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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) COMISION EJECUTIVA PORTUARIA AUTONOMA (CEPA)

THE DETAILED DESIGN

PORT REACTIVATION PROJECT IN LAUNION PROVINCE **OF** E REPUBLIC OF EL SALVADOR FINAL REPOR DESIGN CULATION REPORT ivil Works (1/2) Œ 机酚醛 LIBRARY T1169699[4] **OCTOBER 2002** NIPPON KOEI CO., LTD. SSF CR (4) 02-130

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) COMISION EJECUTIVA PORTUARIA AUTONOMA (CEPA)

THE DETAILED DESIGN ON PORT REACTIVATION PROJECT IN LA UNION PROVINCE OF THE REPUBLIC OF EL SALVADOR

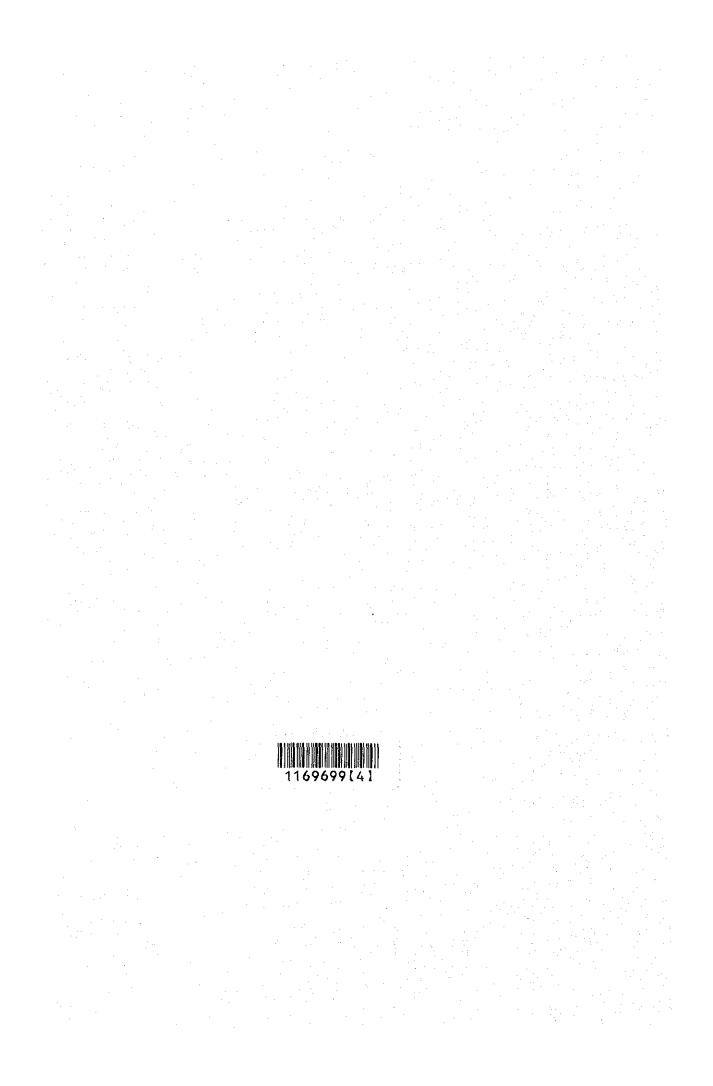
FINAL REPORT

DESIGN CALCULATION REPORT

Civil Works (1/2)

OCTOBER 2002

NIPPON KOEI CO., LTD.



	DESIGN CALCULATION CO	OVER SHEET	
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:	Container and Multi-Purpose Passennger Berth	e Berth	

Calculation Objective:

Desigin Conditions

References, Calculation Notes and Comments

Refer toDrawing

GE-00-001,GE-00-003 SI-01-001~SI-01-007 SI-02-001~GE-02-014

Rev	Prep	pared	No, of	Che	ecked	Rev	iewed	Superseded
	by	Date	Pages	by	Date	by	Date	by Calc No.
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File in Calc. File

Project	Detailed Design on Po	rt Reactivation P	roject in La Union	Calc. File I	No.
Section	Civil	· · · · · · · · · · · · · · · · · · ·		Calc. Inde	K No.
Subject	Quaywall			Page No.	/ Rev.
1 Der	sign Condition	,			References/
	is examination is p	arformed have			Notes S AND
	MMENTARIES FOR P	· · · · · · · · · · · · · · · · · · ·			5 AND
00		OUT MUD HAI	BOOR PACIFILITIE	S IN SAFAIN	
1) P	lan and Usage Conditi	ong	. '		
	Plan Conditions	0115			
	DContainer Berth				
	Planned Water Dep	th : -14.00	m		
	Design Water Dept			· · · · · · · · · · · · · · · · · · ·	
	Crown Height of Be				
	Length	•			·
G)Bulk Berth	: 340.0	m		
(é		11.00			
	Planned Water Dep				
	Design Water Deptl		· · · · · · · · · · · · · · · · · · ·		
	Crown Height of Be				
G	Length	: 220.0	m	х	
(:	Passenger Berth	ng in the second		• • •	
	Planned Water Dep			· ·	
	Design Water Deptl	and the second			
	Crown Height of Be	rth : +5.0 r	n		· .
	Length	: 240.0	m (Piers(30.0m)、	Dolphins 2sets)	· · · · ·
	Usage Conditions				
a)	Dimensions of the Tar	get Vessel			
(DContainer Berth				
	Target Vessel : C	ontainer ships	55,000DWT=0.88	DWT =48,400GT	
	Length overall : 2	94.00 m			
		32.20 m			
	Full load draft :	13.10 m			
(j	DBulk Berth				
Tai	get Vessel : Bulk s	hips 43,000~50	,000DWT=0.541D	WT	
			=23,26	$0{\sim}27,050\mathrm{GT}$	
	Length overall : 1	85.00 m	•		
	Molded breadth :	32.20 m			
	Full load draft :	12.00 m			
		· .		· . ·	
	<u></u>	Prepared by	Y. Ando	Checked by 2	NISHIMURA
·····			26107/2002	CHECKEL DY K	
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Project	Detailed Design on F	Port Reactivation F	Project in La U	Inion	Calc, File	<u>No,</u>	
Section	Civil	·		<i></i>	Calc, Inde	ex No.	
Subject	Quaywall				Page No.	2	Rev
							ences/
						Notes	
(A)D	ssenger Berth						
Gra		n 1.	05 0000	a i	0K 000T	XXIII	
	-	Passenger ships			,		
		Passenger ships	195.0 m	Car carriers			
		Passenger ships		Car carriers			
	Full load draft :	Passenger ships	8.5m	Car carriers			
				(No f	ull load)		
b)	Berthing Velocity an	nd Tractive force	·				
	Berthing Velocity	: $V = 0.10 m$	/sec				
	Bollard Contai	ner Berth 1	,000 k N		·		
	Bulk B	erth 1	,000 k N				
	Passen	ger Berth 1	,000 k N				
	(Bre	asting Dolphin)					
		8 1					
(3)	Lifetime and Corros	tion Control					
	Lifetime : 50 ye					·	
	Corrosion Rates	a10					
0)	L.W.L-1.0m~seal						
```	Under seabed	: 0.03mm	/year				
с)	Corrosion Control						
	Above L.W.L-1.0	e		rosion control	rate : 100	)%)	
	Below L.W.L-1.0	m : Cathodic P	rotection Me				
4		<u>.</u>	(Corr	osion control	rate : 90%	6)	
· · · ·							
(4)	Allowable Limit of I						
	Berthi	ng Condition	5.0 cm				
	Earthq	uake Condition	10.0 cm	L			
		• •					
	· · · ·						
	• •						
		Prepared by	Y. Ando	01-1	ad his of	2 11/-	
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Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No,
Section	Civil	Calc. Index No.
Subject	Quaywall	Page No. 3 Rev.
		References/
0 \ N		Notes
•	atural Condition	
(1)	Design Water Level	
	H.W.L : +3.37 m	
( - )	L.W.L : 0.13 m	
(2)	Wind Velocity v=31.0 m/s (Extraordinary Conditions)	
	(Out of Service of Container Crane : V=60,0m/sec)	
	Soil Condition	
(	Container Berth	
cas	e I	
	-11.00 m	
	Silty Clay $N = 1$	
	$\gamma = 14 \text{ kN/m}^3$ , $\gamma' = 4 \text{ kN/m}^3$	
	$c = 5.0 \text{ kN/m}^2$	
	-20.00 m	
	Gravel Sand N =30(50 Gravel portion)	
·	$\gamma = 18.0 \text{ kN/m}^3$ , $\gamma' = 10 \text{ kN/m}^3$	
	$\phi = 35^{\circ}$	
	26.00 m	
_	Rock N > 50	
	$\gamma = 18 \text{ kN/m}^3$ , $\gamma' = 10 \text{ kN/m}^3$	
. (	ase II	
	-11.00 m	
	Silty Clay $N = 1$	· · ·
	$\gamma = 14 \text{ kN/m}^3$ , $\gamma' = 4 \text{ kN/m}^3$	
-	$c = 5.0 \text{ kN/m}^2$	
	-12.00 m	
	Gravel Sand N =30(50 Gravel Portion)	
	$\gamma = 18.0 \text{ kN/m}^3$ , $\gamma' = 10 \text{ kN/m}^3$	
	$\phi = 35^{\circ}$	
	26.00 m	
	Rock $N > 50$	
	$\gamma = 18 \text{ kN/m}^3  \gamma' = 10 \text{ kN/m}^3$	
	y to krom y y == 10 krom	

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Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.			
Section	Civil	Calc. Inde	x No.		. '
Subject	Quaywall	Page No.	4	Re	٧.
		**************************************	Refe	rencés.	/
			Note	5	
		•			
<ul> <li>• • • • • • • • • • • • • • • • • • •</li></ul>	Bulk Berth				
ca	se I				
	10.00 m				
	Silty Clay $N = 1$			· .	
5. St. 1997	$\gamma = 14 \text{ kN/m}^3$ , $\gamma' = 4 \text{ kN/m}^3$		÷		
· ·	$c = 5.0 \text{ kN/m}^2$				
	20.00 m				
	Gravel Sand N =30(50)				
	$\gamma = 18.0 \text{ kN/m}^3$ , $\gamma' = 10 \text{ kN/m}^3$				
	$\phi = 35^{\circ}$			÷	
	28.00m				
	Rock N > 50				
	$\gamma = 18.0 \text{ kN/m}^3$ , $\gamma' = 10.0 \text{ kN/m}^3$				
Ø	Passenger Berth				
	case I				
	-10.00 m				
	Silty Clay $N = 1$				
	$\gamma = 12.8 \text{ kN/m}^3  \gamma' = 2.8 \text{ kN/m}^3$				
	$c = 5.0 \text{ kN/m}^2$				
	19.00 m				
	Gravel Sand $N = 30$ (50)				
-	$\gamma = 18.0 \text{ kN/m}^3$ , $\gamma' = 10.0 \text{ kN/m}^3$				
	$\phi = 35^{\circ}$			1	
	26.00 m				
.*	Rock $N > 50$				
1. •	$\gamma = 18.0 \text{ kN/m}^3$ , $\gamma' = 100 \text{ kN/m}^3$				
	Silty Clay is replaced to sand or stone.				
	Material Container and Bulk Berth : stone ( $\phi = 35^{\circ}$ )				
	Passenger Berth : sand ( $\phi = 35^{\circ}$ )				
		•			
	Prepared by Y. Ande Ch				
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Section Subject (4) (4) Co fol C ( 3 ( ( 5)	Detailed Design on Po Civil Quaywall Coefficient of Horizon efficient of Horizonta lowing formula. kh = 1.5 × N ( N pefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITH Design Seismic Coeffi kh = 0.20	atal Subgrade I al Subgrade R V/cm ³ ) atal Subgrade STANDARDS IES IN JAPAN	Reaction eaction (kh Reaction ( AND COM	) is calcula Kh) of Ru	ıbble Rock	ex No. Referenc Notes ns of the is set to	Rev. es/
Subject (4) (4) (5)	Quaywall Coefficient of Horizon efficient of Horizonta lowing formula. kh = 1.5 × N ( N cefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITI Design Seismic Coeffi	al Subgrade R V/cm³) tal Subgrade STANDARDS IES IN JAPAN	eaction (kh Reaction ( AND COM	Kh) of Ru	Page No. ated by mea	Feferenc Notes	
(4) Co fol C 3 ( ( 5)	Coefficient of Horizon efficient of Horizonta lowing formula. kh = 1.5 × N ( N cefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITT Design Seismic Coeffi	al Subgrade R V/cm³) tal Subgrade STANDARDS IES IN JAPAN	eaction (kh Reaction ( AND COM	Kh) of Ru	ated by mea ibble Rock	Referenc Notes ns of the is set to	
Co fol 3 ( (5)	efficient of Horizonta lowing formula. kh = 1.5×N(N cefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITT Design Seismic Coeffi	al Subgrade R V/cm³) tal Subgrade STANDARDS IES IN JAPAN	eaction (kh Reaction ( AND COM	Kh) of Ru	ıbble Rock	Notes ns of the is set to	es/
Co fol 3 ( (5)	efficient of Horizonta lowing formula. kh = 1.5×N(N cefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITT Design Seismic Coeffi	al Subgrade R V/cm³) tal Subgrade STANDARDS IES IN JAPAN	eaction (kh Reaction ( AND COM	Kh) of Ru	ıbble Rock	is set to	
Co fol 3 ( (5)	efficient of Horizonta lowing formula. kh = 1.5×N(N cefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITT Design Seismic Coeffi	al Subgrade R V/cm³) tal Subgrade STANDARDS IES IN JAPAN	eaction (kh Reaction ( AND COM	Kh) of Ru	ıbble Rock	is set to	
Co fol 3 ( (5)	efficient of Horizonta lowing formula. kh = 1.5×N(N cefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITT Design Seismic Coeffi	al Subgrade R V/cm³) tal Subgrade STANDARDS IES IN JAPAN	eaction (kh Reaction ( AND COM	Kh) of Ru	ıbble Rock	is set to	
Co fol 3 ( (5)	efficient of Horizonta lowing formula. kh = 1.5×N(N cefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITT Design Seismic Coeffi	al Subgrade R V/cm³) tal Subgrade STANDARDS IES IN JAPAN	eaction (kh Reaction ( AND COM	Kh) of Ru	ıbble Rock	is set to	
fol C 3 ( ( 5)	lowing formula. kh = 1.5 × N ( N cefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILIT Design Seismic Coeffi	V/cm³) tal Subgrade STANDARDS IES IN JAPAN	Reaction (	Kh) of Ru	ıbble Rock	is set to	
C 3 ( ( 5)	kh = 1.5×N (N pefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITT Design Seismic Coeffi	tal Subgrade STANDARDS IES IN JAPAN	AND COM				
3 ( (5)	pefficient of Horizon .5N/cm ³ . see in TECHNICAL HARBOUR FACILITI Design Seismic Coeffi	tal Subgrade STANDARDS IES IN JAPAN	AND COM				
3 ( (5)	.5N/cm ³ . see in TECHNICAL HARBOUR FACILITI Design Seismic Coeffi	STANDARDS IES IN JAPAN	AND COM				
(5)	see in TECHNICAL HARBOUR FACILITT Design Seismic Coeffi	IES IN JAPAN		MENTARI	ES FOR PO	RT AND	
(5)	HARBOUR FACILITT Design Seismic Coeffi	IES IN JAPAN		IMENTARII	ES FOR PO	RT AND	· · · · · · · · · · · · · · · · · · ·
(5)	Design Seismic Coeffi		I)  				
	(a) A set of the se	icient					
	(a) A set of the se	icient					· · ·
	kh = 0.20				1		
					and the second		
			en e				an ta
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		Prepared by	Y. Ano 26107		ecked by	R. NISHIMU 08 108	ид 3 12002

Project	Detailed Design on Po	ort Reactivation Pr	oject in La Union	Calc. File	No.	
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	faterial Coefficient Concrete		andre 1, 1, 1, 1, 12 1, 12 14. 11 14. 14.		References/ Notes	
	Unit Weight : (Reinford	ad Concrete) 24	0 kN/m3 (Plain (	^a onavata) 22.6 k	N/m3	
	fodulus of elasticty	: $2.5 \times 10^7$ kN		50mc10107 122.0 A		
	Steel					
	) Steel Pipe Pile	· · ·	· .	· .		
and the second	nit Weight :	77.00 kN/m ³	· ·			
	fodulus of elasticty :	2.0×10 ⁸ kN/m	2		·.	
D	esign Yield Strength :	SKK400 ; 235	N/mm ² SKK49	); 315 N/mm ²		
	llowable Stresses		•			
			(1	Inits : N/mm ² )	·	
	Type of steel Type of stress	SKK400 SHK400 SHK400M SKY400	SKK49 SHK490 SKY49	м	· · · ·	
ľ	Axial tensile stress (per net cross-sectional area)	140	185			÷.
	· · · · · · · · · · · · · · · · · · ·	$140;  \frac{\ell}{\gamma} \leq 18$	$185:  \frac{\ell}{r} \leq 16$			
	Axial compressive stress (per gross cross-sectional area)	$140 - 0.82\left(\frac{\ell}{r} - 18\right);$ $18 < \frac{\ell}{r}$		$\Big); \\ 5 < \frac{\ell}{r} \le 79$		
	(by From 1022-20010) in real	$\frac{1.200,000}{6,700 + \left(\frac{\ell}{r}\right)^2}; 92 < \frac{\ell}{r}$	and the second sec			
	Bending tensile stress (per net cross-sectional area)	140	185		10 J.	
	Bending compressive stress (per gross cross-sectional area)	140	185			
	Examination of members simultaneously subject to axial force and bending moment	(1) In case of the axial ten $\sigma_t + \sigma_{bt} \leq \sigma_{ta}$ and - (2) In case of the axial co $\frac{\sigma_c}{\sigma_{ca}} + \frac{\sigma_{bc}}{\sigma_{ba}} \leq 1.0$	$-\sigma_{t} + \sigma_{bc} \leq \sigma_{ba}$			
	Shearing stress (per gross cross-sectional area)	80	150			
σ _{bi}	$\ell: cffective buckling lengthered for the section of an acting on the section, respectively, \sigma_{ca}: tensile stress due to axial acting on the section, respectively, \sigma_{ca}: allowable tensile stress inertia, respectively (Northered for the section) allowable bending compared for the section of the se$	ea for the gross cross-sect al tensile force and comp (spectively (N/mm ² ) and maximum compress (N/mm ² ) and allowable axial comp /mm ² ) pressive stress (N/mm ² ) forcing Bar	ional area of the member (o ressive stress due to axial c live stress due to bending n pressive stress relating to sn	ompressive force		
		Prepared by	Y. Ando	Checked by P	NISHIMURA	
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Project	Detailed Design on Por	t Reactivation P	oject in La Union	Calc. File	No.
Section	Civil			Calc. Inde	x No.
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					References/
(3)	Reclaimed Material	· ·			Notes
	$\gamma = 18$ kN/m3	γ'=10kN/m3	$\phi = 30^{\circ}$		
(4)	Backfilling Stone				
	$\gamma = 18$ kN/m3	γ'=10kN/m3	$\phi = 40^{\circ}$		
				and the second	
(5)	Rubble Mound	· · · ·	an a		
-	$\gamma = 18$ kN/m3	γ'=10kn/m3	$\phi = 40^{\circ}$	r ja en en en Le recentra en en	
	(Examination of Bear	ring Capacity fo	r Eccentric and Inc	lined Loads	
			$\phi = 35^\circ$ 、 c=2	0.0 kN/m²)	
· · (6)	Sand Filling	×.			
	$\gamma \text{ sat} = 19.00 \text{ kN/m}^3$				
(7)	Coefficient of Friction		· · ·		
	$\mu$ =0.60 (Concrete a				
	0.70 (Asphalt M	at against Rubb	le)		
		· .			
		. *	· · · · · · · · · · · · · · · · · · ·		
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		Prepared by	Y. Ando	Checked by 🎉	. NISHIMUEA
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ect	ion	Civil		· .					Calc. Index	No.
ubj	ubject Quaywall						Page No.	ଓ Rev.		
			······································	· .	· · ·					References/ Notes
	4) L	oad Cond	lition			· .				
	(1)	Examin	ation Case	and Ac	tion Load	•	÷			
	a) Co	ntainer I	Berth						<i></i>	
		Ve	ertical For	ces		Horizonta	l Force	. — — S		
	Case	Dead weight	Surcharge	Wheel loads (crane)	Wheel loads (crane)	Reaction force of thefender	Tractive force	Earthquake force	Condition	Premium coefficient
	In servic	e ()	. 0	0	i O				Ordinary	1.00
	In servic	e O	1 O 1	_					Ordinary	1.00
	Berthin	5 O	0			•: O *			Ordinary	1.00
	Mooring	· 0 ·	<u>`,</u> О	—		,	0		Extraordinary	1.50
	Earthqual	ke O	0		·			0	Extraordinary	1.50
		te O		0	0	1		0	Extraordinary	1.50

b) Passenger Berth

	Vertica	Forces	Hor	izontal F	orces	· .		
Case	Deadweight	Surcharge	Reaction force of thefender	Tractive force	Earthquake force	Condition	Premium coefficient	
Berthing	0	0	0	·		Ordinary	1.00	
Mooring	¹ ; O	· O		0	—	Extraordinary	1.50	
Earthquake	0	0		·	0	Extraordinary	1.50	

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Section	Civil	Deciginan	1 01111000		Journica	Union	Calc. Inde	┉┈┈┈┥┉╸	
Subject	Quay	vall			a da mana a in da mini in la probación		Page No,	<u>9</u>	Rev.
	Guay			<b></b>			Fage No.	Refere	
	·				•			Notes	
	Load Val						· .		
1	Surcharg	general second second	·	en de la composition de la composition Reference de la composition de la compos	· ·		ar Tao ao		
(i)	1.6		nd Bulk B	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -					· · ·
	1 C	1.00		and the state	ess than 40	)m)			
· ·	and the second second	ary Condit		w = 20.0	1997 - A.			с.	
	100 C 100 C	quake Con		w = 10.0 k	at succession of the				
	1			di stati di se	a set galantina.	nd from Wha	arf face line	)	
le e la composition de la composition d La composition de la c	1 - C - C - C - C - C - C - C - C - C -	ary Condit		w = 40.0	kN/m²				• .
	Earth	quake Con	dition :	w = 20.0	kN/m²				
				•					
( ii )	Passenge	er Berth	· · ·					· · · ·	-
	On Platf	form	: (0	rdinary Co	ondition)	w=20.0 kN	$m^2$		
			(Ea	rthquake	Condition)	w=10.0kN/	$m^2$		
			Ve	hicle Load	: T-25		-		
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1								
	On Brea	sting Dolp	hin : No	thing					
	On Brea	sting Dolp	hin : No	thing					
b)	On Brea Crane Lo	• •	ohin : Not	thing					
b)		• •	hin : No	thing					· · · · · · · · · · · · · · · · · · ·
b)		ad		Whe	el Load (l	kNWheel)			
b)		ad Water	r Side	Whe	l Side	Pulling			
b)		ad Wate (kN/V		Whe Lanc (kN/v	l Side vheel)		Rei	marks	
		ad Water	r Side Vheel)	Whe Lanc (kN/v Vertical	Side vheel) Lateral	Pulling	·		
In	Crane Lo	ad Wate (kN/V Vertical	r Side Vheel) Lateral	Whe Lanc (kN/v	l Side vheel)	Pulling	Action dire	ection	to Rail
In Out	Crane Lo service	ad Wate (kN/V Vertical 385	r Side Vheel) Lateral 23	Whe Land (kN/y Vertical 310	l Side vheel) Lateral 19	Pulling (kN/corner)	·	ection d direction	to Rail
In Out Ear	Crane Lo service of service thquake	ad Water (kN/V Vertical 385 500 580	r Side Vheel) Lateral 23 12	Whe Land (kN/v Vertical 310 580 510	l Side vheel) Lateral 19 12 50	Pulling (kN/corner)	Action dire • right-angle • Both directi	ection d direction	to Rail
In Out Ear Tot	Crane Lo service of service thquake tal Weight	ad Water (kN/V Vertical 385 500 580	r Side Vheel) Lateral 23 12 55 N (Extern	Whe Land (kN/v Vertical 310 580 510	l Side vheel) Lateral 19 12 50	Pulling (kN/corner) 590	Action dire • right-angle • Both directi	ection d direction	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight	ad Wate: (kN/V Vertical 385 500 580 : 790 k wheel / co	r Side Vheel) Lateral 23 12 55 N (Extern	Whe Land (kN/v Vertical 310 580 510	l Side vheel) Lateral 19 12 50	Pulling (kN/corner) 590	Action dire • right-angle • Both directi	ection d direction	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight unber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner	Whe Land (kN/M Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50	Pulling (kN/corner) 590 Wheel Base	Action dire • right-angle • Both directi	ection d direction ions	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight unber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner	Whe Land (kN/M Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50 power),	Pulling (kN/corner) 590 Wheel Base	Action direction	ection d direction ions	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight umber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner	Whe Land (kN/M Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50 power),	Pulling (kN/corner) 590 Wheel Base	Action direction	ection d direction ions	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight umber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner	Whe Land (kN/M Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50 power)	Pulling (kN/corner) 590 Wheel Base	Action direction	ection d direction ions	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight umber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner	Whe Land (kN/M Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50 power)	Pulling (kN/corner) 590 Wheel Base	Action direction	ection d direction ions	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight umber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner	Whe Land (kN/M Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50 power)	Pulling (kN/corner) 590 Wheel Base	Action direction	ection d direction ions	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight umber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner	Whe Land (kN/M Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50 power)	Pulling (kN/corner) 590 Wheel Base	Action direction	ection d direction ions	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight umber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner	Whe Land (kN/v Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50 power)	Pulling (kN/corner) 590 Wheel Base	Action direction	ection d direction ions	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight umber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner 1,100 9	Whe Lanc (kN/v Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50 power),	Pulling (kN/corner) 590 Wheel Base 0 1,100	Action direction	ection d direction ions	to Rail
In Out Ear Tot Nu	Crane Lo service of service thquake tal Weight umber : 8	ad Water (kN/V Vertical 385 500 580 : 790 k wheel / co ngrment	r Side Vheel) Lateral 23 12 55 N (Extern orner	Whe Lanc (kN/v Vertical 310 580 510 al electric	l Side vheel) Lateral 19 12 50 power),	Pulling (kN/corner) 590 Wheel Base	Action dire • right-angle • Both directi : 17.2m 900 (minutes)	ection d direction ions m)	to Rail

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c) Reaction Force of the Fender

Fender shall use the thing of the 70% of the Max Deflection of Rubber Fender. Product tolerance is expected in selection. The energy absorption characteristics lower by 10% from the catalog value and to use the reaction force characteristics raise by 10% from the catalog value. A calculation result is shown in the following tables.

	Container Berth	Multi-purpos e Berth	Passenger Ber	th
1.Displacement tonnage: Ms Design Ship Type	Container Ship	Bulk Carrier		Car carrier
DWT(ton)	55,000	43,000 ~ 50,000	25,000 GT	25,000
Length : LOA(m)	294	185	195	200
: Lpp (m)	278	173	173	187
Breadth : B (m)	32.2	32.2	27.0	32.3
Draft: D(m)	13.1	11.8	8.0	8.5
Displacement Ms(ton)	76,300	63,000	18,200	37,000
2.Effective		[		
Berthing energy: E V=0.1m/sec	380 kN-m	259 kN-m	103 kN-m	154 kN-m
3.Fender				
Energy absoption Reaction force	393 kN-m	285 kN-m	110 kN-m	162 kN-m
(cell type fender)	Max 870 kN	Max 700 kN	Max 340 kN	Max 450 kN

[Note: Energy absorption is 90% of catalog value, reaction force is 110% of catalog value]

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- d) Tractive Force of Vessel 1,000 kN/set
- e) Other Condition
  - **OPassenger Berth**

OThe Berthing Force of a vessel does not act on a Platform.

(The front of a Platform is lowered 2m from the face line.)

⁽²⁾The face line of a Passenger Berth appears above 25m from the face line of

Revetment. Structual type is considered as a Dolphin type.

③It does not moor at the time of a storm.

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	DESIGN CALCULATION COVER SHEET								
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Section	Civil	Calc. File No.							
Sub-Section	Quaywall	Calc. Index No.							
Subject:	Container and Multi-purpose	e Berth							

Calculation Objective:

**Stability of Quaywall** 

### **References, Calculation Notes and Comments**

**Refer to Deawings** 

QW-01-001~QW-01-006

Calculation based on

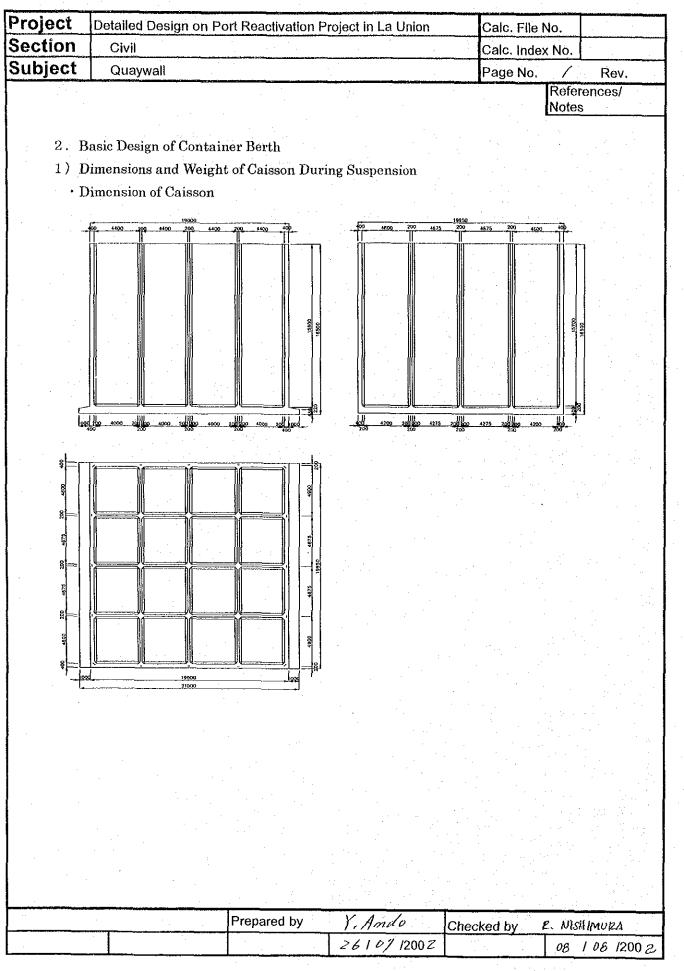
TECHNICAL STANDERDS AND COMMENTARIES

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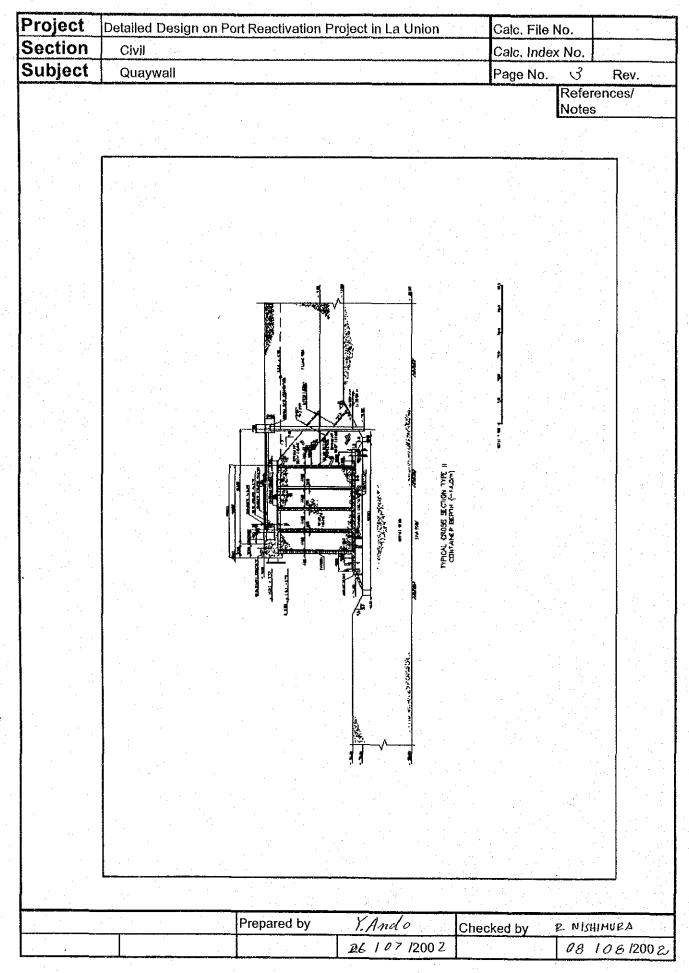
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Subject	Quaywall		Page No.	4	Rev.
				Refere Notes	nces/
~					
Sha	pe and Dimensions of Caisson				
	• Height :	16.50 m	i.		
	• Width :	19.00 m		· .	
	• Length :	19.95 m			
	• Sidewall Thickness :	0.40 m			
· · ·	Bottom Slab Thickness	0.60 m			
	Partition Wall Thickness	0.20 m			
na di seconda di second Reference di seconda di	• Haunch Size :	0.20 m			the second
· ·	• Width of Footing :	1.00 m			÷ .
	• Height of Footing :	0.50 m			
	Haunch Size(Footing)	0.20 m			· .
	• Number of Chambers		· *		
	(Parallel directions to face line) :	4			
	(Vertical directions to face line) :	4	· .		

	Formula (m)	Volume V (m ³ )	Weight W (kN)	Center of gravity position y(m)	₩・y (kN・m/m)
Bottom Slab	19.95*19.00*0.60	227.43	5, 458. 32	0.30	1,637.50
Side Wall	0. 40*(19. 95+(19. 00-2*0. 40)) *(16. 50-0. 60)*2	485. 27	11, 646. 43	8. 55	99, 576, 99
Partition Wall	0. 20*(((19, 95-2*0, 40)*3)+((19, 00- 2*0, 40-3*0, 20)*3))*(16, 50-0, 60)	350. 59	8, 414. 28	8. 55	71,942.09
Vertical Haunch	0. 20 ² *0. 5* (16. 50-0. 60) *4*16	20.35	488.45	8. 55	4, 176. 23
Horizontal Haunch	0. 20 ² *0. 5*{((4. 00+4. 20)*2*8) +((4. 00+4. 275)*2*8)}	5. 27	126.53	0. 67	84.77
Concave Section	0. 2 ³ /3*4*16	0. 17	4.10	0. 68	2.79
Footing	1. 00*0. 50*19. 95*2	19.95	478.80	0.25	119.70
Haunch of Footing	0. 20*1. 00*0. 5*19. 95*2	3, 99	95.76	0. 57	54. 58
Total		1, 113. 03	26, 712. 66	6.65	177, 594. 66

# Weight and Center of Gravity for Caisson

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			Prepared by	Y. Ando	Checked by	R. NISHIMURA
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Sha	ape and Dimensions of Concr	ete Crown and Concrete Lid	
Ć	OConcrete Crown	<u>d</u>	≠ <del>  ← C</del>
	• Size a (Thickness)	: 3.00 m	
· ·	• Size b (Crown Width)	: 4.00 m	
	• Size c	: 1.00 m	Crown
	OConcrete Lid		
	• Thickness	: 0.50 m	

: 0.50 m

Weight and Center of Gravity for wall

	Formula (m)	Volume V (m³/m)	Weight W (kNt/m)	Center of gravity position x(m)	Center of gravity position y(m)	₩•x (kN•m/m)	₩・y (kN・m/m)
Caisson	1, 113. 03/19. 95	55.79	1, 338, 98	10.50	6, 65	14, 059, 29	8,901.95
Concrete Crown	(4. 00+5. 00) *3. 00/2	13.50	305, 10	3. 26	17.94	994. 40	
Concrete Lid	{ (4. 40*4. 60) *8+ (4. 40 *4. 675) *8-0. 20 ² *0. 5 *4*16} *0. 50/19. 95	8.15	184. 20	10. 50	16. 26	1, 934. 08	2, 993. 23
Filling Sand	{[(4. 40*4. 60) *8+(4. 40 *4. 675) *8]*(16. 5-0. 60 -0. 50) -20. 35-5. 27 -0. 17}/19. 95	250. 76	4, 764. 42	10. 50	8. 31	50, 026. 38	39, 584. 22
Backfilling Soil	14. 0*3. 0+1. 0*3. 0*0. 5 +18. 8*1. 0+1. 0*0. 2*0. 5	62.40	1, 156. 18	15. 25	15.38	17, 631. 40	17, 780. 58
Total		1	7, 748, 88	10.92	9, 64	84, 645, 55	74, 734. 82

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Section	Detailed Design on Po	on Reactivation Pl	roject in La Union	Calc. File N	
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2)					Notes
Exa	nination during Buoyanc				
	The following formula r	nust be satisfied in	order to insure the s	stability of the caiss	on during
	floating.				
	$I/V - \overline{CG} = \overline{GM} \ge 0.$	· ·			]
an an taon Taon	V ; Displacement(	•		- <u>V</u> M	
	I; Moment of ine	ang an the second second			
	a de la Calendaria de la C	is at the draft elevat	tion(m⁴)	C C	
н н н	C; Center of buoy				
	G; Center of grav	ity			
	M; Metacenter		· · · ·	·	J
۰D	raft of Caisson				
	Draft of caisson "d" is ca	alculated by the foll	owing formula.		
an da serie de la companya de la com La companya de la comp	$d = \frac{W - V_f \rho \circ g}{D T}$				· · · ·
	BLoog				
	W; Weight of cai				
• • •	$V_f$ ; Volume of for	oting(m ³ )			
	$\rho_{0}g$ ; Unit weight o	f sea water(t/m ³ )			
	B; Width of caiss	on(m)			. *
	L; Length of cais	son(m)			
	d = (26,712.66-23.9	4×10.1)/(19.00	$\times 19.95 \times 10.1$ ) = 6.	91 m	
				· · · · ·	
۰D	isplacement $V = B \times L$ ?	$\times d + V_f = 19.00 \times$	19.95×6.91+23.94	= 2,644.82 m ³	
• P	rimary Moment of Displa				
	$Vy = B L d^2/2 + V_f y =$	19.00×19.95×6.9	$91^2/2 + 7.25 = 9,056.7$	/1 m ⁴	
	V _f y is Primary mo	oment of displacement	ent for footing.		
۰C	enter of Buoyancy (	C = Vy / V = 9,056.7	71 / 2,644.82 = 3.43 c	m	
۰M	loment of Inertia of Area	and the second			
	$I = L \times B^2 / 12 = 19.95$	$5 \times 19.00^3 / 12 = 11$	,403.09 m ⁴		
• St	ability Examination for C	aisson			•
· · ·	GM = I/V - GC = 11,	403.09 / 2,644.82-	(6.65-3.43)	· · ·	•
, i		= 1.6	$09 \text{ m} \ge 0.05 \times \text{d} = 0.0$	5×6.91 =0.35 m	
		Accord	lingly, it is stable duri	ng buoyancy.	
		n de la companya de l La companya de la comp			
		Prepared by	Y. Ando	Checked by	P. NISHINURA
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- 3) Calculation of External Forces
- (1) Earth Pressure

Calculation results of earth pressure are shown below.

a ) Ordinary Condition

	Layer	Elevation	т 1	Coefficient of EarthPressure	Intensity of Earth Pressure	Earth Pressure
		(m)	(kN/m²)		(kN/m ² )	(kN/m)
	1	+5.00	20.000	0.3014	6.028	42.500
	1	+2.00	74.000	0.3014	22.305	42.000
	2	+2.00	74.000	0.2011	14.878	15.950
L	<u>.</u>	+1.04	91.280	0.2011	18.352	10.900
	3	+1.04	91.280	0.2011	18.352	527.948
L		3 -14.50 246.6		0.2011	49.595	041.940

## • Horizontal Earth Pressure

Layer	Earth Pressurc (kN/m)	cos(ψ+δ)	Horizontal Earth Pressurc (kN/m)	Action Height (m)	Moment (kN • m/m)
1	42.500	0.966	41.052	17.713	727.138
2	15.950	0.966	15.407	16.003	246.558
3	527.948	0.966	509.959	6.579	3,355.057
Total			566.417		4,328.752

## • Vertical Earth Pressure

Layer	Earth Pressuro (kN/m)	cos(ψ+δ)	Vertical Earth Pressure (kN/m)	Action Height	Moment (kN · m/m)
1	42.500	0.259	11.000	21.000	230.995
2	15.950	0.259	4.128	21.000	86.693
3	527.948	0.259	136.643	21.000	2,869.505
Total			151.771		3,187.192

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	Prepared by	Y. Ando	Checked by	P. NISHINURA	٠.
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b)	Earthquake (	Condition						
	Layer	Elevation	Load	Seismic Coefficient	Coefficient of EarthPressure	Intensity of Earth Pressure	Earth Pressure	
4		(m)	(kN/m ² )			(kN/m ² )	(kN/m)	
	1	+5.00	10.000	0.200	0.4520	4.520	50.176	
· .	L	+2.00	64.000	0.200	0.4520	28.930	50,176	
	2	+2.00	64.000	0.200	0.3168	20.276	22,092	
÷ .	4	+1.04	81.280	0.200	0.3168	25.750	44.094	
· .	3	+1.04	81.280	0.298	0.3938	32.011	972.992	
.*		-14.50	236.680	0.298	0.3938	93.213	912.002	

Horizontal Earth Pressure

Layer	Earth Pressure (kN/m)	cos(ψ+δ)	Horizontal Earth Pressure (kN/m)	Action Height (m)	Moment (kN ∙ m/m)
1	50.176	0.966	48.466	17.635	854.703
2	22.092	0.966	21.340	16.001	341.455
3	972.992	0.966	939.838	6.504	6,112.860
Total			1,009.644		7,309.018

#### Vertical Earth Pressure

Layer	Earth Pressure (kN/m)	$\cos(\psi+\delta)$	Vertical Earth Pressure (kN/m)	Action Height (m)	Moment (kN • m/m)
11	50.176	0.259	12.986	21.000	272.714
2	22.092	0.259	5.718	21.000	120.077
- 3	972.992	0.259	251.829	21.000	5,288.408
Total			270.533		5,681.199

#### (3) Buoyancy

 $\mathbf{F} = \{ [(14.50+1.04) \times 20.00] + (0.50 \times 1.00) + (0.20 \times 1.00/2) \} \times 10.1$ 

 $=(310.80 + 0.50 + 0.10) \times 10.1$ 

= 3,145.14 kN/m

 $\mathbf{M} = \{[310.80 \times 10.1 \times (20.00/2 + 1.00)]$ 

 $+[0.50 \times 10.1 \times (1.00/2)] + [0.10 \times 10.1 \times (1.00 \times 2/3)]$ 

 $= 34,533.08 \text{ kN} \cdot \text{m/m}$ 

## (4) Earthquake Force

 $F = 7,748.88 \times 0.20 = 1,549.78 \text{ kN/m}$ 

 $M = 1,549.78 \times 9.64 = 14,946.96 \text{ kN} \cdot \text{m}$ 

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#### (5) Residual Water Pressure

Elevation	Intensity of Water Pressure	Residual Water Pressure	Action Height	Moment	
	(kN/m²)	(kN/m)	(m)	(kN · m/m)	
1.04	0.00	6.91	14.76	102.04	
-0.13	11.82	0.51	14.70	102.04	
0.13	11.82	100.01	77.10	1.000.00	
-14.50	11.82	169.81	7.19	1,220.09	
Total	· · · · · ·	176.72	·	1,322.12	

(6) Dynamic Water Pressure (Earthquake Condition)Dynamic water pressure acts only on the front of caisson.

 $P_W = (7/12) \times 10.1 \times 0.2 \times (14.50 \cdot 0.13)^2 = 243.32 \text{ kN/m}$ 

 $h = (2/5) \times (14.50 \cdot 0.13) = 5.75 m$ 

 $Mw = 243.32 \times 5.748 = 1,399.09 \text{ kN} \cdot \text{m/m}$ 

(7) Crane Load

On a container berth, only a seaside is loaded among the crane wheel loads shown in Design Condition.

It loads 16 wheels per a caisson. Load point of crane is the part 3.0m away from the front of concrete crown. (From the front of footing to 4.0m)

a ) During Work

• Vertical Load 385.0 kN/wheel	
All wheel load per a caisson	$P = 385.0 \times 16 = 6,160 \text{ kN}$
Wheel load pcr 1m	p = 6,160 / 19.95 = 308.77  kN/m
• Horizontal Load 23.0 kN/wheel	
All wheel load per a caisson	$P = 23.0 \times 16 = 368.0 \text{ kN}$
Wheel load per 1m	p = 368.0 / 19.95 = 18.45 kN/m
b) Earthquake Condition	
• Vertical Load 580.0 kN/wheel	
All wheel load per a caisson	$P = 580.0 \times 16 = 9,280 \text{ kN}$
Wheel load per 1m	p = 9,280 / 19.95 = 465.16 kN/m
• Horizontal Load 55.0 kN/wheel	
All wheel load per a caisson	$P = 55.0 \times 16 = 880.0 \text{ kN}$
Wheel load per 1m	p = 880.0 / 19.95 = 44.11 kN/m

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Section	Civil		C	alc. Inde	(No.	
Subject	Quaywall	· ·	P	age No.	10	Rev.
(8	) Reaction Force of Fender				Refere Notes	ences/
·	The action direction of reaction f	orce of the fender	that generat	ed by be		is
· ·	mutually offset in earth pressure			2	0	
	Therefore, examination of berthin					
		0				
(9	) Tractive Force					
	On a container berth, mooring po	ets are arranged et	70m 20 0m (1	ner a ca	iecon)	
	P = 1,000  kN / 20.0  m = 50.0  kN		(CI y 20.0111 (1	por a ca	1000117.	
	1 - 1,000 XIV/ 20.0 III - 00.0 KI					
(1	0) Surcharge					
	and the second	10			1	. C
· · · · · ·	On a container berth (less than $201 \text{ M/s}^2$		•		_	OI
· · ·	20kN/m ² (ordinary condition) and	•	•		dered.	
	•	$= 20.0 \times (19.00 + 1.0)$				
		$r = 400.00 \times (1.00 + 2)$	1.1.1		• m/m	
	Earthquake Condition : W					
	Mw	$r = 200.00 \times (1.00 + 1)$	$20.00/2) \approx 220$	00.00 kN	• m/m	
		· ·				
, . <i></i> <b>( 1</b> .	1) Generalization of Load				· . ·	
	· · · · · · · · · · · · · · · · · · ·					

Examination consider as eight cases those with crane load or without, and with surcharge or without, in case of ordinary condition and earthquake condition. Moreover, since it is small enough compared with seismic force, tractive force does not examine.

#### a) Ordinary Condition [With Crane Load • With Surcharge]

unary condition		Jau · With Sur		
	Vertical Force	Resistance Moment Mx	Horizontal Force	Starting Moment Mv
	(kN/m)	$(kN \cdot m/m)$	(kN/m)	(kN·m/m)
Weight of the Wall	7,748.88	84,645.55		
Floating Force	·3,145.14	-34,533.08		
Earth Pressure	<u>15</u> 1.77	3,187.19	566.42	4,328.75
Residual Water Pressure		<u> </u>	176.72	1,322.12
Crane Load	308.77	1,235.08	18.45	359.78
Surcharge	400.00	4,400.00		
Total	5,464.28	58,934.75	761.59	6,010.65

	Prepared by	Y. Ando	Checked by	E. MISHINUEA
		26 1 07 1200 2		08 1 08 12002

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b) ()	rdinary Condition	With Crane L	oad • Without S	urcharge	Refere Notes	nces/
			Resistance Moment Mx (kN • m/m)	-	Starting Moment My (kN • m/m)	
	Weight of the Wall Floating Force	7,748.88	84,645.55			
	Earth Pressure Residual Water Pressure	151.77	3,187.19			
	Crane Load	308.77	1,235.08	18.45	359.78	
c) ()	Total Ordinary Condition	5,064.28 [Without Crar	54,534.75 1e Load • With S		6,010.65	
		Vertical Force V	Resistance Moment Mx	н	My	· ·
-	Weight of the Wall	(kN/m) 7,748.88	(kN · m/m) 84,645.55	(kN/m)	(kN · m/m)	·
	Floating Force	-3,145.14				
	Earth Pressure	151.77	3,187.19	566.42	4,328.75	· .
	Residual Water Pressure			176.72	1,322.12	
	Surcharge	400.00	4,400.00			
	Total	5,155.51	57,699.67	743.14	5,650.87	

d ) Ordinary Condition  $\$  [Without Crane Load  $\cdot$  Without Surcharge]

	Vertical Force V (kN/m)	Resistance Moment Mx (kN • m/m)	Horizontal Force H (kN/m)	Starting Moment My (kN • m/m)
Weight of the Wall	7,748.88	84,645.55		
Floating Force	·3,145.14	-34,533.08		
Earth Pressure	151.77	3,187.19	566.42	4,328.75
Residual Water Pressure			176.72	1,322.12
Total	4,755.51	53,299.67	743.14	5,650.87

e ) Earthquake Condition  $\$  [With Crane Load  $\cdot$  With Surcharge]

· .	Vertical Force V	Resistance Moment Mx	Horizontal Force H	Starting Moment My
· · · · · · · · · · · · · · · · · · ·	(kN/m)	(kN · m/m)	(kN/m)	$(kN \cdot m/m)$
Weight of the Wall	7,748.88	84,645.55		
Floating Force	-3,145.14	-34,533.08		
Earth Pressure	270.53	5,681.20	1,009.64	7,309.02
Residual Water Pressure	·		176.72	1,322.12
Crane Load	465.16	1,860.64	44.11	860.15
Surcharge	200.00	2,200.00		
Seismic Force			1,549.78	14,946.96
Dynamic Water Pressure			243.32	1,399.09
Total	5,539.43	59,854.32	3,023.57	25,837.34

 Prepared by	Y. Ando	Checked by	E- NISHIHURA
	26 1 07 12002		08 1 08 12002

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· · · ·			Refere Notes	onces/

## f ) Earthquake Condition [With Crane Load • Without Surcharge]

	Vertical Force V	Resistance Moment Mx	Horizontal Force H	Starting Moment My
	(kN/m)	$(kN \cdot m/m)$	(kN/m)	(kN · m/m)
Weight of the Wall	7,748.88	84,645.55		
Floating Force	3,145.14	-34,533.08		
Earth Pressure	270.53	5,681.20	1,009.64	7,309.02
Residual Water Pressure			176.72	1,322.12
Crane Load	465.16	1,860.64	44.11	860.15
Scismic Force			1,549.78	14,946.96
Dynamic Water Pressure	<u> </u>		243.32	1,399.09
Total	5,339.43	57,654.32	3,023.57	25,837.34

## g) Earthquake Condition [Without Crane Load • With Surcharge]

ar mq aano o on ano o		Line Boar (140	i oaronargoj	
	Vertical Force V	Resistance Moment Mx	Horizontal Force H	Starting Moment My
	(kN/m)	(kN · m/m)	(kN/m)	(kN · m/m)
Weight of the Wall	7,748.88	84,645.55		
Floating Force	-3,145.14	-34,533.08		
Earth Pressure	<u>2</u> 70.53	5,681.20	1,009.64	7,309.02
Residual Water Pressure		·	176.72	1,322.12
Surcharge	200.00	2,200.00	· ·	
Seismic Force			1,549.78	14,946.96
Dynamic Water Pressure			243.32	1,399.09
Total	5,074.27	57,993.68	2,979.46	24,977.20

h) Earthquake Condition

#### [Without Crane Load · Without Surcharge]

ar bilquano o oliuloion		ranc hoad mit	nout our onurg	201
	Vertical Force V	Resistance Moment Mx	Horizontal Force H	Starting Moment My
	(kN/m)	$(kN \cdot m/m)$	(kN/m)	$(kN \cdot m/m)$
Weight of the Wall	7,748.88	84,645.55		
Floating Force	3,145.14	-34,533.08		
Earth Pressure	270.53	5,681.20	1,009.64	7,309.02
Residual Water Pressure	· · · ·		176.72	1,322.12
Seismic Force			1,549.78	14,946.96
Dynamic Water Pressure			243.32	1,399.09
Total	4,874.27	55,793.68	2,979.46	24,977.20

	Prepared by	Y. Ando	Checked by	NISH I MUZA
		2610712002		08 / 08 /2002

Project	Detailed Design on Port Re	activation Pro	oject in La Unic	n 👘	Calc. File N	o.	
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Subject	Quaywall				Page No.	/3 R	lev.
÷	Examination of Stability ) Examination of Sliding					Reference Notes	<b>}S/</b>
	It checks satisfying the for $\mathbf{F} = \mu \times \mathbf{V} / \mathbf{H} \ge \mathbf{F}'$	mula shown	below as stabi	lity exami	nation of sl	iding.	
· .	F' : Safety Factor (O	rdinary Cond	ition 1.20、Ea	irthquake	Condition 1	.00)	
a)		th Crane Los 51.59 = 5.02	ad • With Sure $\geq 1.20$	hargej O.K			
b)	Ordinary Condition $^{\circ}$ Wi F = 0.70×5,064.28 / 76	and the second second		urcharge O.K			
с)	Ordinary Condition $\lceil Wi \\ F = 0.70 \times 5,155.51 / 74 $	1.1.1.1	Load $\cdot$ With S $\geq 1.20$	urcharge) O.K			
d)	Ordinary Condition $fWi$ F = 0.70×4,755.51 / 74	den in de la companya	Load $\cdot$ Withou $\geq 1.20$	ıt Surchar O.K	gel		
е)	Earthquake Condition F = 0.70×5,539.43 / 3,02	· · ·	and the second second second	urcharge] O.K			· ·
f )		24 - C	Load • Withou	t Surchar	gel		
·	$F = 0.70 \times 5,339.43 / 3,02$ Earthquake Condition			O.K			
. g)	$F = 0.70 \times 5,074.27 / 2,97$	the second second second	ne Load • Wit ≧ 1.00	n Surchar O.K	gej		
h)	Earthquake Condition $F = 0.70 \times 4,874.27 / 2,97$		ne Load•Wit ≧ 1.00	hout Surcl O.K	nargel		
· .							
		e Service Service Service		۰ ۱۰ ۱۰ ۱۰ ۱۰			· · · · ·
	Prer	pared by	Y. And	c Chec	ked by 2	NISHIHU	PA .
			26/07/20				/2002

Project	Detailed Design on Port Reactivation Pro	pject in La Union	Calc, File	No.	and the second second second
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					ences/
(0)	Providentian of Occurring			Notes	5
	Examination of Overturning				
lt ci	ecks satisfying the formula shown below as s	lability examination	of overturning.		
	$F = Mx / My \ge F'$				
	F': Safety Factor (Ordinary Condition 1.	20、Earthquake Cor	ndition 1.00)		
1					
a) C	rdinary Condition $\int With Crane Load \cdot Wi$	th Surcharge J			
	$F = 58,934.75 / 6,010.65 = 9.81 \ge 1.20$	O.K			
· .					
b) C	rdinary Condition ^f With Crane Load • Wi	thout Surcharge]			
	$F = 54,534.75 / 6,010.65 = 9.07 \ge 1.20$	O.K			
c) (	rdinary Condition Without Crane Load •	With Surcharge			
	$F = 57,699.67 / 5,650.87 = 10.21 \ge 1.20$	O.K			
4) (	rdinary Condition [Without Crane Load •	Without Cumbanas 1			
u) t					
	$F = 53,299.67 / 5,650.87 = 9.43 \ge 1.20$	О.К			
af 1. <b>X</b> -				:	
e) E	arthquake Condition With Crane Load • 1				
an An Anna Anna An	$\mathbf{F} = 59,854.32 / 25,837.34 = 2.32 \ge 1.10$	O.K			
f ) E	arthquake Condition [With Crane Load • ]				
	$F = 57,654.32 / 25,837.34 = 2.23 \ge 1.10$	O.K			
			•		
g) E	arthquake Condition [Without Crane Load	• With Surcharge			
	$F = 57,993.68 / 24,977.20 = 2.32 \ge 1.10$	O.K			
h) E	arthquake Condition <b>Without Crane Load</b>	• Without Surcharge	eJ		
	$F = 55,793.68 / 24,977.20 = 2.23 \ge 1.10$	O.K			
· · · ·			·		
			•		
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	Prepared by	Y.Ando	Checked by	$P_{\rm e}$ M(	HINURA

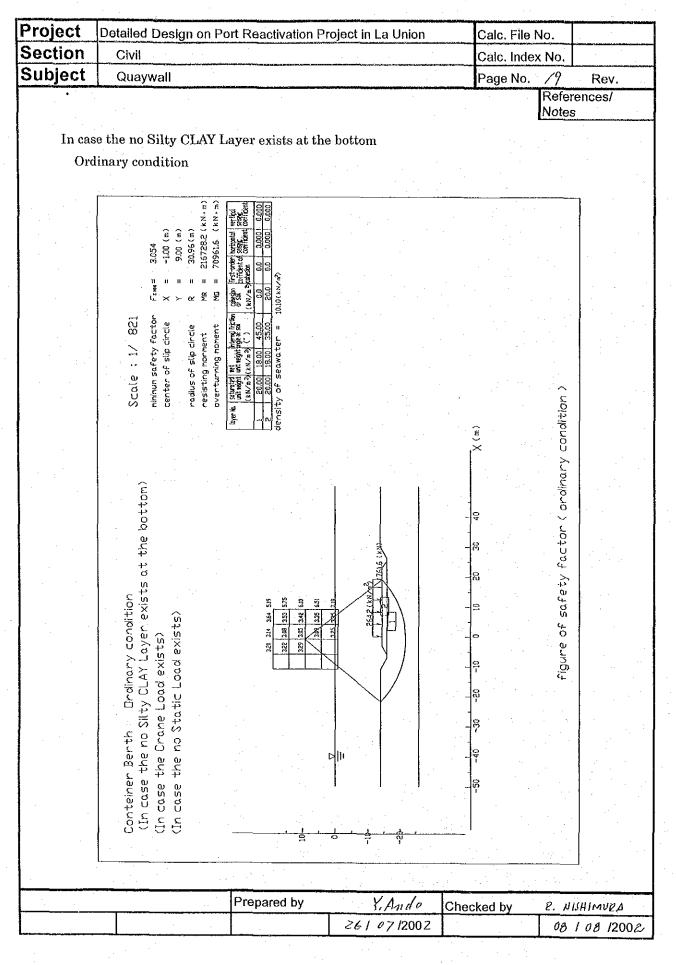
Project	Detailed Design on Po	ort Reactivation Pro	ject in La Union	Calc. File I	No.	
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(3)	Examination of Eccen	ntric and Inclined	Loads		Refere Notes	
a) E	xamination of Subgrad	de Reaction at the	Bottom Surface	of the Wall	110105	
S	ubgrade reaction is cal	culated by the fol	lowing formula (	per 1m).		
	Eccentric volume of lo	bads $e = (B/2)$	$(M_{x} \cdot M_{y})/V$	(m) B:Wall wid	th (m)	
	If it is $e \leq B/6$ , subg	rade reaction is a	trapezoidal disti	ribution.		
	If it is e>B/6, subgr	ade reaction is a f	riangular distril	oution.		
	Subgrade reaction (7	Trapezoidal distri	oution)			
	$p_1 = (1 + 6 \times e / B)$	$\times V / B$ (kN/r	n ² )			
	$p_2 = (1 - 6 \times e / B) >$	<v (kn="" b="" n<="" td=""><td>1²)</td><td></td><td>н. На</td><td></td></v>	1 ² )		н. На	
	Subgrade reaction (1	riangular distrib	ition)			
	$p_1 = (2/3) \times V / (B)$	/2) - e ) (kN/	m²)			
. <i>y</i>	Distribution width	$b' = 3 \times ((B/2))$	e) (m)			
(i)	Ordinary Condition	With Crane Lo	ad $\cdot$ With Surcha	irgej		
Eccen	tric volume of loads	$e = (21.0/2) \cdot (5)$	8,934.75 - 6,010.	65)/5,464.28=0	.81 m	
	.50m e≦B/6 Accord					
	ubgrade reaction p1 =					 
· .				l.0 = 199.65 kN/m		
( ii )	Ordinary Condition	With Crane Lo	ad $\cdot$ Without Sur	charge	·	
	tric volume of loads				92 m	
	.50m e≦B/6 Accord					
	ubgrade reaction p1=		and the second			
			· · · ·	$.0 = 177.88 \text{ kN/m}^2$		· ·
					•	
(iii)	Ordinary Condition	Without Crane	Load · With Sur	chargel		
Eccen	tric volume of loads			-	40 m	
	8.50m e≦B/6 Accord					
	ubgrade reaction p1 =	and the second				
				$.0 = 217.15 \text{ kN/m}^2$		
			,	a minio hivili		
(iv)	Ordinary Condition	Without Crane	Load · Without	Surcharge		
				87)/4,755.51=0	48 m	
	$3.50m e \leq B/6$ Accord					
	ubgrade reaction p1 =			1 m m		
~		and the second		$.0 = 195.38 \text{ kN/m}^2$		
	£7.	( , , , , , , , , , , , , , , , , , , ,	,, , 00.017.21	— 100.00 кімці"		
••••••••••••••••••••••••••••••••••••••		Desperato				
		Prepared by	Y.Ando	Checked by	P. NISH	INURA .

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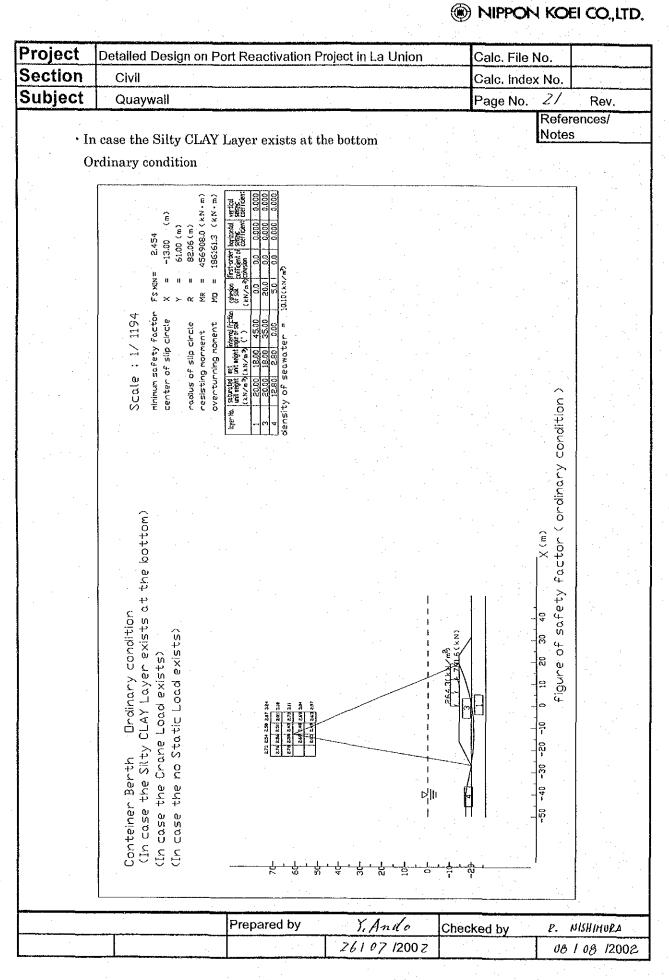
Project	Detailed Design on Po	ort Reactivation Pro	ject in La Union	Calc. File	e No.
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					References/ Notes
(v	) Earthquake Condit	tion 「With Cran	e Load • With Su	rcharge	
1	References/ Notes(v) Earthquake Condition [With Crane Load · With Surcharge]Eccentric volume of loads $e = (21.0/2) \cdot (59,854.32 \cdot 25,837.34) / 5,539.43 = 4.36 m$ B/6=3.50m $e > B/6$ According to the subgrade reaction of triangular distribution. Subgrade reaction $p_1 = (2/3) \times 5,539.43 / ((21.0/2) \cdot 4.36) = 601.37 \text{ kN/m}^2$ Distribution width $b'= 3 \times ((21.0/2) \cdot 4.36) = 18.42 m$ (vi) Earthquake Condition [With Crane Load · Without Surcharge]Eccentric volume of loads $e = (21.0/2) \cdot (57,654.32 \cdot 25,837.34) / 5,339.43 = 4.54 m$ B/6=3.50m $e > B/6$ According to the subgrade reaction of triangular distribution. Subgrade reaction $p_1 = (2/3) \times 5,339.43 / ((21.0/2) \cdot 4.54) = 597.37 \text{ kN/m}^2$ Distribution width $b'= 3 \times ((21.0/2) \cdot 4.54) = 17.88 m$ (vii) Earthquake Condition [Without Crane Load · With Surcharge]Eccentric volume of loads $e = (21.0/2) \cdot (57,993.68 \cdot 24,977.20) / 5,074.27 = 3.99 m$ B/6=3.50m $e > B/6$ According to the subgrade reaction of triangular distribution. 		3 = 4.36  m		
		A second s		-	
	Subgrade reaction p	$b_1 = (2/3) \times 5,539.4$	3/((21.0/2)·4	1.36) = 601.37 k	N/m ²
	Distribution width	b'= 3×((21.0/2)	-4.36) = 18.42 m	1	
	:				
(v	i) Earthquake Condit	ion fWith Cran	e Load • Without	Surcharge	
Ecc	entric volume of loads	e = (21.0/2) - (	57,654.32 - 25,83	37.34)/5,339.43	3 = 4.54  m
B/6	=3.50m e>B/6 Acc	ording to the subgr	ade reaction of t	riangular distril	bution.
	Subgrade reaction p	$b_1 = (2/3) \times 5,339.4$	3/((21.0/2)-4	l.54) = 597.37 k	N/m ²
	Distribution width	$b'= 3 \times ((21.0 / 2))$	-4.54) = 17.88 m	1 ·	•
(vz Ecc	Subgrade reaction p Distribution width iii) Earthquake Condit centric volume of loads =3.50m e>B/6 Acc	$b_1 = (2/3) \times 5,074.2$ $b'= 3 \times ((21.0/2))$ tion [Without Cr $e = (21.0/2) \cdot ($ ording to the subgr	7 / (( 21.0 / 2 ) - 3 - 3.99 ) = 19.52 m cane Load • With 55,793.68 - 24,97 rade reaction of t	3.99) = 519.91 k out Surcharge∫ 77.20) / 4,874.23 riangular distril	N/m ² 7 = 4.18 m pution.
1	Subgrade reaction p				N/m ²
	TX1 11 11 11 11 11				
	Distribution width	$b'=3\times((21.0/2))$	4.18) = 18.97 m	1	
· · · · ·	Distribution width	b'= 3×((21.0/2)	- 4.18) = 18.97 m	1	
	Distribution width	b'= 3×((21.0/2)	- 4.18 ) = 18.97 m	1	
	Distribution width	b'= 3×((21.0/2)	- 4.18 ) = 18.97 m	1	
	Distribution width	b'= 3×((21.0/2)	4.18 ) = 18.97 m	1	
	Distribution width	b'= 3×((21.0/2)	- 4.18 ) = 18.97 m	1	
	Distribution width	b'= 3×((21.0/2)	- 4.18 ) = 18.97 m	1	· · ·
	Distribution width	b'= 3×((21.0/2)	- 4.18 ) = 18.97 m	1	· · · · · · · · · · · · · · · · · · ·
	Distribution width	b'= 3×((21.0/2)	- 4.18 ) = 18.97 m	1	
	Distribution width	b'= 3×((21.0/2)	4.18) = 18.97 п Ү. Алдо	Checked by	R. NISHIMURA

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					References/
b)E	xamination by the	Circular Slip Analysi	s Based on Bishop I	Method	Notes
St	tability examinatio	n of the foundation i	s calculated by the	circular slip a	nalysis
bi	shop method. The	input data of calculat	ion by bishop meth	od is calculated	l using
th	e following formula	as.			
Loa	d width		$B' = ((B/2) \cdot$	e)×2 (m)	
Uni	form load		an a		
Sub	grade reaction is a	trapezoidal distribut	ion q = (( p1	+p ₂ )/(2 $\times$ B)	)) × B
(kN/m	2)	•			
Sub	grade reaction is a	triangular distributio	$q = p_1 \times b / (2)$	$(kN/m^2)$	2)
				· · · ·	· · ·
	Ordinary Conditio		d $\cdot$ With Surcharge		· ·
	ad width	$B' = ((21.0/2) \cdot 0.8)$		:	
	niform load	q = (( 320.76+199.65	5)/( 2×19.37 ))×21	.00 = 282.09  kN	V/m ²
H	orizontal load	P = 761.59  kN /m			
( )	~				
	Ordinary Conditio	and the second	d • Without Surchs	arge]	
	bad width	B' = ((21.0/2) - 0.9)			
		q = (( 304.43+177.88	3)/( 2×19.16 ))×21	.00 = 264.27  kN	J/m²
Н	orizontal load	P = 761.59  kN /m			
(		•		н	
	Ordinary Conditio		Load $\cdot$ With Surcha	argel	
	oad width	B' = ((21.0/2) - 0.4)			
	niform load	q = (( 273.85+217.15	5)/(2×20.19))×21	.00 = 255.33  kN	√m²
Н	orizontal load	P = 743.14  kN/m			* - ± . •
(+ \			· .		
	Ordinary Conditio		Load • Without Su	charge	
	oad width	B' = (( 21.0 / 2 ) - 0.4			
	niform load	q = (( 257.53+195.38	3 )/( 2×20.04 ))×21	.00 = 237.31  kN	√m²
H	orizontal load	P = 743.14  kN / m	•		· ·
	E.u.	at fatera of the		en e	
	Earthquake Condi		Load $\cdot$ With Surcha	rge	
	oad width	$B' = ((21.0/2) \cdot 4.3)$		01116	
	niform load	$q = 601.37 \times 18.42 / 0$	$(2 \times 12.28) = 451.0$	3 kN/m ²	
Н	orizontal load	P = 3,023.57  kN / m			· · ·
				- -	
		Prepared by	Y. Amdo C	hecked by	P. NISHIMURA
		T	261 07 12002		08 1 08 1200

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ıbje	ect	Quaywall	· · ·			······································	Page No.	/8 Rev.
								leferences/ lotes
	(m) 16	arthquake (	andition	With Chan	e Load • Wit	haut Qual		
							large	
		d width			$(.54) \times 2 = 1$			
	Uni	form load	q = 59	$7.37 \times 17.88$	/(2×11.92	) = 448.02	kN/m²	
	Ho	rizontal load	P = 3,	023.57 kN /r	n			
	(vii) E	arthquake (	ondition	Without C	rane Load $\cdot$	With Surch	argel	
	Loa	d width	B' = ((	21.0/2)-3	$(.99) \times 2 = 1$	3.01 m		
1	Uni	form load	$\alpha = 51$	$9.91 \times 19.52$	/(2×13.01	) = 389.93	kN/m ²	
•	· · · · ·	izontal load	. –	979.46 kN /1		,		
	and the second	1				With and Cu	wah awar t	
					rane Load ·		rcnargej	
	and the second	d width			$(.18) \times 2 = 12$			
	Un	form load	q = 51	$3.98 \times 18.97$	/(2×12.64	) = 385.48	kN/m ²	
	Hoi	rizontal load	$\mathbf{P}=2,$	979.46 kN /r	n			
	In a	uddition, abo	ut allowable	e safety facto	or, it carries	out as follo	WS.	
	Ċ	rdinary Con	dition : F	= 1.20	Earthquak	e Condition	: F = 1.00	
	allo	wable value	. Moreover,	rubble widtł	a of the front	of wall bec	Any case sa comes as follo	ws.
	allo Wit	wable value h Silty CLA	. Moreover, 1 Y Layer at t	rubble widtł he bottom	h of the front $L = 1$	of wall bec 6.00m (Di	omes as follo stance from f	ws. ooting)
	allo Wit	wable value	. Moreover, 1 Y Layer at t	rubble widtł he bottom	h of the front $L = 1$	of wall bec 6.00m (Di	comes as follo stance from fo tance from fo	ws. ooting)
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and the second	case the Silty CLAY Layer exists at the bottom		Refere Notes	nces/
E	arthquake condition			
	Scale : 1/ 886 rininum safety factor fs MN = 1.015 center of slip circle X = -15.00(m) Y = 36.00(m) radius of slip circle R = 57.23(m) radius of slip circle R = 57.23(m) verturning moment Ma = 27916.01 (k.N.m) united fitter for same frequent with a state of the state of		ke condition )	
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Project	Detailed Design on Port Reactivation Project In La Union	Calc. File No.
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Subject	Quaywall	Page No. 23 Rev.
		References/ Notes

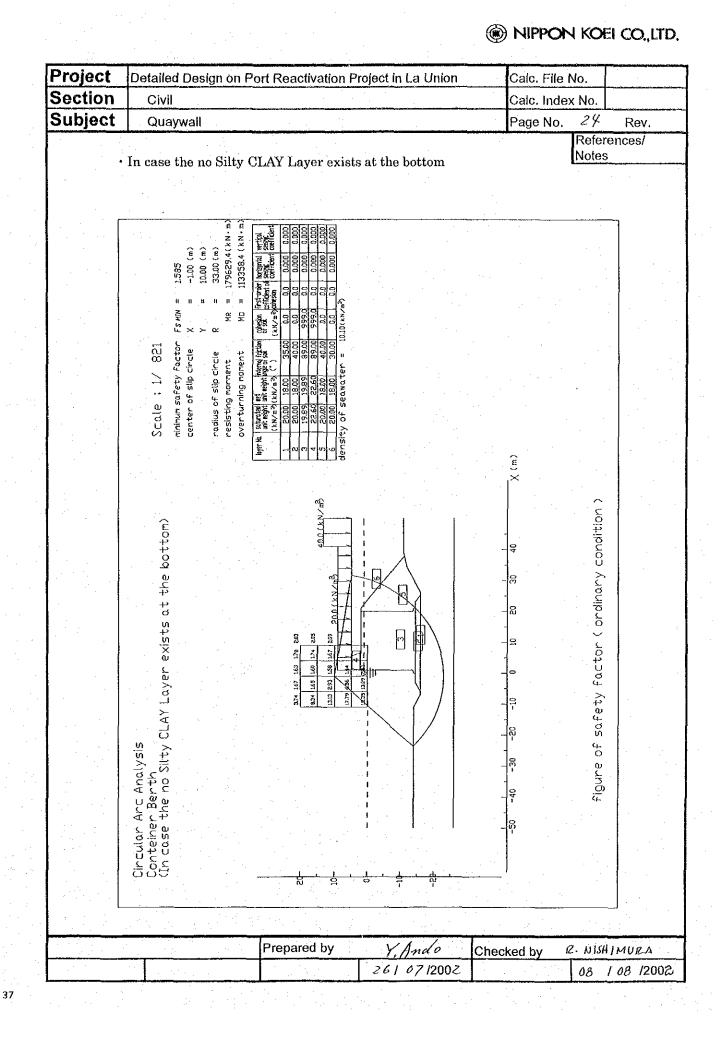
(4) Examination by Circular Slip Analysis

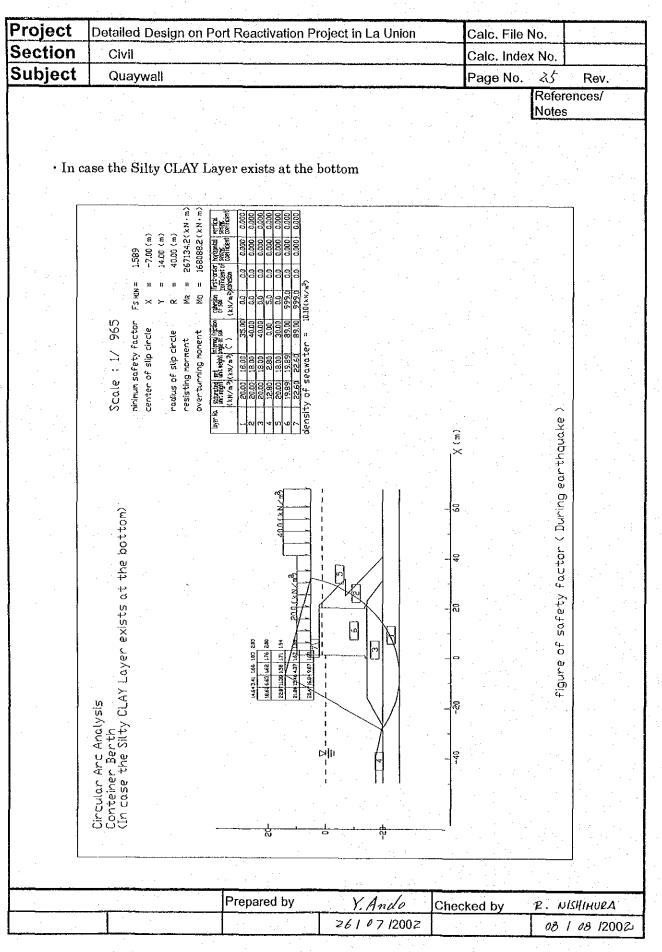
Allowable safety factor of circular slip analysis is F = 1.30.

Examination result of circular slip analysis is shown in the following table. Any case satisfies allowable value.

Examination Case	Safety Factor F
Without Silty CLAY Layer	1.59
With Silty CLAY Layer	1.59

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		Prepared by	Y. Ando	Checked by	P. NISHIMURA
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Section	Civil	Calc. Index	No.
Subject	Quaywall	Page No.	/ Rev.
			References/ Notes
5	) Selection of Fenders		
. (	1) Dimensions of Ships		
	Deadweight tonnage : 55,000DWT, Overall length : 294.0	m,	
	Overall breadth: 32.2m, Full load draft: 13.1m		•
	Length between perpendiculars : log(Lpp)=0.516+0.401 lo	g(DWT)	
	=0.516+0.401 ld		417
	Length between perpendiculars Lpp = 261.1m		
	Full load displacement : log(DT)=0.365+0.953 log(55,0	(00) = 4.883	1
	DT = 76,307 t		
	(2) Calculation of Ship's berthing energy		
· ·	Approach velocity of the berthing ship at the	· -	· .
•	movement of impact against the fender : v=0.10m/s	I	
	Softness factor : Cs=1.0		· · ·
	Shape factor of berth : Cc=1.0		
· ·		1/4 point bei	thing)
	Block coefficient $: Cb=76,307/(261.1 \times 32.1)$		
	Virtual mass factor: $Cm=1+(\pi/(2\times0.673))>$		
		<(10.1/04.4) ²²	1.000
	Ship's berthing energy : $Ef=((76,307\times0.10^2)/2)$	X 0 5 X 1 950	X10X10
	$= 372.00 \text{ kN} \cdot \text{m}$		×1.0×1.0
	-372.00 KIV - III	ч. -	
· · ·	(3) Selection of Fenders		· · ·
	The more economical one is selected among the following fe	ndon	•
•		and the second second	Nem
	Hyper aceV-1000H×2000L (CV2)Energy absoSuper M typeSM-1000H×2000L(M3)Energy abso	in The section of the	
	Super M type SM 1000rl ~ 2000L(M3) Energy and	rption 475 k	
	The second s	1 414	
	Energy absorption of the fender used for examination is the	e vanue that	muniphes
	above mentioned value (written to catalog) by 0.9.	N1 001 M	ОV
	V-1000H×2000L (CV2) E = 491×0.9=441.9 kN · m ≥ 39 OM 1000H×2000L (M2) E = 472×0.9=441.9 kN · m ≥ 39	and the second second	
	SM-1000H×2000L(M3) $E = 473 \times 0.9 = 425.7 \text{ kN} \cdot \text{m} \ge 39$	91.ZZKN•m	O.K
			. · ·

26107/2002 . 08/08/200		Prepared by	Y. Ando	Checked by	, NISHIMURA
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Section	Civil				Calc. File No.		*
Sub-Section	Qua	ywall			Calc. Index No	),	
Subject:	Con	tainer an	d Multi-p	urpose	Berth		
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Calculation							
	Rein	forceme	nt of Cais	sson			
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	TECHNICAL	STANDERD	S AND COM	MENTARI	ES		
	FOR						
	PORT AND H	IARBOUR F	ACILITIES IN	JAPAN		•	
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ection	Civil			Calc. Index No.
ubject	Quaywall	······································		Page No. 7 Rev.
				References/ Notes
6 , De	etail Design o	f Container Berths		
Bai	. arrangemen	t calculation of caisson		
~		1 1 1 1 1 1 1 1 1 1 1	the limit state	design mathed
Bai	r arrangemen	t calculation of caisson calculates by	one munt state	e uesign methoù.
	r arrangemen Jesign Extern	t calculation of caisson calculates by al Forces	the mint state	e design method.
1) D	esign Extern	al Forces		-
1) D	esign Extern			-
1) [] 	esign Extern	al Forces		-
1) [] 	)esign Extern 'he load factor	al Forces	h state are sho	own in a lower table. efficient on crack width o
1) [] 	Design Extern 'he load factor Bottom slab	al Forces is and the combination of load in eac The load factors of ultimate limit	h state are sho Influence co servio	own in a lower table.
1) I T (1)	Design Extern 'he load factor Bottom slab Conditions Under ordinary	al Forces rs and the combination of load in eac The load factors of ultimate limit state	h state are sho Influence co servio	own in a lower table. efficient on crack width o ccability limit state

R'; Bottom slab reaction during an earthquake, F; Hydrostatic pressure

W ; Surcharge ,  $W^\prime$  ; Surcharge during an earthquake ,  $D_f$  ; Deadweight while afloat

 $S_{\,f}$  ; Hydrostatic pressure while afloat

#### (2) Outer Wall

Conditions	Direction of load	The load factors of ultimate limit state	Influence coefficient on crack width of serviceability limit state
Under ordinary conditions	Load from inside	1.1D+1.1S	1.0D+1.0S
While afloat	Load from outside	1.1 S	0.5 S f

D ; Internal earth pressure , S ; Internal water pressure

The allowable crack width is shown in a lower table.

The position of steel reinforcement	Crack Width Wlim(cm)	The minimum covering (cm)
The undersurface of the bottom slab The outside of an outer wall Footing	0.0035 C	8.0
The upper surface of the bottom slab The inner side of an outer wall	0.0040 C	6.0
Partition wall	· · · · · · · · · · · · · · · · · · ·	10.0
		· · · · · · · · · · · · · · · · · · ·

	Prepared by	Y. Ando	Checked by	R. Nishimura
·		2610712002		09/08/2002

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	<u></u>	References/
		Notes
2)	Examination of members to ultimate limit state	
	Examination of a member to ultimate limit state is performed	by confirming that the value for a des
	of sectional capacity $(M_{ud})$ is beyond a value for a design of	section force (M _d ).
4	$\frac{\gamma  \mathrm{i} \mathrm{M}_{\mathrm{d}}}{\mathrm{M}_{\mathrm{ud}}} \leq 1.0$	
	$M_{ud}$	
· .	$\gamma_i$ ; The structure factor 1.0 for earthquake lo	ad, otherwise 1.1
(1	) Calculation of the required amount of steel reinforcement.	
	The amount of steel reinforcement is computed by the follow	wing formula.
	$\Delta (d - \sqrt{d^2 - \frac{4\gamma b\gamma}{M_d}})$	
	$A_{sn} = \frac{A_n (d - \sqrt{d^2 - \frac{4\gamma b\gamma iM_d}{A_n}}}{2 f_{yd}}$	
	A sn 2 f yd	
	where	
	$A_n = 1.7 b_w f'_{cd}$	
н - С	$f_{yd}$ ; Design tensile yield strength of steel rein	forcement $f_{yd} = f_{yk} / \gamma_s$
	$f'_{cd}$ ; Design compressive yield strength of co	
		ncrete $f'_{cd} = f'_{ck} / \gamma_c$
	d ; Effective height	$\frac{1}{cd} = \frac{1}{ck} \gamma_c$
	d ; Effective height	oad, otherwise 1.15
	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3	oad, otherwise 1.15
(2	<ul> <li>d ; Effective height</li> <li>γ_b; The member factor 1.0 for earthquake le</li> <li>γ_s; The material factor of steel reinforcement</li> <li>γ_c; The material factor of concrete 1.3</li> <li>) Calculation of bending capacity</li> </ul>	oad, otherwise 1.15 1.0
(2	<ul> <li>d ; Effective height</li> <li>γ_b; The member factor 1.0 for earthquake le</li> <li>γ_s; The material factor of steel reinforcement</li> <li>γ_c; The material factor of concrete 1.3</li> <li>) Calculation of bending capacity</li> <li>The value for a design of bending capacity is computed by t</li> </ul>	oad, otherwise 1.15 1.0
(2	<ul> <li>d ; Effective height</li> <li>γ_b; The member factor 1.0 for earthquake le</li> <li>γ_s; The material factor of steel reinforcement</li> <li>γ_c; The material factor of concrete 1.3</li> <li>) Calculation of bending capacity</li> <li>The value for a design of bending capacity is computed by t</li> </ul>	oad, otherwise 1.15 1.0
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P \cdot M f_{yd}}{1.7 f'_{ed}} \right\} \neq \gamma_d$	oad, otherwise 1.15 1.0
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_w M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where	bad, otherwise 1.15 1.0 he following formula.
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_u M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where $A_s$ ; The amount of tensile steel reinforcement	bad, otherwise 1.15 1.0 he following formula.
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_w M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where	bad, otherwise 1.15 1.0 he following formula.
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(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_u M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where $A_s$ ; The amount of tensile steel reinforcement	bad, otherwise 1.15 1.0 he following formula.
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(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_u M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where $A_s$ ; The amount of tensile steel reinforcement	bad, otherwise 1.15 1.0 he following formula.
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_u M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where $A_s$ ; The amount of tensile steel reinforcement	bad, otherwise 1.15 1.0 he following formula.
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_u M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where $A_s$ ; The amount of tensile steel reinforcement	bad, otherwise 1.15 1.0 he following formula.
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_u M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where $A_s$ ; The amount of tensile steel reinforcement	bad, otherwise 1.15 1.0 he following formula.
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_u M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where $A_s$ ; The amount of tensile steel reinforcement	bad, otherwise 1.15 1.0 he following formula.
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_u M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where $A_s$ ; The amount of tensile steel reinforcement	bad, otherwise 1.15 1.0 he following formula.
(2	d ; Effective height $\gamma_b$ ; The member factor 1.0 for earthquake le $\gamma_s$ ; The material factor of steel reinforcement $\gamma_c$ ; The material factor of concrete 1.3 ) Calculation of bending capacity The value for a design of bending capacity is computed by t $M_{ud} = A_s f_{yd} d \left\{ 1 - \frac{P_u M f_{yd}}{1.7 f_{ed}} \right\} \neq \gamma_d$ where $A_s$ ; The amount of tensile steel reinforcement	bad, otherwise 1.15 1.0 he following formula.

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Notes

3) Examination of members to serviceability limit state

Examination of the member of serviceability limit state examines a crack width limit state. Moreover,

calculation of crack width is performed by the following formula.

 $W = k_1 \{ 4C + 0.7 (C_{\phi} - \phi) \} [\sigma_{se} / E_s + \varepsilon_{\phi}]$ 

where

W ; flexural crack width (cm)

k 1; constant indicating the effect of the bonding properties of the steel material ,which may usually be taken as 1.0 in the case of deformed bars

C ; covering (cm)

 $C_{\phi}$ ; distance between centers of steel materials (cm)

 $\phi$ ; diameter of steel materials (cm)

 $\sigma_{se}$ ; increased stress on reinforcement (N/mm²)

Es; Young's modulus of reinforcement (200kN/mm²)

 $\varepsilon_{\diamond}$ ; constant introduced to represent the increase of crack width caused by creep and drying shrinkage of concrete (this can be 0.0 under seawater)

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Project	Detailed Design on P	ort Reactivation P	roject in La Union	Calc, File N	10.	
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As s concre	urcharge shown in the following ste, the load does not arge may act on cap	act on filling n	aterials at A room	partition wall su 1. Moreover, in o	rder that dir	ect
	refore, bar arrangeme	ent calculation of	caisson is performe	ed about two case	s.	
TTTT E	- <b>3</b> -Н	[دv] <	BASE Cr SUBB 300 A room B room C 4400 4400 4 200 200 5 SAND 1 5 SAND 1 700 FILLING 200 5 SAND 1 700 5 SAND 1		1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02 1.02	
case.	Static load Surcharge	18.0(kN/ Under ordinar During an earth e on caisson does Under ordinar During an earth	n't act on filling ma 0.0(kN/ y conditions 0.0( quake 0.0(k) ment in upper two	V/m²) kN/m²) N/m²) terials. m²) kN/m²) N/m²) cases, and accej		
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