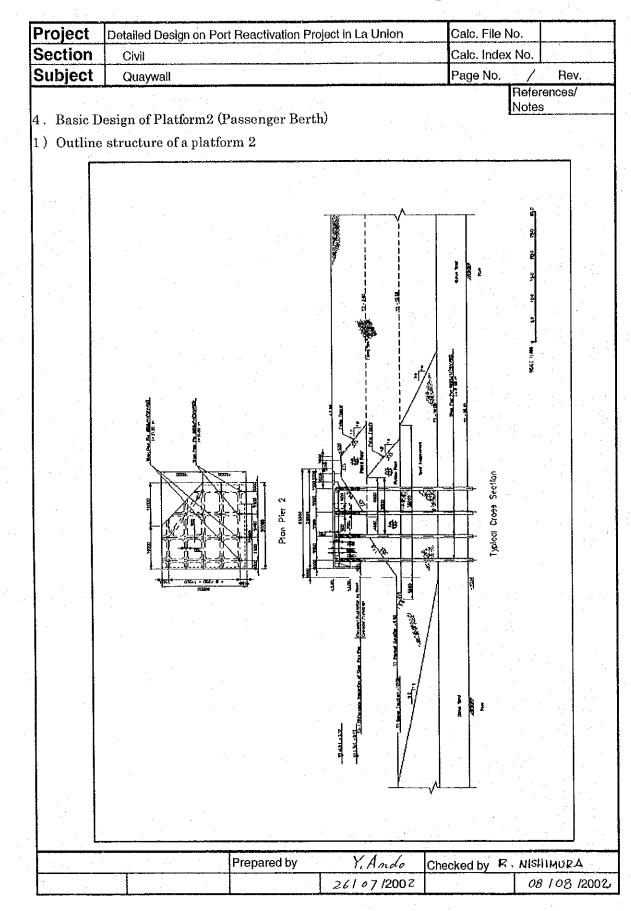
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Т	ECHNICAL STANDERDS	AND COMMENTA	RIES		
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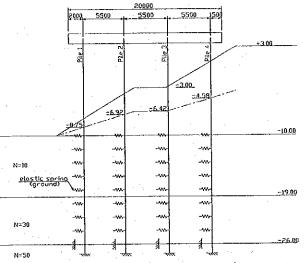
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		References/

2) Analysis model

Member forces acting on individual piles are calculated in 3 dimensional analysis.



Analysis model outline figure (Frame model)

An analysis model is taken as frame structure. (in which the ground is evaluated as an elastic spring.)

A transverse direction spring constant of ground (Kh) is computed using the following formulas.

 $Kh = kh \times D$ (N/cm²) kh : coefficient of horizontal subgrade reaction(N/cm³)

D : pile width (cm)

Ground level	Average N value	kh(N/cm ³)	pile width(m)	Kh(kN/m ²)
Virtual ground surfa	ce			<u> </u>
		3.5	0.70	2,450
-10.	00			
	10	15	0.70	10,500
-19	00			·
	30	45	0.70	31,500
-26	00			

ODimensions of Steel Pipe Pile

 ϕ 800×t14 Section area A = 345.7 cm² (Corrosion consideration A' = 320.6 cm²)

Geometrical moment of inertia $I = 267,050 \text{ cm}^4$

(Corrosion consideration $I' = 247,019 \text{ cm}^4$

Section modulus $Z = 6,686 \text{ cm}^3$

Type of Steel : SKK490 (Design Yield Strength 315 N/mm²)

Prepared by	Y.Ando	Checked by	R. NISHIMURA
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Secti			· · · · · · · · · · · · · · · · · · ·	llandan kalendar dan september dan gerender dan dari yang dan dari yang dan dari yang dari yang dari yang dari y	······································	Calc. Inde	x No.	
Subje	ect Q	uaywall				Page No.	·· 3	Rev.
3) Ca	lculation o	of Load		· · · ·			Refere Notes	inces/
The e	external fo	orces acting	on a platfo	rm 1 is show	n below.			
	• Deadv		Surcharge		quake Force			
- i	•	e Start e e					· · ·	
	Sector Apple 1		+	superstructu	ire			
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	superstruct		304.95 m³		an de la composition de la composition Anal		
I.	Weight of a	superstruct	ure : 上취	邻工全重量 '	7,318.8 → 7,3	320.0 kN		• 1
	convers	sion to equiv	valent unifo	orm distribut	ion load		- -	e a de Francis
		$\mathbf{w}' = 7$,320 / (20.0	×20.0-(10.0	$\times 10.0/2$)) = 20	0.91 kN/m ²		
· · · · ·							•	
(2) §	Surcharge							
Su	rcharge	w = 10.0 kN	∛/m²					
Tof	tal of Sure	harge W'	= 10.0×(20	.0×20.0 (10.	0×10.0/2)) = :	3,500 kN		
	et al al est							
(3) (Calculatio	n of Earthq	uake Force					
P =	= (7,3200-	+3,500)×0.	20 = 2.165.0	0 I N		i an		
						•		
		- 						
							· · · ·	
4) Ex	aminatior	1 case					· · · ·	
	camination		· · · · · ·		Case			
			· · · · · ·	examination Horizontal	case			
			ble of each	examination Horizontal Forces (kN)	case	Action	Premiu	
	load gener	alization ta	ble of each orces (kN)	examination Horizontal Forces (kN) Earthquake		Action direction	Premit	
The case	load gener	ralization ta Vertical F Deadweight	ble of each orces (kN)	examination Horizontal Forces (kN)				ent
The case	load gener Case	vertical F Vertical F Deadweight 7,320.00	ble of each orces (kN) Surcharge	examination Horizontal Forces (kN) Earthquake Force	Condition	direction	coeffici	ent)
Case 1 case 2	load gener Case Earthquake	vertical F Deadweight 7,320.00	ble of each orces (kN) Surcharge 3,500.00	examination Horizontal Forces (kN) Earthquake Force 2,165.00	Condition Extraordinary	direction Sea→Land	coeffici	ent
case 1 case 2 case	load gener Case Earthquake Earthquake	vertical F Deadweight 7,320.00	ble of each orces (kN) Surcharge 3,500.00 3,500.00	examination Horizontal Forces (kN) Earthquake Force 2,165.00 2,165.00	Condition Extraordinary Extraordinary	direction Sea→Land Land→Sea Parallel to	coeffici 1.50 1.50	ent)
Case 1 case 2 case	load gener Case Earthquake Earthquake	vertical F Deadweight 7,320.00	ble of each orces (kN) Surcharge 3,500.00 3,500.00	examination Horizontal Forces (kN) Earthquake Force 2,165.00 2,165.00	Condition Extraordinary Extraordinary	direction Sea→Land Land→Sea Parallel to	coeffici 1.50 1.50	ent
case 1 case 2 case	load gener Case Earthquake Earthquake	vertical F Deadweight 7,320.00	ble of each orces (kN) Surcharge 3,500.00 3,500.00	examination Horizontal Forces (kN) Earthquake Force 2,165.00 2,165.00	Condition Extraordinary Extraordinary	direction Sea→Land Land→Sea Parallel to	coeffici 1.50 1.50	ent
Case 1 case 2 case	load gener Case Earthquake Earthquake	vertical F Deadweight 7,320.00	ble of each orces (kN) Surcharge 3,500.00 3,500.00	examination Horizontal Forces (kN) Earthquake Force 2,165.00 2,165.00	Condition Extraordinary Extraordinary	direction Sea→Land Land→Sea Parallel to	coeffici 1.50 1.50	ent
Case 1 case 2 case	load gener Case Earthquake Earthquake	vertical F Deadweight 7,320.00	ble of each orces (kN) Surcharge 3,500.00 3,500.00	examination Horizontal Forces (kN) Earthquake Force 2,165.00 2,165.00 2,165.00	Condition Extraordinary Extraordinary Extraordinary	direction Sea→Land Land→Sea Parallel to	coeffici 1.50 1.50	ent)

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5) Section						· .	References/ Notes
Compu	ted se	ection	force acting (on pile is sho	wn below as a	a result of	analysis.
Case			Pile	Maximum Moment	Axial force	Maximur Axial for	n
1 . · · ·				kN · m	kN	kN	cm
casel		Pile 1	(Sea side)	861.7	410.8	482.7	
Earthqua	ake	Pile 2		968.7	862.4	934.3	9.1
Sea→Lar	nd	Pile 3		1,025.1	1,000.3	1,072.2	
	. •	Pile 4	(Land side)	1,202.2	1,027.8	1,099.7	
case2		Pile 1	(Sea side)	862.4	787.8	859.7	
Earthqua	ake	Pile 2		1,013.1	612.3	684.2	9.1
Land→So		Pile 3		1,031.8	594.6	666.5	0.1
		Pile 4	(Land side)		363.1	435.0	
case3		Pile 1	(Sea side)	959.6	806.8	878.7	
Earthqua		Pile 2		989.7	1,064.2	1,135.1	
Paralle	1.1				1,084.0	1,155.9	10.3
the	. .	Pile 3	(1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	931.8		990.1	
tace	line	rue 4	(Land side)	1,014.1	918.2	990.1	·

The moment compounded the moment about the parallel direction to the face line, and the moment about the right-angled direction to the face line.

The following cases perform the stress examination of piles from the result of analysis.

Pile 1 : case3 (Earthquake, Action direction	on Parallel to the face line)
Pile 2 : case3 (Earthquake, Action direction	on Parallel to the face line)
Pile 3 : case1 (Earthquake, Action direction	on Sea→Land)
Pile 4 : case1 (Earthquake, Action direction	on Sea→Land)

Prepared by	Y. Ando	Checked by 🕴 👂	NISHIMURA
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oject	Detailed Design on Port Rea	ctivation Project	t in La Union	Calc. File	No.
ection	Civil				x No.
ubject	Quaywall			Page No.	
	xamination of Piles ger Berth , Platform	2	φ 800*	t14	References/ Notes
Stress	Calculation (Case	3) Pile 1			· .
	Dimension	φ8	00*t14	SKK	490
	Cross-sectional Area	A=	345.7 cm [°] 2		
Pile	Section modulus		6, 676'cm^3		
	Radius of qyration of area	r =	27.8 cm ²	· · · ·	
	Bulkling length	1=	1300 cm		·
		l/r=	46.8		
Sectior	Bending Moment	M=	959.6 kN·m		
force	Axial Force	N=	806. 8 kN		
	Allowable Bending Stress	σba=	185 N/mm^2		
	Allowable Axial Compressive Stress	σca≐	148 N/mm ²	-	· · ·
Stress	Premium Coefficient		15		· .
	Bending Stress	σ b≔	144 N/mm ²	< 278	N/mm ² 0.K.
	Axial Compressive Stress	σ c=	23 N/mm^2	< 222	N/mm ² 0.K.
	Examination of menbers simultaneously subject to axial		0.62		O. K.
	Prep	ared by	Y.Amdo Ct	necked by	P. NISHIMURA
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	Detailed Design on Port Reactive	vation Project in La I	Jnion	Calc. File I		
ction	Civil	<u></u>		Calc. Index		Rev.
bject	Quaywall			Page No.	6 Referen	and such that the second s
Passen	ger Berth ,Platform 2		φ 800*t	14	Notes	
Stress	Calculation (Case3)	Pile 2				
	Dimension	φ800*t14	1	SKK	490	
	Cross-sectional Area	A= 345	7 cm^2			
Pile	Section modulus	Z= 6, 6	ettera La V		-	
	Radius of qyration of area	r= 27	.8 cm [^] 2			
	Bulkling length	1= 11	and your			
		1/r= 40	. 4			
Section	Bending Moment	M= 989				
force	Axial Force	N= 1,064	2.244			
	Allowable Bending Stress	σba≃ 1	85 N/mm^2			
	Allowable Axial Compressive Stress	σca= 1				
Stress	Premium Coefficient		. 5			
	Bending Stress	σ b= 1	48 N/mm ²	< 278	N/mm^2	0. K.
	Axial Compressive Stress	σ c=	31 N/mm^2	< 234	N/mm^2	0. K.
	Examination of menbers simultaneously subject to axial	0.	67			0. K.
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oject	Detailed Design on Port	Reactivation Pro	oject in La Union	Calc. File	No.
ection	Civil			Calc. Inde	ex No.
ıbject	Quaywall			Page No.	7 Rev.
Passen	ger Berth ,Platfc	orm 2	φ 80	00*t14	References/ Notes
Stress	Calculation (Ca	nsel) Pile	3		
	Dimension		¢800*t14	SKK	490
	Cross-sectional Area	A=	.345.7 cm^2		
Pile	Section modulus	Z=	6, 676 cm^3		· · · · ·
	Radius of qyrati of area	1 – 1	27.8 cm [^] 2		
	Bulkling length		. 1075 cm		
		1/r=	38.7		
Section	Bending Moment		1,025.1 kN·m		
force	Axial Force	N=	1,000.3 kn		
	Allowable Bending Stress	σba=	185 N/mm	2	
	Allowable Axial Compressive Stress	σ ca=	158 N/mm	2	
Stress	Premium Coefficient	t	1.5 		
	Bending Stress	σb=	154 N/mm	2 < 278	N/mm [^] 2 O.K.
	Axial Compressive Stress	σ c=	29 N/mm	2 < 237	N/mm^2 0. K.
	Examination of menbers simultaneously subject to axial		0, 68		О. К.
	F	Prepared by	Y.Ando	Checked by	R. NISHIMUR
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oject	Detailed Design on Port Reac	tivation Project	in La Union	Calc. File		مغار و منهم معرف من معرف المعرف ا
ection	Civil			Calc. Inde		
ubject	Quaywall			Page No.		Rev.
	ger Berth ,Platform Calculation (Case1		φ 800	*t14	Refere Notes	
	Dimension	\$ 8 ¢)0*t14	SKK	490	
	Cross-sectional Area	A =	345. 7 cm ²			
Pile	Section modulus	7=	6, 676 cm [°] 3			
	Radius of qyration of area	r=	27.8 cm ²			
	Bulkling length	1=	900. cm	· · · · · · · · · · · · · · · · · · ·		
		1/r=	32.4			
Section	Bending Moment		1, 202. 2 kN·m			
force	Axial Force	a da anti-	1,027.8 kN			
	Allowable Bending Stress	σ ba=	185 N/mm^2			
	Allowable Axial Compressive Stress	σ ca=	165 N/mm^2			
Stress	Premium Coefficient		1.5		 	
	Bending Stress	σb=	180 N/mm ²	< 278	N/mm^2	O. K.
	Axial Compressive Stress	σ c=	30 N/mm^2	< 248	N/mn^2	0. K.
	Examination of menbers simultaneously subject to axial		0. 77	· · · ·	<u>, </u>	O. K.
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	Prepa	red by	Y, Ando (Checked by		HIMURA 108 /20

	Detailed Design on Port Reactivation Project in La Union	Calc. File	NO,	
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Subject	Quaywall	Page No.	9	Rev.
7) Examir	nation of Bearing Capacity of Pile		Refe Note	rences/ s
Ultimate	bearing capacity (Ru) is computed using the following	formulas.		
Ru =	$300 \times q \times N \times Ap + N' \times As$ (kN)	,	r	
Who	ere q: Closed area ratio of pile	. * •		
	N : N-value of the ground around pile toe		÷.,	·
. •	N = (N1+N2)/2			
	N1 : N-value at the toe of pile			
	N2 : mean N-value in the range from the to	e of pile to tl	he lev	el 4B above
	B : diameter or width of pile (m)	*		
	N' : mean N-value for total penetration length of	pile		1 a.
	Ap : toe area of pile (m^2)			· .
· .	As : total circumferential area of pile (m^2)	· .		
жл	The pile installation method assumes from Soil C	ondition th	at it	is the nil
int	o "N×As." (see "Highway Bridge Specifications and	the Comme	entary	(in Japan)
(Ad	o "N×As." (see "Highway Bridge Specifications and coording to the standard, it is "2×N×As".) ed area ratio of pile piles shall drive only the length of pile diameter int		- - -	
(Ad (1) Close The -26m).	ccording to the standard, it is " $2 \times N \times As$ ".) ed area ratio of pile	o the bearir	- - -	
(A. (1) Close The -26m). The -26m). The -26m). 1. - 	ecording to the standard, it is " $2 \times N \times As$ ".) ed area ratio of pile piles shall drive only the length of pile diameter int Closed area ratio is set to " $q=0.6$ " from the following file x^{0} x^{0}	o the bearir igures. **	- - -	
(A. (1) Close The -26m). The -26m). The -26m). 1. - 	ecording to the standard, it is " $2 \times N \times As$ ".) ed area ratio of pile piles shall drive only the length of pile diameter int Closed area ratio is set to " $q=0.6$ " from the following file o Outer diameter 700 mm or m × Outer diameter 650 mm or les o x x x x y x x x x	o the bearir igures. **	- - -	
(A. (1) Close The -26m). The -26m). The -26m). 1. - 	ccording to the standard, it is " $2 \times N \times As$ ".) ed area ratio of pile piles shall drive only the length of pile diameter int Closed area ratio is set to " $q=0.6$ " from the following fi o Outer diameter 700 run or m × Outer diameter 650 mm or les o x x x x x x x y x x x x	o the bearir igures. **	ıg str	

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					References/	
(2) Calc	ulation of ultimate	pearing capacity			Notes	1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-
N2 =	(0.8×50+3×0.8)	$\times 30$)/(4 $\times 0.8$) = 3	5			
N = ((50+35)/2=42.5	→ 42				
Ap =	$0.8^2 \times \pi/4 = 0.503$	m^2				
Circu	ımferential arca of	pile per 1 m As' = ($0.8 \times \pi = 2.51$	m²/m		
					· · ·	
Ru = 3	$00 \times 0.6 \times 42 \times 0.503$	+ ($9.5 \times 10 + 6.0 \times 3$	$(0) \times 2.51$			
= 4,	492.93 kN					
				e e e e e e e e e e e e e e e e e e e		
(3) Exar	nination of Bearing	Capacity				
	· · · .	acity is calculated us	sing the follo	wing formulas	. .	
	= Ru / F			· · ·		
when						
· · · · ·	a : allowable bearin	g capacity	· ·			
1. Start 1.	ı : ultimate bearing				•	
F	: safety factor (=	1.50 : earthquake co	ndition)			
F	: safety factor (=	1.50 : earthquake co	ndition)			
	- -			а 14		
a) Exami	nation of Bearing C	apacity(Earthquake	Condition)	1,135 kN	O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit		Condition) = 2,995 kN ≧	1,135 kN	O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 =	Condition) 2,995 kN ≧ Condition、		O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) 2,995 kN ≧ Condition、		О.К	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) 2,995 kN ≧ Condition、		О.К	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) 2,995 kN ≧ Condition、		O.K	
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a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) 2,995 kN ≧ Condition、		O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) = 2,995 kN ≧ Condition、		O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) = 2,995 kN ≧ Condition、		O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) = 2,995 kN ≧ Condition、		O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) = 2,995 kN ≧ Condition、		O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) = 2,995 kN ≧ Condition、		O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) = 2,995 kN ≧ Condition、		O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) = 2,995 kN ≧ Condition、		O.K	
a) Exami Allowa	nation of Bearing C ble bearing capacit	apacity(Earthquake y Ra = 4,493 / 1.5 = case3 (Earthquake	Condition) = 2,995 kN ≧ Condition、		O.K	JZA

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8) Examination of Earthquake-Resistant Performance

The examination of earthquake-resistant is performed by the "simplified method" from the following things.

· An object institution does not have complicated structure.

· A raking pile is not included.

The simplified method evaluates the load carrying capacity of pier by summing up the strength of the steel pipe piles, while assuming that the pier superstructure is a rigid body.

(1) Determination of seismic coefficient for examination

The seismic coefficient for examinations is obtained for the different regional classification in a structure installation position and the natural periods of the ground and the pile supported section. Regional classification is set as region category A.

a) Natural Period of the Ground

The natural period of the ground is computed using the following formulas.

 $T_g=4 \Sigma H_i/V_{si}$

T_g; natural period of the ground (s)

 H_i ; thickness of the i-th layer (m)

 V_{si} ; shear wave velocity in the i-th layer $V_{si} = \sqrt{(G_0 g / \gamma t)}$ (m/s)

 G_0 ; shear modulus (kN/m²)

• sandy ground G₀=14,400N^{0.68} (kN/m²)

- g ; gravitational acceleration .(=9.8m/s²)
- γ_t ; wet unit weight (kN/m³)
- N ; standard penetration test value

The natural period of the ground is computed for the engineering foundation.

The crown height of rubble is set as -6.33m(virtual ground surface). Therefore, it is aimed at the -6.33m \sim -26m foundation.

Level	Hi (m)	soil	N	$\gamma t(kN/m^3)$	$G_0(kN/m^2)$	V _{si} (m/s)
-6.33~-10.0	3.50	sandy	2.33	20.0	25,596	112.05
$-10.0 \sim \cdot 20.0$	10.0	sandy	10	20.0	68,923	183.87
-20.0~-26.0	6.0	sandy	30	20.0	145,481	267.13

Natural Period of the Ground

 $T_g=4 \times (3.50/112.05 + 10.0/183.87 + 6.0/267.13)=0.432s$

Prepared by	Y.Ando	Checked by	R. NISHIMURA
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									Refer Notes	ences/
) Natur	al Pe	riod of Plat	form 2						INDIES	•
'he coeffi	cient	of horizon	tal subgr	ade rea	ction a	nd the	charact	eristic va	alue of	a pile ar
omputed	using	the followi	ng formu	las.						
coefficie	nt of	horizontal s	subgrade	reaction	k _h =2	$\times 1.5N$	(N/cm ³)			
characte	ristic	value of a	pile		$\beta = 4$	√ (khD/	(4EI)) (cn	1 ^{.1})		
• horizont	al sp	ring consta	nt		$K_H = 1$	$2 \times EI/($	[Li³) (kN/	m)		
natural	perio	d pf a Platf	orm 1		Ts = 2	$2 \times \pi \times \pi$	/ (W / (g	×K _H))	(s)	
where	-	average N		the grou	nd dow	n to a d	epth of a	bout $1/\beta$		
		diameter o					-			
		free length				·				
		vertical dis				ead and	l the virt	ual grou	nd surf	ace
		sum of dea								
								uane (* 1	0,040 1	
The calc		on result of	i					1/0	т:	V.,
	D	thickness	I	hi	N	kh	β	1/8	Li	
		of pile(cm)		(m)	7.00	01.04	(cm ⁻¹)	(m) 3.29	(m) 16.29	(kN/m) 1,372
	79.8 70.8	1.3 1.3	247,020 247,020	13.00 11.23	7.08	$\frac{21.24}{11.76}$	0.00304		15.04	1,743
1	<u>79.8</u> 79.8	1.3	247,020	10.75	3.27	9.81	0.00251		14.74	1,853
	79.8	1.3	247,020	9.00	2.33	7.00	0.00231		13.34	2,498
		piles of ind		le rows i	s as fol	lows.				
			: 5、				4:3			
sum of	norize	ontal spring								
			5×1,372-		$3+4 \times 1$.853+32	×2,498)	= 30,482	kN/m	
natural	norio	od pf a Plati					/(9.81>			0 s
		tion of seis								
•		following t					ovomina	tion by	referen	ce is set
		tonowing	igures, s	eisinic t	oemcie	110 101	слашта	ston by	10101011	00 10 000
"kh=0.5		Region A		ĦĦ						
		¥ 0.5				Leger]		-	
		Sairmic coofficient					lu ′ _g <0.1s			
		<u> </u>			-		.1s≦T _g <	0.5s		
		3					$.5s \leq T_g$			
			╾╎╫╞╴╞╶┿╍┽╶╄╍ ┼╫╫═┲╍╉╾╶╎╶┟╶				natural			
		0.91					round ca quation(with	
		0.1	1.0 J. 2.D Period (units: a)	10		L	y uniton (~,	J	
_			Pre	pared by		Y.An	<i>do</i> Ch	ecked by	P. N	disihimura
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(2) Examination of Load Carrying Capacity Using Simplified Method

In the examination of the load carrying capacity of pier using the simplified method, the pile supported section shall be represented with a frame structure model and the horizontal displacement ductility factor of the pile supported section shall be used. Examination is performed using the following formulas.

 $R_a \ge k_h W$

$R_a = \sqrt{(2 \mu_a - 1 + \theta (\mu_a - 1)^2)} \times P_y$

 R_a ; load carrying capacity during an earthquake (kN)

 $\mathbf{k}_{\mathbf{h}}$; seismic coefficient derived

- W ; deadweight of pier and surcharge acting during an earthquake (kN)
- μ_{a} ; allowable displacement ductility factor (=1.3; Class A)
- 0 ;=0 (see "TECHNICAL STANDARDS AND COMMENTARIES FOR PORT AND HARBOUR FACILITIES IN JAPAN")

 P_y ; the horizontal force corresponding to the elastic limit =0.82 P_{uall} (kN)

 P_{uall} ; the horizontal load level at which the bending moment of all piles of the wharf reach the fully plastic state moments both at the pile heads and underground virtual fix points = $\Sigma 2M_{pi}/L_i$ (kN)

 M_p ; fully plastic state moment = $M_{p0} \cdot \cos(\alpha \pi/2)$ (kN·m)

 L_i ; The length of individual pile = $h_i + 1/\beta$ (m)

 M_{p0} ; fully plastic state moment of steel pipe pile when no axial force is acting = $Z_p f_y$ (kN·m)

 Z_p ; plastic sectional modulus of steel pipe pile =4/3×(r³-(r-t)³) (mm³)

 $f_y \ \ \,$; design yield strength of steel pipe pile $\ (N/mm^2)$ $$\rm SKK490$; 315 N/mm^2

r ; radius of steel pipe pile (mm)

t ; thickness of steel pipe pile (mm)

 α ; ratio of the acting axial force N to the yield axial force N₀(=A×fy) when no bending moment is acting =N/N₀

A ; cross-sectional area of steel pipe pile (mm^2)

The case where the examination of load carrying capacity is performed is the case where load acts on land from the sea.

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		<u> </u>	······				ences/
a) Calcula	ation of M	ember Forces A	Acting on In	lividual Pil	es	Notes	
Eartho	uake forc	e of using for e	xamination	of load carr	ying capaci	ty	
1		$320 \times 0.50 = 5.4$					
PT01 1	•			. e 1. 11. 1	1	may be calan	lated usin
The ho	orizontal	force acting o	n the head	s of individ	iual plies i	may be calcu	lated usin
following	formula						
10110 11 110	Iormana.	A second second second					
-	and the second	$\Sigma K_{\rm Hi}$) $\times P$	(kN)				
-	and the second		(kN) porizontal sp	oring consta	ant of indivi	dual piles	
-	and the second	K _{Hi} : 1 free length of	norizontal sp number of		· · · · · · · · · · · · · · · · · · ·	dual piles Hi(kN/piese)	
-	and the second	K _{Hi} : ł	norizontal sp number of pile		Κηι / ΣΚηι	Hi(kN/piese)	
-	= (K _{Hi} /	K _{Hi} : I free length of a pile Li (m)	norizontal sp number of pile 5.0	Кні	K _{Hi} / ΣK _{Hi} 0.225128	Hi(kN/piese) 1,217.943	
-	= (K _{Hi} /	K _{Hi} : h free length of a pile Li (m) 16.29	norizontal sp number of pile 5.0 5.0	K _{Hi} 6,862	K _{Hi} / ΣK _{Hi} 0.225128 0.285880	Hi(kN/piese) 1,217.943 1,546.610	
-	= (K _{Hi} /	K _{Hi} : free length of a pile Li (m) 16.29 15.04	norizontal sp number of pile 5.0 5.0 4.0	K _{Hi} 6,862 8,714	K _{Hi} / ΣK _{Hi} 0.225128 0.285880 0.243121	Hi(kN/piese) 1,217.943 1,546.610 1,315.287	
-	= (K _{Hi} / Pile 1 Pile 2 Pile 3	K _{Hi} : h free length of a pile Li (m) 16.29 15.04 14.74	norizontal sp number of pile 5.0 5.0 4.0	K _{Hi} 6,862 8,714 7,411	 K_{Hi} / Σ K_{Hi} 0.225128 0.285880 0.243121 0.245871 	Hi(kN/piese) 1,217.943 1,546.610 1,315.287	
-	= (K _{Hi} / Pile 1 Pile 2 Pile 3	K _{Hi} : h free length of a pile Li (m) 16.29 15.04 14.74	norizontal sp number of pile 5.0 5.0 4.0 3.0	K _{Hi} 6,862 8,714 7,411 7,495	 K_{Hi} / Σ K_{Hi} 0.225128 0.285880 0.243121 0.245871 	Hi(kN/piese) 1,217.943 1,546.610 1,315.287	

$M_{1} = (1)$	$(2) \times L_1 \times H_1$	$(KIN \cdot m)$		
	free length of a			
÷	pile Li	Hi	M1	
Pile 1	16.29	1.217.943	9 917 70	

1,546.610

1,315.287

Pile 413.341,330.1608,871.14The axial force of individual piles may be calculated using following formula.

 $N_{i} = ((M_{i+1,i} + M_{i,i+1}) / L_{i+1,i}) \cdot ((M_{i,i+1} + M_{i+1,i}) / L_{i,i+1})$

15.04

14.74

where

Pile 2

Pile 3

 $M_{i:1,i}$: bending moment acting on the head of the (i-1)-th pile due to the horizontal force of the side beam of the i-th pile (kN \cdot m)

11,630.02

9,691.03

- $M_{i,i\cdot 1}$: bending moment acting on the head of the i-th pile due to the horizontal force of the side beam of the (i-1)-th pile (kN \cdot m)
- $M_{i,i+1}$: bending moment acting on the head of the i-th pile due to the horizontal force of the side beam of the (i+1)-th pile (kN \cdot m)

 $M_{i+1,i}$: bending moment acting on the head of the (i+1)-th pile due to the horizontal force of the side beam of the i-th pile (kN \cdot m)

Li-1,i	: The interval	of the pile of the (i-1) th pile and i-th pile.
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						Refere	nces/
$L_{i,i+1}$: The interval of	the pile of the	i [.] th pile and	(i+1)-th p	ile.	Notes	
ince a pile	interval is 3 spans	, it is bending	moment by	the followi	ng formula	s.	
M1,	$_{2} = 1.0 \times M_{1} = 1.0 \times$	(10,284.35 =	9,917.70 k	N・m			
M ₂ ,	$_1 = 0.5 \times M_2 = 0.5 \times$	(12,059.96 =	5,815.01 k	N·m	•		
	$_{3} = 0.7 \times M_{2} = 0.7 \times M_{2}$						
	$_2 = 0.7 \times M_3 = 0.7 \times$						
	$_4 = 0.5 \times M_3 = 0.5 \times$	-					
	$_{3} = 1.0 \times M_{4} = 1.0 \times$	and the second second second					
111.4,	3 1.0 / 114 1.0 /	. 0,100.00	0,011.11 K				
The int	ownl of each mile :	a a follore					
	erval of each pile is		1.9.E.40.	D:1- 0	<	20	
	e 1 \sim Pile 2 : 5.30m		and the second sec	The 3	~rne 4 : 5	.उ∪m₀	
	al force of individu	-					
	- (9,917.70+5,815.0						
	(9,917.70+5,815.0)		•	and the second second			
$N_3 = 1$	((8,141.01+6,783.7	2)/5.40)-((4,84)	5.52+8,871.1	4)/5.30) = 1	175.79 kN		
$N_4 =$	((4,845.52+8,871.1	4)/5.30) = 2,58	8.05 kN	÷			
		Pile 1	Pile 2	Pile 3	Pile4		· .
Deadweig	$ht + Surcharge^{\otimes_1}$	2,855.96	3,397.08	2,852.2			
	Ni	-2,968.44	204.60	175.7		3.05	
To	otal (Ni)	-112.48	3,601.68	3,028.0	8 4,413	3.88	
※ 1 ∶It o	computes in static	analysis.					
	:						
\ ~ · ·	tion of the elemen	t characteristi	cs of a pile				
5) Calcula							
	ent characteristics	of a pile consi	-	1.			
The elem		. –	der corrosion		·		
The elem (i) Secti	onal modulus of st	eel pipe pile in	der corrosion elastic dom	ain	3 mm ³		· .
The elem (i) Secti		eel pipe pile in	der corrosion elastic dom	ain	3 mm ³	•	· .
The elem (i) Secti Z _p =	onal modulus of st =4/3×(r ³ −(r−t) ³)=	eel pipe pile in 4/3×(3993—(3	der corrosion elastic dom 399—13)3)=8	ain ,011,657.33		(M _{no})	· · · ·
The elem (i) Secti Z _p = (ii) Fully	onal modulus of st =4/3×(r ³ −(r−t) ³)= • plastic state mom	eel pipe pile in 4/3×(3993—(3 ent of steel pip	der corrosion elastic dom 399—13)3)=8	ain ,011,657.33		(M _{po})	
The elema (i) Secti Z _p = (ii) Fully and 2	onal modulus of st =4/3×(r ³ −(r−t) ³)= • plastic state mom The yield axial force	eel pipe pile in $4/3 \times (399^3 - (3))$ lent of steel pip le (N ₀)	der corrosion elastic dom 399—13) ³)=8 pe pile when	ain ,011,657.33 no axial fc		(M _{po})	· · ·
The elema (i) Secti Z _p = (ii) Fully and 7 Creations	onal modulus of st =4/3×(r ³ −(r−t) ³)= • plastic state mom Fhe yield axial force oss-section area of	eel pipe pile in 4/3×(399 ³ -(3 ent of steel pip e (N ₀) steel pipe pile	der corrosion elastic dom 399-13) ³)=8 pe pile when A' = 32,05	ain ,011,657.33 no axial fo 9.95 mm²		(M _{po})	· · · · · · · · · · · · · · · · · · ·
The cleme (i) Secti Z _p = (ii) Fully and 7 Cre M'h	onal modulus of st =4/3×(r^3 -(r - t) ³)= plastic state mom The yield axial for oss-section area of p0=Zpfy=8,011,657.5	eel pipe pile in $4/3 \times (399^3 - (33))$ eent of steel pip e (N ₀) steel pipe pile $33 \times 315 / 1,000$	der corrosion elastic dom 399	ain ,011,657.33 no axial fo 9.95 mm²		(M _{po})	· · · · · · · · · · · · · · · · · · ·
The elements (i) Secti Zp= (ii) Fully and 7 Cre M'h	onal modulus of st =4/3×(r ³ −(r−t) ³)= • plastic state mom Fhe yield axial force oss-section area of	eel pipe pile in $4/3 \times (399^3 - (33))$ eent of steel pip e (N ₀) steel pipe pile $33 \times 315 / 1,000$	der corrosion elastic dom 399	ain ,011,657.33 no axial fo 9.95 mm²		(M _{po})	
The elements (i) Secti Zp= (ii) Fully and 7 Cre M'h	onal modulus of st =4/3×(r^3 -(r - t) ³)= plastic state mom The yield axial for oss-section area of p0=Zpfy=8,011,657.5	eel pipe pile in $4/3 \times (399^3 - (33))$ eent of steel pip e (N ₀) steel pipe pile $33 \times 315 / 1,000$ 315 / 1,000 = 10	der corrosion elastic dom 399	ain ,011,657.33 no axial fo 9.95 mm ² 9.67 kN•m	rce acting		
The eleme (i) Secti Z _p = (ii) Fully and 7 Cre M'h	onal modulus of st =4/3×(r^3 -(r - t) ³)= plastic state mom The yield axial for oss-section area of p0=Zpfy=8,011,657.5	eel pipe pile in $4/3 \times (399^3 - (33))$ eent of steel pip e (N ₀) steel pipe pile $33 \times 315 / 1,000$	der corrosion elastic dom 399	ain ,011,657.33 no axial fo 9.95 mm ² 8.67 kN·m	rce acting	<u>2. Ni</u>	5H1MUIZA 1 08 /200 2

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c) Calcula	ation of Full	y Plastic State Momen	t (M _p)	Notes
	ulation of " d		•	
· · · · ·	lo.	N (kN)	N ₀ (kN)	α (=N/N ₀)
	e 1	112.48	50,494.43	-0.00222750
	e 1 e 2	3,601.68	50,494.43	0.0713282
	e 2 e 3	3,028.08	40,395.54	0.0749608
	e 4	4,413.88	30,296.66	0.1456886
		which multiplied N'0 by	v the number of eac	h pile.
	5 one value	, mon maniphoa 110 ×	,	
(ii) Calc	ulation of fu	Illy plastic state momen	nt (M _p)	
		moments are compute		o formulas.
• •				6 lotinalao.
	$p = Mp_0 \times co$			<u> </u>
	No.	$\frac{M_{p0} (kN \cdot m)}{10.010.00}$	$\frac{M_{p} (kN \cdot m)}{12.019.28}$	杭頭モーメント(kN・ > 9,917.70
[]	le 1	12,618.36	12,618.28	
	le 2	12,618.36	12,539.24	> 11,630.02
	le 3	10,094.69	10,024.79	< 9,691.03
Pi	ile 4	7,571.02	7,373.63	< 8,871.14
		which multiplied M'po		
d) Calcul	lation of the orizontal for	which multiplied M' _P o Horizontal Force (Py) ce (Py) corresponding t	Corresponding to tl	ne Elastic Limit
d) Calcul The ho formulas	lation of the orizontal for	Horizontal Force (Py) ce (Py) corresponding t	Corresponding to tl	ne Elastic Limit
d) Calcul The ho formulas	lation of the prizontal for s. $Py = 0.82 \times$	Horizontal Force (Py) ce (Py) corresponding t Puall	Corresponding to th to the elastic limit i	ne Elastic Limit s computed using t
d) Calcul The ho formulas	lation of the prizontal for s. $Py = 0.82 \times$ P_{uall} : th	Horizontal Force (Py) ce (Py) corresponding t Puall e horizontal load level	Corresponding to th to the elastic limit i at which the bend	ne Elastic Limit s computed using t ing moments of all
d) Calcul The ho formulas	lation of the prizontal for s. $Py = 0.82 \times$ P_{uall} : th the	Horizontal Force (Py) ce (Py) corresponding t Puall e horizontal load level e pier reach the fully pl	Corresponding to th to the elastic limit i at which the bend	ne Elastic Limit s computed using t ing moments of all
d) Calcul The ho formulas	lation of the prizontal for s. $Py = 0.82 \times$ P_{uall} : th the (=	Horizontal Force (Py) ce (Py) corresponding t P_{uall} e horizontal load level e pier reach the fully pl Σ Hj (kN))	Corresponding to the to the elastic limit is at which the bend astic state moment	ne Elastic Limit s computed using t ing moments of all s
d) Calcul The ho formulas	lation of the prizontal for s. $Py = 0.82 \times$ P_{uall} : th the (=	Horizontal Force (Py) ce (Py) corresponding t Puall e horizontal load level e pier reach the fully pl	Corresponding to the to the elastic limit is at which the bend astic state moment	ne Elastic Limit s computed using t ing moments of all s
d) Calcul The ho formulas	lation of the orizontal for s. Py = 0.82× Puall : th the (= Hj : th	Horizontal Force (Py) ce (Py) corresponding t P_{uall} e horizontal load level e pier reach the fully pl Σ Hj (kN))	Corresponding to the tastic limit is at which the bend astic state moment at which the bendi	ne Elastic Limit s computed using t ing moments of all s
d) Calcul The ho formulas	lation of the orizontal for s. Py = 0.82× Puall : th the (= Hj : th	Horizontal Force (Py) ce (Py) corresponding to Puall e horizontal load level c pier reach the fully pl Σ Hj (kN)) e horizontal load level reach the fully plastic s	Corresponding to the tastic limit is at which the bend astic state moment at which the bendi	ne Elastic Limit s computed using t ing moments of all s
d) Calcul The ho formulas	lation of the prizontal for s. $Py = 0.82 \times$ P_{uall} : th the (= Hj : th	Horizontal Force (Py) ce (Py) corresponding to Puall e horizontal load level e pier reach the fully pl Σ Hj (kN)) e horizontal load level reach the fully plastic s (=2×Mpi / Li) (kN)	Corresponding to the to the elastic limit is at which the bend astic state moment at which the bendi state moments	ne Elastic Limit s computed using t ing moments of all s ng moments of ind
d) Calcul The ho formulas where	lation of the orizontal for s. Py = 0.82× Puall : th the (= Hj : th	Horizontal Force (Py) ce (Py) corresponding to Puall e horizontal load level e pier reach the fully pl Σ Hj (kN)) e horizontal load level reach the fully plastic s (=2×Mpi / Li) (kN)	Corresponding to the clastic limit is at which the bend astic state moment at which the bendistate moments ent of individual pil	ne Elastic Limit s computed using t ing moments of all s ng moments of ind e
d) Calcul The ho formulas where	lation of the prizontal for s. Py = 0.82× Puall : th the (= Hj : th Mpi : f	Horizontal Force (Py) ce (Py) corresponding to Puall e horizontal load level c pier reach the fully pl Σ Hj (kN)) e horizontal load level reach the fully plastic s (=2×Mpi / Li) (kN) fully plastic state momon Li (m)	Corresponding to the tastic limit is at which the bend astic state moment at which the bendistate moments the function of individual pil M_{pi} (kN·m)	ne Elastic Limit s computed using t ing moments of all s ng moments of ind e <u>Hi (kN)</u>
d) Calcul The ho formulas where	lation of the prizontal for s. $Py = 0.82 \times$ P_{uall} : th the (= Hj : th Mpi : f	Horizontal Force (Py) ce (Py) corresponding to Puall e horizontal load level Σ Hj (kN)) e horizontal load level reach the fully plastic s (=2×Mpi / Li) (kN) cully plastic state mome Li (m) 16.29	Corresponding to the tothe elastic limit is at which the bend astic state moment at which the bend istate moments ent of individual pil M_{pi} (kN·m) 12,618.28	ne Elastic Limit s computed using t ing moments of all s ng moments of ind e <u>Hi (kN)</u> 1,549.59
d) Calcul The ho formulas where	lation of the prizontal for s. $Py = 0.82 \times$ P_{uall} : th the (= Hj : th Mpi : f No. le 1 le 2	Horizontal Force (Py) ce (Py) corresponding to Puall e horizontal load level Σ Hj (kN)) e horizontal load level reach the fully plastic s (=2×Mpi / Li) (kN) fully plastic state mome Li (m) 16.29 15.04	Corresponding to the contrast of the elastic limit is at which the bend astic state moment at which the bend istate moments the function of individual pil M_{pi} (kN·m) 12,618.28 12,539.24	ne Elastic Limit s computed using t ing moments of all s ng moments of ind e Hi (kN) 1,549.59 1,667.52
d) Calcul The ho formulas where	lation of the orizontal for s. $Py = 0.82 \times$ P_{uall} : th the (= Hj : th Mpi : f No. le 1 le 2 le 3	Horizontal Force (Py) ree (Py) corresponding to Puall e horizontal load level e pier reach the fully pl Σ Hj (kN)) e horizontal load level reach the fully plastic state (=2×Mpi / Li) (kN) fully plastic state mome Li (m) 16.29 15.04 14.74	Corresponding to the contrast of the elastic limit is at which the bend astic state moment at which the bend is tate moments the function of individual pil M_{pi} (kN·m) 12,618.28 12,539.24 10,024.79	ne Elastic Limit s computed using t ing moments of all s ng moments of ind e Hi (kN) 1,549.59 1,667.52 1,360.58
d) Calcul The ho formulas where	lation of the prizontal for s. $Py = 0.82 \times$ P_{uall} : th the (= Hj : th Mpi : f No. le 1 le 2	Horizontal Force (Py) ce (Py) corresponding to Puall e horizontal load level Σ Hj (kN)) e horizontal load level reach the fully plastic s (=2×Mpi / Li) (kN) cully plastic state mome Li (m) 16.29 15.04 14.74 13.34	Corresponding to the contrast of the elastic limit is at which the bend astic state moment at which the bend istate moments the function of individual pil M_{pi} (kN·m) 12,618.28 12,539.24	ne Elastic Limit s computed using t ing moments of all s ng moments of ind e H _i (kN) 1,549.59 1,667.52 1,360.58 1,105.62
d) Calcul The ho formulas where	lation of the orizontal for s. $Py = 0.82 \times$ P_{uall} : th the (= Hj : th Mpi : f No. le 1 le 2 le 3	Horizontal Force (Py) ree (Py) corresponding to Puall e horizontal load level e pier reach the fully pl Σ Hj (kN)) e horizontal load level reach the fully plastic state (=2×Mpi / Li) (kN) fully plastic state mome Li (m) 16.29 15.04 14.74 13.34 Puall =	Corresponding to the to the elastic limit is at which the bend astic state moment at which the bend state moments ent of individual pil M_{pi} (kN·m) 12,618.28 12,539.24 10,024.79 7,373.63	ne Elastic Limit s computed using t ing moments of all s ng moments of ind e Hi (kN) 1,549.59 1,667.52 1,360.58 1,105.62 5,683.31
d) Calcul The ho formulas where	lation of the orizontal for s. $Py = 0.82 \times$ P_{uall} : th the (= Hj : th Mpi : f No. le 1 le 2 le 3	Horizontal Force (Py) ce (Py) corresponding to Puall e horizontal load level Σ Hj (kN)) e horizontal load level reach the fully plastic s (=2×Mpi / Li) (kN) cully plastic state mome Li (m) 16.29 15.04 14.74 13.34	Corresponding to the contrast of the elastic limit is at which the bend astic state moment at which the bend is tate moments the function of individual pil M_{pi} (kN·m) 12,618.28 12,539.24 10,024.79	ne Elastic Limit s computed using t ing moments of all s ng moments of ind e H _i (kN) 1,549.59 1,667.52 1,360.58 1,105.62

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The pile head moment of "Pile 3" and "Pile 4" exceeds the fully plastic state moment. Therefore, other piles shall share a part of horizontal load of acting on "PIle 3" and "Pile 4".

a ') Calculation of Member Forces Acting on Individual Piles

The redistributed horizontal load is shown below.

	free length of a pile Li (m)	number of pile	Кні	Кні / ΣКні	Hi(kN/piese)
Pile 1	16.29	5.0	6,862	0.225128	1,340.000
Pile 2	15.04	5.0	8,714	0.285880	1,660.000
Pile 3	14.74	4.0	7,411	0.243121	1,330.000
Pile 4	13.34	3.0	7,495	0.245871	1,080.000
		$\Sigma \mathrm{K}_{\mathrm{Hi}} =$	30,482		

The pile head moments (Mi) of individual piles are shown below.

e Den F	free length of a pile Li (m)	Hi	Mi
Pile 1	16.29	1,340.000	10,911.61
Pile 2	15.04	1,660.000	12,482.67
Pile 3	14.74	1,330.000	9,799.44
Pile 4	13.34	1,080.000	7,202.77

Since a pile interval is 3 spans, it is bending moment by the following formulas.

$M_{1,2} = 1.0 \times M_1 = 1.0 \times 10,911.61$	= 10,911.61 kN \cdot m
$M_{2,1} = 0.5 \times M_2 = 0.5 \times 12,482.67$	= $6,241.34 \text{ kN} \cdot \text{m}$
$M_{2,3} = 0.7 \times M_2 = 0.7 \times 12,482.67$	= 8,737.87 kN · m
$M_{3,2} = 0.7 \times M_3 = 0.7 \times 9,799.44$	$= 6,859.61 \text{ kN} \cdot \text{m}$
$M_{3,4} = 0.5 \times M_3 = 0.5 \times 9,799.44$	= 4,899.72 kN · m
$M_{4,3} = 1.0 \times M_4 = 1.0 \times ~7,202.77$	= 7,202.77 kN · m

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	Prepared by	KAndo	Checked by	R. NISHIMURA
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Project	Detailed Design on	tailed Design on Port Reactivation Project in La Union				File No.	
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Subject	Quaywall				Page	No. 18	Rev.
	erval of each pile	is as follows.				Refe Notes	rences/ s
1	2 : 5.30m Pil			Pilo 2~Pilo	$4 \cdot 530m$		
1 - 1 - 1	1	e fan de le composition de la		11160-1116	- - , 0.0011	o .	
	al force of individ						
$N_1 =$	- (10,911.61+6,24	1.34)/5.30 = -	3,236.41 k	N			
N2 =((10,911.61+6,241	.34)/5.30)-((8,	737.87+6,	859.61)/5.40) = 347.98	kN	
$N_3 =$	((8,737.87+6,859.	61)/5.40)-((4.8	899.72+7,2	202.77)/5.30)	= 604.93	kN	
	((4,899.72+7,202.					ta ta se	
184 —	((4,055,72+7,202.	11/10.00/ - A,	200.40 MI				
	an a			· · ·			
		Pile 1	Pile 2	Pile 3	Pile 4		· · ·
Deadweie	ght + Surcharge ^{*†}		3,397.08	_	1,825.83		
Douanoie	Ni	-3,236.41	347.98	604.93	2,283.49		
T	otal (Ni)	-380.45	3,745.06	3,457.22	4,109.32		
	computes in stati	analysis.					
/X 1 . IU	computed in state						•
			(74	N	· ·		
and the second second second	lation of Fully Pla		oment (W	р)		1. 1. 1. 1.	
(i) Calc	ulation of " α (=N/	N ₀)"					
		N (kN)		0 (kN)		$(=N/N_0)$	
· · · · · · · · · · · · · · · · · · ·	le 1	-380.45		0,494.43		0075344	
		3,745.06		0,494.43	****	0741679	
		3,457.22		0,395.54		0855843	
		4,109.32		0,296.66		1356360	
※N 0 i	s the value which	multiplied N	"0 by the r	number of ea	ich pile.		
(ii) Cale	ulation of fully pl	astic state m	oment (M	p)			
		0 (kN·m)		(kN·m)	杭頭 t -	· メント (kN・	·m)
		12,618.36		2,617.48		10,911.61	
		12,618.36		2,532.82	>	12,482.67	7
		10,094.69		10,003.61	>	9,799.44	1

 M_{p0} is the value which multiplied M'_{p0} by the number of each pile.

7,571.02

Pile 4

and the second	· · · · ·	1		
	Prepared by	Y.Ando	Checked by	R. NISHIMURA
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7,399.83

7,202.77

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Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	:
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d') Calculation of the Horizontal Force (Py) Corresponding to the Elastic Limit

No.	L_i (m)	M _{pi} (kN·m)	H _i (kN)
Pile 1	16.29	12,617.48	1,549.49
Pile 2	15.04	12,532.82	1,666.67
Pile 3	14.74	10,003.61	1,357.71
Pile 4	13.34	7,399.83	1,109.55
	Puall =		5,683.42

• Calculation of the horizontal force (Py) corresponding to the elastic limit $P_y=0.82 P_{uall}=0.82 \times 5,683.42 = 4,660.40 \text{ kN}$

e) Examination of Earthquake Resistant Performance

As for the allowable displacement ductility factor (µa), importance level adopts the value 1.30 of the class-A.

• Calculation of the Load Carrying Capacity of the Pile Supported Section during an Earthquake(Ra) of Platform 2

O.K

 $R_a = \sqrt{(2 \mu_a - 1)} \times P_y = \sqrt{(2 \times 1.3 - 1)} \times 4,660.40 = 5,894.99 \text{ kN}$

· Earthquake force of using for examination of load carrying capacity

 $k_hW=0.50 \times 10,820 = 5,410 \text{ kN} \leq \text{Ra}$

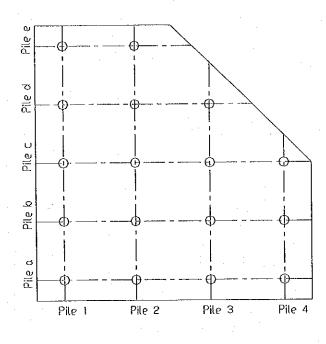
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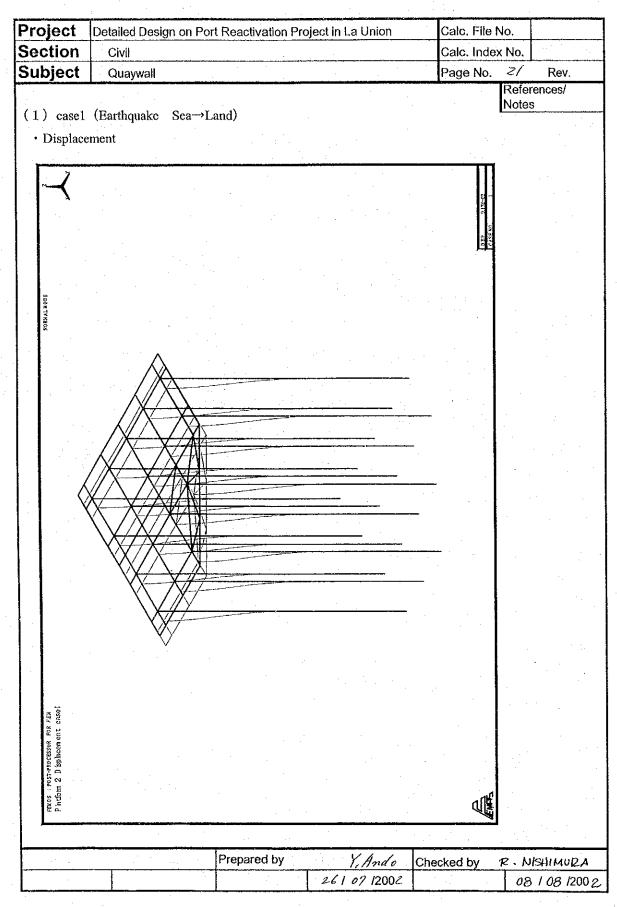
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1) Cross Section Force Figure

The number of the pile shown in a cross-sectional force figure is shown in the following figures.



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Project Detailed Design on Port Reactivation Project in La Union Calc, File No. Section Calc. Index No. Civil 22 Subject Page No. Rev. Quaywall References/ Notes • Bending Moment for Y-Axis (Pile Row "a" Pile 1 (Left Side)~Pile 4 (Right Side)) HORKAL KODE 10-311903 ,6624E+01 00+395157. 1,7078E+0(80055+0 0+30584 47705-0 0+30210 8860E+0 0+3812 0+3800 0+3216 0-3999 11 V 3255+0 767E+I +310 4328E+00 1116+02 OSAPE+0 0+30616 16358+0 11406-0 • 200 F 357E+0 6632+01 34046. 6326+0 2846+0 - 35200 11640 543E+0 3048+0 19 0+32566 8042+0 0+31140 22514E+0 27336-0 1553E+00 91 26VLE'6-922E4 02 1826+02 10+3129 758E+02 0-3550 7318E+C 2468+00 0+3060 0+3020 575E+0 0-367 1.9512E-03 8.0916E+00 10+302231 10+211151 10-36295-01 10+30169. 10+36092 ZA- JIPIT-B-1808E+02 10-302623 50+5216 661 02 942E+03 10-3621 2028-30 9130864 176 02 101-20121 8-123 Bending Moment for Y-Axis Pile Row "a" casel : POST-PROCESSOR FOR F.E.M. YAndo Prepared by Checked by R. NISHIMURA 261 07 12002 08 108 12002

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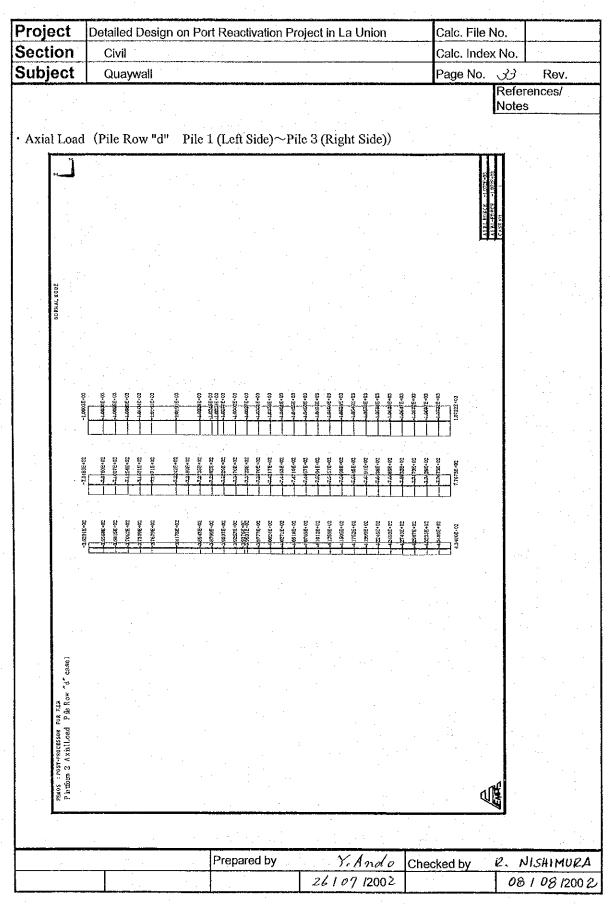
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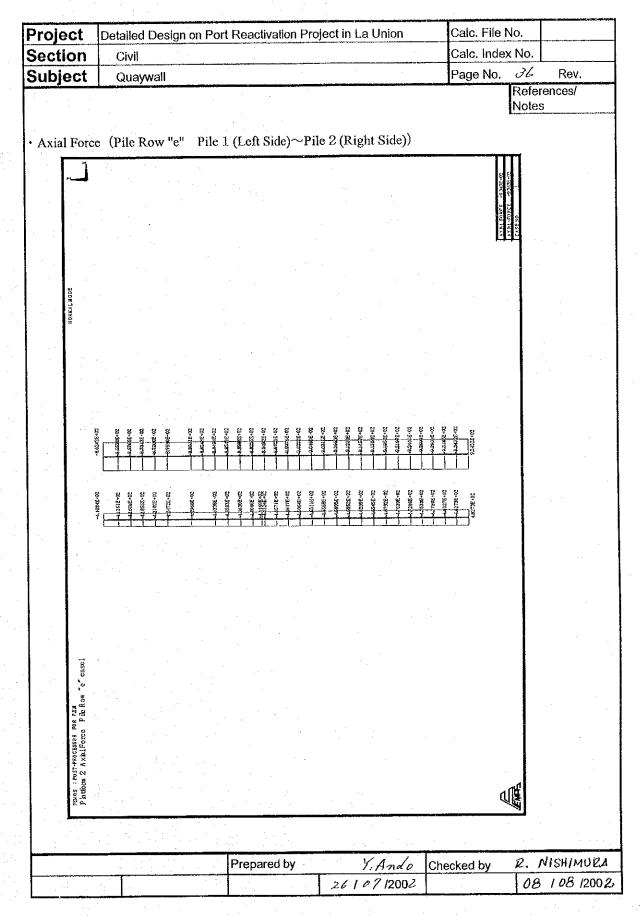
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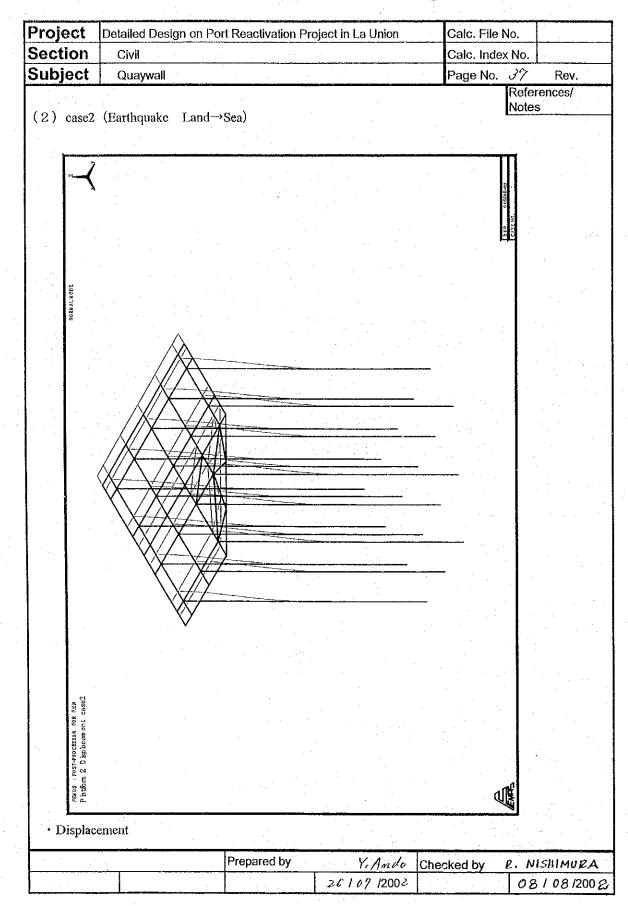


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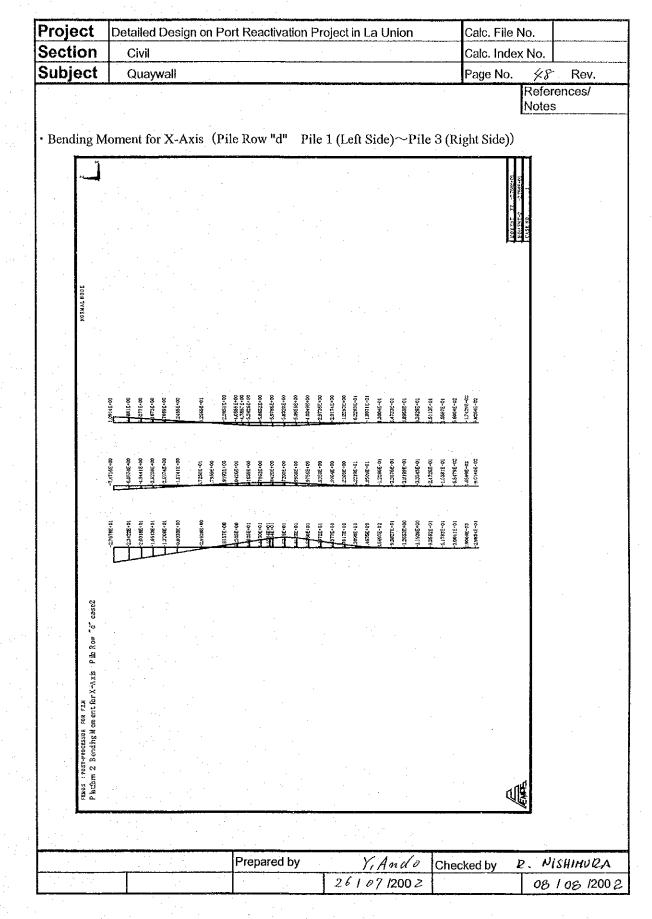
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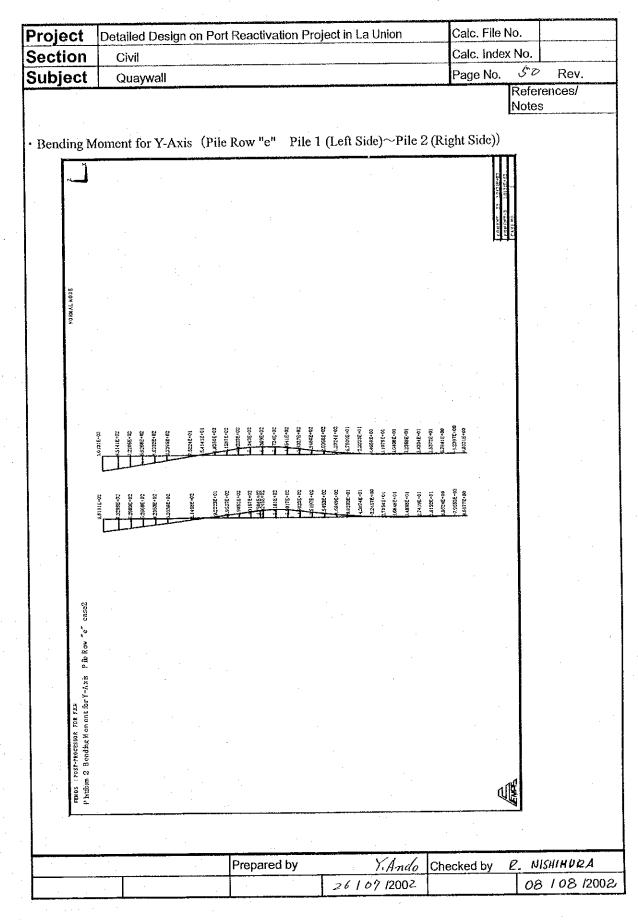
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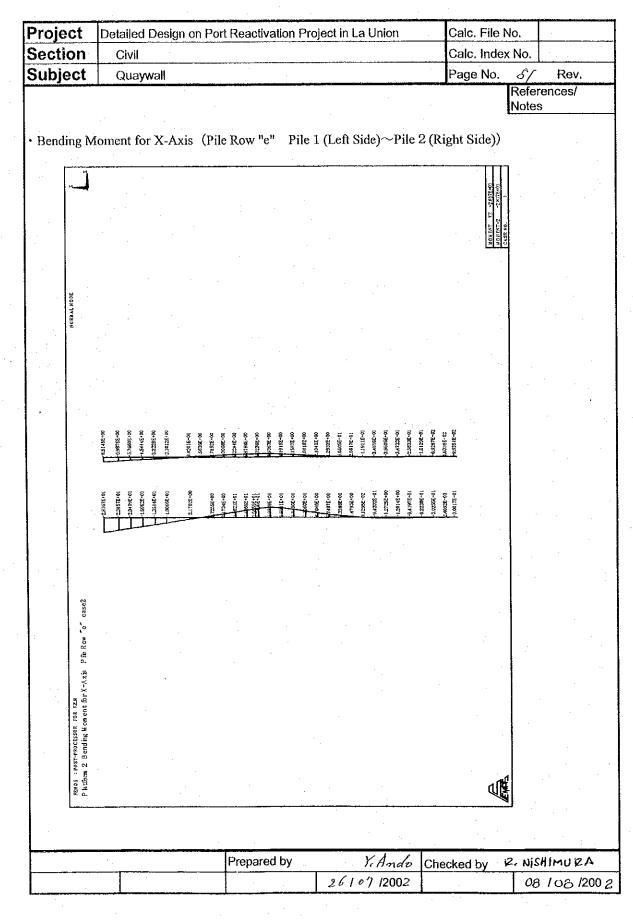
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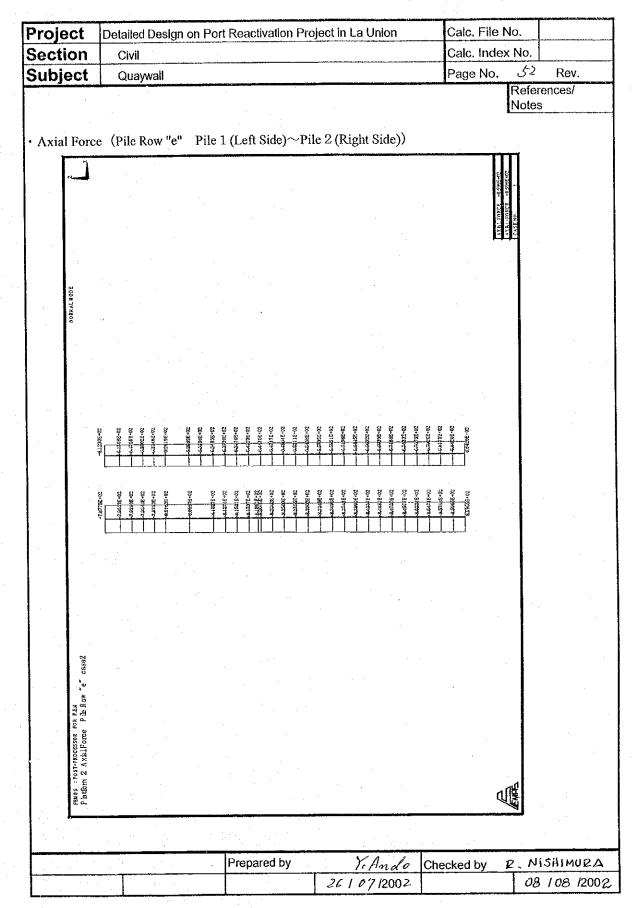
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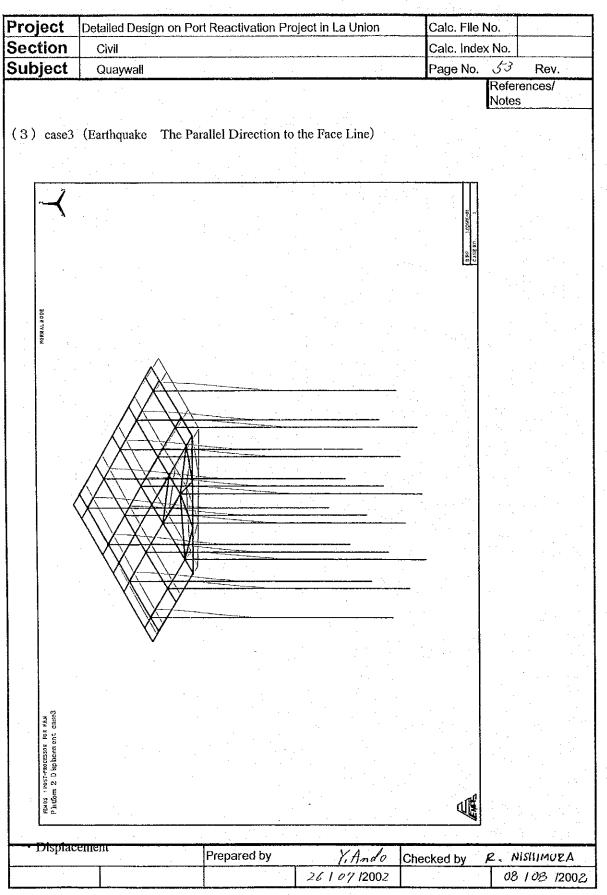
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Project	Detailed Design on Por	t Reactivation Project in La Unio	n Calc. File N	0.
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