	-OK-

3-3 Live Load Stress for Side Lifting (Sleeper Beam)



R1 =	33.300	t
R2 =	8.325	t



R1 =	27.245	t
Ml =	27.245	t m
Ql =	34.814	t

Combination for Live load & Dead load

Bending

Md + Ml =	35.909	t m
-----------	--------	-----

$$\sigma_b \text{ (kg/cm}^2\text{)} = M' \text{ max} / Zx' \quad I_b = 2400 \text{ kg/cm}^2$$

Side Lifting	1.575	0.66	OK
--------------	-------	------	----

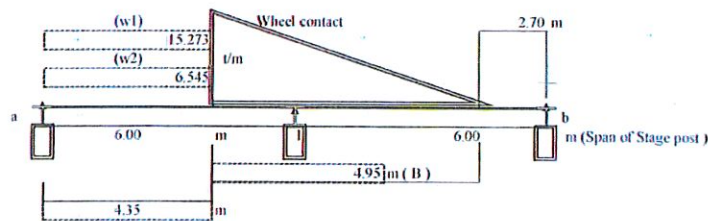
Shearing

Ql + Qd =	41.115	t
-----------	--------	---

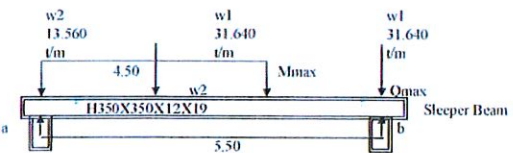
$$\sigma_s \text{ (kg/cm}^2\text{)} = Q' \text{ max} / Ae' \quad fs = 1350 \text{ kg/cm}^2$$

Slant Lifting	1.098	0.81	OK
---------------	-------	------	----

3-4 Live Load Stress for Slant Lifting (Sleeper Beam)



R1 =	31.640	t
R2 =	13.560	t



R1 =	25.887	t
Ml =	25.887	t m
Ql =	34.105	t

Combination for Live load & Dead load

Bending

$M_d + M_l =$	34.551 t.m
---------------	------------

$$\sigma_b \text{ (kg/cm}^2\text{)} = M' \text{ max} / Z_s' \quad f_b = 2400 \text{ kg/cm}^2$$

Slant Lifting	1.515	0.63	-OK-
---------------	-------	------	------

Shearing

$Q_l + Q_d =$	40.406 t
---------------	----------

$$\sigma_s \text{ (kg/cm}^2\text{)} = Q' \text{ max} / A_e' \quad f_s = 1350 \text{ kg/cm}^2$$

Slant Lifting	1.079	0.80	-OK-
---------------	-------	------	------

<u>Result</u>	USE	H-Beam	H350X350X12X19
---------------	-----	--------	----------------

4 Checking of Stage post

Size	H-Beam	Pn	Lr (m)	Ap (m ²)	Sn	Ls (m)	Lc (m)	Qu (t/m ²)
		Pile toe N-value	Round length	Section Area	Sand N-value	Pile in sand	Pile in clay	Qu in clay
	300	25	1.2	0.090	20	3.1	12.0	10.000
	Section depth (cm)	E (kg/cm ²)	Ix (cm ⁴)	Iy (cm ⁴)	Ae (cm ²)	Zx (cm ³)	Weight (kg/m)	B
	30	2100000	20200	7.55	118.4	1350	94	0.0033

4-1 Checking of Bearing capacity

Axial force by Dead Load N1 3.749 t

Axial force by Live Load N2 27.000 t

Axial force by Strut Dead Load N3

	H-Beam	Weight (kg/m)	Span (m)	Assort	Direction	Total weight (t)
Strut 1st layer	35H	150	6.00	1	2	1.800
Strut 2nd layer	35H	150	6.00	1	2	1.800
Strut 3rd layer	35H	150	6.00	1	2	1.800
Strut 4th layer	35H	150		1	2	
Strut 5th layer	35H	150		1	2	
Strut 6th layer	35H	150		1	2	
				Single-1 Double-2	One direction-1 Two direction-2	5.400

N3

Axial force by Strut Force N4

	Reaction (t/m)	Transfer (%)	Span (m)	Assort	Direction	Total weight (t)
Strut 1st layer	15	1.5	6.00	1	2	2.700
Strut 2nd layer	17	1.5	6.00	1	2	3.060
Strut 3rd layer	14	1.5	6.00	1	2	2.577
Strut 4th layer				1	2	
Strut 5th layer				1	2	
Strut 6th layer				1	2	
				Single-1 Double-2	One direction-1 Two direction-2	8.337

N4

Axial force by Horizontal Load N5 = $H \times 0.5 \times l_2 / l_1$

H (Horizontal Load)

(Car weight + Carriage weight) * 20% 9.000 t

H (Width of Platform) 6.0 m

l2 (Length to Imaginary point) 9.96 m

N5 = 7.467 t

Axial force by Pile weight N6 0.936 t

Axial Vertical Force (N1+N2+N3+N4+N5+N6)

52.889 t

Ultimate Bearing Capacity

H-Beam 300 (H-300 x 300 x 10 x 15)
Level (-m) 22.0 m

$$Q = 30 \cdot P_n \cdot A_p + ((S_n \cdot L_s) / 5 + (Q_u \cdot L_c) / 2) \cdot L_r$$

154.380 t

Allowable Bearing Capacity

$$Q_a = Q \cdot 2/3$$

102.920 t

-OK-

4-2 Checking of Stress

Bending

By Horizontal Load

$$M_{max} = H * 0.5 / L.O * (L.1 + L.2) + N.4 * 0.5$$

15.318 t.m

$$\sigma_b \text{ (kg/cm}^2\text{)} = M'_{max} / Z_x'$$

1.135 kg/cm²

f_b =

2.400 kg/cm²

H (Horizontal Load)

$$(\text{Car weight} + \text{Carriage weight}) * 20\%$$

9.000 t

L.O (Number of Stage post per width of Platform)

2 pc

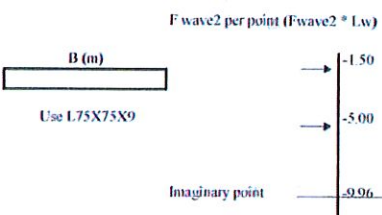
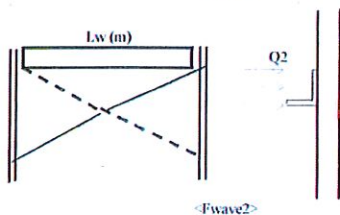
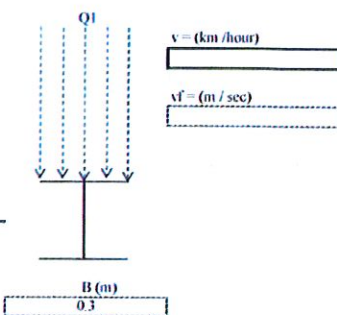
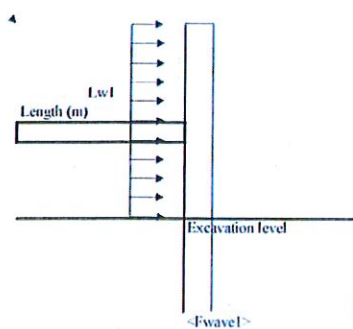
L.1 (Lowest Bracing to Excavation level)

1.90 m

L.2 (L.1 to Imaginary Bearing point)

3.06 m

By Other than Horizontal Load
Wave Stress



$$Q1 \text{ (m)} = B * v * 1.0$$

$$Q2 \text{ (m)} = B * v * 1.0$$

$$F \text{ wave1 (kg/m)} = (r / g) * (Q1) * (v - v_0)$$

$$F \text{ wave2 (kg/m)} = (r / g) * (Q2) * (v - v_0)$$

$$r = 1,000$$

$$g = 9.81$$

m3
m3
kg/m
kg/m

$$M_{max1} \text{ (kg.m)} = (F \text{ wave1}) * L_{w1}^2 / 2$$

$$M_{max2} \text{ (kg.m)} = (F \text{ wave2 per point} * \text{Cantilever})$$

$$\sigma_b' \text{ (kg/cm}^2\text{)} = (M_{max1} + M_{max2}) / Z_x$$

kg.m
kg.m
kg/cm²

Compression

C max = N 52 889 t

F = 2,400 kg/cm2

N (Axial Vertical Force) 52 889 t

σ_c (kg/cm2) = C max / Ae 447 kg/cm2

fc, Allowable Compression Stress
(Ihk < 40mm)

Slenderness ratio λ = Buckling length (lk) / iy 66

$\lambda = \sqrt{((\pi \cdot E) / (0.6F))} = 120$
 $\lambda \leq 120$

Buckling Length = L1 + L2
Bracing to Imaginary point

fc = 1,554 kg/cm2

Temporary

fc = $\frac{\{1-0.4(\lambda/120)^2\}F}{1+0.445(\lambda/120)^2} \cdot (5/6)$

Combination

Cs = $\sigma_b / f_b + \sigma_c / f_c$

0.76

without wave

-OK-

Cs = $\sigma_b / f_b + \sigma_b' / f_b + \sigma_c / f_c$

0.76

with wave

-OK-

Result: Use Stage Post H-Beam

300

(H-300 x 300 x 10 x 15)

22.0 m

5 Checking of King post

Size							
H-Beam	Pn	Lr (m)	Ap (m ²)	Sn	Ls (m)	Lc (m)	Qu (t/m ²)
Pile toe N-value	Round length	Section Area	Sand N-value	Pile in sand	Pile in clay	Qu in clay	
300	25	1.2	0.090	20	2.8	5.4	8.000
Section depth (cm)	E (kg/cm ²)	Ix (cm ⁴)	Iy (cm ⁴)	Ae (cm ²)	Zx (cm ³)	Weight (kg/m)	e (m)
30	2100000	20200	7.55	118.4	1350	94	0.50
Axial force by strut Dead Load (t)		Axial force by strut Force (t)		Other force on strut (t)		Pile Dead weight (t)	
N3	5.400	N4	8.337	0.1t/m	3.600		1.114

Axial Vertical Force (Pn) = N3 + N4 + Other force + Pile weight

18.452 t

Eccentric Bending Moment (Me) = Pa * e (Distance of eccentricity)

9.226 t.m

Pull out force (Pn) = N4 - N3

2.937 t

Buckling Length (Lk) = L1 + L2

4.96 m

λ = Buckling length (Lk) / iy

66

Ultimate Bearing Capacity

Q = 30 * Pn * Ap

67.500 t

5-1 Allowable Bearing Capacity

Qa = Q * 2/3

45.000 t

-OK-

5-2 Ultimate Frictional Capacity

Rf = ((Sn * Ls) / 5 + (Qu * Lc) / 2) * Lr

39.120 t

-OK-

5-3 Bending Stress

fb = 2.400 kg/cm²

$\sigma_b = Me / Zx$

683 kg/cm²

Compression Stress

fc = 1.554 kg/cm²

$\sigma_c = Pa / Ae$

156 kg/cm²

Cs = $\sigma_b / fb + \sigma_c / fc$

0.39

-OK-

Result: Use King Post H-Beam

300

(H-300 x 300 x 10 x 15)

15.05 m

CALCULATION SHEET

FOR

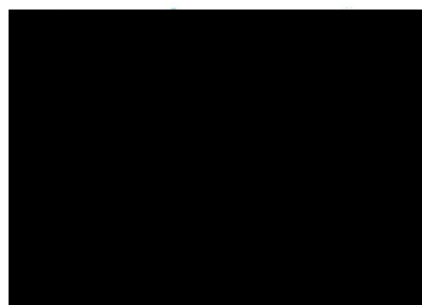
PRELOADING

AT

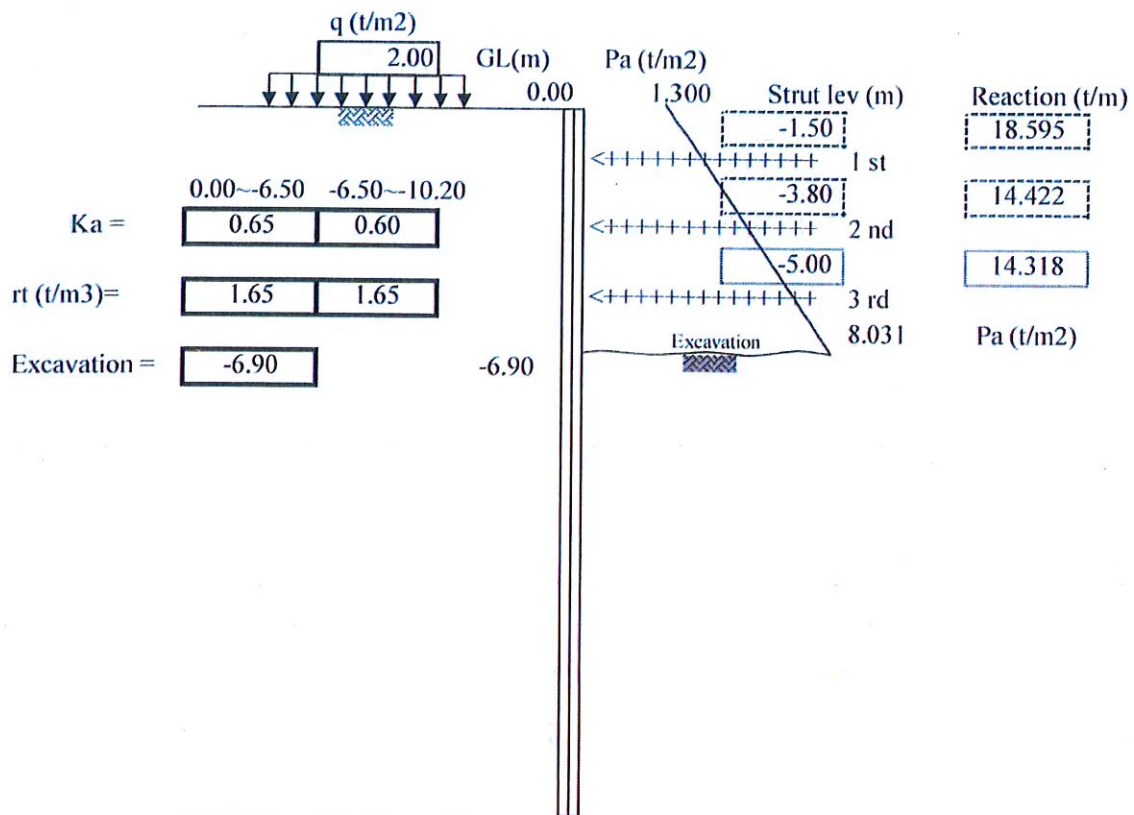
CUSTOMER: วี.เค. การโยธา (2013) จำกัด

PROJECT: NA REVA CHAROENNAKHON

DATE: 28-เม.ย.-22



< Checking of Strut Reaction >



$$Pa \text{ (t/m}^2\text{)} = K_a [(r \times h) + q]$$

$$\text{Reaction (t/m)} = (Pa_1 + Pa_X) \times H \times 1/2$$

PROJECT:
CUSTOMER
LOCATION

NA REVA CHAROENNAKHON
วิ.เค. การโยธา (2013) จำกัด
CHAREONNAKHON

PRELOADING SHEET

GRIDLINE:
COORDINATE:
LOCATION:

DATE:

TOTAL **45** TON

CYLINDER NO:	capacity TON	PSI

BOLT&NUT:
LENGTH,L0 cm

NO	TON	PSI	(cm)	REMARK
1	12			
2	24			
3	45			
4				
5				
6				
AVERAGE ΔL				-
				-

PRELOADING CALCULATION

- 1) REACTION STRUT **18.6 ton/m**
2) SPAN STRUT **6 m**

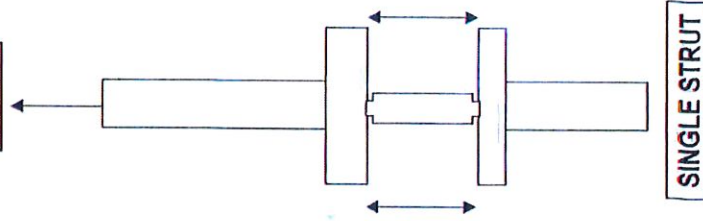
Sol.

$$= 18.6 \times 6 \text{ ton}$$
$$= 112 \text{ ton}$$

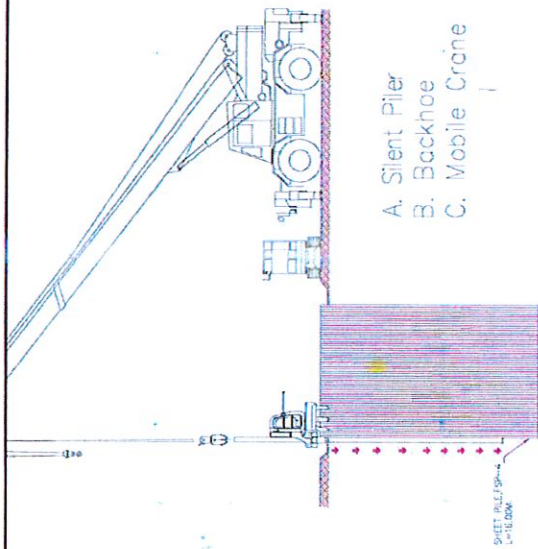
PRELOADING 40% OF STRUT FORCE

$$= 44.6 \text{ ton}$$

say 45 ton



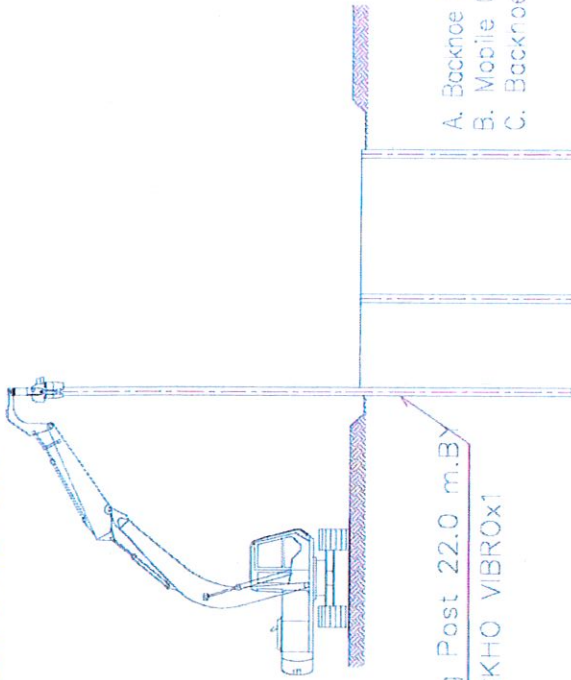
1. Driving Sheet Pile



A. Silent Piler
B. Backhoe
C. Mobile Crane

SHEET PILE 15.00m

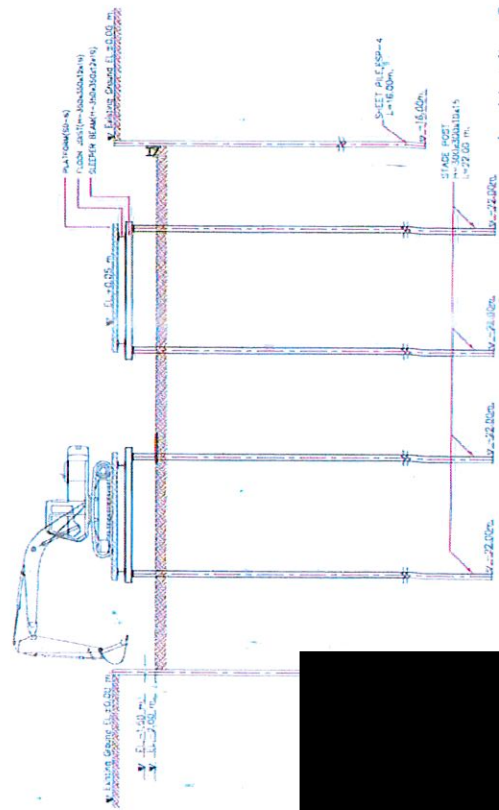
2. Driving King Post And Install Platform



A. Backhoe Vario
B. Mobile Crane
C. Backhoe

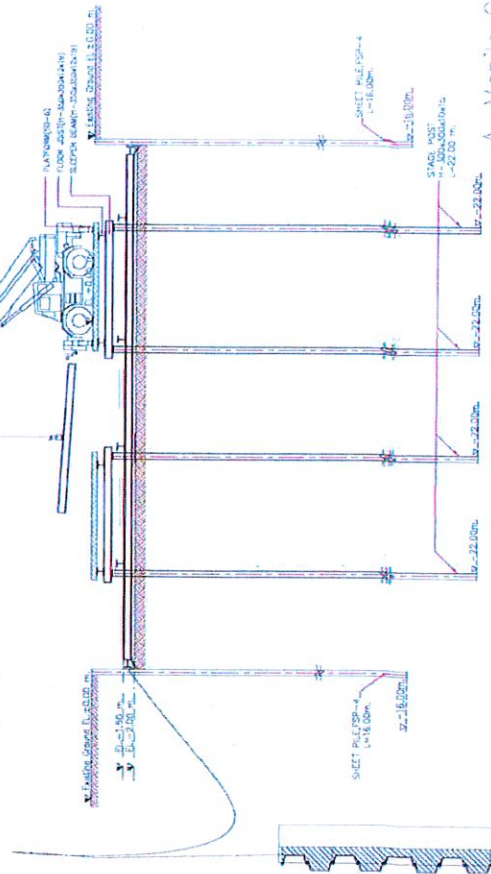
DRIVING King Post 22.0 m. BY
1. BACKHO VIBROx1

3. Excavate to -1.50m For Installation Platform And Install Bracing At -2.00m



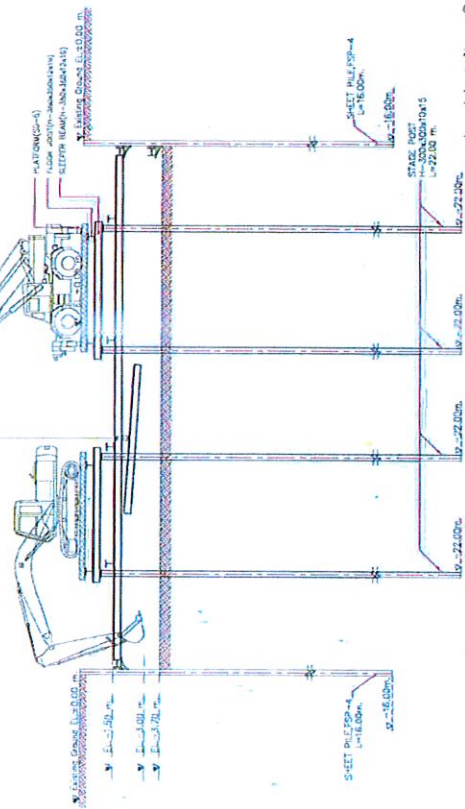
A. Mobile Crane
B. Backhoe

4.1 Install Bracing At -1.50m. 4.2 Packing Concrete By Customer 4.3 Pre Loading



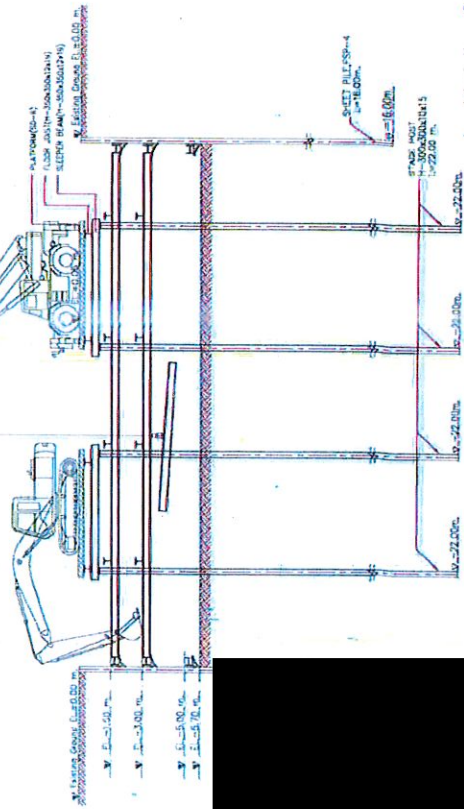
A. Mobile Crane
B. Backhoe

5. Excavate to -3.70m For Install Bracing^{2nd} At -3.00m



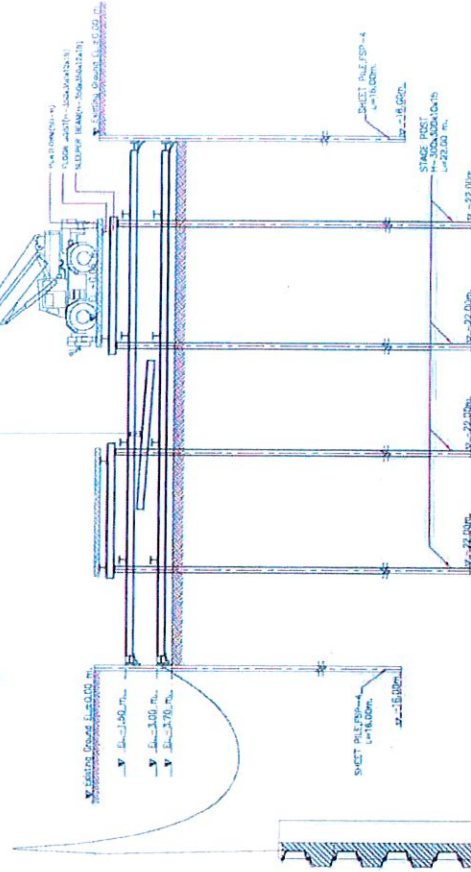
A. Mobile Crane
B. Backhoe

7. Excavate to -5.50m For Install Bracing^{3rd} At -5.00m



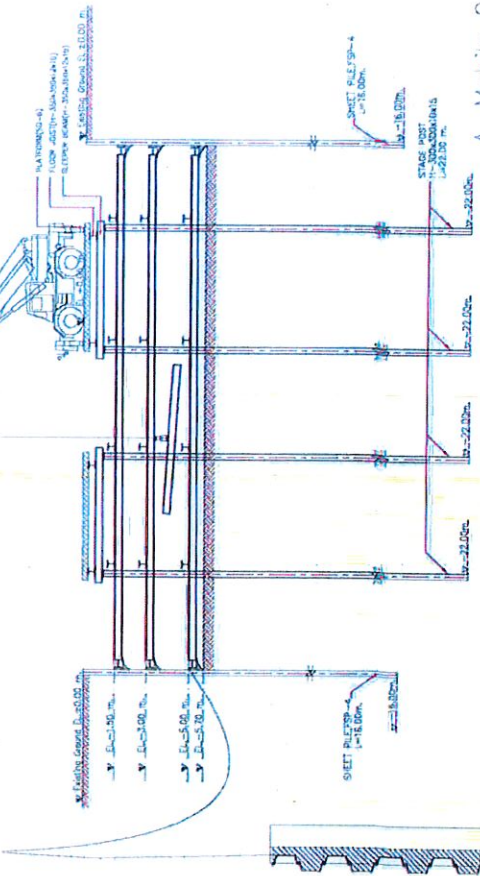
A. Mobile Crane
B. Backhoe

6.1 Install Bracing^{2nd} At -3.00m.
6.2 Packing Concrete By Customer
6.3 Pre Loading



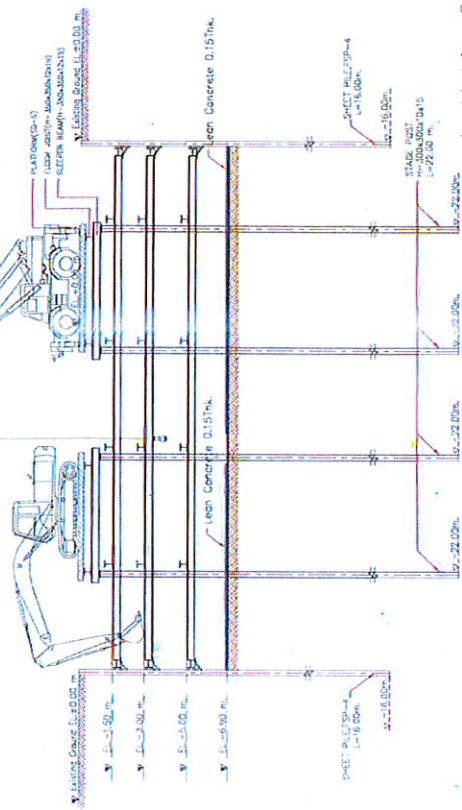
A. Mobile Crane
B. Backhoe

8.1 Install Bracing^{3rd} At -5.00m.
8.2 Packing Concrete By Customer
8.3 Pre Loading



A. Mobile Crane
B. Backhoe

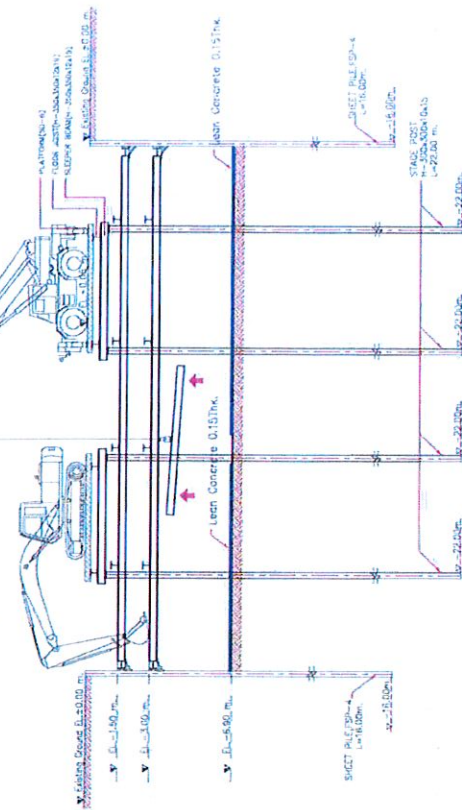
9. Final Excavate to -6.90m. Formwork footing
And Cast Lean Concrete Close Sheet pile immediate By Customer



A. Mobile Crane
B. Backhoe

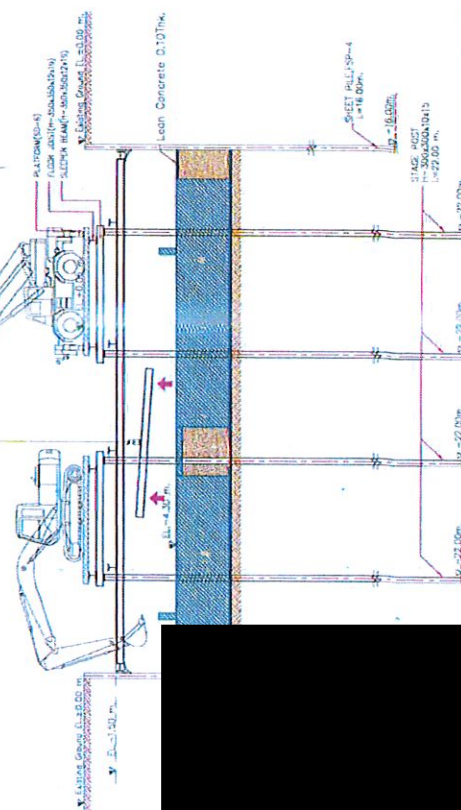
A. Mobile Crane
B. Backhoe

10.1 Making Lean Concrete For Casting At-6.90m
10.2 Backfill Sand And Cast Lean Concrete Close to Sheet Pile
10.3 Remove Bracing 3rd



A. Mobile Crane
B. Backhoe

11.1 Making Footing And Slab As 12x30m
11.2 Backfill Sand And Cast Lean Concrete Close to Street Pile
11.3 Remove Bracing 2nd

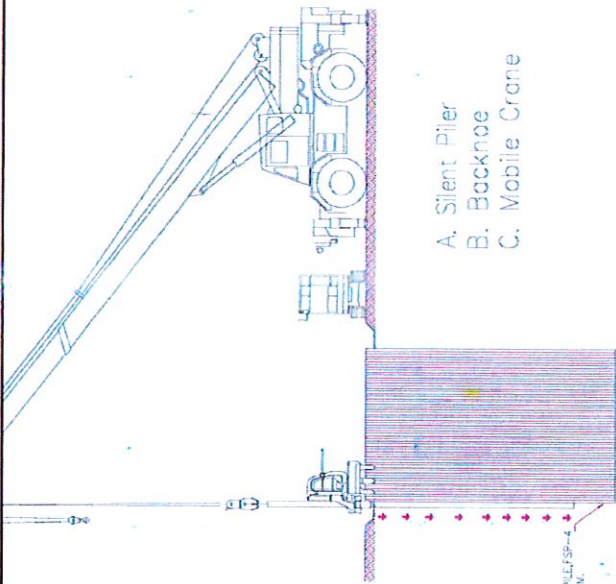


A. Mopile Crane
B. Backhoe

-
- Technical drawing of a sheet pile wall cross-section. The drawing shows a wall with a central blue section and side sections with a brick pattern. Dimensions include a total width of 22.00m, a central section width of 8.50m, and a side section width of 1.60m. A crane is shown on the left, and a truck is shown on the right. The wall is labeled "R-Wall to Existing Soil Level" and "Backfill Sand By Customer". The drawing also shows "Extraction Sheet Pile With Instant Void With Sand Water" and "Remove Platform And Extraction King Pile". The wall is labeled "Sheet Pile Wall" and "Sheet Pile Wall".

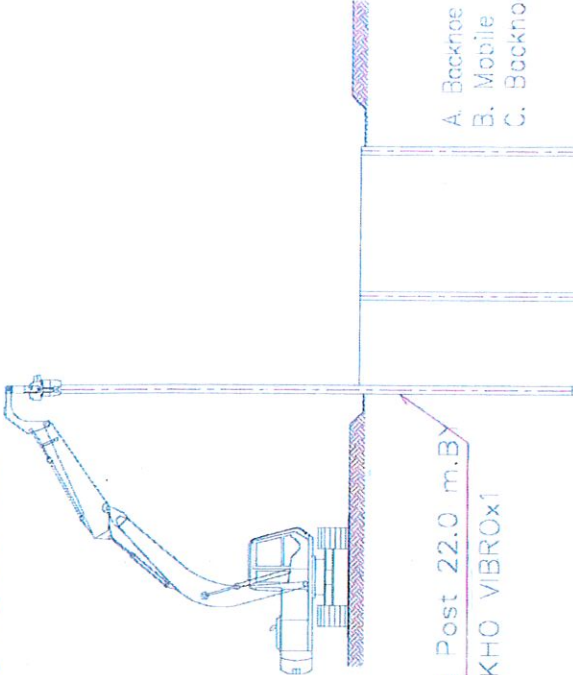
A. Backhoe Vibro
B. Backhoe

1. Driving Sheet Pile



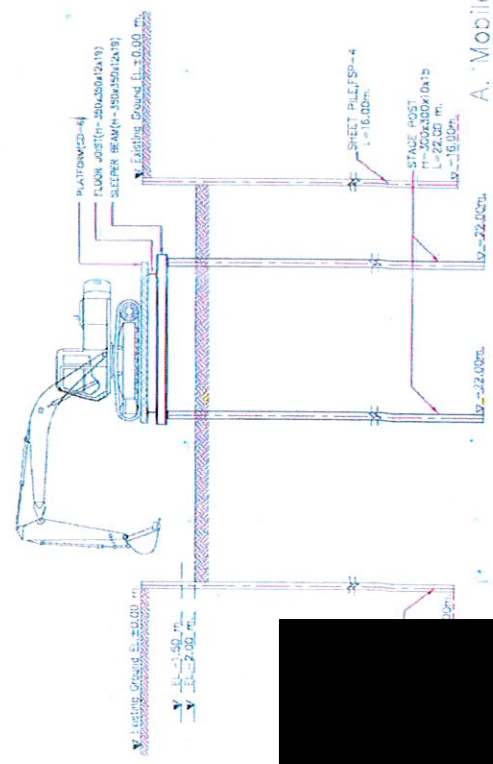
A. Silent Piler
B. Backhoe
C. Mobile Crane

2. Driving King Post And Install Platform



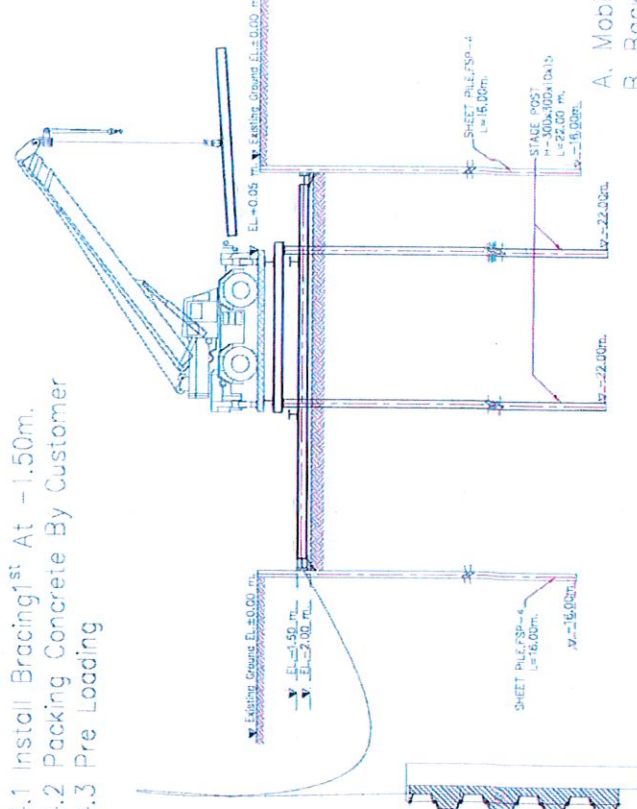
A. Backhoe Vibro
B. Mobile Crane
C. Backhoe

3. Excavate to -1.50m For Installation Platform And Install Bracing1st At -2.00m



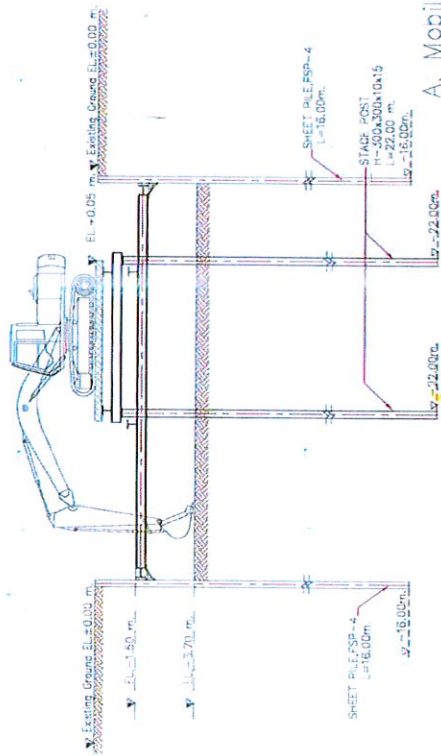
A. Mobile Crane
B. Backhoe

4.1 Install Bracing1st At -1.50m. 4.2 Packing Concrete By Customer 4.3 Pre Loading



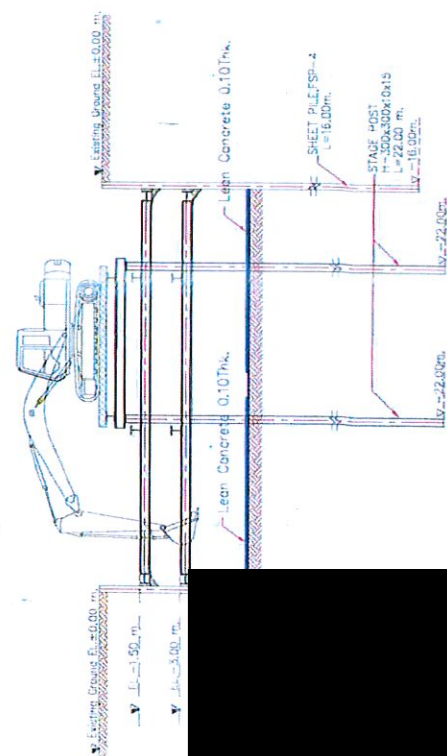
A. Mobile Crane
B. Backhoe

5. Excavate to -3.70m For Install Bracing^{2nd} At -3.00m



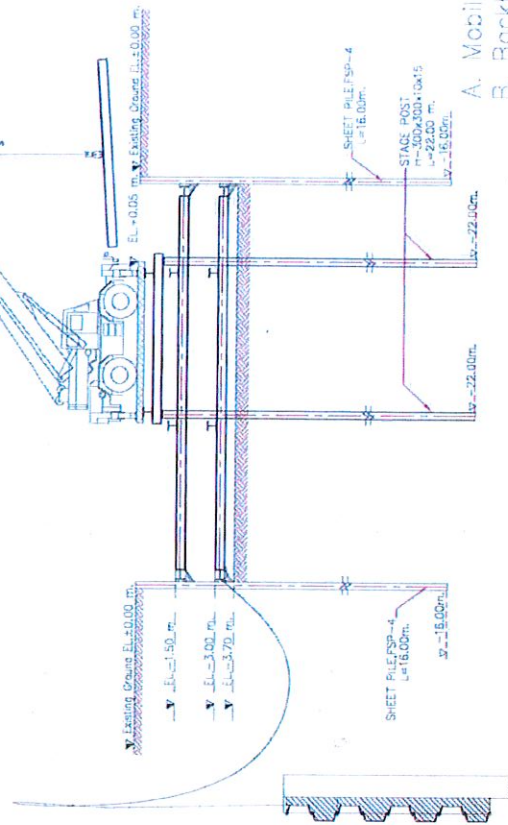
A. Mobile Crane
B. Backhoe

7. Final Excavate to -5.50m. For Making Footing And Cast Lean Concrete Close Sheet Pile



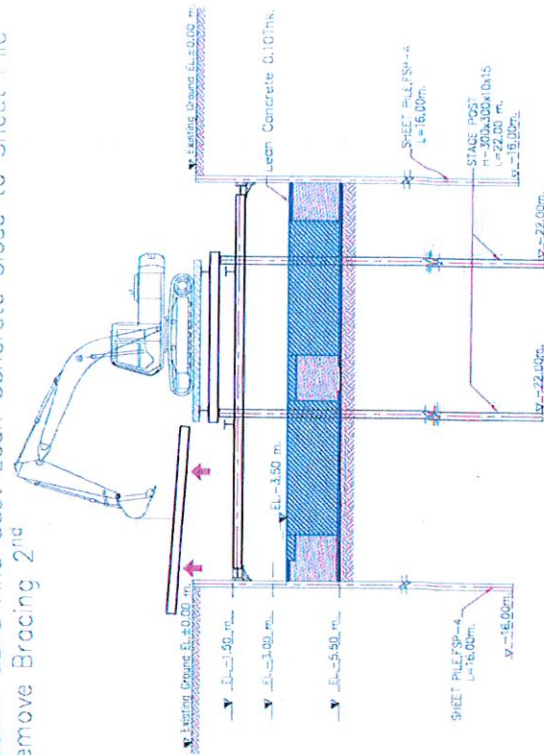
A. Backhoe

6.1 Install Bracing^{2nd} At -3.00m.
6.2 Packing Concrete By Customer
6.3 Pre Loading



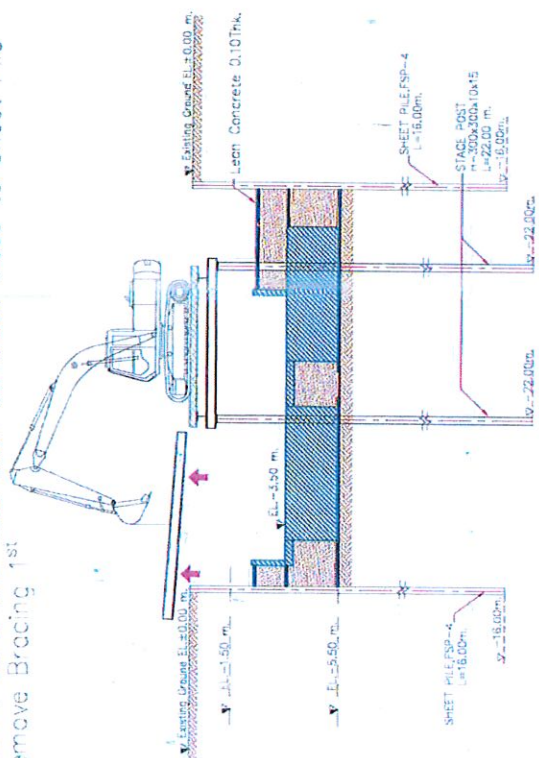
A. Mobile Crane
B. Backhoe

8.1 Making Footing And Slab At -3.50m
8.2 Backfill Sand And Cast Lean Concrete Close to Sheet Pile
8.3 Remove Bracing^{2nd}



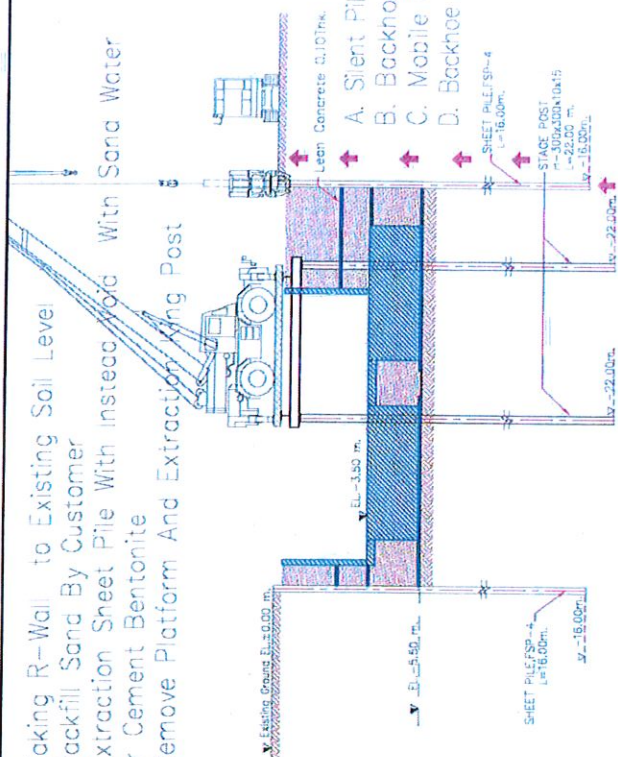
A. Backhoe

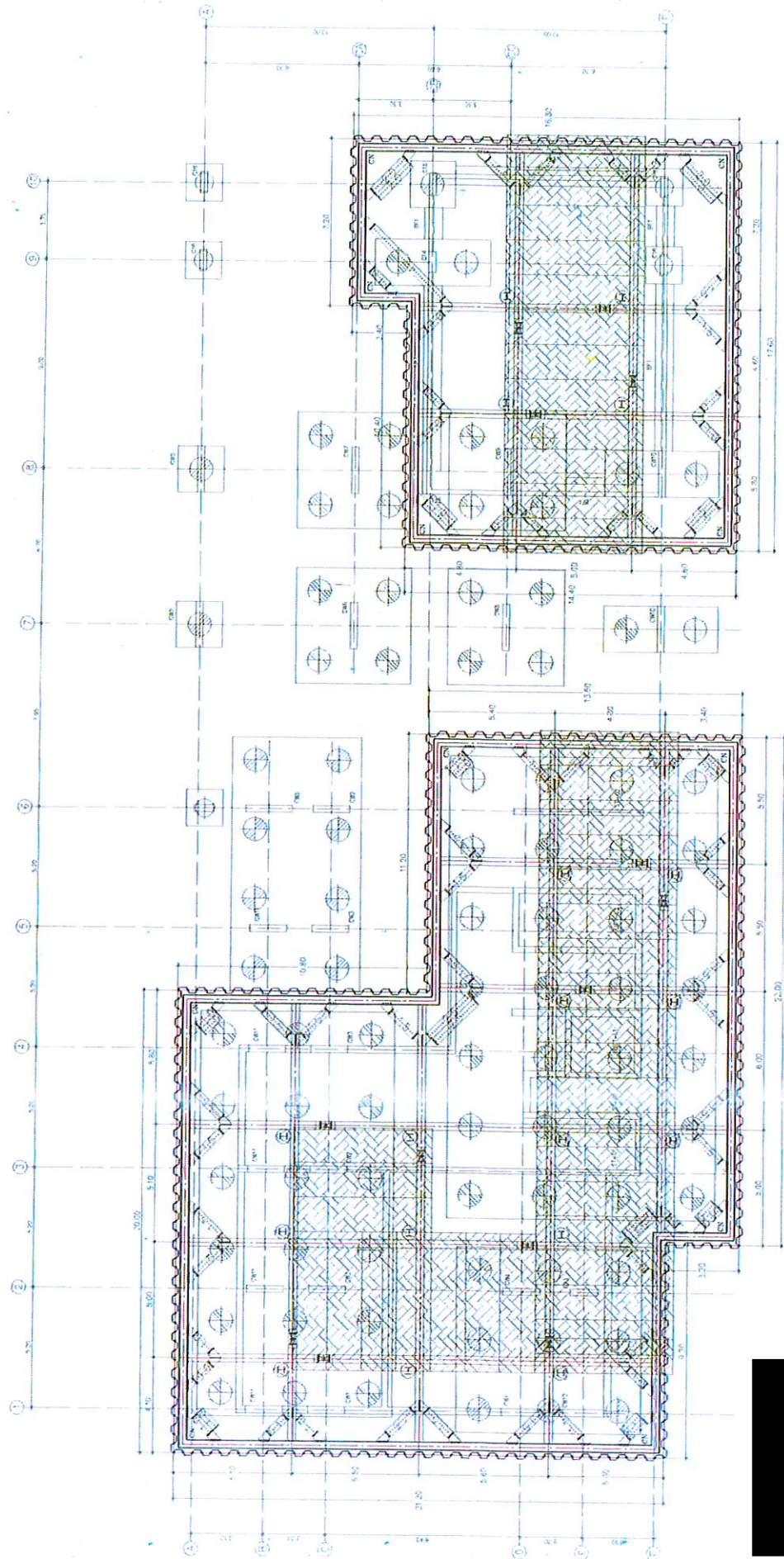
- 9.1 Making R-Wall At-2.00m
9.2 Backfill Sand And Cast Lean Concrete Close to Sheet Pile
9.3 Remove Bracing 1st



A. Backhoe

-
- 10.1 Making R-Wall to Existing Soil Level.
- 10.2 Backfill Sand By Customer
- 10.3 Extraction Sheet Pile With Instead Acid With Sand Water Or Cement Bentonite
- 10.4 Remove Platform And Extraction King Post



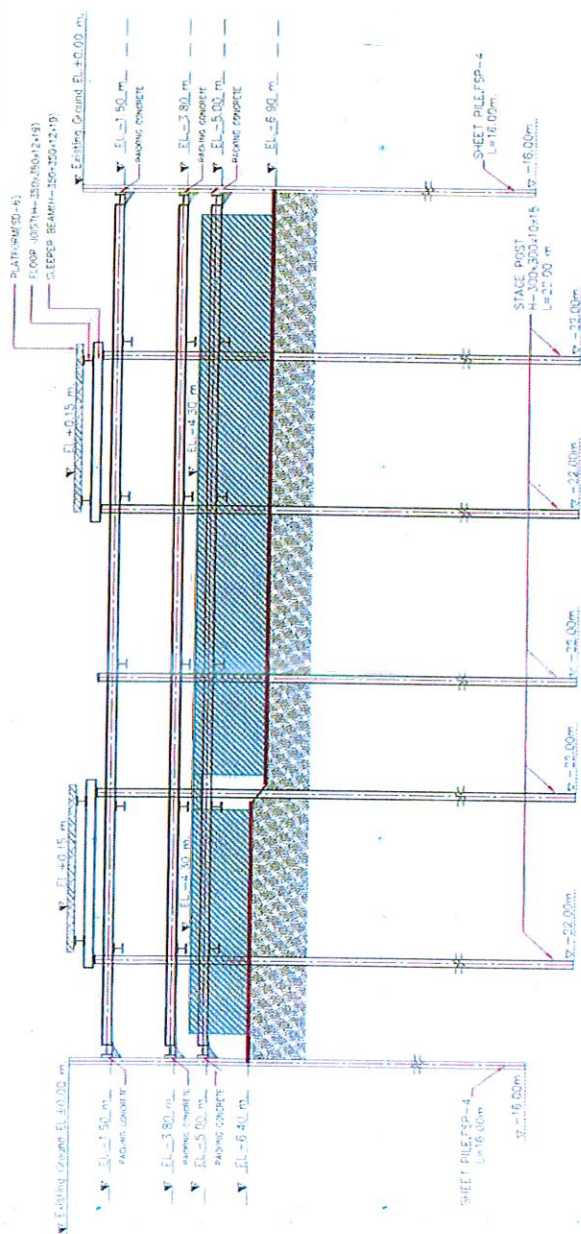


RETENTION TANK

WATER TANK

Layer	Elevation	Member
Strut Layer 1	-1.50 m	W350x350x150 kg/m @ 6.00 m
Strut Layer 2	-3.80 m	W300x300x100 kg/m @ 6.00 m
Strut Layer 3	-5.00 m	W300x300x100 kg/m @ 6.00 m

Layer	Elevation	Member
Wale Layer 1	-1.50 m	W350x350x150 kg/m, Spac 3.00 m
Wale Layer 2	-3.80 m	W300x300x100 kg/m, Spac 3.00 m
Wale Layer 3	-5.00 m	W300x300x100 kg/m, Spac 3.00 m

[illegible]

SECTION RETENTION TANK

SUMMARY OF BRACING MEMBER RETENTION TANK

Layer	Elevation	Member
Strut Layer 1	+1.50 m.	W300x300x300 sq./m @ 6.00 m
Strut Layer 2	-3.00 m.	W300x300x300 sq./m @ 6.00 m.

Layer	Elevation	Member
Wale Layer 1	-1.50 m	W300x300x100 kg/m, Span 3.00 m
Wale Layer 2	-3.00 m	W210x300x100 kg/m, Span 3.00 m