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Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.
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		References/ Notes

1.1. Anode 1

- .1.1. Anode to be use
 - Model; ANODE-1
 - Dimension; (230+250) X 240 X 790 (mm)
 - Net Mass; 121.7kg (Exclude core)
 - Output Current; 3.5 amp. (Seawater resistivity = 25 ohm.cm)
 - Design Life; 20 years
- 1.2. Design conditions and Performance of Aluminum alloy anode
- Performance of Aluminum alloy anode
 - Closed circuit potential; -1050 mV vs. SCE, or more negative
 - Driving voltage; 0.25 V
 - Capacity; 2600 A.hr/kg or more
 - Density of Aluminum Alloy; 2.7g/cm³
- Design conditions
 - Seawater resistivity; 25 ohm.cm
 - Current reduction factor of anode; 50 %
 - Design life; 20 years
- .1.3. Calculation
- (1) Anode resistance

Anode resistance is calculated by the following formula

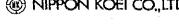
When L/D<6,

 $R = (0.266 \times p) / (S)^{0.5}$

FN: Calculation_Sheet

- p; Seawater resistivity 25(ohm.cm)
- S; Surface area of anode (cm²)
- L; Anode length 79cm
- D; Equivalent diameter of anode (cm)
- A; Upper base in trapezoid (trapezium) of anode cross section 23.0cm

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1		Prepared by	Y, Ando	Checked by	R. Mishimasa
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B; Lower base in trapezoid (trapezium) of anode cross section 25.0cm

C; Height in trapezoid (trapezium) of anode cross section 24.0cm

D = $[A + B + 2 \times (C^2 + (B-A)^2/4)^{0.5}] / 3.14 = 30.6 \text{ cm}$ L/D = 2.5 (<6) S= $[A + B + 2 \times (C^2 + (B-A)^2/4)^{0.5}] \times L + (A+B)/2 \times C \times 2 = 8739.3 \text{ cm}^2$ R = $(0.266 \times 25) / 8739.3^{0.5} = 0.071 \text{ chm}$

(2) Output current

Initial output current of anode is calculated by the following formula

I = E/R

where,

1; Initial output current of anode (A)

E ; Driving voltage 0.25(V)

R ; Anode resistance (ohm)

I = 0.25 / 0.071 = 3.5 A

(3) Anode net mass

Anode net mass is calculated by the following formula

W=(VA-Vc) Xa /1000

where,

W ; Anode net mass(kg)

V_A; Volume of Aluminum alloy, including inside core (cm³)

 $V_A = (A+B) \times C \times 1/2 \times L = 45504.0 \text{ cm}^3$

V_c; Volume of inside core 444.4 (cm³)

a; Aluminum alloy density 2.7(g/cm³)

 $W=(V_A-V_C) \times a$ / 1000 = (45504.0-444.4) × 2.7 /1000 = 121.7 kg

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	(1)		nance of Aluminum					
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			g voltage ; 0,25 V					
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	•	Densi	y of Aluminum Alloy	, 2.7g/cm³				
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	•		ater resistivity ; 25 of					
			nt reduction factor of	anode ; 50 %				
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			Prepared by	Y. Ando	Checked by	z, N12	HITTULA	

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Subject	Quaywall	Page No.	4	Rev.
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2.3. Calculation

(1) Anode resistance

Anode resistance is calculated by the following formula

When L/D<6,

 $R = (0.266 \times p) / (S)^{0.5}$

where,

p ; Seawater resistivity 25 (ohm.cm)

S; Surface area of anode (cm2)

L; Anode length 105.0cm

D; Equivalent diameter of anode (cm)

A; Upper base in trapezoid (trapezium) of anode cross section 17.0cm

B ; Lower base in trapezoid (trapezium) of anode cross section 21.0cm

C; Height in trapezoid (trapezium) of anode cross section 19.0cm

D =
$$[A + 2 \times (C^2 + (B-A)^2/4]^{0.5}] / 3.14 = 17.6 cm$$

L/D = 5.9 (<6)

 $S=[A + 2 \times (C^2 + (B-A)^2/4)^{0.5}] \times L + (A+B)/2 \times C \times 2 =6519.0 \text{ cm}^2$

 $R = (0.266 \times 25) / 6519.0^{0.5} = 0.082 \text{ ohm}$

(2) Output current

Initial output current of anode is calculated by the following formula

i = E/R

where,

1; Initial output current of anode (A)

E ; Driving voltage 0.25(V)

R; Anode resistance (ohm)

I = 0.25 / 0.082 = 3.0 A

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	(3) Anode net mass		

Anode net mass is calculated by the following formula

W≃(V_A-V_C) X a / 1000

where,

W; Anode net mass (kg)

V_A; Volume of Aluminum alloy, including inside core (cm³)

 $V_A = (A+B) \times C \times 1/2 \times L = 37905.0 \text{ cm}^3$

V_c: Volume of inside core 462.0 (cm³)

a; Aluminum alloy density 2.7(g/cm3)

 $W=(V_A-V_C) \times a / 1000 = (37905.0-462.0) \times 2.7 / 1000 = 101.1 kg$

(4) Design life of anode

Design life of anode is calculated by the following formula

 $T = (\dot{Q} \times W) / (8760 \times I \times f)$

where,

T; design life of anode (yr)

Q ; Capacity 2600 A.hr/kg

W ; Anode net mass (kg)

I; initial output current of anode 3.0A

f; current reduction factor of anode 0.5

8760; Time per year (hr/year)

 $T = (2600 \times 101.1) / (8760 \times 3.0 \times 0.5) = 20 \text{ year}$

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Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004				
Section	Civil	Calc. File No.					
Sub-Section	Quaywall	Calc. Index No.					

Subject:

Passenger Berth

Calculation Objective:

Stability of Bitte base

References, Calculation Notes and Comments

Refer to drawings

QW-02-029,QW-02-030

Calculation based on

TECHNICAL STANDERDS AND COMMENTARIES

FOR

PORT AND HARBOUR FACILITIES IN JAPAN

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Calc. File No. **Project** Detailed Design on Port Reactivation Project in La Union Calc. Index No. Section Civil Subject Page No. Rev. Quaywall References/ Notes 4) Calculation of Active Earth Pressure 10.0 kN/m2 18.0 kN/m3 10.0 kN/m3 30.0 Surcharge: a ·Unit weight of soil ·Submerged unit weight of soil Angle of internal friction : φ
Angle of friction between
backfilling material and 15.0 backface wall ; δ · Coefficient of active earth 0.3014 pressure : Ka · Mater Surface Elevation (Distance from Crown) 1.63 m Active and Horizontal Earth Pressure : Pah Action point Overturning Height Earth moment earth pressure earth pressure Pressure Pa·Ya (kN/m2) (kN/m2) (kN/10) (kN·m/m) 22.519 1.630 11.708 10 23 1.270 11.454 15.15 0.606 Total 32.750 Active and Vertical Earth Pressure :
t Upper surface Lower surface Earth moment earth pressure earth pressure (kN/m2) (kN·m/m) 39.627 39.627 (kN/m2) (kN/m) Xa(m) 0.780 Tota! 5. Calculation of Passive Earth Pressure · Surcharge : 0.0 tbm2 Unit weight of soil 10.0 tum3 Angle of internal friction : φ
 Angle of friction between backfilling material and 15.0 backface wall ; o Coefficient of active earth 1.9765 pressure : Ka Passive and Horizontal Earth Pressure
Height Upper surface Lower surface Pph Earth Action point Cychiling moment earth pressure earth pressure Pressure Pph·Yp (kN/m2) (kN/m) 19.468 (kN/m2) Yp(m) (tf·m/m) 0.90 0.300 43.26 5 840 Passive and Vertical Height Upper surface Earth Pressure : Lower surface Action point Uverturning Earth earth pressure earth pressure Pressure Ppv-Xp (kN/m2) (kN/m2) (kN/m) (tf·m/m) 0.000 0.000 合h 5) Generalization of Load Moment by Vertical Moment by Load Load horizontal load (kN/m) My (kN-m/m) 1651.930 (kN/m) Mh (kN·m/m) Deadweight:Wd 465.334 -70.423 Mooring Force: Pu 140.84 -250.000 478.873 Buoyancy: U •91.07 323.305 Active Earth Pressure: Pa 5.581 39.62 28.602 32.750 Passive Earth Pressure:Pp -5.216 304.205 0.000 1118.258 -19.468 149.979 (2) Calculation of Safety Factor F = (μ · (Wd+Pmr+Pav) +Pp) / (Pmh+Pah) F = (Wd·Xd+V·Xo+Pav·Xa) / (Pah·Ya+Pp·Yp+Pmh·Ymh) Safety Factor of Sliding Safety Factor of Overturning Safety Factor of Sliding Safety Factor of Overturning Friction Moering 1.22 >1.2 OK 2.21 >1.2 OK Condition Y. Ando Prepared by P. NISHIMURA Checked by 26/07/2002 08 1 08 12002

Calc. File No. **Project** Detailed Design on Port Reactivation Project in La Union Section Calc. Index No. Civil S Rev. Subject Page No. Quaywall References/ Notes 3. Examination of Bearing Capacity (1) Bottom Reaction e = b / 2 → x x = (Mv-Mb) / V • ; eccentricity of resultant force (m) b; width of bottom (m)

Mv; moment for an observing point by vertical resultant force (kN·m)

Mh; moment for an observing point by horizontal resultant force (kN·m) V ; vertical resultant force (kN) Mh(kN·m) 505.783 shape of distribution (m) (m) 1.537 Triangle Since it is "e≥b/6", bottom reaction is shape of triangle Bottom reaction is computed by the following formulas. p1=2/3*V/(b/2-e) b'=3*(b/2-e) where, p1:reaction at the front toe (m)
b':distribution width of bottom reaction b'(m) 6.040 p1(kN/m2) 100.728 (2) Allowable Bearing Capacity and Examination of Bearing Capacity Allowable bearing capacity is calculated by the following formula as=1/F*(B*71*B*Nr+72*D*Na)+72*D qa , bearing capacity (tVm2)

B ; smallest width of foundation (m) D : embedded length of foundation (m)
71 : unit weight of soil below the level of foundation bottom (kN/m3) (submerged unit weight if submerged)
72: unit weight of soil above the level of foundation bottom (kN/m3) (submerged unit weight if submerged) Nr. Nq ; bearing capacity factors \$\phi\$: internal friction angle β : shape factor of foundation 0.3 0.5-0.1(B/L) Shape of foundation Continuous Square ※) B; short side length L ; long side length F : safety factor The safety factor should not be less than 2.5 as a general rule 8(m) y 2(kN/m3) The examination of bearing capacity of foundation on ground is as follows. q a(kN/m2) 1420.000 Prepared by Y. Ando MISHIMURA Checked by 1 08 /2002 261 07 12002 00

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Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004
Section	Civil	Calc. File No.	
Sub-Section	Revetmentl	Calc. Index No.	
Subject:	West Rivetment		

References, Calculation Notes and Comments

Calculation Objective:

Refer to drawing

RV-00-001,RV-00_004~RV-00-005

RV-01-001~RV-01-023

Calculation based on

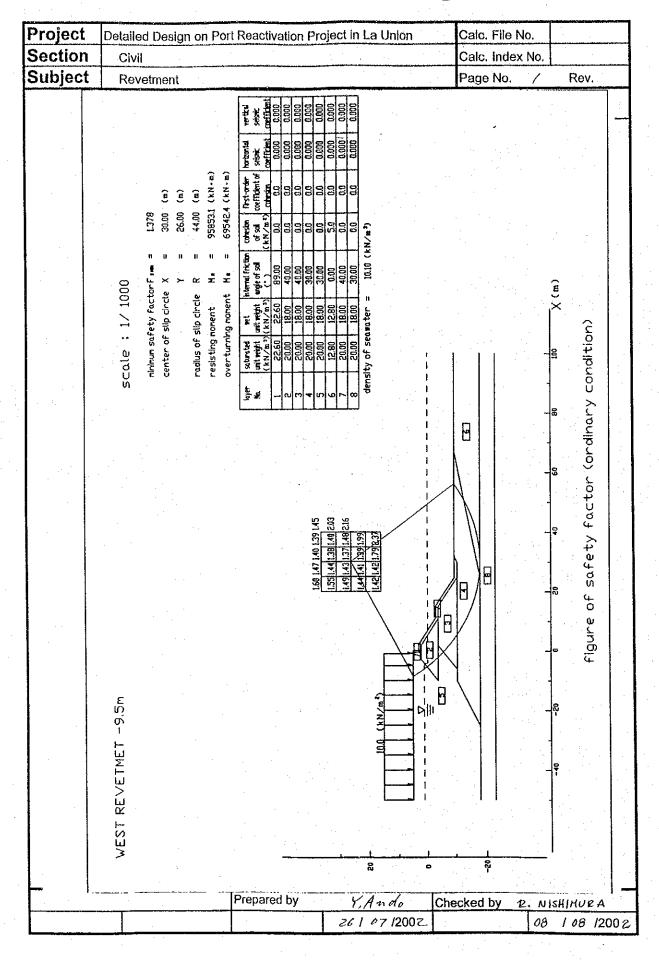
TECHNICAL STANDERDS AND COMMENTARIES

FOR

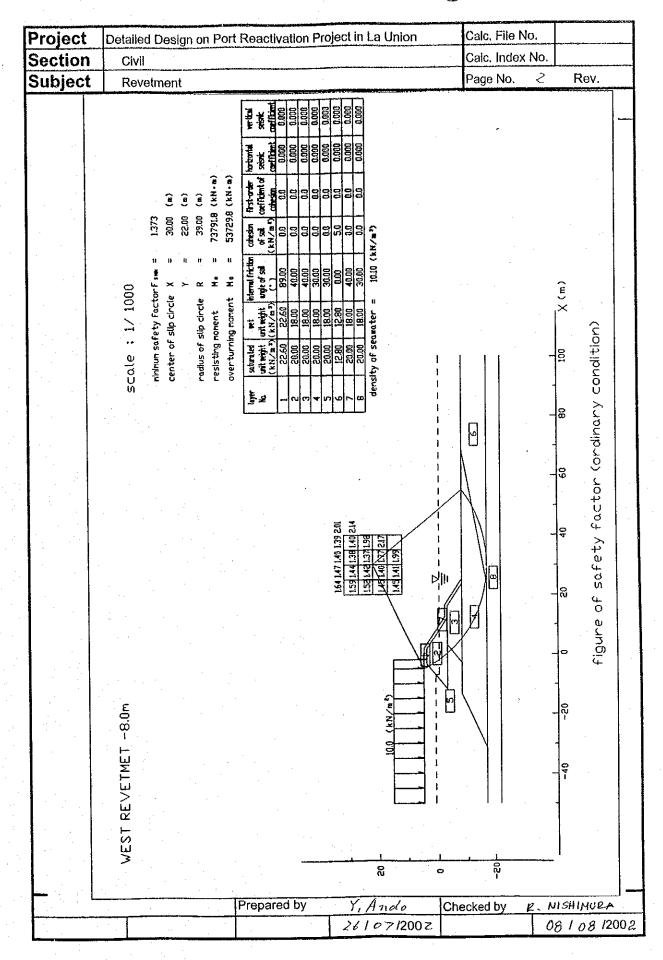
PORT AND HARBOUR FACILITIES IN JAPAN

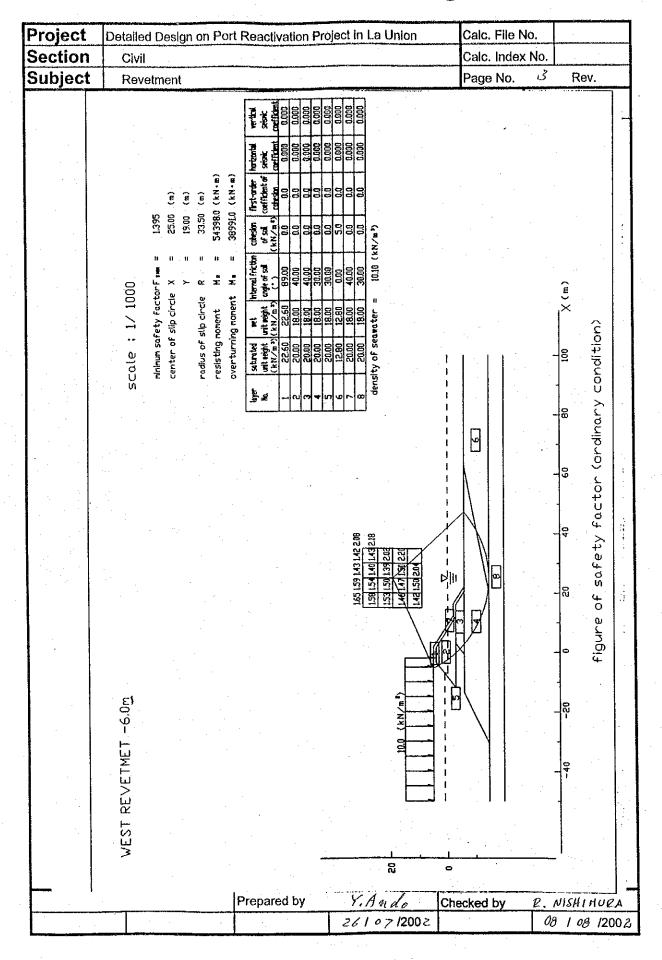
Stability of Revetment

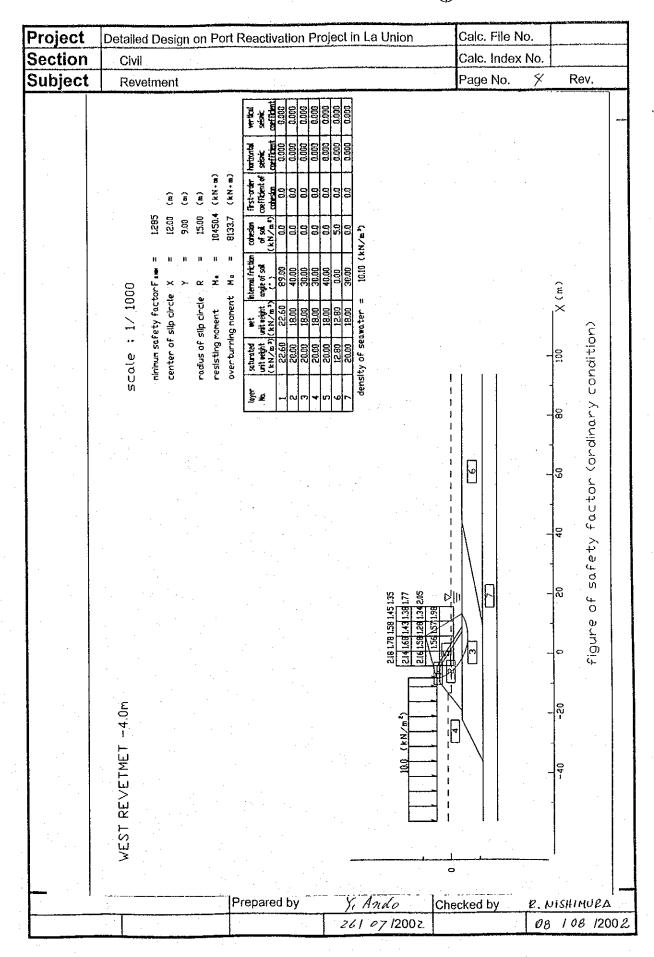
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Sub-Section	Revetmentl	Calc. Index No.	
Subject:	East Revetment		
Calculation O	hiootivo	·····	

Calculation Objective:

Stability of Revetment

References, Calculation Notes and Comments

Refer to drawing

RV-00-001~RV-00-003

RV-02-001~RV-02-020

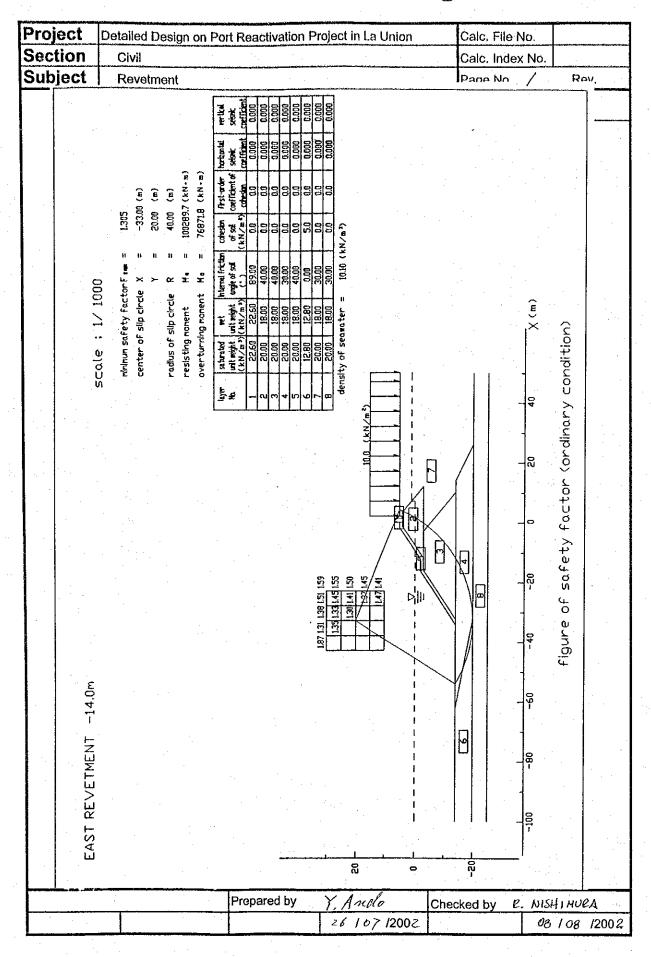
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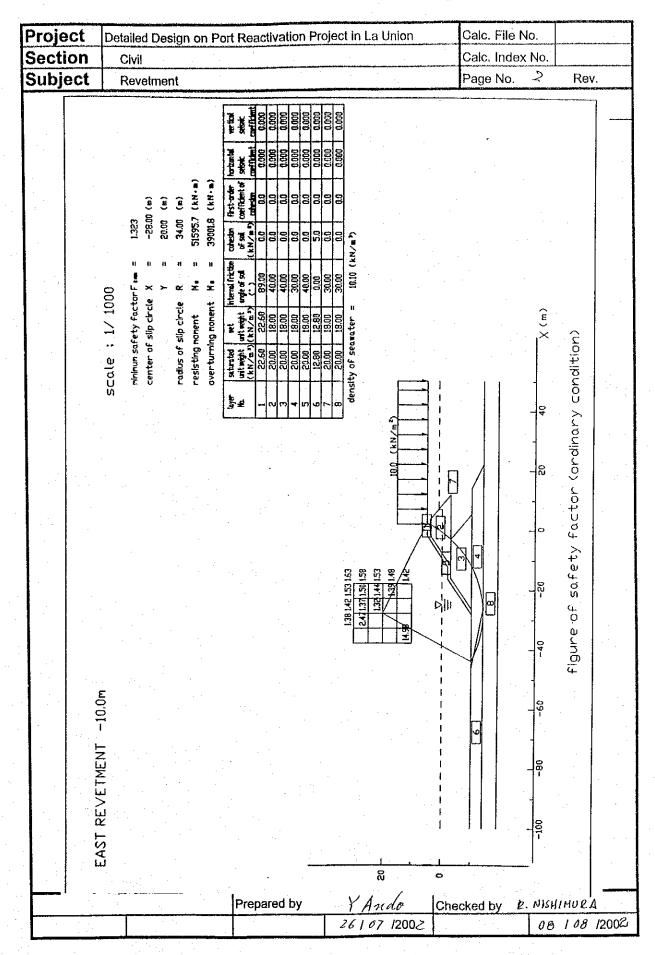
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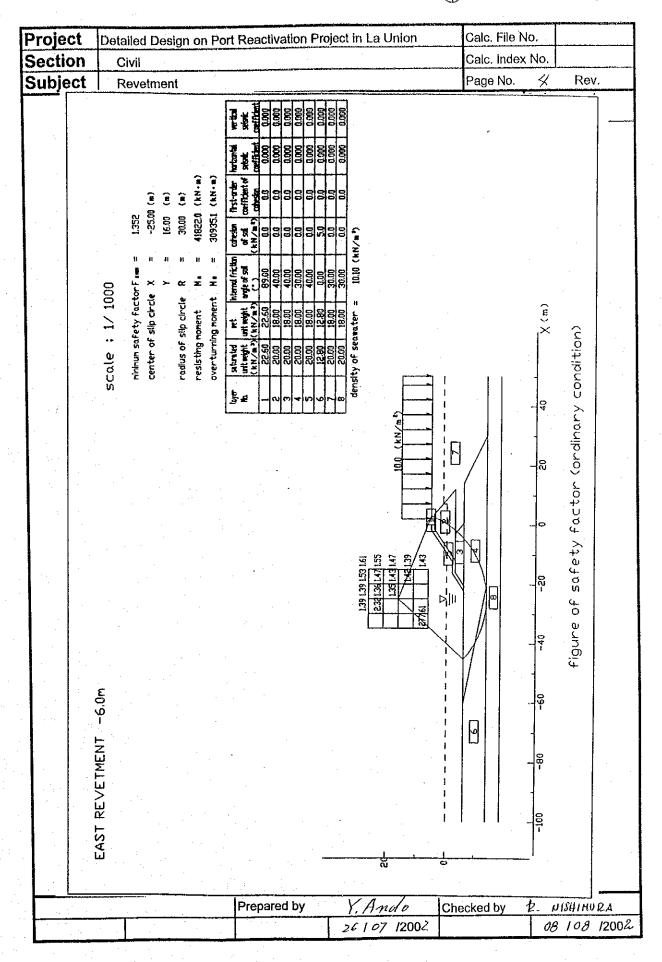
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		Prepared by Y. Ando Che	cked by Z	, NISHIMUR	Л
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Sub-Section	Revetmentl	Calc. Index No.					

Subject:

Revetment (EAST & WEST)

Calculation Objective:

Stability of armor stone

References, Calculation Notes and Comments

Refer to drawings

RV-00-001~RV-00-008

RV-01-001~RV-01-023

RV-02-001~RV-02-020

Calculation based on

TECHNICAL STANDERDS AND COMMENTARIES

FOR

PORT AND HARBOUR FACILITIES IN JAPAN

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Subject	Revetment	Page No. / Rev.
		References/ Notes

WAVE HIDCASTING

WAVE HIGHT AT THE FRONT OF EAST REVETMENT

Dumping Area A (West) 前面の発生波高

	オヘレーション時	10年確率	50年確率	
WIND VELOCITY U (m/s)	15	23.217	29.7	27.8
FETCH (m)	7,625	7,625	7,625	7,625
H 1/3 (m)	0.904	1.450	1,883	1.756
T 1/3 (sec)	3.111	3.741	4.134	4.026

	F (km)	01 - 0	∆0 cos ((01 − 0) △0		
	6.8	31	39	33.430	194.852	
MAIN DIRECTION	10.6	0	17	17.000	180.200	
MWIN DIFFICITOR	9.4	10.5	10	9.833	90.878	
	8.8	20.5	15	14.050	115.811	•
	6.8	35_	9.0	7.372	41.066	
-			90	81.685_	622.807	
•			VALI	D FETCH	7.625 km	

Dumping Area A (North) & Dumping Area B 前面の発生波高

	オヘレーション時	10年確率	50年確率	
風速 U(m/s)		23.217	29.7	27.8
吹送距離 (m)	10,133	10,133	10,133	10,133
H 1/3 (m)	1.026	1.655	2.153	2.007
T 1/3 (sec)	3,370	4.066	4.500	4.381

	F (km)	$\theta 1 - \theta$	Δθ	$\cos(\theta 1 - \theta) \triangle \theta$	
	14.8	16.2	8.3	7.970	113.279
	10.8	8.5	4.6	4.549	48.595
主方向	17.2	0	12.8	12.800	220.160
	7.2	26.5	38.0	34.008	219.128
			63.7	59.327	601.162
				有効フェッチ	10.133 km

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WEIGHT OF ARMOR STONE CALCURATION FORMULA (Hudson's Formula)

ρr * H3 M≕ NS3(Sr-1)3

Where

M :minimum mass of rubble stones

 ρ r: density of armor stones (t/m3)

H: wave height used in the stability calculation (m)

Ns: stability number

Sr: specific gravity of rubble stones relative to sea water

			 •		
Return Period Rp Coefficient of disaster D _N	10年 1%	50年 1 0 %		10年	50年 ·
Density of armor stone Gs Density of sea water y w	2.60 1.03 t	f/m3			
K _D	4.0	4.9			
Wave height H _{1/3}	1.655	2.153		1.45	1.883

Gs=2.60 の場合 Dumping Area "A'

	Temporary Revetment A-North Return Period			
Damage ratio		10years	50years	
0%~5%	$K_{D} = 4.0$	0.49	1.09	
50/ ~ 100/	V -10	0.40	0.89	

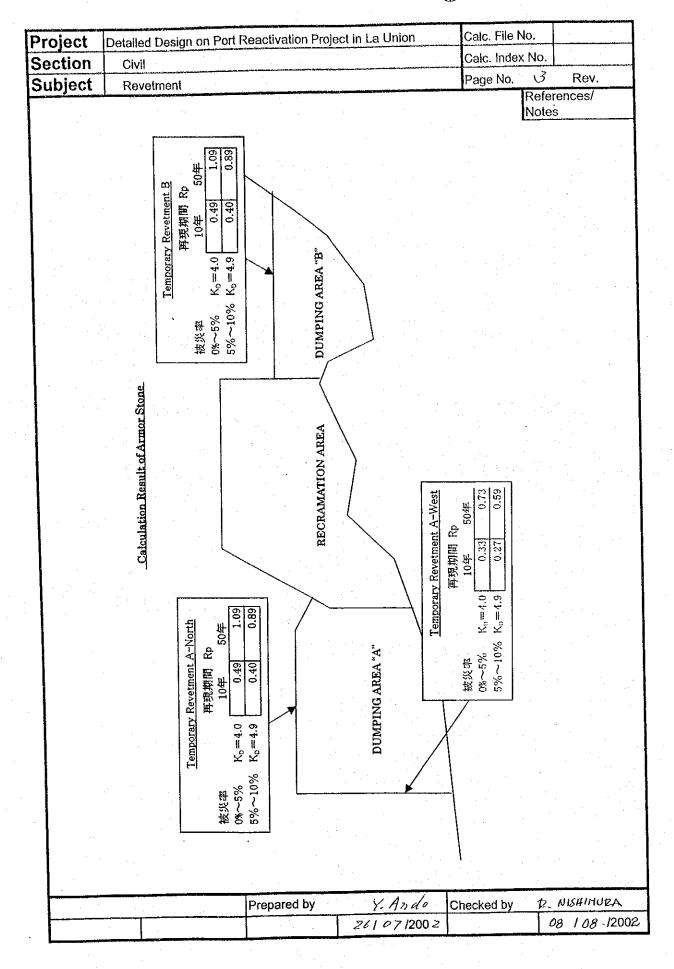
Temporary Revetment A-West					
Return Period					
Damage ratio	10vears 50vears				
$0\%\sim5\%$ $K_D=4.0$	0.33 0.73				
$5\%\sim10\% \text{ K}_{D}=4.9$	0.27 0.59				

Dumping Area "B"

Temporary Revetment B

e trata de la companya del companya del companya de la companya de	Keturn Period			
Damage ratio		10years	50years	
0%~5%	$K_0 = 4.0$	0.49	1.09	
5%~10%	$K_{\rm D} = 4.9$	0.40	0.89	

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				References/ Notes
	1. Design Conditions			
	1-1. Form and Dimensions	~ ·	•	
	Crown Height		5.000 (m)	÷
	Bottom Height	•	-3.000 (m)	
	1-2. Tide Level		•	
	H. W. L		3. 370 (m)	
	L. W. L		-0.130 (m)	
	_			
	1-3. Residual Water Height			
	R. W. L		1.033 (m)	4.5
	1-4. Surcharge			
	1-4, Surcharge	Normal Condition	n Seismic Cond	lition
		(kN/m²) 19.600	(kN/m²) 9.800	
			•	
	1-5. Seismic Coefficient For Earth Pressure		0. 200	
	For Inertia Force		0. 200	
	1-6. Safety Factor	Manual	Seismic condition	
	Sliding	Normal condition 1. 200	1. 000	n
-	Overturning	1. 200	1. 100	
	Bearing Capacity (Sandy Soil)	2. 500	2. 500	
	Bearing Capacity (Cohesive Soil)	1.500	1. 500	
		•		•
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References/Notes 2. Stability in Normal Condition 2-1.: Earth Pressure and Water Pressure [1] Coefficient of earth Pressure $K_* = \frac{\cos^2(\phi - \psi)}{\cos^2(\phi - \psi)} \left[\frac{\sin(\phi + \delta) \cdot \sin(\phi - \delta)}{\cos(\phi + \psi) \cdot \cos(\phi - \delta)} \right]^4$ $K_* : Coefficient of active earth pressure $	Section	Civil			·		Calc. Ir		
2. Stability in Normal Condition 2-1.: Earth Pressure and Water Pressure [1] Coefficient of earth Pressure $K_* = \frac{\cos^2(\phi - \psi)}{\cos^2(\phi - \psi)}$ $K_* : Coefficient of active earth pressure $	Subject	Revetment					Page N		
$K_* = \frac{\cos^*(\phi - \psi)}{\cos^*(\psi - \cos(\delta + \psi) \left[1 + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \beta)}{\cos(\delta + \psi) \cdot \cos(\psi - \beta)}\right]^*}$ $K_* : Coefficient of active carth pressure $		2. Stability in Norm	nal Condition			•		,	
$K_* = \frac{\cos^*(\phi - \psi)}{\cos^*(\psi - \cos(\delta + \psi))} \left[1 + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \beta)}{\cos(\delta + \psi) \cdot \cos(\psi - \beta)}} \right]^*$ $K_* : \text{Coefficient of active carth pressure} $ $\phi \text{ 評価上的歌題所有} $ $\beta : \text{Ite 表面形外配 左 才 所} $ $\psi : \text{壁面 序的 } $ Point $A < -3.000m >$ $Point of action Level (5) (5) (6) (6) (7) (7) (8) (8)$ $B : < -1.000m >$ $Point of action - ovel (8) (9) (9) (9) (9) (9) (9) (9) (9) (9) (9$				*-			·	-	
$\cos^2 \psi \cdot \cos(\delta + \psi) \left[1 + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \beta)}{\cos(\delta + \psi) \cdot \cos(\psi - \beta)}} \right]^2$ K. : Coefficient of active earth pressure ϕ : 濟面上內部階階角 β : 地速面が公面上本等角 (g) ψ : 壁面が鉛面上本等角 (g) $(g$			n earm Fressur		-ψ)				
### 1		A Committee of the Comm	ψ·cos(δ+ψ)	$1+\sqrt{\frac{s}{c}}$	in(φ+δ os(δ+ψ)·sin(¢)·cos(ų	$\left[\frac{(\beta-\beta)}{(\beta-\beta)}\right]^2$	•	
Point of action Level $\begin{pmatrix} \beta \\ 0 \end{pmatrix}$ $\begin{pmatrix} \phi \\ 0 \end{pmatrix}$ $\begin{pmatrix} \delta \\ 0 \end{pmatrix}$ $\begin{pmatrix} \psi \\ 0 \end{pmatrix}$ $\begin{pmatrix} \kappa \\ $		φ:背面土内 β:地表面が ψ:壁面が鉛	部摩擦角 水平となす角 直となす角	h pressure	(度) (度) (度) (度)	ang	deign	luid cons	Spiction
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		A < -3.000				· · · · ·			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		(m)	('\$)		(°)				
Point B. $\langle -1.000m \rangle$ Point of action_evel $\begin{pmatrix} \beta \\ (m) \end{pmatrix}$ $\begin{pmatrix} \psi \\ (^{\circ}) \end{pmatrix}$ Point $\begin{pmatrix} \psi \\ (^{\circ}) \end{pmatrix}$ Point of action_level $\begin{pmatrix} \beta \\ (^{\circ}) \end{pmatrix}$ $\begin{pmatrix} \psi \\ (^{\circ}) \end{pmatrix}$ $\begin{pmatrix} \psi \\ (^{\circ}) \end{pmatrix}$ $\begin{pmatrix} \psi \\ (^{\circ}) \end{pmatrix}$ Point of action_level $\begin{pmatrix} \beta \\ (^{\circ}) \end{pmatrix}$ $\begin{pmatrix} \psi \\ (^{\circ}) \end{pmatrix}$	•						 		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			m >						
Point C - $\langle 1.000m \rangle$ Point of action Level β ϕ δ ψ κ . 1.000~ 5.000 0.0 40.0 15.0 180.0 -0.2011 Point D $\langle 3.000m \rangle$ Point of action Level β ϕ δ ψ κ . (m) $\langle 0 \rangle$ (o) $\langle 0 \rangle$ (o) $\langle 0 \rangle$ 0.2011			vel β	(°)	(°)	ψ (°)	K.	- 1	
C- $\langle 1.000m \rangle$ Point of action Level β (0)		-1.000∼ 5	. 000 0. 0	40.0	15.0	180.0	-0. 2011	· :	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			a >						
Point D < 3.000m > Point of action Level $\begin{pmatrix} B & \phi & \delta & \psi & K_* \\ (m) & (°) & (°) & (°) & (°) & (°) \end{pmatrix}$ 5.000~ 3.000 0.0 40.0 15.0 0.0 0.2011		(m)	(%)		(°)	(°)			
Point of action Level $\begin{pmatrix} \beta & \phi & \delta & \psi & K_* \\ (m) & (°) & (°) & (°) & (°) & (°) & 15.0 & 0.0 & 0.2011 & 0.00 & 0$		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	. 000 0. 0	40.0	15.0	180.0	-0. 2011		
5.000~ 3.000 0.0 40.0 15.0 0.0 0.2011		Point of action Le		φ	δ	ψ	к.		
Propaged by VA A Charlash by D well with A									
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ILICHOLOU NY 1 M M/M ILINECKEO DV F MUNICIPAL			Prepared by	Y	Amela	1	Checked b	v P. A	ISHIMURA

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[2] Intensity of Earth Pressure

$$P_{\cdot} = \left[\Sigma \gamma \cdot h + \frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)} \right] \cdot K_{\cdot}$$

P.: Intensity of active earth pressure (kN/m²)
γ: Unit weight of soil (kN/m²)
h: Thickness of soil layer (m)
ω: Surcharge (kN/m²)
ψ: Angle of the wall surface to vertical (degree)
β: Angle of the ground surface to horizontal (degree)
K.: Coefficient of active earth pressure

A: < -3.000m >

Point	of Action Level (m)	h (E)	γh (kN/m²)	Σγh (kN/㎡)	ψ (*)	$\frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)}$	Kacos (δ+ψ)	P. (kN/m²)
	5. 000	0. 000	0. 000	0. 000	0, 0	19. 600	0. 1942	3.806
	1. 033	3. 967	71. 406	71. 406	0, 0	19. 600	0. 1942	17.673
	1. 033	3. 967	71. 406	71. 406	0. 0	19. 600	0. 1942	17. 673
	-3. 000	4. 033	40. 330	111. 736	0. 0	19. 600	0. 1942	25. 505

Point

B. < -1.000m

Poin	t of Action Level (m)	h (m)	γh (kN/m²)	Σγh (kN/m²)	ψ (°)	$\frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)}$	Kacos (δ+ψ)	P. (kN/m²)
	-1. 000	0.000	0. 000	0.000	180. 0	19. 600	0. 1942	3. 806
	5. 000	-6.000	-108. 000	-108.000	180. 0	19. 600	0. 1942	-17. 167

Point

C < 1.000m >

Poin	t of Action Level (m)	h (E)	ን h (kN/㎡)	Σγη (kN/m²)	ψ ([°)	$\frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)}$	Kacos ($\delta + \psi$)	P. (kN/m²)
	1. 000	0.000	0. 000	0.000	180. 0	19. 600	0. 1942	3. 806
	5. 000	-4.000	-72. 000	-72.000	180. 0	19. 600	0. 1942	-10. 176

. Point

3.000m

Poin	t of Action Level (m)	h (E)	アト (kN/㎡)	Σγh (kN/π²)	ψ (υ)	$\frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)}$	Kacos (δ+ψ)	P. (kN/m²)
	5. 000	0.000	0.000	0, 000	0. 0	19. 600	0. 1942	3. 806
	3. 000	2.000	36.000	36, 000	0. 0	19. 600	0. 1942	10. 798

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[3] Earth Pressure

$$P_{i} = \frac{1}{2} \cdot P_{i} \cdot H$$

P. : Earth pressure (kN/m)
h : Thickness of Soil (m)
P. : Intensity of active earth pressure

Point

A ∴ < -3.000m > -

No.	Form	ula	₽.(kN/m²)		h (m)	P. (kN/m)
1 2	1/2	X	3. 806	X	3. 967	7. 549
	1/2	X	17. 673	X	3. 967	35. 054
3.4	1/2	X	17. 673	X	4. 033	35. 638
	1/2	X	25. 505	X	4. 033	51. 431

B < -1.000m >

No.	Formula	P.(kN/m²)	-	h (m)	₽。 (kN/m)
1 2	1/2 x	3. 806	X	-6, 000	-11. 418
	1/2 x	-17. 167	X	-6, 000	51. 501

Point

C / < 1.000m

No.	Formula P. (kN/m²) h (m)	P₅ (kN/m)
1 2	1/2 x 3.806 x -4.000 1/2 x -10.176 x -4.000	-7. 612 20. 352

Point

3.000m

No		Form	ula	P. (kN/m²)) .	h (m)	P _c (kN/m)
	2	1/2 1/2	X	3, 806 10, 798	X X	2. 000 2. 000	3. 806 10. 798

1	 			
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Jubject	Revenien						Reference Notes	es/
	F43 ** *	J. T. andle Dungar	ura and Mar	mont				
	[4] Horizonta Point	100	•					
	A < -3.0	00m >	Horizontal :	Earth Pressure				•
	No.	Arr	n lenght	Moment of Hori	zontal Force	:		
		(kN/m)	(m)	MPH(kN·m/m)				
	1 2	7. 549 35. 054	6. 678 5. 355	50. 412 187. 714				
*	3 4	35. 638 51. 431	2. 689 1. 344	95, 831 69, 123				
	Total 1	29. 672		403, 080				•
	Point	1	Horizontal E	arth Pressure				
	B < -1.	000m					٠	
	No.	(kN/m) Ai	rm lenght (m)	Moment of Ho MPH(kN·m/m)	rizontal For	ce		
	1 -	11. 418 51. 501	2. 000 4. 000	-22. 836 206. 004		·		
	 	40. 083		183, 168		4		
	<u> </u>	 	1.	<u> </u>	• "			
	Point C < 1.	000m ك1	Horizontal E	arth Pressure				
	No.		ırm lenght	Moment of Hor	izontal For	e		
		(kN/m)	(m)	MPH(kN·m/m)				
	1 2	-7. 612 20. 352	1.333 2.667	-10. 147 54, 279				
	Total	12. 740		44. 132				
				.1				
	D < 3.	000m >	Horizontal I	earth Pressure				
	No.		rm lenght	Moment of Hori	zontal Force	: E		
	PI	l (kn/m)	(m)	Moment of Hori MPH (kN·m/m)				
	1 2	3. 806 10. 798	1.333 0.667	5. 073 7. 202				
	Total	14. 604		12. 275				
					i			
							=	
		Dra	pared by	Y. Ando	Che	cked by	Z. NISHI	HURA

roject	Detailed	Design on Po	ort Reactivat	ion Project in	La Union	Calc. File I	·	-
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:	[5] Vert	ical Earth Pres	sure and Mon	ient			1, -	
	Point	4	•		actor of Earth Pro	, secura	•	
	A+t <	−3, 000m 🚍 🔾	>	/			•	
	No.	Earth Pressure P. (kN/m)	tan (ψ+δ)	Pv (kN/m)	_Arm lenght (m)	: Moment of V M _{P V} (kN·m/m)	ertical Force	
	2	7. 549 35. 054	0. 268 0. 268	2, 023 9, 3 94	5. 000 5. 000	10, 115 46, 970	· .	.*
	3 4	35, 638 51, 431	0. 268 0. 268	9, 551 13, 784	5. 000 5. 000	47, 755 68, 920		
	Total			34. 752		173. 760		
	Point B <	-1.000m ·	>-	Vertical Fact	or of Earth Press	ure		
	No.	Earth Pressur P ₆ (kN/m)		PV (kN/m)	Arm lenght (m)	Moment of Ve M _{P v} (kN·m/m)	rtical Force	
	1 2	-11. 418 51. 501	0. 268 0. 268	-3. 060 13. 802	4. 000 4. 000	-12, 240 55, 208		
	Total			10.742		42. 968		
	Point C <	1. 000m	>	Vertical Fa	ctor of Earth Pre	ssure		
	No.	Earth Pressur Ps (kN/m)	re tan(ψ+δ)	P _v (kN/ss)	Arm lenght (m)	Moment of Ve Mrv (kN·m/m)	enical Force	
	1 2	-7. 612 20. 352	0. 268 0. 268	-2. 040 5. 454	2, 500 2, 500	-5. 100 13. 635		
	Total	<u> </u>		3, 414		8. 535		
	Point D <	3. 000m	>	Vertical Fa	ctor of Earth Pre	ssure		
	No.	Earth Pressur P. (kN/m)	tan(ψ+δ)	P _Y (kN/m)	Arm lenght (m)	Moment of Ve Mry (kN·m/m)	rtical Force	
	1 2	3. 806 10. 798	0. 268 0. 268	1. 020 2. 894	1,500 1,500	1. 530 4. 341		
	Total	<u> </u>		3. 914		5. 871		
		•	•					•
			Prepar	ed by	Y. Ando	Checked by	12. NISH	IHURA
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References/ Notes

[6] Water Pressure and Moment

$$P_{i} = \frac{1}{2} \cdot h_{i} \cdot p_{i} + h \cdot p_{i}$$

P.: Residual Water Pressure (kN/m)
p.: Intensity of Residual Water Pressure (under L.W.L.)
h.: Distance from R.W.L. to L.W.L. (m)
h: Depth from wall bottom to L.W.L. (m)
7.: Unit Weight of Water (kN/m) (m) (m) (kN/m³)

Point

A < -3.000m >

No.	pŧ	h	Ρ.	(kN/m)	у	Mex (kN·m/m)
1 2	1/2 x 11.746x 11.746x	1. 163 2. 870		6. 830 33. 711	3. 258 1. 435	22. 252 48. 375
Total				40. 541		70. 627

Point

B < −1.000m

No.	p,	h	P. (kN/m)	у	Mex (kN·m/m)
1 2	1/2 x 11.746x 11.746x	1. 163 0. 870	6. 830 10. 219	1. 258 0. 435	8. 592 4. 445
Total			17. 049		13. 037

Point

C < 1.000m >

No.		p.	- , h ,,	P.	(kŅ/m)	у	Mex (kN·m/m)
1	1/2 x	0. 333x	0. 033		0.005	0.011	0. 000
Total		-			0. 005		0.000

Point

D . < 3.000m . >

No. Residual water pressure at this point

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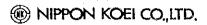


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						Refer Notes	ences/
2	-2. Weig	ht of Wall					
		ght and Center of Gravity of E	ach Block				
	[filling	Coordin	ate of Gravit	y Center		
	No	Base x Height χ γ W (kN/m)	× (m)	y (m)	W·x (kN·m/m)	W·y (kN·m/m)	-
	1 1,	/2x 0.500x 2.000x18.000 = 9.000	1. 333	4. 333	11. 997	38. 997	1
	Total	9.000	* 1.333	* 4.333	11, 997	38. 997	
	Back	filling D1	Coordina	te of Gravity	/ Center		A STORY
	No	BaseXHeight X Y W (kN/m)	× (m)	y (m)	W∙x (kN·m/m)	W·y (kN·m/m)	
	1	2,500x 2,000x23,000 = 115,000	1. 250	-2.000	143. 750	-230. 000	
•	Total	115. 000	* 1.250	* -2.000	143. 750	-230.000	
	Back i	filling D2	Coordinat	te of Gravity	Center		
ż	No	Base xHeight x γ W (kN/m)	× (m)	y (m)	W·x (kN·m/m)	W·y (kN·m/m)	:
	1	2.500x 2.000x23.000 = 115.000	3. 750	-2. 000	431, 250	-230.000	
	Total	. 115.000	* 3.750	* -2. 000	431. 250	-230. 000	
•	Back	filling <1	Coordinat	e of Gravity	Center		
	No	Base XHeight Y W (kN/m)	x (m)	y (m)	W·x (kN·m/m)	W·y (kN·m/m)	
·	1	1.500x 2.000x23.000 = 69.000	0 . 750	0. 000	51.750	0.000	
	Total	69. 000	* 0 . 750	* 0.000	51. 750	0.000	
	Back	filling C2	Coordinate	of Gravity (Center		
	No	Base XHeight x Y W (kN/m)	ж (m)	у (m)	W·× (kN·m/m)	W·y (kN·m/m)	
	1	2.000x 2.000x23.000 = 92.000	2. 500	0.000	230, 000	0.000	
	Total	92. 000	* 2.500	* 0.000	230.000	0.000	
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						Notes	ences/
	Back	filling B1	Coordin	te of Gravity	y Center		,
	No	Base×Height x γ W(kN/m)	x (m)	y (m)	W·× (kN·m/m)	W y (kN∙m/m)	
	1 2	2. 000x 1. 967x23. 000 = 90. 482 2. 000x 0. 033x23. 000	1, 000	2. 016	90. 482	182. 412	
		= 1.518	1.000	1.016	1. 518	1,542	
·	Total	92.000	* 1.000	* 2.000	92.000	183. 954	
	Bacl	k filling A1	Coordinat	e of Gravity	Center	*	1
!	No	Base×Height x γ W (kN/m)	x (m)	y (m)	W·x (kN·m/m)	W∙y (kN·m/m)	
·	1 2	1.000x 2.000x23.000 = 46.000 1/2x 0.500x 2.000x23.000	0. 500	4. 000	23. 000	184. 000	
		= 11.500	1. 167	3. 667	13, 420	42. 170	
İ	Total	57. 500	* 0.633	* 3.933	36. 420	226. 170	
	Bac	k filling AS	Coordin	ate of Gravit	y Center		
	No	Base XHeight X Y W (kN/m)	x (m)	y (m)	W∙× (kN·m/m)	W∙y (kN·m/m)	
	1	0.500x 2.000x20.000 = 20.000	1. 750	4. 000	35. 000	80. 000	
	Total	20.000	* 1.750	* 4.000	35. 000	80, 000	
	Bac	k filling BS	Coordinate	of Gravity C	enter		
	No	Base dle ight x γ W (kN/m)	x (m)	у (m)	W·× (kN·m/m)	W∙y (kN·m/m)	
	1	1.500x 3.967x20.000 = 119.010	2. 750	3. 016	327. 278	358. 934	
	2	1.500x 0.033x20.000 = 0.990	2. 750	1.016	2. 722	1.006	
	Total	120.000	* 2.750	* 3.000	330. 000	359. 940	
	Ba	ck filling CS	Coordin	ate of Gravit	y Center		 1
	No	Base×Height x γ W(kN/m)	x (m)	y (m)	W·x (kN·m/m)	W∙y (kN∙m/m)	
	1	1.500x 3.967x20.000 = 119.010	4. 250	3.016	505. 792	358. 934	
	2	1.500x 2.033x20.000 = 60.990	4. 250	0.016	259. 208	0. 976	
	Tota	180.000	* 4. 250	* 2.000	765. 000	359, 910	
		Prepared	by	Y. And	Checked	lby e Nis	H IMUR A
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* Coordinate of Gravity Center
$$x = \frac{\sum W \cdot x}{\sum W} \quad y = \frac{\sum W \cdot y}{\sum W}$$

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	[2] Point		• •				Refere Notes	ences/
	No				W.	Arm lengh		7
	1 2 3 4 5 6 7 8 9 10	AS BS CS Total			9, 000 115, 000 115, 000 69, 000 92, 000 92, 000 57, 500 20, 000 120, 000 180, 000	1. 333 1. 250 3. 750 0. 750 2. 500 1. 000 0. 633 1. 750 2. 750 4. 250	143. 750 431. 250 51. 750	
	No	Name of Bloc	k Weight		W, (kN/m)	Arm lengh	M (kN·m/m)	
	1 2 3 4 5 6 7	Back filling C1 C2 B1 A1 AS BS			9, 000 69, 000 92, 000 92, 000 57, 500 20, 000 120, 000	1. 333 0. 750 2. 500 1. 000 0. 633 1. 750 2. 750	11. 997 51. 750 230. 000 92. 000 36. 398 35. 000 330. 000	
	Poin			· ·	459. 500		787. 145	
		< 1.000m >						
	No	Name of Block	Weight		W, (kN/m)	Arm lenght	M (kN·m/m)	r
	2 3 4	Back filling B1 A1 AS			9. 000 92. 000 57. 500 20. 000	1. 333 1. 000 0. 633 1. 750	11. 997 92. 000 36. 398 35. 000	
	<u> </u>	Total			178. 500		175. 395	
	Point							
	No	Name of Block	Weight		W. (kN/m)	Arm lenght x (m)	M., (kN·m/m)	
	2	Back filling A1			9. 000 57. 500	1. 333 0. 633	11. 997 36. 398	
:		otal			66.500		48. 395	
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	[3] _{Weig} Backfill	ght and Gravity (n Block (Un	der R.W.L.)		Refere Notes	nces/	
	《D1》		٠,	Coordi	 nation of Gr	avity Center			
	No	BasexHeigh	nt χ γ~γ' W(kN/m)	× (m)	y (m)	W· x (kN·m/m)	VV·y (kN·m/m)		
·	1	2.500x 2.0	00x10.000 = 50.000	1. 250	-2.000	62. 500	-100.000		
	Total		50. 000	* 1.250	* −2. 000	62. 500	-100.000		
	《D2》			Coordi	nation of Gr	avity Center			
	No	BasexHeigh	W (kN/m)	× (m)	y (m)	W·x (kN·m/m)	W·y (kN·m/m)		
		2. 500x 2. 00	00x10,000 = 50.000	3. 750	-2. 000	187. 500	-100, 000		
	Total		50, 000	* 3.750	* ~2. 000	187. 500	-100.000		
	(C1)			Coordina	ation of Grav	ity Center		J	
	No	BasexHeight	x γ-γ' W(kN/m)	× (m)	у (m)	VV·x (kN·m/m)	W·y (kN·m/m)		
	1	1.500x 2.00	0x10.000 = 30.000	0: 750	0. 000	22. 500	0. 000	٠.	
	Total		30. 000	* 0.750	* 0.000	22. 500	0.000		
	(C2)			Coordina	tion of Gravi	ty Center		•	
	No	BaserHeight	x γ~γ' W(kN/m)	x (m)	у (п)	W·x (kN·m/m)	W·y (kN·m/m)		
	1	2. 000x 2. 00	0x10.000 = 40.000	2. 500	0.000	100.000	0.000		
	Total	<u> </u>	40. 000	* 2.500	* 0.000	100.000	0.000		
	(B1)			Coordina	tion of Grav	ty Center			
	No	Base ₄ Height	x γ-γ' W(kN/m)	× (m)	y (m)	W·× (kN·m/m)	W·y (kN·m/m)		
	1	2.000x 0.033		1.000	1.016	0. 660	0. 671		
	Total		0. 660	* 1.000	* 1.016	0. 660	0. 671		
	(A1) (AS)	No Buoyancy No Buoyancy		····	·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		
	· -		epared by		Y. Ando	Chester 1	, mu	11.30 A	
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BS)	Coordination of Gravity Center
-----	--------------------------------

No	BasevHeight x y-y' W(kN/m)	x (m)	y (m)	W·× (kN·m/m)	. W∙y (kN·m/m)
1	1,500x 0.033x10.000 = 0.495	2. 750	1.016	1. 361	0. 503
Total	0. 495	* 2.750	* 1.016	1, 361	0. 503

(CS)		Coordination of Gravity Center						
No	BasedHeight: x $\gamma - \gamma'$ W (kN/m)	× (m)	y (m)	W·x (kN·m/m)	W·y (kN·m/m)			
1	1.500x 2.033x10.000 = 30.495	4. 250	0. 016	129, 604	0. 488			
Total	30. 495	* 4.250	* 0.016	129. 604	0. 488			

Coordination of Gravity Center
$$x = \frac{\sum W \cdot x}{\sum W} \qquad y = \frac{\sum W \cdot y}{\sum W}$$

<u> </u>		
	Prepared by	Ando Checked by E. NISHIMURA
	261	7 /2002 48 / 08 / 2002

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						Refe Note	erences/ es
	643				,		
1	Point A	uoyancy and Mo	> ment				
	No	7	Weigh		A		
		Name	Weigh		VV Arm L	enght Mw m) (kN·m,	/m)
	1 2 3	D1 D2 C1		5(0.000 3.1	750 187	500 500
•	3	C1 C2		30	0.000 0. 0.000 2.	750 22	500 500
	4 5	C2 B1		· (). 660 1. i	000 100.	000 660
	6 7	BS CS		· (), 495 2.), 495 4.	000 0. 750 1. 250 129.	361
		Total		201	. 650	504.	125
P	Point B.	< -1.000m	>				
	No	Name	Weigh	t \	Vv Arm Lo N/m) x (n	enght Mwv n) (kN·m/	(m)
	1 2	C1 C2		30	. 000 0. 7 . 000 2. 5	750 22. 500 100.	500
	2 3 4	B1 BS		0	. 660 1. 0 . 495 2. 7	0.00	660 361
		Tota!		71	. 155	124.	
	Point C	< 1.000m	>				
	No	Name	Weight	. v	Vv Arm L N/m) × (m	enght Mwv	m)
	1	B1		0	. 660 1. 0		660
		Total		0	. 660	0.	660
	Point						<u></u>
	D No	< 3.000m Buoyancy at th	> is Point				
		e e				•	
	2-3 (Other Force					
	. U. (anti Loice					
•	1	No other force					
			••				
•							
		·		<u> </u>			
			Prepared by	Y. And	Checked	lby E. N	ijh/hur a
·····	- 1			261 07/200			1 08 1200

Section Carlo Subject F	Alled Design on Port F Civil Revetment Stability of Wall Total Vertical Force H: Total Vertical Force H: Total Horizontal Force H: Total Horizontal Force H: Total Horizontal Force H: Total Horizontal Force H: Total Force H: Total Vertical Force	erce on ertical Force	(ki (ki (ki ki k	Verturi N V/m) V/m) V·m/m)	ning Ma Mo	π) M ₀ 60 45	(kN·m/m) 403.080 70.627	Rev. erences/
Subject F	Revetment Stability of Wall Sliding \[\frac{\mu \cdot \text{V}}{H} \] Total Vertical Force \[\frac{\mu \cdot \text{Coefficient of Friction}{\mu \cdot \text{Moment of Total Volument of Total Howard Moment of Total Howard \text{Volument of Total Howard Moment of Total Howard \text{Volument of Wolff of Wall Buoyancy} \] Total	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(ki (ki (ki ce (ki ki ce (ki))))))))))))))))))))))))))))))))	N/m) N·m/m) N·m/m) N·m/m) N·m/m) N·m/m)	Ma (kN·m/n 173.76 2127.14 -504.12	π) M ₀ 60 45	(kN·m/m) 403.080 70.627	erences/
2-4. \$ [1] F	Stability of Wall Sliding # V H /: Total Vertical Force	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(ki (ki (ki ce (ki ki ce (ki))))))))))))))))))))))))))))))))	N/m) N·m/m) N·m/m) N·m/m) N·m/m) N·m/m)	Ma (kN·m/n 173.76 2127.14 -504.12	π) M ₀ 60 45	(kN·m/m) 403.080 70.627	
[1] F M M P A I I	Sliding # V H /: Total Vertical Force I: Total Horizontal Force I: Coefficient of Friction I: Moment of Total Volume I: Moment of Total Horizontal IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(ki (ki (ki ce (ki ki ce (ki))))))))))))))))))))))))))))))))	N/m) N·m/m) N·m/m) N·m/m) N·m/m) N·m/m)	Ma (kN·m/n 173.76 2127.14 -504.12	60 45 25	(kN·m/m) 403. 080 70. 627	es
[1] F M M P A I I	Sliding # V H /: Total Vertical Force I: Total Horizontal Force I: Coefficient of Friction I: Moment of Total Volume I: Moment of Total Horizontal IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(ki (ki (ki ce (ki ki ce (ki))))))))))))))))))))))))))))))))	N/m) N·m/m) N·m/m) N·m/m) N·m/m) N·m/m)	Ma (kN·m/n 173.76 2127.14 -504.12	60 45 25	403. 080 70. 627	
F M M Pc A I	# \frac{\mu \cdot \vertical \text{Force}}{H} /: Total Vertical Force Total Horizontal Force Coefficient of Friction Moment of Total Volume Moment of Total Horizontal Angle Moment of Total Horizontal Angle Angle Angle Earth Pressure An	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(ki (ki (ki ce (ki ki ce (ki))))))))))))))))))))))))))))))))	N/m) N·m/m) N·m/m) N·m/m) N·m/m) N·m/m)	Ma (kN·m/n 173.76 2127.14 -504.12	60 45 25	403. 080 70. 627	
F M M Pc A I	# \frac{\mu \cdot \vertical \text{Force}}{H} /: Total Vertical Force Total Horizontal Force Coefficient of Friction Moment of Total Volume Moment of Total Horizontal Angle Moment of Total Horizontal Angle Angle Angle Earth Pressure An	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(ki (ki (ki ce (ki ki ce (ki))))))))))))))))))))))))))))))))	N/m) N·m/m) N·m/m) N·m/m) N·m/m) N·m/m)	Ma (kN·m/n 173.76 2127.14 -504.12	60 45 25	403. 080 70. 627	
M M Pc A I I F	H / : Total Vertical Force d : Total Horizontal Fo l : Coefficient of Friction e : Moment of Total Vo lo : Moment of Total Hobit / -3.000m Earth Pressure Residual Water Pressure Weight of wall Buoyancy Total	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(kl) ce (kl) H (l) 2 129	N/m) N·m/m) N·m/m) (N/m) 3. 672	Ma (kN·m/n 173.76 2127.14 -504.12	60 45 25	403. 080 70. 627	
M M Pc A I I F	/ : Total Vertical Force : Total Horizontal Fo : Coefficient of Friction : Moment of Total Vo : Moment of Total Hospit < -3.000m	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(kl) ce (kl) H (l) 2 129	N/m) N·m/m) N·m/m) N·m/m) (N/m) 3. 672	Ma (kN·m/n 173.76 2127.14 -504.12	60 45 25	403. 080 70. 627	
M M Pc A I I F	# : Coefficient of Friction # : Moment of Total V. # : Moment of Total V. # : Moment of Total How int	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(kl) ce (kl) H (l) 2 129	N·m/m) N·m/m) N·m/m) (N/m) 3. 672 0. 541	Ma (kN·m/n 173.76 2127.14 -504.12	60 45 25	403. 080 70. 627	
M M Pc A A I I F	# : Coefficient of Friction # : Moment of Total V. # : Moment of Total V. # : Moment of Total How int	on ertical Force orizontal For V (kN/m) 34. 752 869. 500 -201. 650	(kf	N·m/m) N·m/m) (N/m) 3. 672 0. 541	Ma (kN·m/n 173.76 2127.14 -504.12	60 45 25	403. 080 70. 627	
M M Pc A I I	e: Moment of Total Volument of Total Volument of Total Hobint < -3.000m Earth Pressure Residual Water Pressure Weight of wall Buoyancy Total	V (kN/m) 34. 752 869. 500 -201. 650	H (F	(N/m) (N/m) 3. 672). 541	Ma (kN·m/n 173.76 2127.14 -504.12	60 45 25	403. 080 70. 627	
Po A I	eint -3.000m Earth Pressure Residual Water Pressure Weight of wall Buoyancy Total	∨ (kN/m) 34. 752 869. 500 -201. 650	H (F	(N/m) 9. 672). 541	M _k (kN·m/r 173.76 2127.14 -504.12	60 45 25	403. 080 70. 627	
A I F	4 -3.000m > Earth Pressure Residual Water Pressure Weight of wall Buoyancy Total	34. 752 869. 500 -201. 650	129	3. 672 0. 541	173, 76 2127, 14 -504, 12	60 45 25	403. 080 70. 627	
1	tesidual Water Pressure Weight of wall Buoyancy Total	34. 752 869. 500 -201. 650	129	3. 672 0. 541	173, 76 2127, 14 -504, 12	60 45 25	403. 080 70. 627	
1	tesidual Water Pressure Weight of wall Buoyancy Total	869.500 -201.650	9). 541 ———	2127. 14 -504. 12	45 25 ———	70. 627	
	Weight of wall Buoyancy Total	-201.650)		-504. 12	25	70. 627	
	Buoyancy Total	-201.650)). 213	-504. 12	25	470 707	
		702. 602	2 170), 213	1706 78	20	472 707	1
	Sliding				1130.10	JU	473. 707	
 	Sliding							1
		· · · · · · · · · · · · · · · · · · ·				urning	· · · · · · · · · · · · · · · · · · ·	
	Safety Factor F	Al	lowable \	/alues	Safety Factor	F	Allowab	le Values
Po	0.600 x 702.602	2. 476	≧ 1. 20		1796. 780	3. 793	≥1.20	
Po	170. 213	2.470	<u>⊆</u> 1. 20		473, 707	0. 750	= 1. 20	
_	oint	·						
В	< -1.000m >							
		V (kN/m)	H (k	cN/m)	Ma (kN·m/n	n) Ma	(kN·m/m)	
	arth Pressure	10. 742). 083	42. 96		183. 168	·
l R	esidual Water Pressure Veight of wall	459. 500	- 17	. 049	787. 14		13. 037	
	Buoyancy	~71.155	5		-124. 52	21 -		
ļ -	Total *	399. 087	7 57	1. 132	705. 59)2	196. 205	
			<u></u> -				 -	1
<u> </u>	Sliding	<u></u>			Overt	turning		
	Safety Factor F	Allowab	le Values	Sa	afety Factor	F	Allowab	le Values
[0.500 x 399.087	0 400	\. no		705. 592	3 500		
	57. 132	3. 492	≥1.20		196. 205	3. 596	≧1.20	
_		<u> </u>	1	, .				1

Prepared by

Y. Ando

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Checked by

P. NISHIHURA

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Point

C < 1.000m

	V (kN/m)	H (kN/m)	Ma (kN·m/m)	M。 (kN·m/m)
Earth Pressure Residual Water Pressure	3. 414	12. 740 0. 005	8. 535	44. 132
Weight of wall Buoyancy	178. 500 -0. 660	0.005	175. 395 -0. 660	0.000
Total	181. 254	12. 745	183. 270	44. 132

Sliding			Ov	erturning]
Safety Factor F	Allo	wable Va	lues Safety Factor	F A	llow <u>a</u> ble	 Values
0.500 x 181.254	7 440		183. 270		. 1	
12. 745	7. 110	≥1.20	44. 132	4. 152	≧1.20	

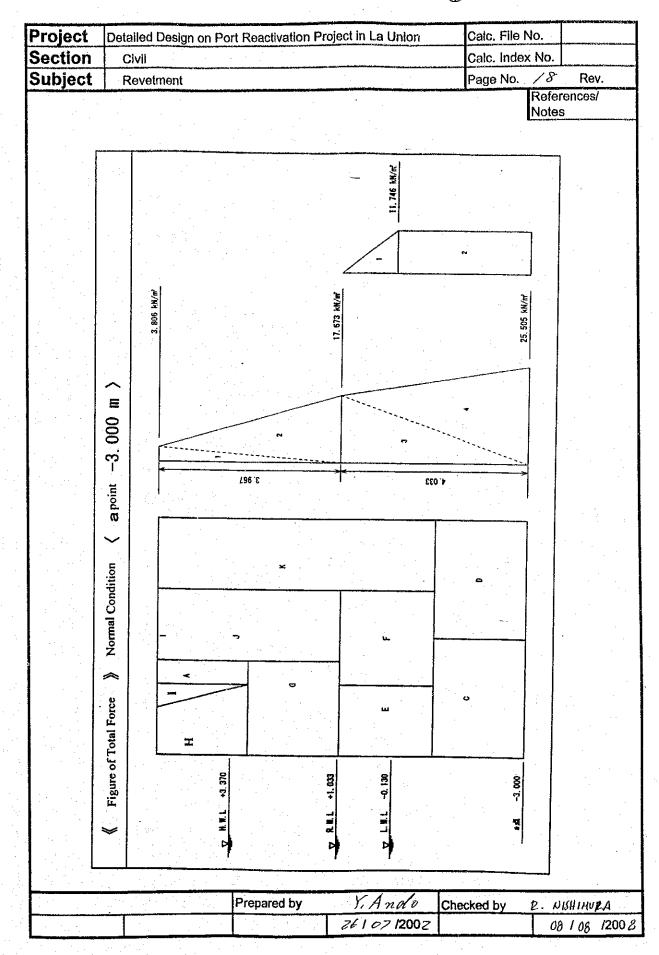
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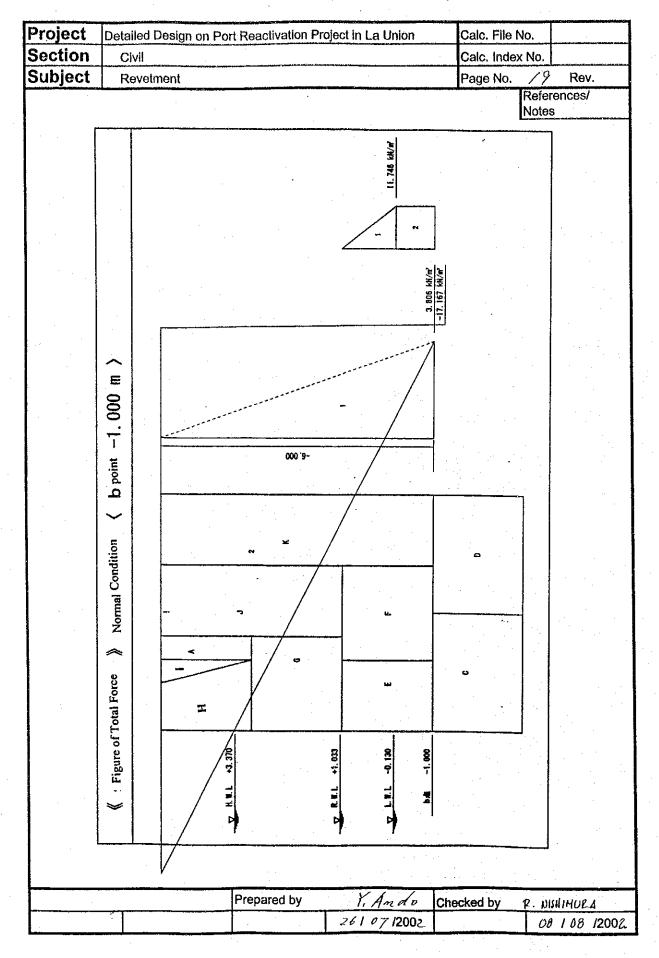
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	V (kN/m)	H (kN/m)	Ma (kN·m/m)	M _o (kN·m/m)
Earth Pressure Residual Water Pressure	3. 914	14. 604 0. 000	5. 871	12. 275
Weight of wall Buoyancy	66. 500 0. 000		48. 395 0. 000	0.000
Total	70. 414	14. 604	54. 266	12. 275

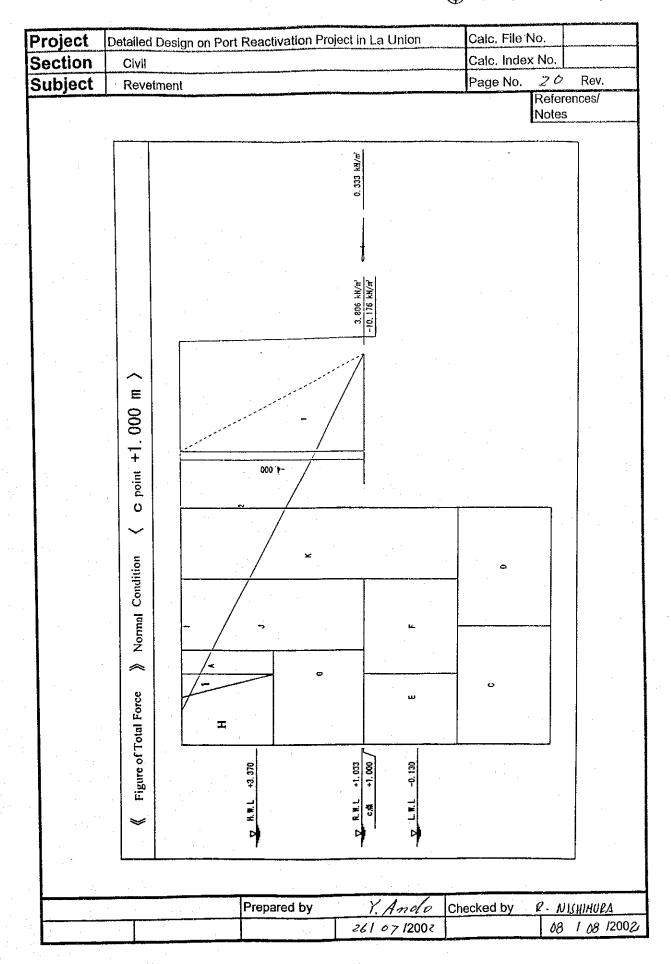
Sliding			Over	turning]
Safety Factor F	Allo	wable Value	Safety Factor	F A	llowable	Values
0. 500 x 70. 414	2 410	≩1.20	54. 266			
14. 604	2.410	⊊1.20	12. 275	4. 420	≧1.20	

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FN: Calculation_Sheet



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	d point +3. 000 m	
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	W H. 43.370 W H. 1.033	∇ L. L0. 130
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		Name and Address of the Owner, where the Owner, which is the Owner,		
Project	Detailed Design on Port Reactivation Project in La Union	Calc. File N	10.	and the second s
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2-5. Bearing Capacity

[1]. Reaction of Bottom Surface of Caisson

c)
$$e < 0$$
 Case

$$p_1 = \left(1 + \frac{6 \cdot e}{b}\right) \cdot \frac{V}{b} \qquad p_1 = \frac{2 \cdot V}{3 \cdot x} \qquad p = \frac{V}{b}$$

$$p_1 = \frac{2}{3} \cdot \frac{V}{x}$$

$$_{\mathbf{p}} \stackrel{!}{=} \frac{\mathsf{V}}{}$$

$$p_2 = \left(1 - \frac{6 \cdot e}{b}\right) \cdot \frac{V}{b} \qquad p_2 = 0$$

$$b' = 3 \cdot x$$

$$p_i = 0$$

$$x = \frac{M_x - M_b}{V}$$

$$e = \frac{b}{2} -$$

p₁: MaximumReaction Force p₂: MinimumReaction Force b : Width of Wall : Vertical resultant force act on wall : Distribution width of bottom reactions in case e>b/6

Mr : Moment of Vertical force act on wall $(kN \cdot m/m)$ Ms: Moment of Horizontal force act o wall (kN·m/m)
e: Eccentricity of resultant force of Verucal and Horizontal

$$\times = \frac{M_R - M_P}{V} = \frac{54.266 - 12.275}{70.414} = 0.596 \text{ (m)}$$

$$e = \frac{b}{2} - x = \frac{1.500}{2} - 0.596 = 0.154 (m)$$

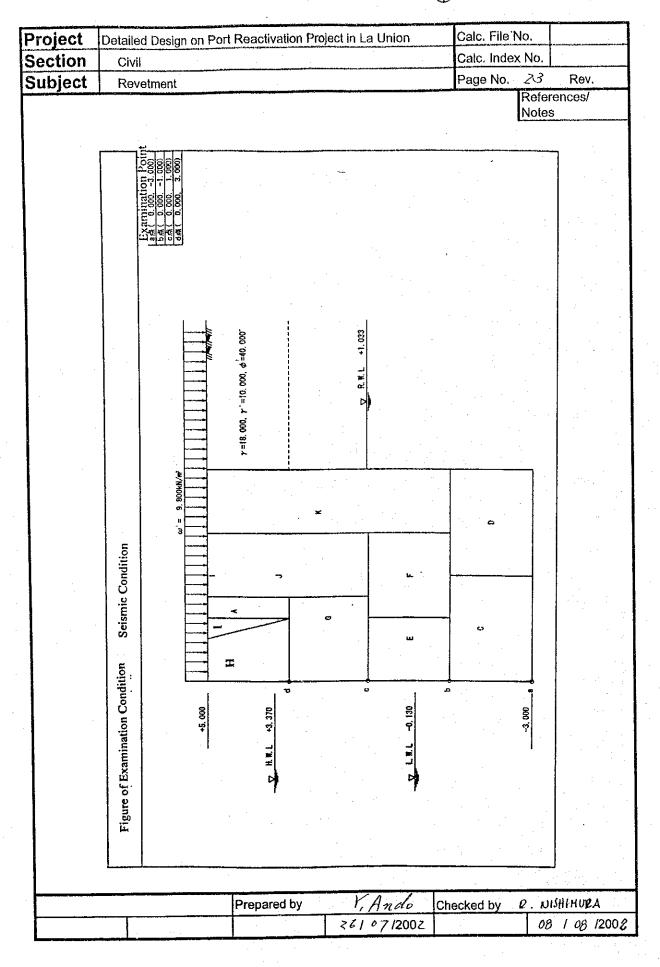
a) 0 < e ≤ b / 6 Ø Case

$$\mathbf{p}_1 = \left(1 + \frac{6 \cdot e}{b}\right) \cdot \frac{V}{b} = \left(1 + \frac{6 \times 0.154}{1.500}\right) \times \frac{70.414}{1.500} = 75.860 \text{ (kN/m}^2)$$

$$p_2 = \left(1 - \frac{6 \cdot e}{b}\right) \cdot \frac{V}{b} = \left(1 - \frac{6x \ 0.154}{1.500}\right) x - \frac{70.414}{1.500} = 18.026 \ (kN/m^2)$$

Allowable Bearing Capacity of Rubble Mound OK. Maximum Reaction Force

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	Prepared by	Y. And	Checked by	e. NISHIMUEA
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	3. ! Stability in Seismic Condition	

3-1. : Earth Pressure and Water Pressure

[1] Coefficient of Earth Pressure

$$K_{\bullet} = \frac{\cos^{2}(\phi - \psi - \theta)}{\cos \theta \cdot \cos^{2}\psi \cdot \cos(\delta + \psi + \theta) \left[1 + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \beta - \theta)}{\cos(\delta + \psi + \theta) \cdot \cos(\psi - \beta)}}\right]^{2}}$$

Κ.: Coefficient of active earth pressure
 φ: Angle of Internal friction of Soil

: Angle of the ground surface to horizontal : Angle of the wall surface to vertical

ないれでする一句、 : Angle of wall friction

Seismic Coefficient

k': Apparent seismic coefficient by following formula

Composite seismic angle which is defined as angle by following formula tan-1K or tan-1K'

$$k' = \frac{\sum \gamma \cdot h + \gamma w \cdot h w + \omega}{\sum \gamma \cdot h + \omega} \cdot k$$

γ: Unit Weight of Soil γw: Unit Weight of Water h: Thickness of layer (under water) hw: 土層の海水につかっている深さ ω: Surcharge

Point

< -3.000m >

Po	int of action Level (m)	β (*)	(°)	δ (°)	ψ (°)	k or k'	θ (°)	K,
	5.000~ 1.033	0.0	40.0	15.0	0.0	0. 20	11.31	0. 3168
	1.033~ -3.000	0.0	40. 0	15.0	0.0	0. 20 0. 27	11. 31 15. 11	0. 3168 0. 3702

B. < -1.000m:

Po	int of action (m)	Level	β (°)	(°) φ	(°')	ψ (°)	k or k'	(°)	к.	
	-1.000~	5. 000	0.0	40. 0	15.0	180.0	0. 20	11.31	-0. 3168	I

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	Point of action		· · · · · · · · · · · · · · · · · · ·			4lı	L or	Δ	К.		
	ronn or actic		β (°)	(°)	δ (°)	(°)	k or k'	(°)		: •	
	1.000	~ 5.000	0.0	40.0	15.0	180.0	0. 20	11. 31	-0.3168	i I	
	Point	 									
		3. 00 0 m	>								
*,	Point of action		 	ф	δ	ψ	k or	θ	κ,		
	(m)	β (°)	(³ .)	δ (°)	ψ (°)	k or k'	θ (°)			
	5, 000	~ 3,000	0.0	40.0	15.0	0.0	0, 20	11.31	0.3168	ļ	
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[2] "Intesity of Earth Pressure

$$P_{\bullet} = \left[\sum_{\gamma \cdot h} + \frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)} \right] \cdot K_{\bullet}$$

p.: Intensity of active earth pressure (kN/m^2) ?: Unit Weight of Soil (kN/m^3) ?: Unit Weight of Soil Layer (kN/m^2) ? ω : Surcharge (kN/m^2) ? ψ : Angle of the wall surface to vertical (*) β : Angle of the ground surface to horizontal (*) κ : Coefficient of active earth pressure

Point

< −3.000m · >

Poin	t of action Level (m)	h (m)	ァ _カ (kN/㎡)	Σγh (kM/m²)	ψ (υ)	$\frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)}$	Kacos (δ + ψ)	P, (kN/m²)
	5. 000	0.000	0.000	0.000	0. 0	9. 800	0. 3060	2. 999
	1. 033	3.967	71.406	71.406	0. 0	9. 800	0. 3060	24. 849
	1. 033	3. 967	71. 406	71. 406	0. 0	9. 800	0. 3060	24. 849
	-3. 000	4. 033	40. 330	111. 736	0. 0	9. 800	0. 3576	43. 461

Point

B < -1.000m

Poi	nt of action Level (m)	(m)	γh (kN/m²)	Σ'γ h (kN/m²)	ψ (°)	$\frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)}$	Kacos ($\delta + \psi$)	P. (kN/m²)
	-1. 000	0.000	0. 000	0.000	180. 0	9. 800	0. 3060	2. 999
	5. 000	-6.000	-108. 000	-108.000	180. 0	9. 800	0. 3060	-30. 049

Point

1.000m ">

Poi	nt of action Level (m)	h (n)	ፖ h (kN/㎡)	Σγh (kN/m²)	ψ (⁰)	$\frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)}$	Kacos (δ+ψ)	P, (kN/m²)
	1. 000	0.000	0. 000	0.000	180. 0	9. 800	0. 3060	2. 999
	5. 000	-4.000	-72. 000	- 72 .000	180. 0	9. 800	0. 3060	-19. 033

Point

3.000m

nt of action Level (m)	£	かり (kN/㎡)	Σγh (kh/m²)	ψ (°)	$\frac{\omega \cdot \cos \psi}{\cos (\psi - \beta)}$	Kacos(δ+ψ)	P. (kN/m²)
 5. 000	0.000	0, 000	0.000	0. 0	9. 800	0. 3060	2. 999
3. 000	2.000	36, 000	36.000	0. 0	9. 800	0. 3060	14. 015

Prepared by	YAndo	Checked by	Z. WISHIMURA
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[3] Earth Pressure

$$P_i = \frac{1}{2} \cdot P_i \cdot h$$

P6: Earth Pressure (kN/m)
h: Thickness of Soil (m)
P6: Intensity of active earth pressure

Point

A : < -3.000m : >

No.	Form	ula	P. (kN/m²)	1	h (m)	₽。 (kN/m)	
1 2	1/2 1/2	X	2. 999 24. 849	X X	3. 967 3. 967	5. 949 49. 288	
3 4	1/2 1/2	X	24. 849 43. 461	X X	4. 033 4. 033	50. 108 87. 639	

Point

B < -1.000m

No.	Formula	P.(kN/m²))	h (m)	P _t (kN/m)
1 2	1/2 x	2. 999	X	-6.000	-8. 997
	1/2 x	-30. 049	X	-6.000	90. 147

Point

C < 1.000m

1	No.	Formula	P.(kN/m²)	-	h (nn)	₽₅ (kN/m)	
	1 2	1/2 x 1/2 x	2, 999 -19, 033	X	-4. 000 -4. 000	-5. 998 38. 066	

Point

D < 3.000m

No.	Formu	ia	P. (kN/m²)		h (na)	₽。 (kN/m)
1 2	1/2 1/2	X	2. 999 14. 015	X	2. 000 2. 000	2. 999 14. 015

Prepared by	Y. Ando	Checked by 1	2. NESHIHURA
	26 07 2002		08 08 1200 Z

		THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER. THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.
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	······································	Potoropenel

[4] Horizontal Earth Pressure and Moment

Point

A. < -3.000m : > Horizontal Earth Pressure

No.	PH (kN/m)	Arm lenght (m)	Moment of Ho MPH (kN·m/m)	rizontal force
1 2	5. 949 49. 288	6. 6 78 5. 355	39. 727 263. 937	
3 4	50. 108 87. 639	2. 689 1. 344	134. 740 117. 787	
Total	192. 984		556. 191	

Point

B < -1.000m > Horizontal Earth Pressure

No.	PH (kN/m)	Arm lenght (m)	Moment of Ho MPH (kN·m/m)	rizontal force
1 2	-8. 997 90. 147	2. 000 4. 000	-17. 994 360. 588	
Total	81. 150		342, 594	

Point

C < 1.000m > Horizontal Earth Pressure

No.	PH (kN/m)	Arm lenght (m)	Moment of Ho MPH (kN·m/m)	rizontal force				
1 2	-5. 998 38. 066	1. 333 2. 667	-7. 995 101. 522					
Total	32. 068		93. 527					

Point

D < 3.000m > Horizontal Earth Pressure

No.	PH (kN/m)	Arm lenght	Moment of Horizontal i	for
1 2	2. 999 14. 015	1. 333 0. 667	3. 998 9. 348	
Total	17. 014		13. 346	

Prepared by	Y. Ando	Checked by	2. NISHIMURA
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						1	References/ Notes
	[5] Ver	tical Earth Pres	ssure and Mor	nent			
	Point A <	-3.000m	· • · · · · · · · · · · · · · · · · · ·	Vertical f	actor of Earth Pr	ressure	
	No.	Earth Pressur P. (kN/m)	e tan(ψ+δ)	Pv (kN/m)	Arm lenght	Moment of Ve	rtical Force
	1 2	5, 949 49, 288	0. 268 0. 268	1, 594 13, 209	5, 000 5, 000	7, 970 66, 045	
	3 4	50, 108 87, 639	0. 268 0. 268	13. 429 23. 487	5, 000 5, 000	67. 145 117. 435	
	Total	<u> </u>		51, 719		258. 595	
	Point B <		>	Vertical fa	ctor of earth Pres	ssure	
	No.	Earth Pressur P. (kN/m)	e tan(ψ+δ)	Pv (kN/m)	Arm lenght (m)	Moment of Ve	tical Force
	1 2	-8. 997 90. 147	0. 268 0. 268	-2. 411 2 4. 159	4. 000 4. 000	-9. 644 96. 636	
	Total			21. 748		86. 992	
	Point C < No.	1.000m Earth Pressur P6 (kN/m)	> e tan(ψ+δ)	Vertical :	factor of earth Pr Arm lenght	Moment of Ver	ical Force
	1 2	-5. 998	0. 268 0. 268	-1.607 10.202	2. 500 2. 500	M _{PV} (kN·m/m) -4. 018 25. 505	
	Total	00.000	0. 200	8. 595	2.000	21. 487	
	Point		•	0.000	J	21.407	en de la companya de
	D: <	3.000m	>	Vertical	factor of Earth I	ressure	
	No.	Earth Pressu P. (kN/m)	re $tan(\psi+\delta)$	P _Y (kN/m)	Arm lenght (m)	Moment of Ven Mry (kN-m/m)	ical Force
	1 2	2. 999 14. 015	0. 268 0. 268	0. 804 3. 756	1. 500 1. 500	1. 206 5. 634	
	Total	<u>i </u>		4. 560		6. 840	
		······································	Prepared	by	Y. Ando	Checked by	2 NISHIHURA
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[6] Water Pressure and Moment

$$P_* = \frac{1}{2} \cdot h_* \cdot p_* + h \cdot p_*$$

(kN/m)

P.: Residual Water Pressure (kN/m

P.: Intensity of Residual water Pressure (under L.W.L.)

h. Distance from R.W.L. to L.W.L. (m)

h. Depth from wall bottom to L.W.L. (m)

7.: Unit Weight of water (kN/m)

(kN/m³)

Point

A < -3.000m > -

No.	p.	h	P. (kN/m)	у	Mr. (kN·m/m)
: 1 2	1/2 x 11.746x 11.746x		6. 830 33. 711	3. 258 1. 435	22. 252 48. 375
Total			40. 541		70. 627

Point

B < -1.000m

No.	p, h	P. (kN/m)	у .	Mrs (kN·m/m)
1 2	1/2 x 11. 746x 1. 163 11. 746x 0. 870	6. 830 10. 219	1. 258 0. 435	8. 592 4. 445
Total		17. 049		13. 037

Point

C < 1.000m >

No.		p.	h	P, (kN/m)	У	M, (kN·m/m)
1	1/2 x	0. 333x	0.033	0. 005	0. 011	0.000
Total				0. 005		0.000

D点 〈 3.000m 面 〉 No Residual Water Pressure at this point

1	<u> </u>			
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ection	Civil	Calc. Inde	x No.
ubject	Revetment	Page No.	♂/ Rev.
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	3-2. Dynamic Water Pressure		
	[1] Dynamic Water Pressure		
	$p_{\bullet \bullet} = \frac{7}{8} \cdot k \cdot \gamma_{\bullet} \cdot \sqrt{H \cdot y}$		
	$p_{i,i} = \frac{8}{m_i \kappa \cdot \gamma, \forall n \cdot y}$		
	p. : Dynamic Water Pressure		(kN/m²)
	k: Seismic Coefficient Y: Unit weight of water H: Depth of water y: Depth from water surface to examination point	10.	200 100 (kN/m³) 870 (m)
	y: Depth from water surface to examination point		(m)
	[2] Total force of Dynamic Water Pressure and Acting Point	er er	
	$P_{4*} = \frac{7}{12} \cdot k \cdot \gamma_{*} \cdot \sqrt{H} \cdot y^{3/2}$:	
· .	$h_{iv} = \frac{2}{-} \cdot y$		
	.		
	P ₄ . Total force of Dynamic Water Pressure h ₄ . Depth from examination point to force acting point		(kN/m) (m)
	[3] Total force of Dynamic Water Pressure and Moment		
	Point A < -3.000m >		
	$p_{4*} = \frac{7}{8} \times 0.200 \times 10.100 \times \sqrt{2.870 \times 2.870}$	= 5	073 (kN/m²)
	$P_{\bullet \bullet} = \frac{7}{12} \times 0.200 \times 10.100 \times \sqrt{2.870} \times 2.870^{3/2}$	= 9	.706 (kN/m)
	$h_{\bullet \bullet} = \frac{2}{-x} \times 2.870$	= 1	148 (m)
	$M_b = 9.706x 1.148$		142 (kN·m/m)
,			

Y. Ando

2610712002

Checked by

Prepared by

2 HISHIHURA

08 / 08 /2002

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Point

$$p_{4*} = \frac{7}{8} \times 0.200 \times 10.100 \times \sqrt{2.870 \times 0.870}$$

$$=$$
 2.793 (kN/m²)

$$P_{\bullet \bullet} = \frac{7}{12} \times 0.200 \times 10.100 \times \sqrt{2.870} \times 0.870^{3/2}$$

$$h_{**} = \frac{2}{5} \times 0.870$$

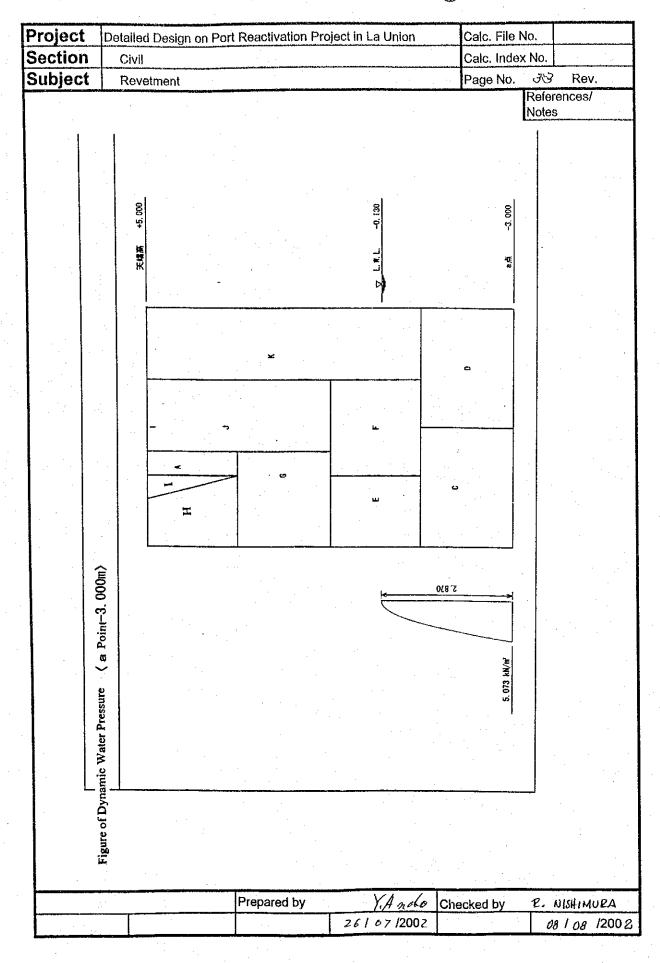
$$Point M_b = 1.620x 0.348$$

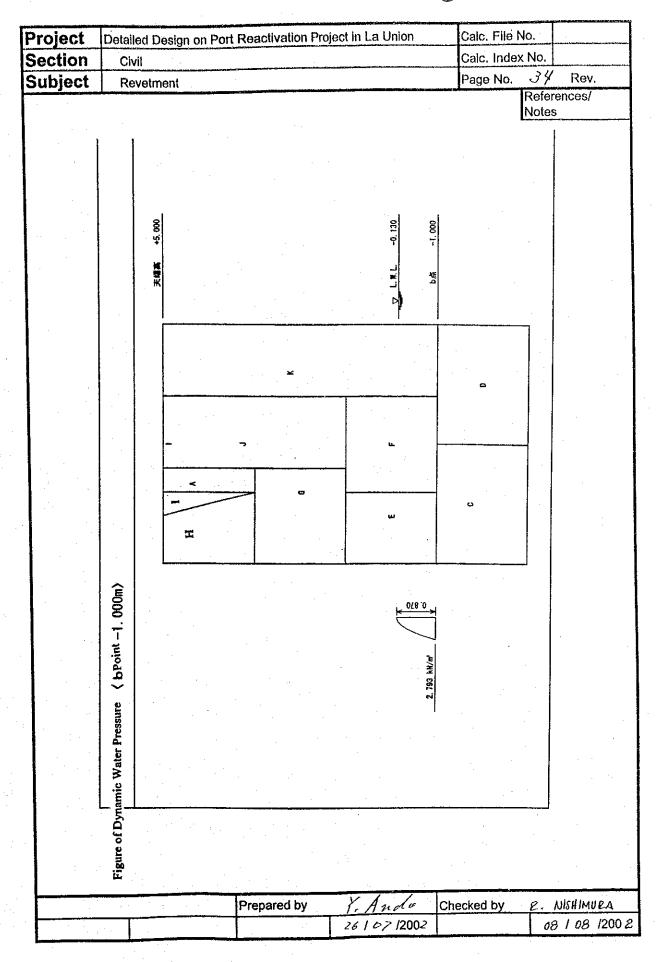
0.564 (kN·m/m)

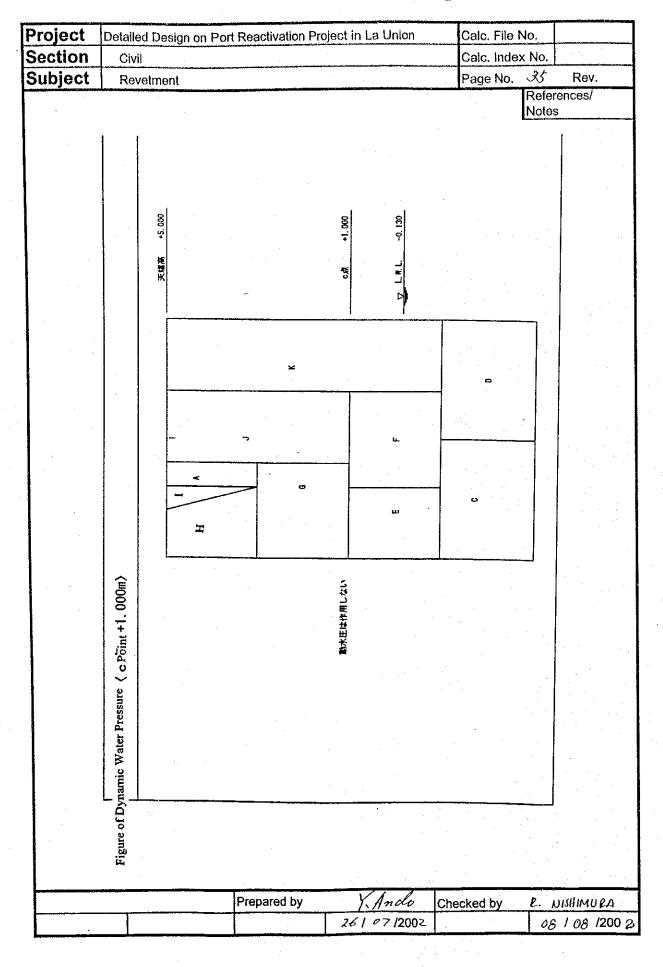
C. < 1.000m >
Point No Dinamic Water Pressure at this Point

D. < 3.000m > -No Dinamic Water Pressure at this Point

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		,	Prepared by	Y. Ando	Checked by	2. NISHIMURA
۱				261 07 12002		08 08 2002







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	《dPoint +3.000m》		
	Figure of Dynamic Water Pressure		
	Figure of Dyn		•
	Prepared by Y. Ando	Checked by	2. NISHIHURA
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	[1]		ic Force and Mome	ent			Reference Notes	s/
	, n	< -3,000m /				 }		•
	 - -	No Name	W (kN/m)	K _h	Wh (kN/r	n) y (m)	M. h (kN·m/m)	
		1 Back filling 2 D1 3 D2 4 C1 5 C2 6 B1 7 A1 8 AS 9 BS 10 CS	9. 000 115. 000 115. 000 69. 000 92. 000 57. 500 20. 000 120. 000 180. 000	0. 200 0. 200 0. 200	23. 00 23. 00 13. 80 18. 40 11. 50 4. 00 24. 00	00	23, 000 23, 000 41, 400 55, 200 92, 000 79, 730 28, 000 144, 000	1
	D-3	Total			173. 90	10	679. 529	
	Poir B	n. < −1.000m	>					J
		lo Name	W (kN/m)	K,	Wh (kN/m) y (m)	M. h (kN-m/m)]
		1 Backfilling 2 C1 3 C2 4 B1 5 A1 6 AS 7 BS	9, 000 69, 000 92, 000 92, 000 57, 500 20, 000 120, 000	0. 200 0. 200 0. 200 0. 200 0. 200 0. 200 0. 200	1.80 13.80 18.40 18.40 11.50 4.00 24.00	0 1.000 0 1.000 0 3.000 0 4.933 0 5.000	9, 599 13, 800 18, 400 55, 200 56, 730 20, 000 96, 000	
		Total			91.90	0	269. 729	
	Poir C	nt < 1,000m	`				1	
	r	io Name	> W (kN/m)	Kh	W _h (kN/m)	у (т)	M (13) (3)	
		Backfilling Backfilling Bi Ai AS	9. 000 92. 000 57. 500 20. 000	0. 200 0. 200 0. 200 0. 200 0. 200	1. 800 18. 400 11. 500 4. 000	3. 333 1. 000 2. 933	5. 999 18. 400 33. 730 12. 000	
		Total			35. 700		70. 129	
	Poi D		>			~ 1		
	N	lo Name	W (kN/m)	K,	Wh (kN/m)	y (m)	M. b (kN·m/m)	
		1 Backfilling 2 A1	9. 000 57. 500	0. 200 0. 200	1.800 11.500	1, 333	2. 399	
		Total		0. 200	13. 300	 	10. 730	
	!					1	13. 129	
			Prepared by	j	Ando	Checked by	, R. WISHIMU	10.4
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No Other Forc No Other Forc 3-5. Stability of Wall [1] Sliding	No Other Force No Other Force 3-5. Stability of Wall [1] Sliding	Subject	Revetment	Page No. 🤡 Rev.
F =	F = H F = M _A V: Total Vertical Force (kN/m) H: Total Horizontal Force (kN/m) H: Coefficient of Friction Ma: I Moment of Total Vertical Force (kN/m) Ma: Moment of Total Horizontal Force (kN/m/m) Point A < -3.000m > V (kN/m) H (kN/m) M _A (kN·m/m) M _B (kN·m/m) Earth Pressure 51.719 192.984 258.595 556.191 Residual Water Pressure 869.500 173.900 2127.145 70.627 Weight of Wall Buoyancy -201.650 9.706 -504.125 11.142 Total 719.569 417.131 1881.615 1317.489 Sliding Overturning Safety Factor F Allowable Value Safety Factor F Allowable Value 0.600 x 719.569 1.035 ≥1.00 1881.615 1317.489 1.428 ≥1.10 Point B ₁ < -1.000m; > V (kN/m) H (kN/m) M _A (kN·m/m) M _A (kN·m/m) M _A (kN·m/m) Earth Pressure 21.748 81.150 86.992 342.594 Residual Water Pressure 17.049 19.900 787.145 269.729 13.037 Weight of Wall 80.900 787.145 269.729 13.037 Weight of Wall 459.500 91.900 787.145 269.729 19.900 787.145 26		No Other Forc	•
V: Total Vertical Force (kN/m) H: Total Horizontal Force (kN/m) μ: Coefficient of Friction (kN/m) (kN-m/m) Ms: Moment of Total Vertical Force (kN-m/m) Ms: Moment of Total Vertical Force (kN-m/m) Ms: Moment of Total Vertical Force (kN-m/m) Ms: Moment of Total Horizontal Force (kN-m/m) Weight of Wall 51. 719 19. 984 258. 595 556. 191 Residual Water Pressure 40. 541 2127. 145 679. 529 Dynamic Water Pressure 9. 706 -504. 125 11. 142 Total 719. 569 417. 131 1881. 615 1317. 489 Sliding Overturning Safety Factor F Allowable Value Safety Factor F Allowable Value Point B: < -1.000m: > V (kN/m) H (kN/m) Ms. (kN-m/m) Ms. (kN-m/m) Ms. (kN-m/m) Residual Water Pressure V (kN/m) H (kN/m) Ms. (kN-m/m) Ms. (kN-m/m) Ms. (kN-m/m)	V: Total Vertical Force (kN/m) H: Total Horizontal Force (kN/m) µ: Coefficient of Friction Ma: Moment of Total Vertical Force (kN-m/m) Ma: Moment of Total Horizontal Force (kN-m/m) Weight of Wall 51.719 192.984 258.595 565.191 Residual Water Pressure 51.719 192.984 258.595 566.191 Weight of Wall 869.500 173.900 2127.145 679.529 Dynamic Water Pressure 9.706 -504.125 11.142 Total 719.569 417.131 1881.615 1317.489 Safety Factor F Allowable Value Safety Factor F Allowable Value Overturning Point Barth Pressure V (kN/m) H (kN/m) Ma (kN-m/m) Ma (kN-m/m) Ma (kN-m/m) Barth Pressure 21.748 81.150 86.992 342.594 Residual Water Pressure 21.748 81.150		[1] Sliding [2] Overturning $F = \frac{\mu \cdot V}{F} = \frac{M_a}{F}$	g
V (kN/m) H (kN/m) M _k (kN·m/m) M ₆ (kN·m/m) M ₆ (kN·m/m)	V (kN/m) H (kN/m) M _s (kN·m/m) M _s (kN·m/m) M _s (kN·m/m)		V: Total Vertical Force (kN/m) H: Total Horizontal Force (kN/m) μ: Coefficient of Friction Ma: I Moment of Total Vertical Force (kN⋅m/m) Moment of Total Horizontal Force (kN⋅m/m)	
Earth Pressure S1. 719 192. 984 258. 595 556. 191 70. 627 Weight of Wall Buoyancy -201. 650 9. 706 -504. 125 11. 142	Earth Pressure S1. 719 192. 984 258. 595 556. 191 70. 627 Weight of Wall Buoyancy -201. 650 9. 706 -504. 125 11. 142	-		(1.1)
Sliding Overturning	Sliding Overturning		Earth Pressure 51. 719 192. 984 Residual Water Pressure Weight of Wall Buoyancy -201. 650 173. 900	258. 595 2127. 145 -504. 125 556. 191 70. 627 679. 529
Safety Factor F Allowable Value Safety Factor F Allowable Value	Safety Factor F Allowable Value Safety Factor F Allowable Value			
Doing Doi	0. 600 x 719.569 1. 035 ≥1. 00 1881.615 1. 428 ≥1. 10 Point B₁ < -1.000m : > V (kN/m) H (kN/m) M₁ (kN·m/m) M₀ (kN·m/m) M₀ (kN·m/m) Earth Pressure Residual Water Pressure Weight of Wall Buoyancy. 459.500 91.900 787.145 269.729 Dynamic Water Pressure -71.155 1. 620 -124.521 0. 564 Total 1 410.093 191.719 749.616 625.924 Safety Factor F Allowable Value 0. 500 x 410.093 1.069 ≥1.00 749.616 1. 197 ≥1.10			Factor F Allowable Value
B ₁ < -1.000m : > V (kN/m) H (kN/m) M ₁ (kN·m/m) M ₀ (kN·m/m) M ₀ (kN·m/m) M ₁ (kN·m/m) M ₂ (kN·m/m) M ₁ (kN·m/m) M ₂ (kN·m/m) M ₃ (kN·m/m) M ₃ (kN·m/m) M ₄ (kN·m/m) M ₂ (kN·m/m) M ₃ (kN·m/m) M ₄ (kN·m/m) M ₃ (kN·m/m) M ₄ (kN·m/m)	B ₁ < -1.000m : > V (kN/m) H (kN/m) M ₁ (kN·m/m) M ₀ (kN·m/m) M ₀ (kN·m/m) M ₁ (kN·m/m) M ₂ (kN·m/m) M ₃ (kN·m/m) M ₄ (kN·m/m)		0. 600 x 719. 569 1. 035 ≥1. 00 188	81.615 1.428 ≥1.10
Earth Pressure Residual Water Pressure Weight of Wall Buoyancy Dynamic Water Pressure 21. 748 81. 150 86. 992 13. 037 13. 037 145 269. 729 13. 037 145 269. 729 1. 620 1. 620 1. 620 1. 620 0. 564 1. 625. 924 Total 1	Earth Pressure 21.748 81.150 86.992 342.594 Residual Water Pressure 459.500 91.900 787.145 269.729 Buoyancy -71.155 1.620 -124.521 0.564 Total 410.093 191.719 749.616 625.924 Safety Factor F Allowable Value Safety Factor F Allowable Value 0.500 x 410.093 1.069 ≥1.00 749.616 1.197 ≥1.10			
Dynamic Water Pressure 1. 620 0. 564 Total 410.093 191.719 749.616 625.924 Sliding Overturning Safety Factor F Allowable Value 0.500 x 410.093 1.069 ≥1.00 749.616 1.197 ≥1.10	Dynamic Water Pressure 1.620 0.564 Total 410.093 191.719 749.616 625.924 Sliding Overturning Safety Factor F Allowable Value 0.500 x 410.093 1.069 ≥1.00 749.616 1.197 ≥1.10	· · · · · · · · · · · · · · · · · · ·	Earth Pressure 21. 748 81. 150 Residual Water Pressure 459. 500 91. 900	86. 992 342. 594 13. 037 787. 145 269. 729
Safety Factor F Allowable Value Safety Factor F Allowable Value 0.500 x 410.093 1,069 ≥1.00 749.616 1.197 ≥1.10	Safety Factor F Allowable Value Safety Factor F Allowable Value 0.500 x 410.093 1.069 ≥1.00 749.616 1.197 ≥1.10		Dynamic Water Pressure 1. 620	0. 564
1.069 ≥ 1.00 1.197 ≥ 1.10	1. 197 ≥1. 10			
		·	1,069 ≥ 1,00	1.197 ≥ 1.10



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Point

C < 1.000m

				
	∨ (kN/m)	H (kN/m)	M. (kN·m/m)	M. (kN·m/m)
Earth Pressure Residual Water Pressure	8. 595	32.068 0.005	21. 487	93. 527
Weight of Wall Buoyancy	178. 500 -0. 660	35. 700	175. 395 -0. 660	0. 000 70. 129
Dynamic Water Pressure		0.000		0.000
Total	186, 435	67.773	196. 222	163. 656

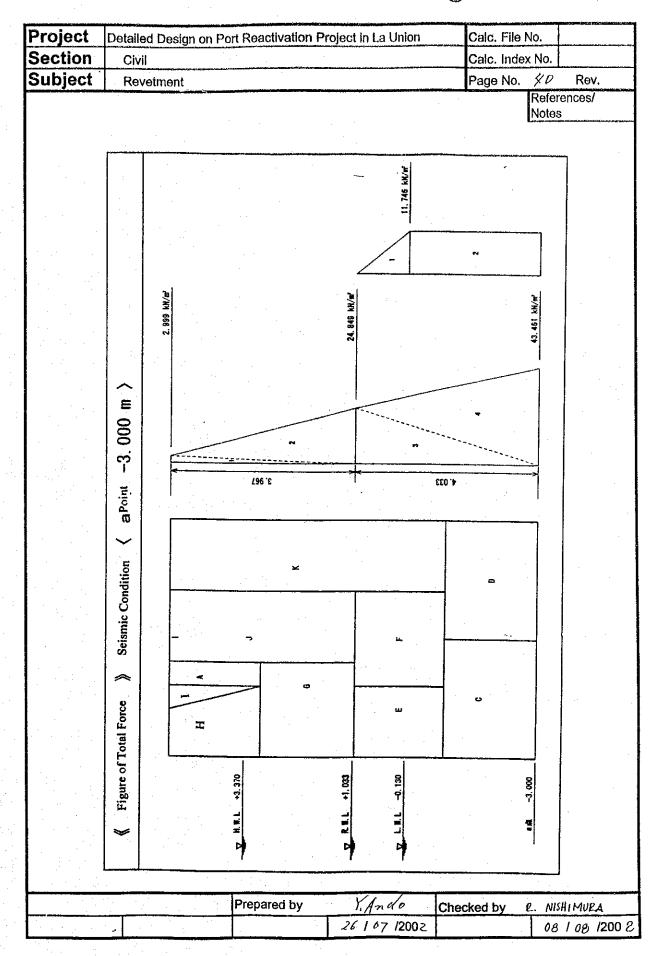
Sliding	•	Overturning			
Safety Factor F	Allow	able Value	Safety Factor	F Allo	wable Valu
0.500 x 186.435	1 075	>4.00	196. 222		
67. 773	1.3/5	≧1.00	163. 656	1. 198	≧1.10

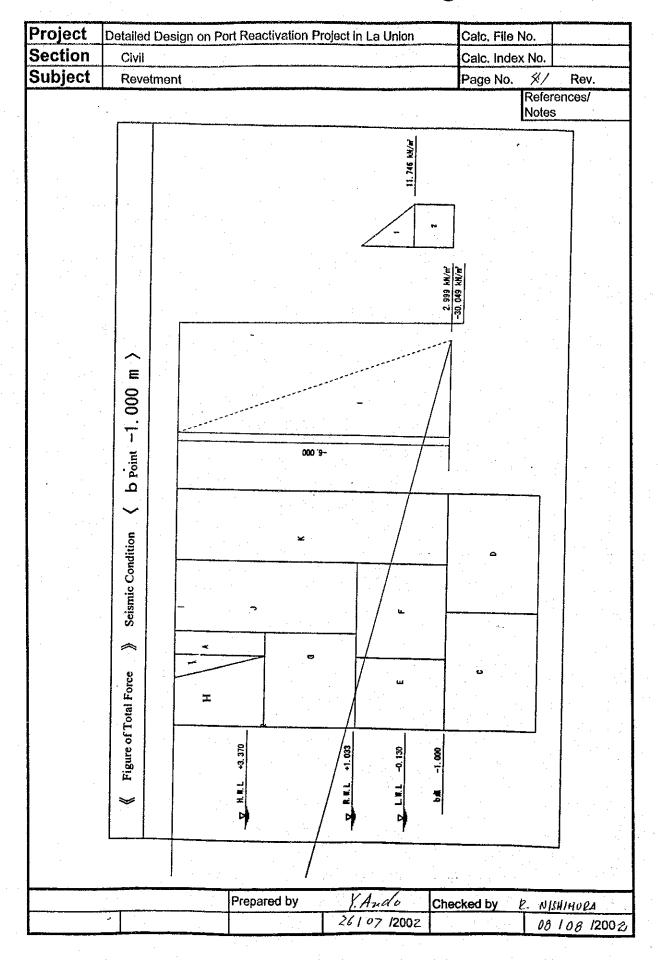
Point D < 3.000m

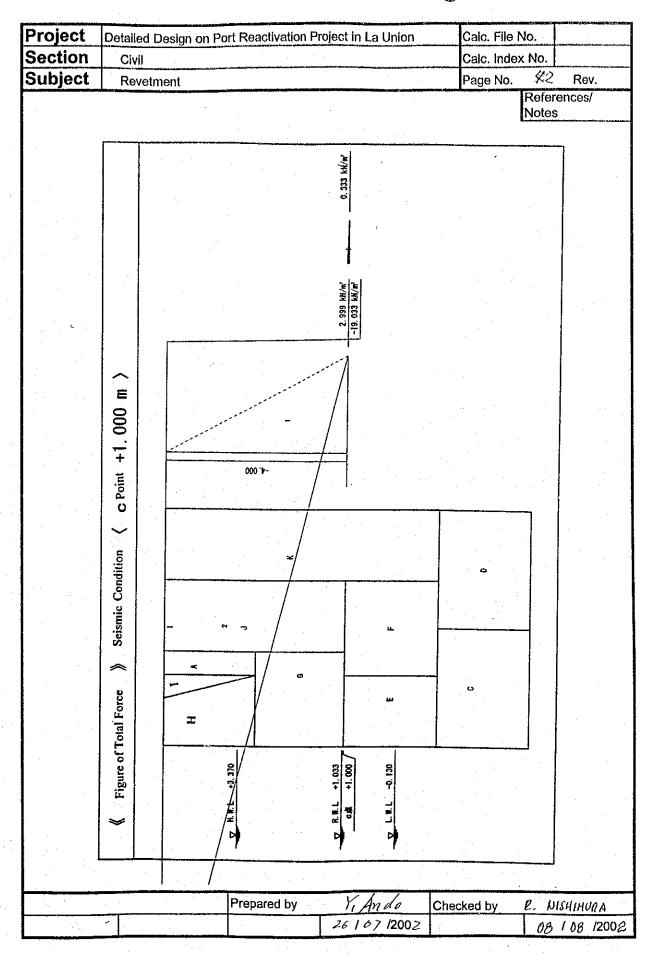
	∨ (kN/m)	H (kN/m)	Mr (kN·m/m)	M _b (kN-m/m)
Earth Pressure Residual Water Pressure Weight of Wall Buoyancy Dynamic Water Pressure	4. 560 66. 500 0. 000	17. 014 0. 000 13. 300 0. 000	6. 840 48. 395 0. 000	13. 346 0. 000 13. 129 0. 000
Total	71.060	30.314	55. 235	26, 475

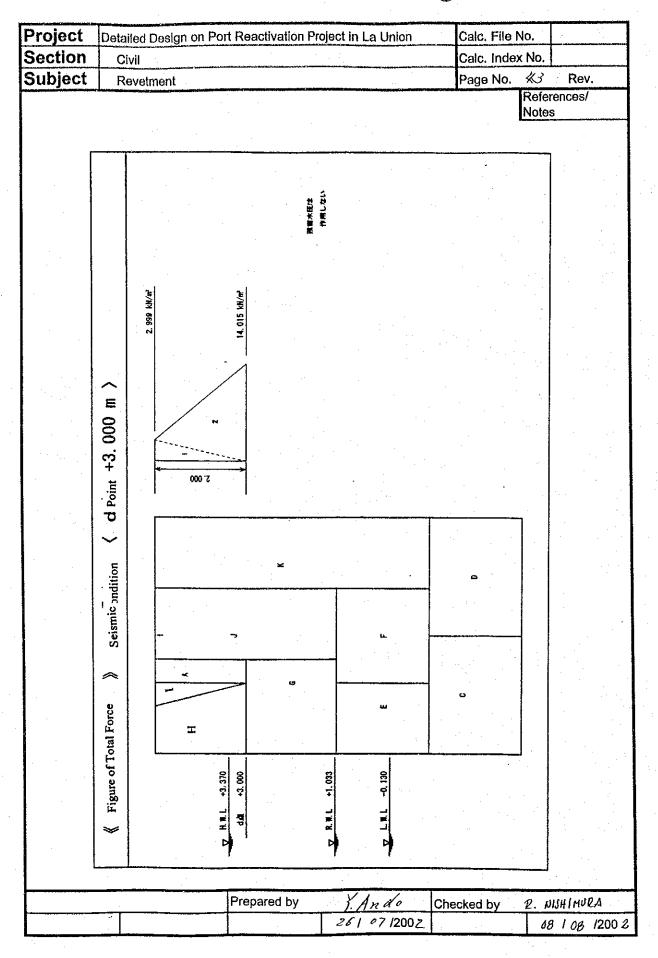
Sliding				Overturning				
Safety Factor F	Allowa	ble Value		Safety Factor	F AI	lowable \	 alue	
0.500 x 71.060	1 170	>1.00	Ţ	55. 235				
30. 314	1. 1/2	≤1.00	≧1.00		26. 475	2. 086	≧1.10	

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Subject	Revelment	Page No. ∜∮ Rev.		
Reference				

3-6. Bearing Capacity

[1]. Reaction of Bottom Surface of Caisson

$$p_1 = \left(1 + \frac{6 \cdot e}{b}\right) \cdot \frac{V}{b} \qquad p_1 = \frac{2 \cdot V}{3 \cdot x} \qquad p = \frac{V}{b}$$

$$p_1 = \frac{2}{3} \cdot \frac{V}{x}$$

$$p = \frac{V}{h}$$

$$p_2 = \left(1 - \frac{6 \cdot e}{b}\right) \cdot \frac{V}{b} \qquad p_2 = 0$$

$$b' = 3 \cdot x$$

$$x = \frac{M_R - M_b}{V} \qquad e = \frac{b}{2}$$

Pi I Maximum Reaction Force (kN/m²)

Pi Minimum Reaction Force (kN/m²)

b Width of Wall (m)

V Vertical resultant force act on wall (kN/m²)

b Distribution width of bottom reactions in case e> b/6

Ma Moment of vertical force act on wall (kN·m/m)

Mo Moment of horizontal force act on wall (kN·m/m) Eccentricity of resultant force of vertical and horizontal

$$x = \frac{M_R - M_0}{V} = \frac{55.235 - 26.475}{71.060} = 0.405 \text{ (m)}$$

$$e = \frac{b}{2} - x = \frac{1.500}{2} - 0.405 = 0.345 \text{ (m)}$$

b) e > b / 6 Case

$$p_1 = \frac{2 \cdot V}{3 \cdot x} = \frac{2x \quad 71.060}{3x \quad 0.405} = 116.972 \quad (kN/m^2)$$

$$b' = 3 \cdot x = 3x \quad 0.405 = 1.215 \quad (m)$$

$$p_2 = 0$$

Maximum Reaction Force ≤ Allowable Bearing Capacity of Rubble Mound 116.972 (kN/m²) ≤

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