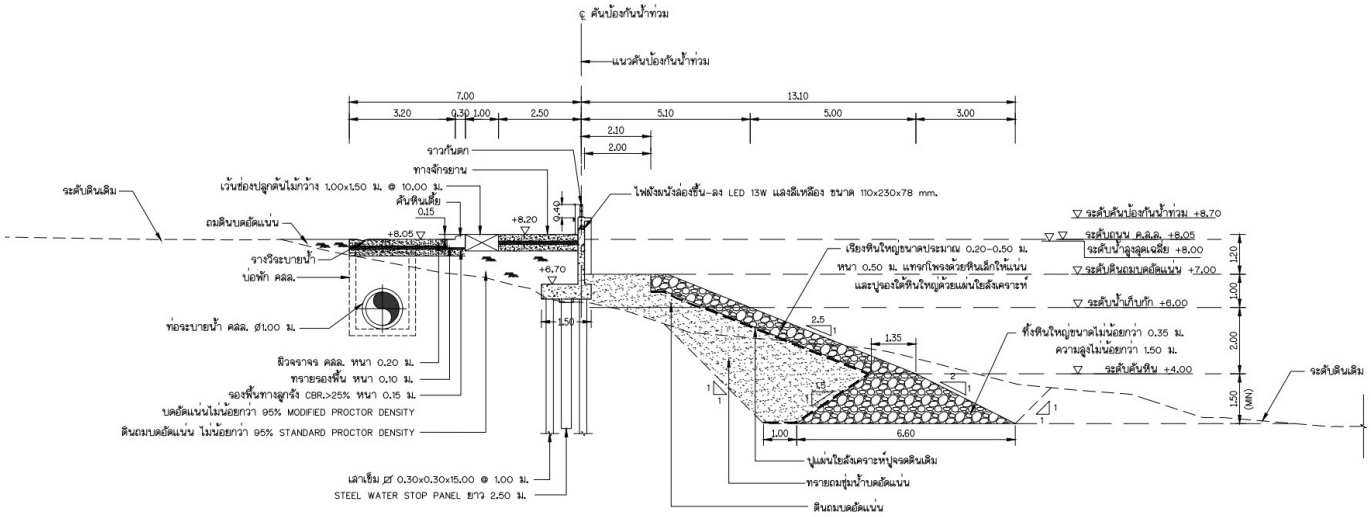
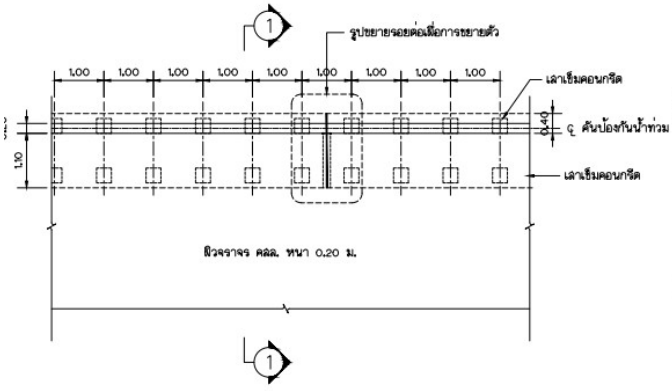
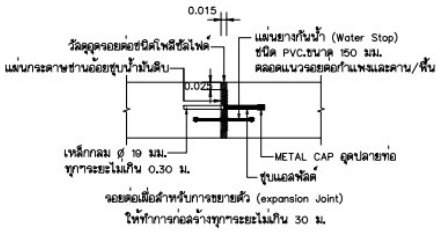
รายการคำนวณเขื่อนป้องกันน้ำท่วม





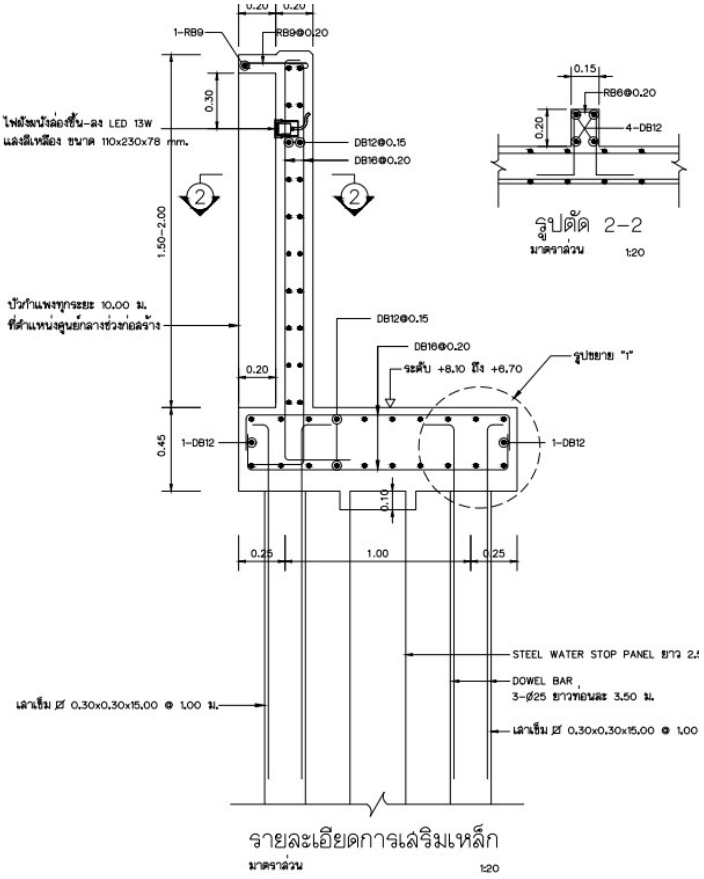
แปลน

มาตราส่วน 1:75



รายละเอียดรอยต่อเผื่อการขยายตัว

มาตราส่วน 1:10



รายละเอียดการเสริมเหล็ก

มาตราส่วน 1:20

PTC	PROJECT : ศาลปกครองพิษณุโลก อ.เมือง จ.พิษณุโลก			PROGRESS TECHNOLOGY CONSULTANTS CO.,LTD
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Working Stress Design
CRITERIA DESIGN

1 คอนกรีต

$f'c$ = 240 ksc

$f_c = 0.375 f'c$ = 90 ksc

$n = \frac{135}{\sqrt{f'c}}$ = 8

2 เหล็กข้ออ้อย (SD 40)

$f_s = 0.5 fy$ = 1,700 ksc

$k = \frac{1}{1 + \frac{f_s}{n f_c}}$ = 0.297

$j = 1 - \frac{k}{3}$ = 0.9

$R = \frac{1}{2} f_c j k$ = 12.03 ksc

3 เหล็กกลม (SR 24)

$f_s = 0.5 fy$ = 1,200 ksc

$k = \frac{1}{1 + \frac{f_s}{n f_c}}$ = 0.375

$j = 1 - \frac{k}{3}$ = 0.875

$R = \frac{1}{2} f_c j k$ = 14.77 ksc

PTC	PROJECT : สะพานลอยคนข้าม จ.ชัยภูมิ			PROGRESS TECHNOLOGY CONSULTANTS CO.,LTD
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4 น้ำหนักบรรทกจร

Wind Load	=	50	kg/m2
Surcharge load on floor	=	1,000	kg/m2

5 น้ำหนักบรรทกคงที่

น้ำหนักน้ำ	=	1.00	Ton/m3
น้ำหนักดินอัดแน่นแห้ง	=	1.60	Ton/m3
น้ำหนักดินอัดแน่นเปียก	=	2.10	Ton/m3
น้ำหนักคอนกรีตเสริมเหล็ก	=	2.40	Ton/m3

$\emptyset$ = 30° (Compacted Soil)

$$Ka = \frac{1 - \sin \emptyset}{1 + \sin \emptyset} = 0.333$$

$$Kp = \frac{1}{Ka} = 3.00$$

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PTC				PROGRESS TECHNOLOGY
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	CHANASAK	18/3/66		

6 PILE IN SAND

$$Q_a = Q_b + Q_s / F.S - SW$$

(2.5)

($b \times w \times L \times 2.4^{T/m3}$)

SELF WT. OF PILE

6.1) End Bearing

$$Qb = \sigma'_v \; N_q \; A_b$$

σ'_v = Effective Overburden Pressure

N_q = Soil Bearing Capacity α $\varnothing$ L/B

L = Pile Length

B = Pile Size

$\varnothing$	N_q	
	L/B = 25	L/B = 50
28°	12	9
30°	17	14
32°	25	22
34°	40	37
36°	58	56
38°	89	88
40°	37	136

A_b = Cross Section Area Atend

6.2) Skin Friction

$$Q_S = F_S \; A_S$$

A_S = Perimter Areg Offile

$F_S = K_S \; \sigma'_v \tan \delta$

σ'_v = Average Effectiue Overburden Presser

δ = Friction Angle Between Pile in Sand

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Pile	δ	K_S	
		Loose	Dense
Stgel	20°	0.5	1
Conceect	0.75 $\varnothing$	1	2
Timber	0.67 $\varnothing$	1.5	4

Sand

SPT_{-}^{N}	Recative Densitg DR (%)	Angle of Friction $\varnothing$
0 - 5	0 - 5	26 - 30
5 - 10	5 - 30	28 - 35
10 - 30	30 - 60	35 - 42
30 - 50	60 - 95	38 - 46

Clay

SPT_{-}^{N}	Consistencg	Unconfined Compresgive Strangth		C = qu/2 (T/m^2)
		qu (kN/m^2) X 0.1	qu (LT/m^2) X 0.1 $\approx S_u$	
0 - 2	Very Soft	0 - 25	0 - 2.5	0 - 1.25
2 - 5	Soft	25 - 50	2.5 - 5	1.25 - 2.5
5 - 10	Medium	50 - 100	5 - 10	2.5 - 5
10 - 20	Stiff	100 - 200	10 - 20	5 - 10
20 - 30	Very Stiff	200 - 400	20 - 40	10 - 20
> 30	Hard	> 400	> 40	> 20

PTC	PROJECT : หนองบัวระเหว จ.ชัยภูมิ			PROGRESS TECHNOLOGY CONSULTANTS CO.,LTD
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7 PILE IN CLAY

$$Q_a = Qb + QS / FS - SW$$

FS = (2.5)

SW = ($b \times w \times L \times 2.4^{T/m3}$) SELF WT. OF PILE

7.1) End Bearing

$$Q_b = C_b \; N_C \; A_b$$

S_U

C_b = Undrain Shgar Strength S_U

N_C = Coefficient of Pile Footng = 9

A_b = Cross Section Area

7.2) Skin Friction

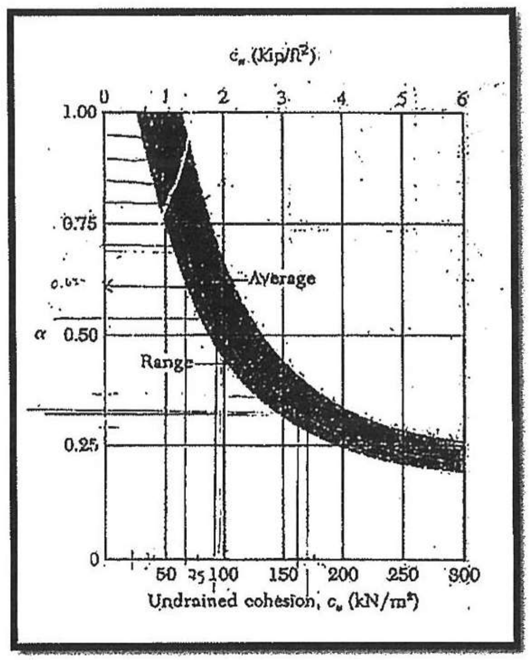
$$Q_S = C_S \; \alpha \; A_S$$

C_S = Average of S_U Along Dile Length

α = Adhesion Factor

Friction Between Oilg and Clay

A_S = Derimeter Area of Pile



PTC	PROJECT :			PROGRESS TECHNOLOGY CONSULTANTS CO.,LTD
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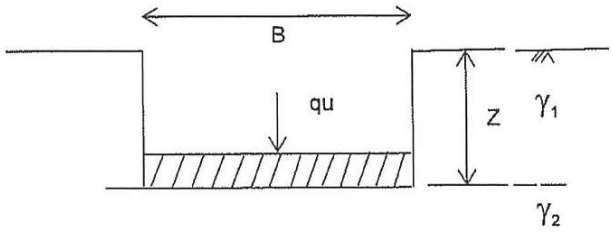
8 SOIL BEARING CAPACITY

REFER TO TERZAGHI'S EQUATION



(Typgof) FOOTING	N_C	qu N_q	N_γ
Strip/Long/Continous	C N_C	+ γ_1 Z N_q	+ 0.5 γ_2 B N_γ
Square	1.3C N_C	+ γ_1 Z N_q	+ 0.4 γ_2 B N_γ
Circolan	1.3C N_C	+ γ_1 Z N_q	+ 0.3 γ_2 B N_γ
Rectiangula	(1+0.3 b/l) C N_C	+ γ_1 Z N_q	+ 0.5 γ_2 B(1-0.2B/L) N_γ

q_U = Ultimate Bearing Capacity

C^{qa} = Alcowable (Safe) Bearing Capacity ; FS = 3"

γ = Soil Desity

Z = Depth

B = Width of Footing

L = Length

Ø	0°	5°	10	15	20	25	30°	35°	40	45	50
N_C	5.7	7.3	9.6	12.9	17.7	25.1	37.2	57.8	95.2	172	348
N_q	1	1.6	2.7	4.4	7.4	12.7	22.5	41.4	81.3	173	415
N_γ	0	0.5	1.2	2.5	5.0	9.7	19.7	42.4	100	298	1,153

PTC	PROJECT: ฝายป้องกันน้ำท่วม จ. ชัยภูมิ			PROGRESS TECHNOLOGY CONSULTANTS CO., LTD.
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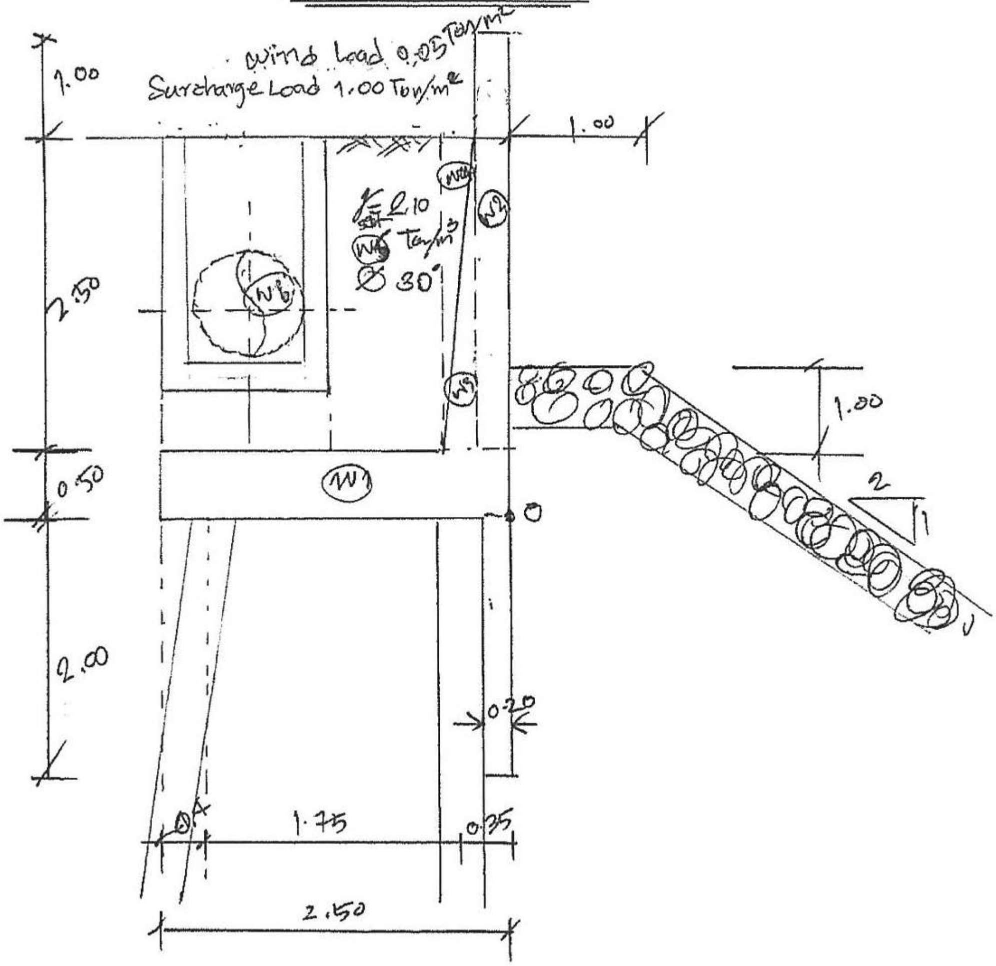
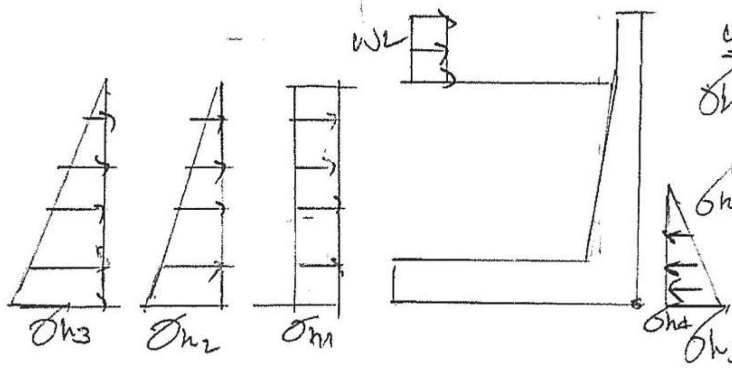
ออกแบบคันป้องกันน้ำท่วม



พิจารณาการ Overturning & Sliding

- พิจารณาด้านแรงกระทำด้านข้างต่อกำแพง



หาค่า σh

$\sigma_{h1} = K_a S_u$

$= 0.333 \times 1 = 0.333$ Ton/m²

$\sigma_{h2} = K_a(\gamma_{sat} - \gamma_w)h$

$= 0.333(2.1 - 1.0)3 = 1.10$ Ton/m²

$\sigma_{h3} = 1(3) = 3$ Ton/m²

$WL = 0.05$ Ton/m²

$\sigma_{h4} = K_p(\gamma_{dry})h_p$

$= 3(1.6)(1.5) = 7.20$ Ton/m²

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Horizontal Force & Moment

	Force (Ton)	Arm (M.)	Moment (Ton-m)
F_1 =	$0.333 \times 3 = 0.999$	3/2	1.4985
F_2 =	$\frac{1}{2} \times 3 \times 1.10 = 1.65$	3/3	1.65
F_3 =	$\frac{1}{2} \times 3 \times 3 = 4.5$	3/3	4.5
F_4 =	$0.05 \times 1.00 = 0.05$	$3+\frac{1}{2}$	0.175
F_5 =	$\frac{1}{2} \times 1.5 \times 7.20 = 5.40$	1.5/3	2.70

$\Sigma F = F_1 + F_2 + F_3 + F_4 - F_5 =$ **1.799 Ton**

$\Sigma M = M_1 + M_2 + M_3 + M_4 - M_5 =$ **5.1235 Ton-m**

Vertical & Moment

	W (Ton)	ARM (m)	Moment (Ton-m)
W_1 =	$0.5 \times 2.50 \times 2.4 = 3.00$	2.5/2	3.75
W_2 =	$0.20 \times 3.5 \times 2.4 = 1.68$	0.25/2	0.21
W_3 =	$\frac{1}{2} \times 2.50 \times 0.20 = 0.25$	0.2+0.066	0.0665
W_4 =	$\frac{1}{2} \times 2.5 \times 0.20 = 0.25$	0.2+0.066+0.066	0.083
W_5 =	$2.10 \times 2.50 \times 2.10 = 11.025$	0.40+2.1/2	15.98
W_6 =	$\frac{3.14 \times 1 \times 1}{4} \times 2.10 = 1.6485$	0.40+1.4	2.9673

$\Sigma W = W_1 + W_2 + W_3 + W_4 + W_5 - W_6 =$ **16.85 Ton**

$\Sigma M = 3.75 + 0.21 + 0.0665 + 0.083 + 15.98 - 2.967 =$ **20.09 Ton-m**

Check Overturning

$$F.S. = \frac{M_R}{M_A} = \frac{20.09}{5.1235} = 3.92 > 1.50 \text{ ok.}$$

Check Sliding

$$F.S. = \frac{\mu(\Sigma W)}{\Sigma F} = \frac{0.40(16.85)}{1.799} = 3.74 > 1.3 \text{ ok.}$$

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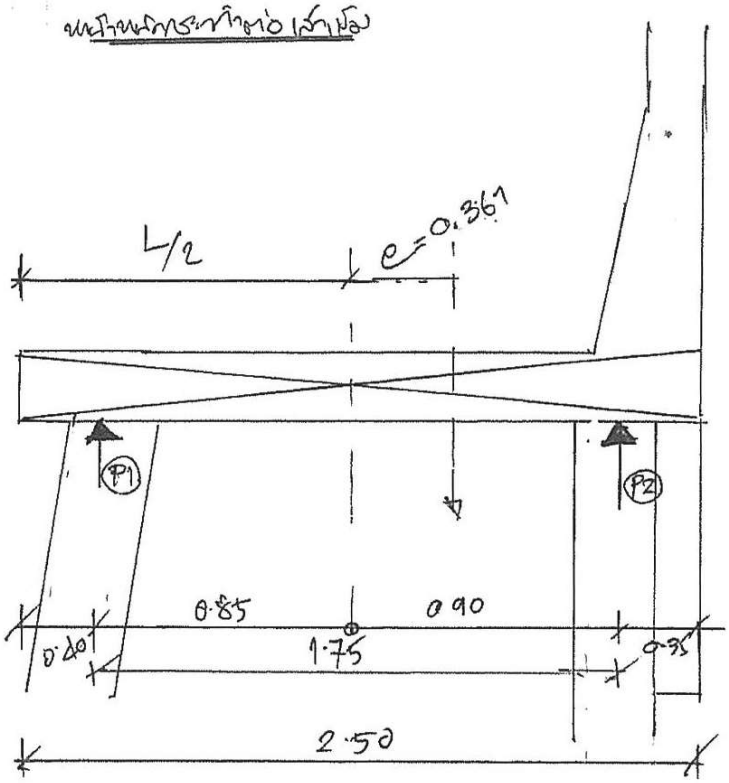
แสดงแผนภาพการกระทำของแรงเยื้องศูนย์



ระยะเยื้องศูนย์

$$e = \frac{L}{2} - \frac{M_R - M_O}{\Sigma W}$$

$$e = \frac{2.5}{2} - \frac{20.09 - 5.1235}{16.85}$$

$$e = 0.361 \text{ m.}$$

การหาขนาดของแรงเสาเข็ม

$$P_i = \frac{\Sigma W}{N} \pm \frac{\Sigma W e x_i}{\Sigma x_i^2}$$

$$P_1 = \frac{16.85}{2} - \frac{16.85(0.361)(0.85)}{(0.85)^2+(0.9)^2} = 5.051 \text{ Ton}$$

$$P_2 = \frac{16.85}{2} + \frac{16.85(0.361)(0.90)}{(0.85)^2+(0.9)^2} = 11.997 \text{ Ton}$$

For SPACING 1.50 m.

$P_1 \times 1.5 = 5.051 \times 1.5 =$ 7.57 Ton/Pile

$P_2 \times 1.5 = 11.997 \times 1.5 =$ 18.00 Ton/Pile

ออกแบบเสาเข็มเจาะ (ใช้เสาเข็มขนาด 0.30 x 0.30 ม.)

Skin Friction

LEYER (3.-7.5) (CLAY)

$Q_S = C_S \alpha A_S$ ∴ SPT = 7, C_S = 4.5 Ton/m²

$Q_S = 4.5(0.80)(0.30 \times 4 \times (7.5-3))$

$Q_{S\ (3-7.5)} = 19.44$ Ton

LEYER (7.5-9) (CLAY)

$Q_S = C_S \alpha A_S$ ∴ SPT ≈ 15, C_S = 7.5 Ton/m²

$Q_S = 7.5(0.60)(0.30 \times 4(9-7.5))$

$Q_{(7.5-9)} = 8.10$ Ton

LEYER (9.-10) (SAND)

$Q_S = A_S f_S$ ∴ $f_S = k_s \bar{\sigma}_v (\tan \delta)$, SPT = 13, $\phi = 36°$

$\bar{\sigma}_{v\ 9+10} = (\gamma_{sat} - \gamma_w) h_1$

$= (2.1-1)(9.5)$

$= 10.45$ Ton/m²

$k_o = 1 - \sin \phi$

$k_o = 1 - \sin 36°$

$k_o = 1 - 0.588 = 0.411$

$\frac{k_s}{k_o} = 2$

$k_s = 2(0.411)$

$k_s = 0.822$

$\tan \delta = \tan(0.75 \times 36)$

$\tan \delta = 0.51$

$f_s = 0.822(10.45)(0.51) = 4.38$

$Q_S = A_S f_S = 4.38.(0.30 \times 4 \times (10-9)) = 5.25$ Ton

$\Sigma Q_S = 32.79$ Ton

END Bearing (SAND)

$$Q_b = \sigma'_v N_q A_b$$

$$Q_b = 10.45\,(58)\,(0.30 \times 0.30)$$

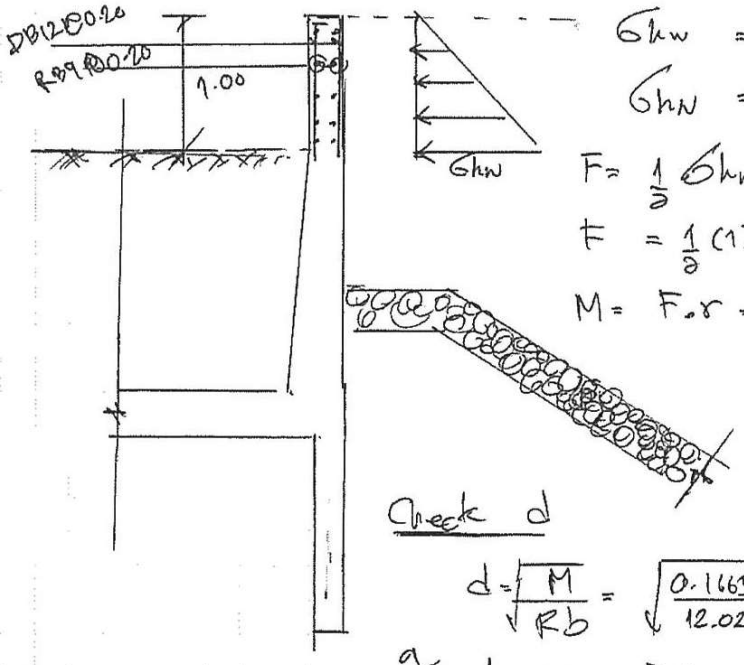
$$\Sigma Q_b = 54.55 \text{ Ton}$$

S.W. (เข็มตอก) $= 0.30 \times 0.30 \times 7 \times 2.4 = 1.512$ Ton

$$Q_a = \frac{Q_s + Q_b}{F.S.} - S.W = \frac{33.42}{2.5} \text{ Ton/Pile} > 18.00 \text{ Ton/Pile}$$ OK

ออกแบบเข็มกันดิน

หาปริมาณเหล็กเสริมของเข็มกันดิน



$\sigma_{hw} = \gamma_w h$

$\sigma_{hw} = 1.00(1) = 1$ Ton/m²

$F = \frac{1}{2}\sigma_{hw} \times h$

$F = \frac{1}{2}(1)(1) = 0.5$ Ton

$M = F.r = 0.5 \times \frac{1}{3} = 0.165$ Ton-m

Check d

$$d = \sqrt{\frac{M}{R_b}} = \sqrt{\frac{0.165 \times 100 \times 1000}{12.0285 \times 100}} = 3.72 \text{ cm}$$

ใช้ d = 15 cm > 3.27 cm OK.

หาเหล็กเสริม

$$A_s = \frac{M}{f_s.jd} = \frac{0.165 \times 1000 \times 100}{1700 \times 0.90 \times 15} = 0.725 \text{ cm}^2/\text{m}$$

เหล็กกันร้าว

$A_{st} = 0.002bt$

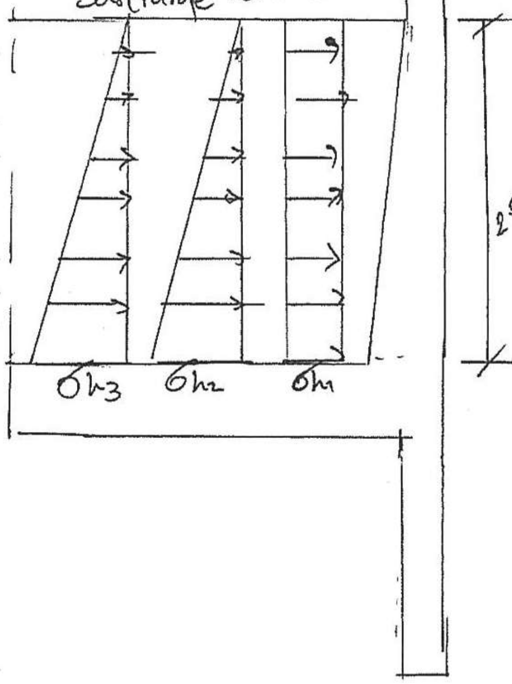
$A_{st} = 0.002(100)(40)$

$A_{st} = 4\ cm^2/m$

ใช้ DB12@0.20, $A_s = 5.652\ cm^2/m > 4.00\ cm^2/m$ OK

หาแรงเฉือนที่กำแพง

Surcharge Load = 1.00 Ton/m²



หา σh

$\sigma h_1 = K_a S_a$

$\sigma h_1 = (0.333)(1) = 0.333\ Ton/m^2$

$\sigma h_2 = K_a(\gamma_{sat} - \gamma_w)h$

$= (0.333)(2.1-1)(2.5) = 0.915\ Ton/m^2$

$\sigma h_3 = \gamma_w h$

$= (1)(2.5) = 2.5\ Ton/m^2$

Horizontal Force & Moment

Force (Ton)	Arm (M).	Moment (Ton-m)
$F_1 = 0.333 \times 2.5 = 0.8325$	2.5/2	1.040
$F_2 = \frac{1}{2} \times 2.5 \times 0.915 = 1.143$	2.5/3	0.953
$F_3 = \frac{1}{2} \times 2.50 \times 2.50 = 3.125$	2.5/3	2.604
$\Sigma F = 5.1005$ Ton		$\Sigma M = 4.597$ Ton-m

Check d=

$$d = \sqrt{\frac{M}{Rb}} = \sqrt{\frac{6.10 \times 1000 \times 100}{12.0285 \times 100}} = 20.60 \text{ cm}$$

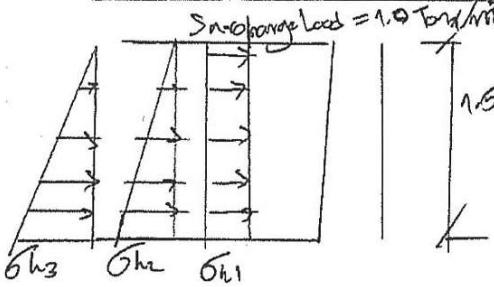
ใช้ $d = 32.5$ cm > 20.60 cm Ok.

หาเหล็กเสริม

$$A_s = \frac{M}{f_s \cdot j \cdot d} = \frac{6.100 \times 1000 \times 100}{1700 \times 0.90 \times 35} = 10.25 \text{ cm}^2/\text{m}$$

ใช้ DB12 @0.10, $A_s = 11.304 \text{ cm}^2/\text{m} > 10.25 \text{ cm}^2/\text{m}$ Ok

Check Moment ที่ความสูง 1.5 m. เพื่อคำนวณหาเหล็กเสริม



หา σh

$\sigma_{h1} = k_a S_u = 0.333 \times 1. = 0.333 \text{ Ton/m}^2$

$\sigma_{h2} = k_a(\gamma_{sat} - \gamma_w)h = 0.333 \times 1.10 \times 1.5 \text{ Ton/m}^2$

$= 0.549$

$\sigma_{h3} = \gamma_w h = 1(1.5) = 1.5 \text{ Ton/m}^2$

Horizaltal Force & Moment

Force (Ton)	Arm (M).	Moment (Ton-m)
$F_1 = 0.333 \times 1.5 = 0.4995$	1.5/2	0.374
$F_2 = \frac{1}{2} \times 1.5 \times 0.549 = 0.41175$	1.5/3	0.205
$F_3 = \frac{1}{2} \times 1.5 \times 1.5 = 1.125$	1.5/3	0.5625
$\Sigma F = 2.036$ Ton		$\Sigma M = 1.1415$ Ton-m

หาเหล็กเสริม

$$A_s = \frac{M}{f_s \cdot jd} = \frac{1.1415 \times 100 \times 1000}{1700 \times 0.90 \times 24.5} = 3.04 \text{ cm}^2/\text{m}$$

ใช้ DB12 @0.20, $A_s = 5.652 \text{ cm}^2/\text{m} > 3.04 \text{ cm}^2/\text{m}$ Ok

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Check V_c

$$V_c = 0.29\sqrt{f'_c}\, bd \times \frac{1}{1000}$$

$$V_c = \frac{0.29\sqrt{240} \times 100 \times 32.5}{1000} = 14.60 \text{ Ton} > 75.100 \text{ Ton}$$ Ok

เหล็กรับการแตกร้าว (Shrinkage)

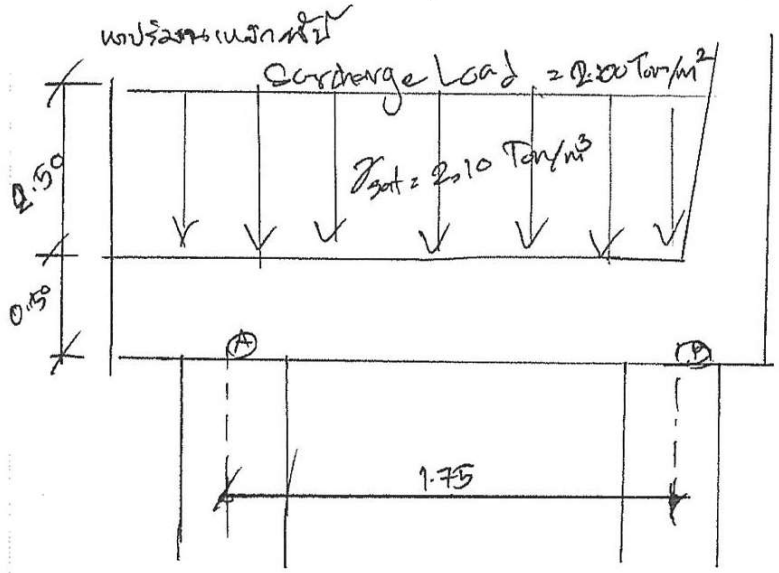
$$A_{st} = 0.0018\, bt$$

$$= 0.0018 \times 40 \times 100$$

$$A_{st} = 7.2 \text{ cm}^2/\text{m}$$

ใช้ DB12@0.20, A_s = 11.304 cm^2/m > 7.2 cm^2/m Ok

แบบจำลองเหล็กเสริม



$$\text{Moment}_{A-B} = \frac{1}{8}\left((2.4 \times 0.5) + (2.1 \times 2.5) + 2\right) \times (1.75)^2$$

$$M_{A-B} = 3.23 \text{ Ton-m}$$

แบบจำลองเหล็กเสริมหลัก

$$A_s = \frac{M}{f_s j d} = \frac{3.23 \times 100 \times 1000}{1700 \times 0.90 \times 42.5} = 4.96 \text{ cm}^2/\text{m}.$$

แบบเหล็กรับแรงเฉือน

$$A_{st} = 0.0018bt - 0.0015(100)(50) = 9 \text{ cm}^2/\text{m}$$

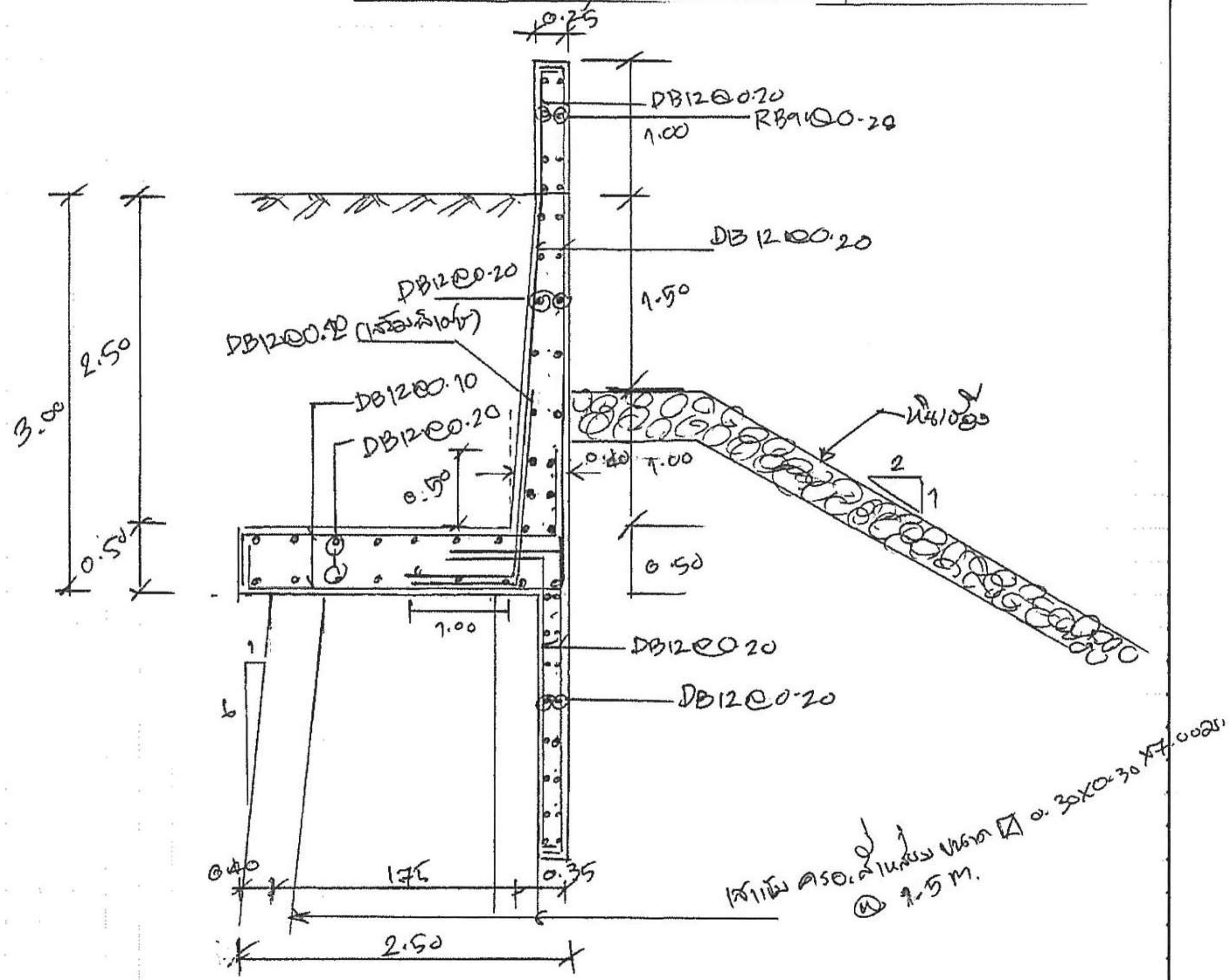
	PROJECT: ศูนย์บ่อทรายท่อง จ.ชัยภูมิ			PROGRESS TECHNOLOGY CONSULTANTS CO., LTD.
PTC	DESIGNED BY: CHANTSAK	DATE: 18/3/65	PAGE: 9	

ใช้ DB12@0.10, A_s = 11.304 cm²/m 79.00 m²/m ok

เหล็กรับอุณหภูมิ (แนวนอน)

A_{st} = 0.0018bt = 0.0018 × 100 × 50 = 9.00 cm²/m

ใช้ 2DB12@0.20, A_s = 11.304 cm²/m 79.00 cm²/m OK



LOG OF BORING No. CYP-BH-1

PROJECT : สำรวจและออกแบบระบบป้องกันน้ำท่วม พื้นที่ชุมชนจังหวัดชัยภูมิ

LOCATION : เทศบาลเมืองชัยภูมิ จังหวัดชัยภูมิ

DEPTH, m.	SAMPLE No.	TYPE OF SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL
0					
	01	SS			Sandy CLAY, dark brown, FILL. (CL) 1.00 m.
	02	SS			Fine sandy CLAY, brown, soft to medium stiff. (CL)
	03	SS			3.00 m.
	04	SS			(A) 4.00 m.
5	05	SS			Fine sandy CLAY, brown, medium stiff. (CL)
	06	SS			7.50 m.
	07	SS			Silty CLAY trace fine sand, li-brown, very stiff. (CL) 9.00 m.
	08	SS			Silty fine SAND, li-brown, medium dense. (SM) 10.50 m.
10	09	SS			Silty CLAY trace fine sand, li-greyish brown, stiff to very stiff. (CL)
	10	SS			13.50 m.
	11	SS			Silty CLAY trace fine sand, li-greyish brown, hard. (CL)
15	12	SS			18.00 m.
	13	SS			Fine sandy CLAY, li-greyish li-brown, hard. (CL)
	14	SS			22.00 m.
20	15	SS			Silty CLAY some fine sand, li-brown, stiff. (CL)
	16	SS			24.00 m.
	17	SS			Silty CLAY trace to some sand, reddish brown, hard, Decomposed SILTSTONE. (CL)
	18	SS			28.58 m.
25	19	SS			END OF BORING
	20	SS			(A) Clayey fine SAND trace to some gravel, li-brown, loose. (SC)
	21	SS			
30					

GRAPHIC LOG

○ Natural Water Content
× Plastic Limit
△ Liquid Limit
(%)
20 40 60 80 100

○ Su (UC) ● Su' (UC)
△ Su (FV) ▲ Su' (FV)
× Qp/2
(t/m²)
2.5 5 7.5

□ SPT . N (Blow/ft)
20 40 60

SPT ≈ 7
C_u = 4.5 Ton/m²

M = 9.5

STS INSTRUMENTS COMPANY LIMITED	BORING STARTED : 24/09/56	RIG. ACKER	WL. -0.35 M. 24 Hrs. After Boring
	BORING FINISHED : 25/09/56	FOREMAN : PNG.	JOB No. : 14950

(หลุมเจาะที่ 1)