PORT REACTIVATION PROJECT IN LA UNION PROVINCE FIN

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CTOBER 2002 NIPPON KOEI W

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

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

FINAL REPORT

DESIGN CALCULATION REPORT

Civil Works (2/2)

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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 (2/2)

OCTOBER 2002

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	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.	
Calculation O	bjective: Stability of Breasting Dolph	ln .	

:			
References.	Calculation	Notes and	Comments

Refer toDrawings

QW-02-001,QW-02-004

Calculation based on

TECHNICAL STANDERDS AND COMMENTARIES

FOR -

PORT AND HARBOUR FACILITIES IN JAPAN

Design Load

Refer to Design Conditions of this Report

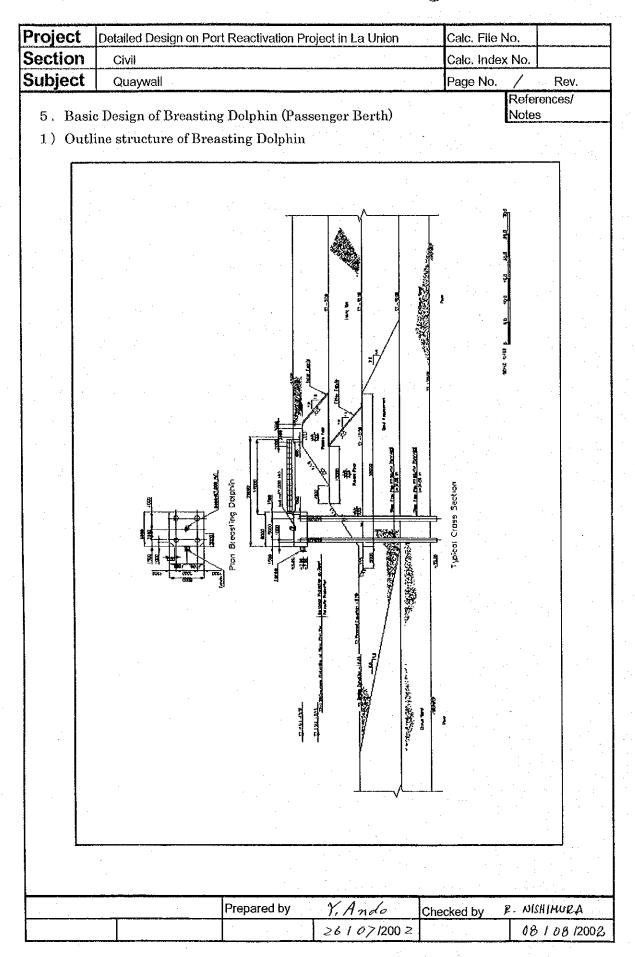
Considered Berthing Condition

Seismic Condition

Mooring Condition

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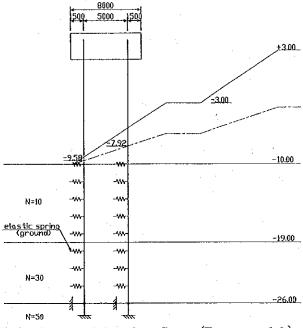


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2) Analysis model

References/ Notes

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.

 $Kh = kh \times D \quad (N/cm^2)$

kh: coefficient of horizontal subgrade reaction(N/cm³)

D : pile width (cm)

Ground level	Average N-value	kh(N/cm³)	pile width(m)	$Kh(kN/m^2)$
Virtual ground surface	·			
		3.5	1.10	3,850
-10.00				
	10	15	1.10	16,500
·19.00				
	30	45	1.10	49,500
-26.00				

ODimensions of Steel Pipe Pile

 ϕ 1,100×t14 Section area A = 477.6 cm² (Corrosion consideration A' = 443.1 cm²)

Geometrical moment of inertia I = 704,287 cm⁴

(Corrosion consideration $I' = 652,161 \text{ cm}^4$

Section modulus $Z = 12,805 \text{ cm}^3$

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

Prepared by	Y. Ando	Checked by 2- NISHI MURA
	2610712002	08 1 08 /2002

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Sub-Section	Quay	wall		Calc. Index No.		
Subject:	Pass	enger Be	rth			
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3) Calculation of Load

References/ Notes

- (1) Calculation of reaction force of the fender
- a) Dimensions of the target vessel

Deadweight tonnage: 25,000DWT,

length overall: 200.0m, Molded breadth: 32.2m, Full load draft: 8.5m

Gross tonnage (GT) of car carriers is computed using the following formulas.

 $GT=1.477 \times DWT$

Gross tonnage (GT) of car carriers $1.477 \times 25,000 = 36,925 \text{ GT}$

Length between perpendiculars: 187.0 m

Full load displacement : log(DT)=1.915+0.588 log(36,925) = 4.6006

DT = 39,864 t \rightarrow DT = 40,000t

b) Calculation of Ship's berthing energy

berthing velocity of vessel : v=0.10m/s

Length between perpendiculars : Lpp = 187.0 m

 ${\rm softness\ factor} \hspace{1.5cm} : \hspace{.1cm} {\rm Cs}{=}1.0$

berth configuration factor : Cc=1.0

distance from the point where the vessel touches the mooring facilities to the center of gravity of the vessel as measured along the face line of the mooring facilities

1 = 35.0 m

(The central line between dolphins, and the vessel center of gravity shall be in agreement.

1 = 70.0 / 2 = 35.0m)

block coefficient : Cb=40,000 / $(187.0 \times 32.2 \times 8.5 \times 1.03) = 0.759$

radius of gyration : $r = (0.19 \times 0.759 + 0.11) \times 187.0 = 47.537$

eccentricity factor : $Ce = 1 / (1 + (35/47.537)^2) = 0.648$

vessel mass factor : Cm=1+($\pi/(2\times0.759)$)×(8.5/32.2)=1.546

berthing energy : Ef= $((40,000 \times 0.10^2)/2) \times 0.648 \times 1.546 \times 1.0 \times 1.0 = 200.36 \text{ kN} \cdot \text{m}$

c) Reaction Force of the Fender

An advantageous thing is economically used for fender among following two.

• HC 800H(J2) Catalog value Energy Absorption $E = 224.0 \text{ kN} \cdot \text{m}$

(HYPER SELL) Reaction Force R = 502.0 kN

• HO 800H(X100) Catalog value Energy Absorption $E = 224.0 \text{ kN} \cdot \text{m}$

(HYPER OMEGA) Reaction Force R = 502.0 kN

Energy absorption of fender checks that it is less than berthing energy. Energy absorption of the fender used for examination is the value that multiplies above mentioned value (written to catalog) by 0.9.

HC 800H $224.0 \times 0.9 = 201.6 \text{ kN} \cdot \text{m} \ge \text{Ef} = 200.36 \text{ kN} \cdot \text{m}$ O.K

HO 800H $224.0 \times 0.9 = 201.6 \text{ kN} \cdot \text{m} \ge \text{Ef} = 200.36 \text{ kN} \cdot \text{m}$ O.K

Prepared by	Y. Ando	Checked by	E. MISHIHUEA
	26/07/2002		08 108 12002

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In consideration of product deviation, 110% of value of catalog value is used for reaction force of fender.

$$R = 502.0 \times 1.1 = 442.2 \text{ kN} \rightarrow 552.2 \text{ kN}$$

$$R = 502.0 \times 1.1 = 441.1 \text{ kN} \rightarrow 552.2 \text{ kN}$$

Therefore, even if it uses which fender, reaction force of the fender is taken as R=560.0 kN.

(2) Calculation of Deadweight of the Superstructure

$$W1 = 8.0 \text{m} \times 8.0 \text{m} \times 3.0 \text{m} \times 24.0 \text{ kN/m}^3 = 4,608 \text{ kN}$$

(3) Calculation of Buoyancy

Buoyancy, which acts on superstructure in the examination at the time of HWL, is taken into consideration.

$$U = 8.0 \text{m} \times 8.0 \text{m} \times 1.37 \text{m} \times 10.1 \text{ kN/m}^3 = 885.57 \text{ kN}$$

(4) Calculation of Earthquake Force

$$P = 4.608 \times 0.20 = 921.60 \text{ kN}$$

(5) Tractive Force of Vessel

Bollard (1,000kN) is prepared in breasting dolphin. The action direction to examine is carried out as follows.

- · the vertical direction to the face line (0°)
- the parallel direction to the face line (90°)
- · the direction of 45 degree to the face line

Moreover, tractive force of vessel shall act in the place which separated only 50 cm from the surface (+5.00) of superstructure. The moment by tractive force of vessel in pile head (+3.50) is as follows.

$$M = 1,000.00 \times 2.0 = 2,000.00 \text{ kN} \cdot \text{m}$$

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	Case		Vertical F Dead weight		Reac force o	tion of the	Horizo Tracti force vesso	ve l	Forces (Moment tractive force	of 3	Earthqu force o	of	Conditio	on	Action d	irectio	, l	m oefficie nt	
case	91	berthing	4,608.00	885.5				-			_		Ordina	гy	Sea→	Land		1.00	ļ
case	1	berthing	4,608.00	-	560	.00							Ordina		Sea→	Land		1.00	
case		earthqua ke	4,608.00	885.5	7	_	_				921.6	0	Extraordi y		Sea→	Land		1.50	
case	•	earthqua ke	4,608.00		-	-			·	.	921.6	0	Extraordi y	nar	Sea→	Land		1.50	
case		earthqua ke	4,608.00	885.5	7 -	- [•	-		921.6	0	Extraordi y		Land→Sea			1.50	
cas	Ī	earthqua ke	4,608.00		-	-	_		· -		921.6	0	Extraordinar y Extraordinar y Extraordinar y Extraordinar		nar Parallel to face line nar Parallel to face line nar Land-Sea			1.50	-
cas		earthqua ke	4,608.00	885.5	7 -	-	-		_		921,6	0					line	1.50	
cas		earthqua ke	4,608.00		-	-					921.6	0					line	1,50	
cas		mooring	4,608.00	885.5	7 -	٠. أ	1,000	.00	2,000.0	00								1.50	
case		mooring	4,608.00	-	-	<u>-</u> 1.	1,000	.00	2,000.0	00			Extraord y		ar Land/Sea			1.50	
case		mooring	4,608.00	885.5	7		1,000	.00	2,000.0	30		· · ·	Extraord y		directio	n of 4	5°	1.50	
case		mooring	4,608.00	-		-	1,000	00.0	2,000.0	00	· . –		Extraord y		directio	n of 4	5°	1.50	
case		mooring	4,608.00	885.5	7	-	1,000	0.00	2,000.0	00			Extraord	·	Parallel t	o face	line	1.50	
cas		mooring	4,608.00	_		_	1,000	0. 0 0	2,000.0	00			Extraord y	inar	Parallel t	o face	line	1.50	_
S	ince	hori	zontal	force	of mo	oring	cor	ndit	ion i	s la	arger	thai	n horiz	ont	tal for	ce c	of e	arthq	luak
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A	n e	xamin	ation o	case i	show	n belo	ow.								(kN	· m	.)	
			Verti	ical Fore	es (kN)		Horiz	ontal	Forces	(kN)							Prem	- 1	
	, .	Case	Deady	veight	Buoyancy	React force o	f the	for	ctive ce of essel	tr	mrnt of active orce	Cor	ndition	Ac	tion direc	tion	coeff nt	icie	
	Deadweight Buoyancy fender berthing 4,608.00 885.57 560.00			-				rdinary		Sea→Lan	Sea→Land 1.0		0						

		Vertical For	rces (kN)	Horizontal Forces (kN)					Premiu m
, , ,	Case	Deadweight	Виоуалсу	Reaction force of the fender	Tractive force of vessel	Momrnt of tractive force	Condition	Action direction	coeffici nt
case1	berthing	4,608.00	885.57	560.00	–	_	Ordinary	Sea→Land	1.00
case2	berthing	4,608.00	-	560.00		_	Ordinary	Sea→Land	1.00
case3	mooring	4,608.00	885.57	-	1,000.00	2,000.00	Extraordinary	Land→Sea	1.50
case4	mooring	4,608.00	-	-	1,000.00	2,000.00	Extraordinary	Land→Sea	1.50
case5	mooring	4,608.00	885.57	_	1,000.00	2,000.00	Extraordinary	direction of 45°	1.50
case6	mooring	4,608.00	 .	_	1,000.00	2,000.00	Extraordinary	direction of 45°	1.50
case7	mooring	4,608.00	885.57	-	1,000.00	2,000.00	Extraordinary	Parallel to face line	1.50
case8	mooring	4,608.00		- '	1,000.00	2,000.00	Extraordinary	Parallel to face line	1.50

	Prepared by	YiAndo	Checked by	2. NISHIMURA
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C) C	force of pile	References/ Notes

5) Section force of pile

Computed section force acting on pile is shown below as a result of analysis.

Case	Pile	Maximum Moment kN·m	Composition Moment kN·m	Axial force kN	Maximum Axial force kN	Displacement t cm	
casel	Pile 1	1,078.0	1,078.0	481.7			
	(Sea side)	0.0	1,010.0	101.1	1,479.0	4.9	
HWL	Pile 2	1,170.0	1,170.0	1,381.0	1,410.0	4.5	
	(Land side)	0.0	1,130.0	1,001.0			
case2	Pile 1	1,078.0	1078023	708.1			
	(Sea side)	0.0			1,701.0	4.9	
LWL	Pile 2	1,170.0	770	1,603.0	1,701.0	4.5	
	(Land side)	0.0					
case3	Pile 1	1,906.0	1,906.0	1,927.0			
	(Sea side)	0.0	1,900.0	1,921.0	2,025.0	8.9	
HWL	Pile 2	2,070.0	2,070.0	-63.7	2,020.0	0.9	
S.	(Land side)	0.0	2,070.0	05.1			
case4	Pile 1	1,906.0	1,906.0	2,246.0			
	(Sea side)	0.0	ĺ	2,240.0	2,246.0	9.0	
LWL	Pile 2	2,070.0	12/07/010		2,240.0	9.0	
	(Land side)	0.0		24,58			
case5	Pile 1	1,303.0	1,909.6	2,339.0			
	(Sea side)	1,396.0	1,909.6	2,339.0	2,437.0		
HWL	Pile 2	1,512.0	2.073.6			9.3	
	(Land side)	1,419.0] 9.5	
	Pile 1	1,415.0	0.000.0	020.0	-378.4	ļ	
	(Sea side)	1,418.0	2,003.2	932.0			
case6	Pile 2	1,303.0	1,909.62	25600	244		
i	(Land side)	1,396.0	1,1003.0	2.00	2,658.0		
LWL	Pile 1	1,512.0	0.070.0	9550		0.0	
	(Sea side)	1,419.0	2,073.6	-255.0		9.3	
	Pile 2	1,415.0	0.000.0	1 152 0	156.9		
	(Land side)	1,418.0	2,003.2	1,153.0			
case7	Pile 1	62.4	1.074.0	1.097.0			
1 .	(Sea side)	1,973.0	1,974.0	1,927.0	9.095.0	0.4	
HWL	Pile 2	69.5	9.007.9	1.007.0	2,025.0	9.4	
	(Land side)	2,006.0	2,007.2	1,927.0		,	
case8	Pile 1	62.3		12 1 C 10			
	(Sea side)	1,973.0	197410	22148.U	0.047.0		
LWL	Pile 2	68.5		1 0 40	2,247.0	9.4	
	(Land side)	2,006.0	12/007/24	12 149 0			

Examination of stress performs only the pile and case in the table where stress becomes large by which hatching is carried out.

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6) Stress Examination of Piles

Notes

Passenger Berth Breasting Dolphin

φ1100*t14

	Dimension	(51100*t14		SKK 490	
	Cross-sectional Area	. A=	477.6 cm²2			gygeneg Addyrig od Amerika yr Madriau (1984)
Pile	Section modulus	Z=	12,805 cm ²			
	Radius of gyration of area	r=	38, 4 cm ²			
	Buckling length]=	1308 ст			
		l/r=	34. 1			
Section force	Bending Moment		1, 078. 0 kN·m			
	Axial Force	N=	703. 1 kN			
	Allowable Bending Stress	σba=	185 N/ttm^2			
	Allowable Axial Compressive Stress	σ ca=	163 N/mm²2		·	
Stress	Premium coefficient		1. 0			
	Bending Stress	σb=	84 N/mm^2	<	185 N/mm^2	0. K.
	Axial Compressive Stress	σ c=	15 N/mm^2	<	163 N/nm^2	O. K.
	Examination of members simultaneously subject to axial force and bending moment		0. 55			0. K.

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	Dimension	φ1100*t14	SKK 490
Pile	Cross-sectional Area	A= 477.6 cm^2	
	Section modulus	Z= 12,805 cm^3	
	Radius of gyration of area	r= .38,4 cm²2	
	Buckling length]= 1142 cm	
		1/r= 29.7	
Section	Bending Moment	M= 1,170.0 kN·m	
force	Axial Force	N= 1,603.0 kN	
	Allowable Bending Stress	σba= 185 N/mm²2	
	Allowable Axial Compressive Stress	σca= 169 N/mm²2	
Stress	Premium coefficient	1.0	
	Bending Stress	σb= 91 N/um²2	< 185 N/mm^2 0. K.
	Axial Compressive Stress	σc= 34 N/nm ²	< 169 N/nm ² 0. K.
	Examination of members simultaneously subject to axial force and bending moment	0.69	О. К.

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6) Stress Examination of Piles

References/ Notes

Passenger Berth Breasting Dolphin

φ1100*t14

	Dimension		00*t14	-	SKK 490	
	Cross sectional Area	1.995	477.6 cm ²			
Pile	Section modulus	Z=	12,805 cm ³			
	Radius of gyration of area	r=	38.4 cm ²		·	
	Buckling length	74 g): 1 =[15];	1308 cm		and the second s	
		1/r=	34. 1			
Section	Bending Moment	M=	1,078.0 kN-m			
force	Axial Force	N =	703.1 kN			
	Allowable Bending Stress	σba=	185 N/mm^2			
	Allowable Axial Compressive Stress	σ ca=	163 N/um^2		: .	
Stress	Premium coefficient		1.0			
	Bending Stress	σb=	84 N/mm^2	<	185 N/mm^2	O. K.
	Axial Compressive Stress	σ c=	15 N∕mn^2	<	163 N/ma^2	O. K.
	Examination of members simultaneously subject to axial force and bending moment		0, 55			O. K.

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Notes

Passenger Berth Breasting Dolphin

φ1100*t14

	Dimension	φ1]	l00*t14		SKK 490	
	Cross-sectional Area	Λ=	477.6 cm ²			
Pile	Section modulus	Z=	12,805 cm ³			
	Radius of gyration of area		38.4 cm ²			
	Buckling length	l=	1142 cm			
		1/r=	29. 7	•		
Section	Bending Moment	M= ^{dise}	1, 170. 0 kN·m			
force	Axial Force	N =	1, 603. 0 kN			
	Allowable Bending Stress	σba=	185 N/mm^2			
	Allowable Axial Compressive Stress	σ ca=	169 N/mm ² 2			
Stress	Premium coefficient		1.0			
	Bending Stress	σb=	91 N/mm²2		185 N/mm²2	0. K.
	Axial Compressive Stress	σ c=	34 N/mm^2	<	169 N/mm^2	O. K.
	Bxamination of members simultaneously subject to axial force and bending moment		0. 69			0. K.

Prepared by	YiAndo	I CO I I CONTO DI	2. NISHIHUZA
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Passenger Berth Breasting Dolphin

φ1100*t14

	Dimension	$\phi 11$	00*t14		SKK 490	
	Cross-sectional Area	1.4-4.	477.6 cm ²			
Pile	Section modulus	Z=	12,805 cm ² 3			
	Radius of gyration of area	r=	38, 4 cm ²			
·	Buckling length	1=	1142 cm	, , 		
	·	1/r=			:	
Section	Bending Moment	M = 2	2, 070. 0 kN·m			
force	Axial Force	N =	255.8 kN			<u> </u>
	Allowable Bending Stress	σba=	185 N/mm^2			·
	Allowable Axial Compressive Stress	σca=	169 N/mm^2			
Stress	Premium coefficient		1, 5			
	Bending Stress	σb=	162 N/mm^2	<	278 N/mm^2	O. K.
	Axial Compressive Stress	σc=	5 N/mm^2	<	253 N/mm^2	O. K.
	Examination of members simultaneously subject to axial force and bending moment		0. 60			O. K.

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	2610712002		08 1 08 1200 2

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Passenger Berth Breasting Dolphin

φ1100*t14

	Dimension	φ 1	100*t14		SKK 490	
	Cross-sectional Area	A=	477.6 cm ²			
Pile	Section modulus	Z=	12,805 cm ³			
	Radius of gyration of area	r=	38.4 cm ²	٠.		
	Buckling length	1=	0 cm			
		1/r=	0, 0			
Section	Bending Moment	M =	2,073.6 kN·m			
force	Axial Force	N= -	-476. 5 kN			
	Allowable Bending Stress	σba=	185 N/nm^2			
	Allowable Axial Compressive Stress	σta=	185 N/mm²2			
Stress	Premium coefficient		1. 5			
	Bending Stress	σbt=	162 N/ma^2	< '	278 N/mm ²	0. K.
	Axial Compressive Stress	σt=	10 N/mm^2	<	278 N/ma^2	0. K.
	Examination of members simultaneously subject to axial force and bending moment	σt+σbt=	171.91 N/mu^2	<	278 N/mm ^ 2	O. K.

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	a ceanr	ger Berth Breasting	Dolphin		μ φ1100*t14	Votes
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c	· · · · · · · · · · · · · · · · · · ·	Calculation (Case6)	: D:16.1			
	uress	Carculation (caseo)	Liter			
· . [Dimension	4.1	100*t14	- SKK 490	
		Dimension	φιι	100×014	SNR 490	<u> </u>
		Cross-sectional	A-	477.6 cm ²		
		Area	A	ATTO CIL Z		
ŀ		Section modulus	7-	12,805 cm ² 3		
	Pile	Section modulus	<i>L</i> -	12,000 011 0		
	ſ	Radius of gyration		38,4 cm 2		
		of area	17	38. 4 Gil 2		
		Dualiling longth	1- 0	1308 cm		
		Buckling length	1-	1300 dii		
			1/r=	24 1		
			1/1	34. 1		
ſ		Bending Moment	M-15/36	1, 909. 0 kN·m		
	Section		WI-	1, 303. 0 KV III		
	force	Axial Force	/ =	2,560.0 kN		
		Axiai roice		25.000 MV		
. [1.	Allowable Bending	σba=	185 N/mm^2		
		Stress	σba=	100 10 110 2		:
		Allowable Axial	σca=	163 N/mm^2		
	1	Compressive Stress	o ca-	103 (7 mil 2		
		Premium coefficient		1.5		
	Stress	1				
		Bending Stress	σb=	149 N/mm^2	< 278 N/mm²	2 O.K.
		bending Stress	0 D-	1-45 17100 2	210 10 111	2 0.1.
,		Axial Compressive	er 0.	54 N/ma^2	< 245 N/mm ²	2 0.K
·		Stress	σc=	OT 1V III 2	. 240 WILL	D O. IL
	!	Examination of members simultaneously subject to axial		0. 76	-	0. K.
		force and bending moment		V. 10		V. IL

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Passenger Berth Breasting Dolphin

φ1100*t14

	Dimension		100*t14	SKK 490	
	Cross-sectional Area	1	477. 6 cm ²		
Pile	Section modulus	Z=	12,805 cm ² 3	· · · · · · · · · · · · · · · · · · ·	
	Radius of gyration of area	r =	38.4 cm ²		
	Buckling length] =	1308 cm		
		1/r=	34. 1		
Section	Bending Moment	M= 1300	1, 974. O kN·m		:
force	Axial Force	N =	2, 148.0 kN		
	Allowable Bending Stress	σba=	185 N/mm^2	·	
	Allowable Axial Compressive Stress	σca=	163 N/mm^2		
Stress	Premium coefficient		1.5		
	Bending Stress	σb=	154 N/mm^2 <	278 N/mm^2	0. K.
	Axial Compressive Stress	σc=	45 N/mm^2 <	245 N/mm^2	0. K.
	Examination of members simultaneously subject to axial force and bending moment		0. 74		0. K.

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Passenger Berth Breasting Dolphin

φ1100*t14

	Dimension	$\phi 11$	00*t14	SKK 490	
	Cross-sectional Area	A= - 14.1	477, 6 cm ²		
Pile	Section modulus	Z =	12,805 cm ² 3		
	Radius of gyration of area	r=	38.4 cm ²		
·	Buckling length	1=	1142 cm		
			29. 7		
Section	Bending Moment	1 3 91.77	2, 007.2 kN·m		
force	Axial Force	N= 2	2, 149. 0 kN		
	Allowable Bending Stress	σba=	185 N/nm ²		
	Allowable Axial Compressive Stress	σ ca=	169 N/tm^2		
Stress	Premium coefficient		1.5		
	Bending Stress	σb=	157 N/mm^2 <	278 N/mm^2	O. K.
	Axial Compressive Stress	σ c=	45 N/mm^2 <	253 N/mm²2	O. K.
	Examination of members simultaneously subject to axial force and bending moment		0.74		O. K.

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7) Examination of Bearing Capacity of Pile

Ultimate bearing capacity(Ru) is computed using the following formulas.

$$Ru = 300 \times q \times N \times Ap + N' \times As \quad (kN)$$

Where 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 toe of pile to the level 4B above

B: diameter or width of pile (m)

N': mean N-value for total penetration length of pile

Ap: toe area of pile (m2)

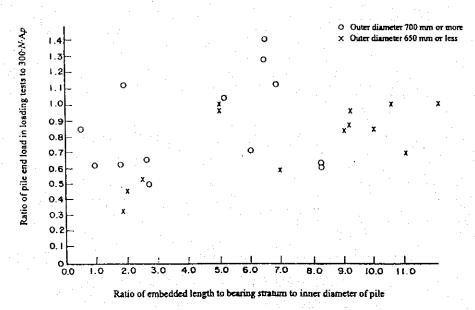
As: total circumferential area of pile (m2)

**The pile installation method assumes from Soil Condition that it is the pile installation by inner excavation. Therefore, the 2nd term of the upper formula is made into "N×As." (see "Highway Bridge Specifications and the Commentary(in Japan)") (According to the standard, it is "2×N×As".)

(1) Closed Area Ratio

The piles shall drive only the length of pile diameter into the bearing stratum (below 26m).

The Closed area ratio is set to "q= 0.6" from the following figures.



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(2) Calculation of Ultimate Bearing Capacity

$$N2 = (1.1 \times 50 + 3 \times 1.1 \times 30) / (4 \times 1.1) = 35$$

$$N = (50+35)/2 = 42.5 \rightarrow 42$$

$$Ap = 1.1^2 \times \pi / 4 = 0.950 \text{ m}^2$$

Circumferential area of pile per 1m As' = $1.1 \times \pi = 3.45$ m²/m

$$Ru = 300 \times 0.6 \times 42 \times 0.950 + (9.5 \times 10 + 6.0 \times 30) \times 3.45$$

= 8,130 kN

(3) Calculation of Maximum Pulling Resistance

$$Rut = (9.5 \times 10 + 6.0 \times 30) \times 3.45 = 948 \text{ kN}$$

(4) Examination of Bearing Capacity

The allowable bearing capacity is calculated using the following formulas.

$$Ra = Ru / F$$

where

Ra: allowable bearing capacity

Ru: ultimate bearing capacity

F : safety factor (=2.50: berthing condition)

(=1.50 : mooring condition)

a) Examination of Bearing Capacity (Berthing Condition)

Allowable bearing capacity Ra = $8,130 / 2.5 = 3,252 \text{ kN} \ge 1,701 \text{ kN}$ O.K

b) Examination of Bearing Capacity (Mooring Condition)

Allowable bearing capacity Ra = $8,130 / 1.5 = 5,420 \text{ kN} \ge 2,658 \text{ kN}$ O.K

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(5) Examination of Pulling Resistance

The allowable pulling resistance is calculated using the following formulas.

Rat = Rut / F

where

Rat: allowable pulling resistance
Rut: maximum pulling resistance

F: safety factor (= 3.00: berthing condition)

(=2.50: mooring condition)

a) Examination of Pulling Resistance (Berthing Condition)

Allowable pulling resistance Rat = $948 / 3.0 = 316 \text{ kN} \ge 0 \text{ kN}$ O.K

b) Examination of Pulling Resistance (Mooring Condition) Allowable pulling resistance Rat = $948 / 2.5 = 379 \text{ kN} \ge 378.4 \text{ kN}$

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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)

Hi ; 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)

Go; shear modulus (kN/m²)

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

g ; gravitational acceleration (=9.8m/s2)

γι ; 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 -6.5m(virtual ground surface). Therefore, it is aimed at the -6.5m ~ -26 m foundation.

Level	Hi (m)	soil	N	$\gamma_{\rm t}({\rm kN/m^3})$	$G_0(kN/m^2)$	$V_{si}(m/s)$
-8.75~-10.0	1.25	sandy	2.33	20.0	25,596	112.05
-10.0~-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

 $T_e=4\times(1.25/112.05+10.0/183.87+6.0/267.13)=0.352s$

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b) Natural Period of Breasting Dolphin

References/ Notes

The coefficient of horizontal subgrade reaction and the characteristic value of a pile are computed using the following formulas.

- coefficient of horizontal subgrade reaction k_h=2×1.5N (N/cm³)
- characteristic value of a pile

$$\beta = 4\sqrt{(k_hD/(4EI))(cm^{-1})}$$

· horizontal spring constant

$$K_H = 12 \times EI/(Li^3) (kN/m)$$

natural period pf a Breasting Dolphin

$$T_S = 2 \times \pi \times \sqrt{(W/(g \times K_H))}$$
 (s)

where N : average N-value of the ground down to a depth of about $1/\beta$

$$1S-2 \wedge \pi \wedge \sqrt{(W/(g \wedge KH))}$$
 (S

D: deameter or width of the pile (=1.10m)

Li: free length of a pile $= hi+1/\beta$

hi: vertical distance between the pile head and the virtual ground surface

W: sum of deadweight and surcharge during an earthquake (=4,608 kN)

The calculation result of the spring constant of individual pile

	D	thickness	I	hi	N	kh	β	1/β	Li	Кн
	(cm)	of pile(cm)	(cm4)	(m)			(cm ⁻¹)	(m)	(m)	(kN/m)
Pile									,	
1	109.8	1.3	652,161	13.08	9.11	27.33	0.00275	3.63	16.71	3,354
Pile										
2	109.8	1.3	652,161	11.42	6.04	18.12	0.00249	4.02	15.44	4,249

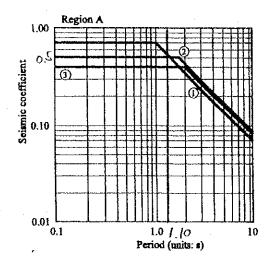
The number of piles of individual pile rows is twe

sum of horizontal spring constant $\Sigma K_H = (2 \times 3,354 + 2 \times 4,249) = 15,205 \text{ kN/m}$ natural period of Breasting Dolphin

$$T_S = 2 \times \pi \times \sqrt{(4,608/(9.81 \times 15,205))} = 1.10 \text{ s}$$

c) Determination of seismic coefficient for examination

From the following figures, seismic coefficient for examination by reference is set to "kh=0.5".



	:41	_
T _g ; natural period	of	tl
③ 0.5s≦T _g		
② $0.1s \le T_g < 0.5s$		
① $T_g < 0.1s$		
Legend		

he ground calculated with equation(s)

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(2) Examination of Load Carrying Capacity Using Simplified Method

References/ Notes

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.

 $R_a \ge k_h W$

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

Ra ; load carrying capacity during an earthquake (kN)

kh ; seismic coefficient derived

W ; deadweight of pier and surcharge acting during an earthquake (kN)

 $\mu_{\rm a}$; allowable displacement ductility factor (=1.3; Class A)

0 ; =0 (see "TECHNICAL STANDARDS AND COMMENTARIES FOR PORT AND HARBOUR FACILITIES IN JAPAN")

Py ; the horizontal force corresponding to the elastic limit =0.82Puall (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 $= \sum 2M_{pi}/L_i$ (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)

fy ; design yield strength of steel pipe pile (N/mm2)

SKK490; 315 N/mm²

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 (mm²)

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

			 	
	Prepared by	Y. Ando	Checked by	e. Nishimula
		261 0712002		08 1 08 12002

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a) Calculation of Member Forces Acting on Individual Piles

Earthquake force of using for examination of load carrying capacity

$$P = 4,608 \times 0.50 = 2,304 \text{ kN}$$

The horizontal force acting on the heads of individual piles may be calculated using following formula.

$$Hi = (K_{Hi} / \Sigma K_{Hi}) \times P$$
 (kN)

KHi: horizontal spring constant of individual piles

	free length of a pile Li (m)	Kın	K _{Hi} / ΣK _{Hi}	Hi(kN)
Pile 1	16.71	3,354	0.441136	508.189
Pile 2	15.44	4,249	0.558864	643.811
	$\Sigma \mathrm{K}_{\mathrm{Hi}} =$	7,603		

XThe number of piles of individual pile rows is two.

"Hi" is the horizontal force per a pile.

The pile head moments (Mi) of individual piles may be calculated using following formula.

$$Mi = (1/2) \times Li \times Hi$$
 (kN · m)

	free length of		
	a pile Li (m)	Hi	M_0
Pile 1	16.71	508.189	4,246.22
Pile 2	15.44	643.811	4.971.55

The axial force of individual piles may be calculated using following formula.

$$Ni' = (M_1 + M_2) / LL$$
 (kN)

M₁, M₂: the pile head moment of pile 1 and pile 2

LL : pile interval (=5.00m)

 $N_1' = (-1) \times (4,246.22 + 4,971.55) / 5.00 = -1,843.55 \text{ kN} \cdot \text{m}$

 $N_2' = (4,246.22 + 4,971.55) / 5.00 = 1,843.55 \text{ kN} \cdot \text{m}$

The axial force (Ni), which acts on pile head of each pile, is shown below.

	Pile 1	Pile 2
Deadweight + Surcharge		
×1	1,152.00	1,152.00
Ni	-1,843.55	1,843.55
Total (Ni)	-691.55	2,995.55

X1: It computes in static analysis.

	Prepared by	Y. Ando	Checked by	e- WISHIMURA
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b) Calculation of the element characteristics of a pile

The element characteristics of a pile consider corrosion.

(i) Sectional modulus of steel pipe pile in elastic domain

$$Z_p=4/3\times(r^3-(r-t)^3)=4/3\times(549^3-(549-13)^3)=15,304,657 \text{ mm}^3$$

(ii) Fully plastic state moment of steel pipe pile when no axial force acting (M_{po}) and The yield axial force (N_0)

Cross-section area of steel pipe pile $A' = 44,312 \text{ mm}^2$ $M_{p0} = Z_p f_y = 15,304,657 \times 315 / 1,000,000 = 4,820.97 \text{ kN} \cdot \text{m}$ $N_0 = A f_y = 44,312 \times 315 / 1,000 = 13,958.33 \text{ kN}$

c) Calculation of Fully Plastic State Moment (Mp)

(i) Calculation of " α (=N/N₀)"

No.	N (kN)	N_0 (kN)	α (=N/N ₀)
Pile 1-1	691.55	13,958.33	-0.04954421
Pile 1 - 2	-691.55	13,958.33	-0.04954421
Pile 2 - 1	2,995.55	13,958.33	0.21460691
Pile 2 - 2	2,995.55	13,958.33	0.21460691

(ii) Calculation of fully plastic state moment (Mp)

Fully plastic state moments are computed using the following formulas.

$$Mp = Mp_0 \times cos(\alpha \times \pi/2)$$
 (kN·m)

No.	M _{p0} (kN·m)	M _p (kN⋅m)	Mi (kN·m)
Pile 1 - 1	4,820.97	4,806.38	> 4,246.22
Pile 1 – 2	4,820.97	4,806.38	> 4,246.22
Pile 2 - 1	4,820.97	4,549.63	< 4,971.55
Pile 2 – 2	4,820.97	4,549.63	< 4,971.55

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d)Calculation of the Horizontal Force (Py) Corresponding to the Elastic Limitation of the Horizontal Force (Py)

The horizontal force (Py) corresponding to the elastic limit is computed using the following formulas.

 $Py = 0.82 \times P_{uall}$

where P_{uall} : the horizontal load level at which the bending moments of all the piles of the pier reach the fully plastic state moments

 $(= \Sigma Hj (kN))$

Hj : the horizontal load level at which the bending moments of individual piles reach the fully plastic state moments

 $(=2 \times Mpi / Li)$ (kN)

Mpi : fully plastic state moment of individual pile

No.	L _i (m)	M _{pi} (kN·m)	H _i (kN)
Pile 1 - 1	16.71	4,806.38	575.23
Pile 1 - 2	16.71	4,806.38	575.23
Pile 2 - 1	15.44	4,549.63	589.17
Pile 2 - 2	15.44	4,549.63	589.17
	Puall =		2,328.80

The pile head moment of "Pile2" exceeds the fully plastic state moment. Therefore, other piles shall share a part of horizontal load of acting on "Pile2".

a-1) Calculation of Member Forces Acting on Individual Piles

The redistributed horizontal load is shown below.

	free length of a pile Li (m)	K _{Hi}	K _{Hi} / ΣK _{Hi}	Hi(kN)
Pile 1	16.71	3,354	0.441136	567.000
Pile 2	15.44	4,249	0.558864	585.000
	$\Sigma \mathrm{K}_{\mathrm{Hi}} =$	7,603		

The number of piles of individual pile rows is two.

"Hi" is the horizontal force per a pile.

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

	free length of		
	a pile Li (m)	Hi	$\mathbf{M_{i}}$
Pile 1	16.71	567.000	4,737.29
Pile 2	15.44	585.000	4,516.20

	Prepared by	Y. Ando	Checked by	e. NISHIHUEA
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The axial force by pile head moment of each pile (Ni) is calculated as follows.

References/ Notes

 $N_1' = (-1) \times (4,737.29 + 4,516.20) / 5.00 = -1,850.70 \text{ kN} \cdot \text{m}$

$$N_2' = (4,737.29 + 4,516.20) / 5.00 = 1,850.70 \text{ kN} \cdot \text{m}$$

The axial force (Ni), which acts on pile head of each pile, is shown below.

	Pile 1	Pile 2
Deadweight + Surcharge ^{**1}	1,152.00	1,152.00
Ni	-1,850.70	1,850.70
Total (Ni)	-698.70	3,002.70

X1: It computes in static analysis.

c - 1) Calculation of Fully Plastic State Moment (Mp)

(i) Calculation of " α (=N/N₀)"

No.	N (kN)	N ₀ (kN)	α (=N/N ₀)
Pile 1 - 1	-698.70	13,958.33	-0.0500561
Pile 1 – 2	-698.70	13,958.33	-0.0500561
Pile 2 - 1	3,002.70	13,958.33	0.2151189
Pile 2-2	3,002.70	13,958.33	0.2151189

(ii) Calculation of fully plastic state moment (Mp)

No.	M _{p0} (kN⋅m)	M _p (kN⋅m)	Mi (kN⋅m)
Pile 1 - 1	4,820.97	4,806.08	> 4,737.29
Pile 1 - 2	4,820.97	4,806.08	> 4,737.29
Pile 2-1	4,820.97	4,548.35	> 4,516.20
Pile 2 - 2	4,820.97	4,548.35	> 4,516.20

m d-1) Calculation of the Horizontal Force (Py) Corresponding to the Elastic Limit

No.	L _i (m)	M _{pi} (kN·m)	H _i (kN)
Pile 1 – 1	16.71	4,806.08	575.23
Pile 1 – 2	16.71	4,806.08	575.23
Pile 2 - 1	15.44	4,548.35	589.16
Pile 2 - 2	15.44	4,548.35	589.16
	P _{uall} =		2,328.78

· Calculation of the horizontal force (Py) corresponding to the elastic limit

$$P_y = 0.82 P_{uali} = 0.82 \times 2,328.78 = 1,909.60 \text{ kN}$$

Prepared by	Y. Ando	Checked by	e. NISHIHURA
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		٠.	References/ Notes

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.

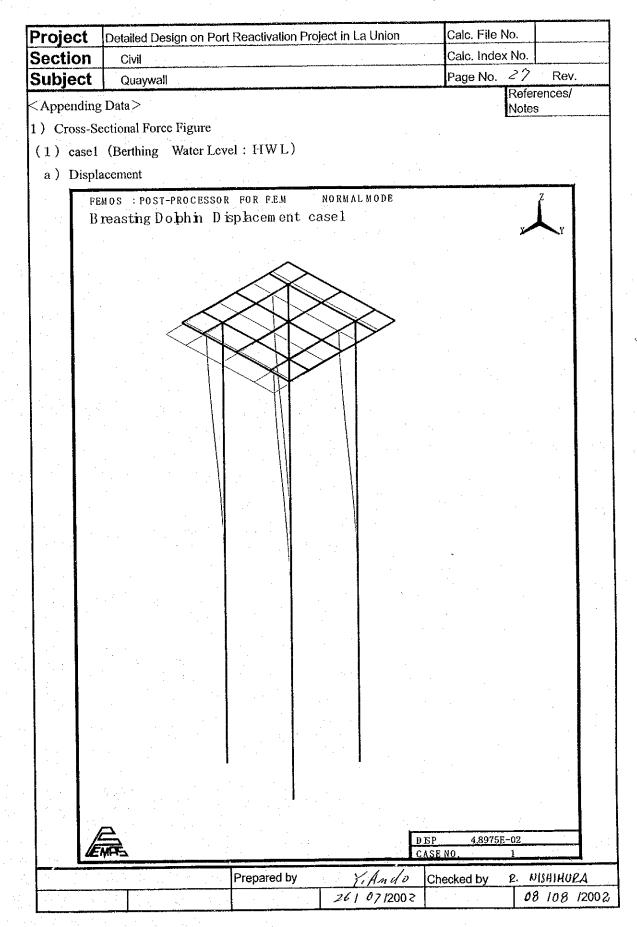
· Calculation of the Load Carrying Capacity of the Pile Supported Section during an Earthquake(Ra) of Breasting Dolphin

$$R_a = \sqrt{(2 \mu_a - 1)} \times P_y = \sqrt{(2 \times 1.3 - 1)} \times 1,909.60 = 2,415.47 \text{ kN}$$

· Earthquake force of using for examination of load carrying capacity

$$k_hW=0.50\times4,608.00=2,304.00\ kN \le Ra$$
 O.K

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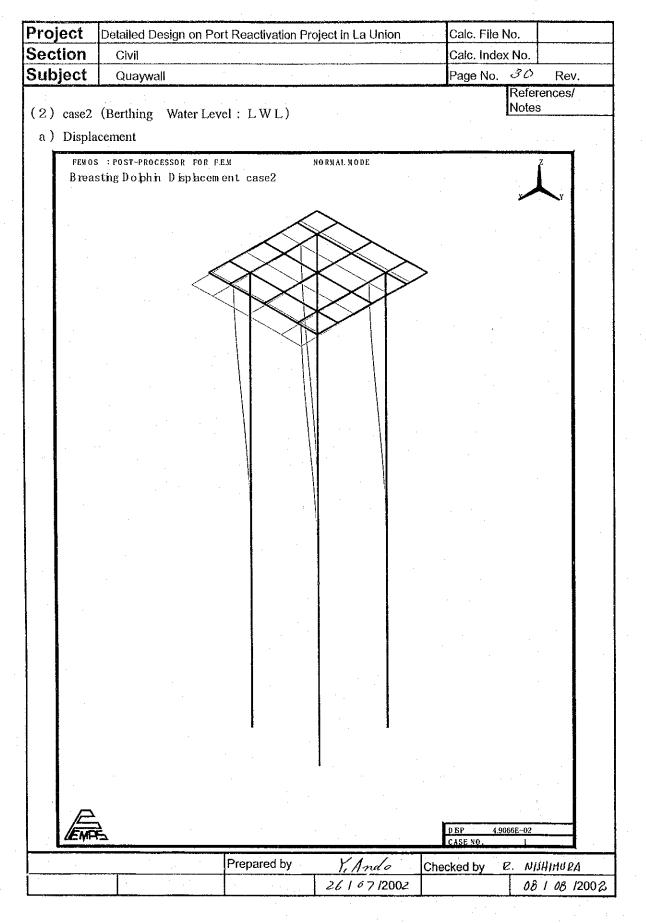
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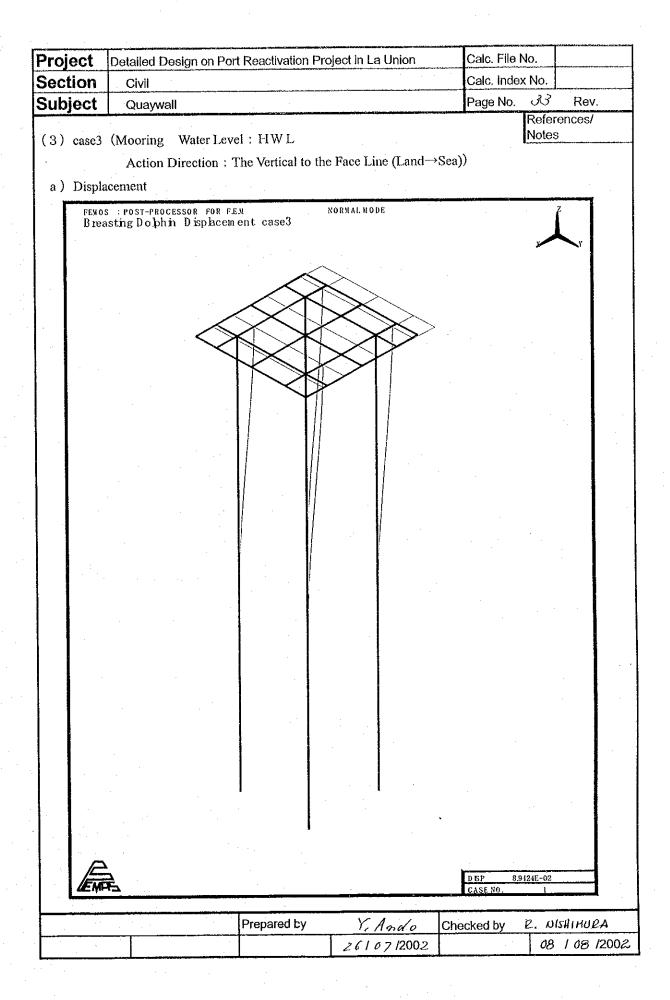
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			107E+021.39D5E40-1.3905E		
ļ		-49148E-0249	448E+02-1.3939E+0-1.3939E	+03	
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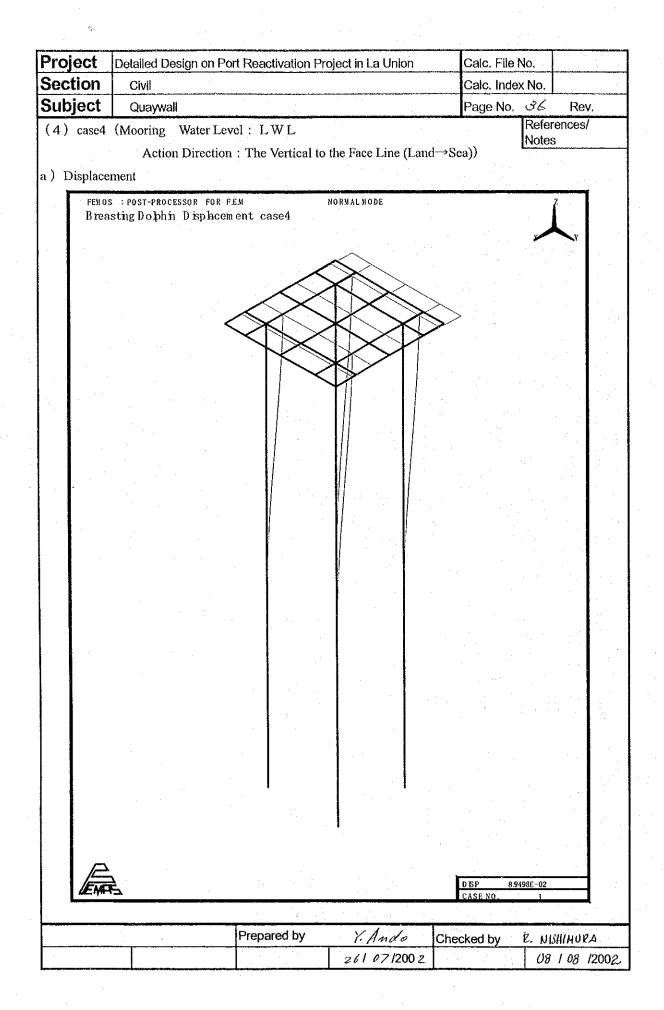
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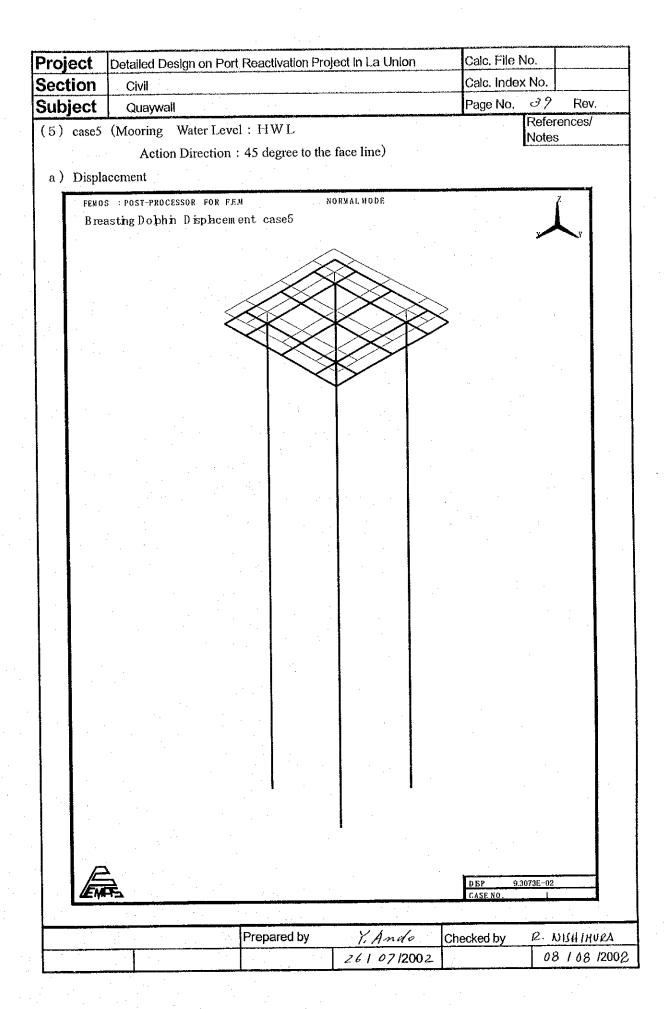
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Project	Detailed Design on Po	ort Reactivation Proie	ct in La Union	Calc. File No.	
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	ng Moment			Refe Note	rences/
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		-8.5816E+0 -8.5816E+01 1.8866	E+0 1.8866E+02		
		3.2011E+043.2011E+02 4.5436	E+0 4,5436E+02		
	•	.5441E+01-1.5441E+02 -12006	E+0 42006E+02		
		-⊋8871E+01-78871E+02 -9 5359	E+8-9-5459E+03		
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Section	Cìvil			Calc. Index No.	
Subject	Quaywall			Page No. <i>38</i>	
c) Axial	Force			Ref Note	erences/ es
	: POST-PROCESSOR FOR F sting Force AxialForce		NORNAL MODE		7 x
		-2.1480E+03-2.1480E+03 -			
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		-2.1907E±03+2.1907E+03 -2.1925E±03+2.1925E+03 -2.1949E+0+2.1949E+03	. III		
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		-2.2358E+0+2.2358E+03 -2.2392E+0+2.2392E+03	11		
		-2.2426E+0+2.2426E+03			
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EMP	5			AXBL FORCE -2.246 AXBL-FORCE -2.246	
				CASE NO. 1	
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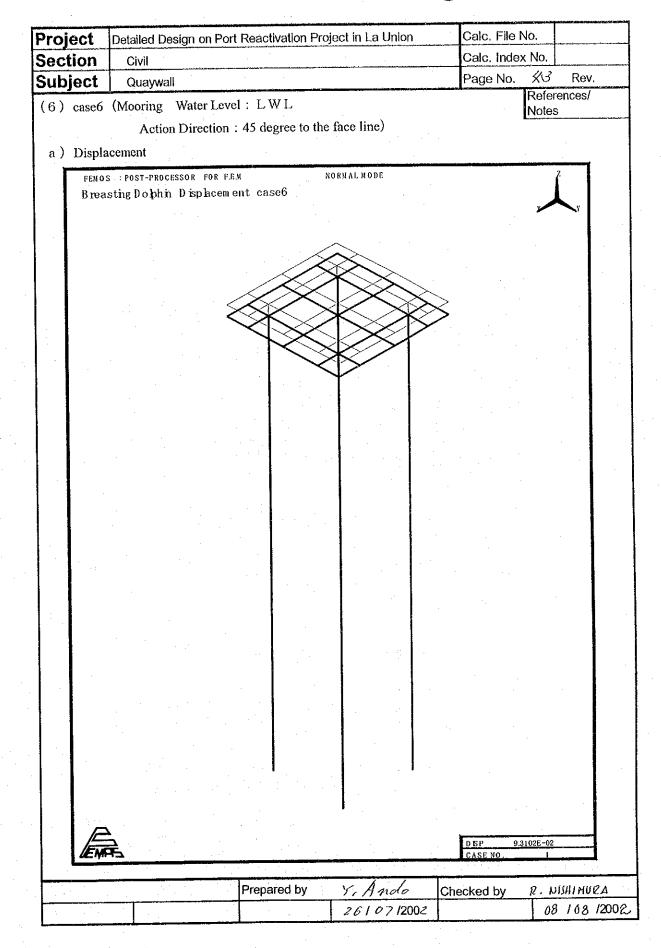


Project Detailed Desi	gn on Port Reactivation Project in La Union	Calc. File No.	
Section Civil		Calc. Index No.	
Subject Quaywall		Page No. 🛠 🗸	Re
b) Bending Moment for Y	-Axis		rences
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FEMOS : POST-PROC			Z
Breasting Dolphin	Bending Moment for Y-Axis case5		У
	1.3919E+03 1.3032E+03 1.5124E+03 1.4146E+03 1.306f6-02 1.2230 1-03 1.415 E-03 1.3237E+03		
	1,1356 +03 1,0625E 03 1,2217 +03 1,1418E+03		
	7.9389E 027.4154E+02-8.3401E 027.7793E+02		
	5,2302E+ p2 5,8106E+0 1 5 ,4018E+ p2 5,9601E+02		•
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	-2.8127E+012.6010E+02 12.5252E+012.3217E+02		
	-6.0475E+0 -6.0866E+01 -1.3515E+0 1.3167E+02 2.3135E+0 2.2135E+02 -8.2898E+0 -8.1359E+02		
	-0222E+0 -8183E+02 -42281E+0 -9551E+02		
	-7309E+0 -4231E+02 -27821E40 -588E402		
	-2 397E+0-7 D279E+02 - 357E+0 - 107E+02		
	-2.307E+0-7.4587E+02 -0.4815E+0-8.4697E+02 -0.4005E+0-8.4562E+02		
	0.2513E+0 <mark>-8-2</mark> 54E+02 <mark>-0.1</mark> 458E+0 -8-2 215E+02		
	\$.176E+0 \$.589E+02 \$.1860E+0 7.138E+02		
	-7.1613E+0-6.386E+02 -6.8711E+0-6.1727E+02		
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	-1.5835E+0 -3181E+020779E+08392E+02		
	■.2985E+0 ■ 8.1067E+02 ■ 2.8516E+0 ■ 2.6837E+02		
	2.1785£+0 2.0510E+02 1.8090E+0 1.7015E+02		
	1.2388E+0 1.1655E+02 9.5312E+0 8.9550E+01 4.6661E+0 4.3799E+01 -2.6383E+0 -2.4654E+01		
	4.6683E+01 E.5869E+01 2.9143E+012.7611E+01		
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	3.9108E+01 3.6836E+01 3.4109E+01 3.2103E+01		
	-2.7556E+0-2.5922E+01 -2.0880E+0-1.9613E+01		
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Section Subject	Civil Quaywall			Calc. Inde	κ No.	
Subject	Quaywall					
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) Bending	Moment for X-Axis				11000	
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		-1.6713E+0-1.6704E+01	-2.7658E+0-2.7657E+01			
		-4.8966E+0-4.8977E+01	5.2324E+0-5.2319E+01			
		-6.0095E+0-6.0115E+01	-5.8659E+0-5.8652E+01			
		-5.8440E+0-5.8463E+01	-5.4178E+0-5.4171E+01			
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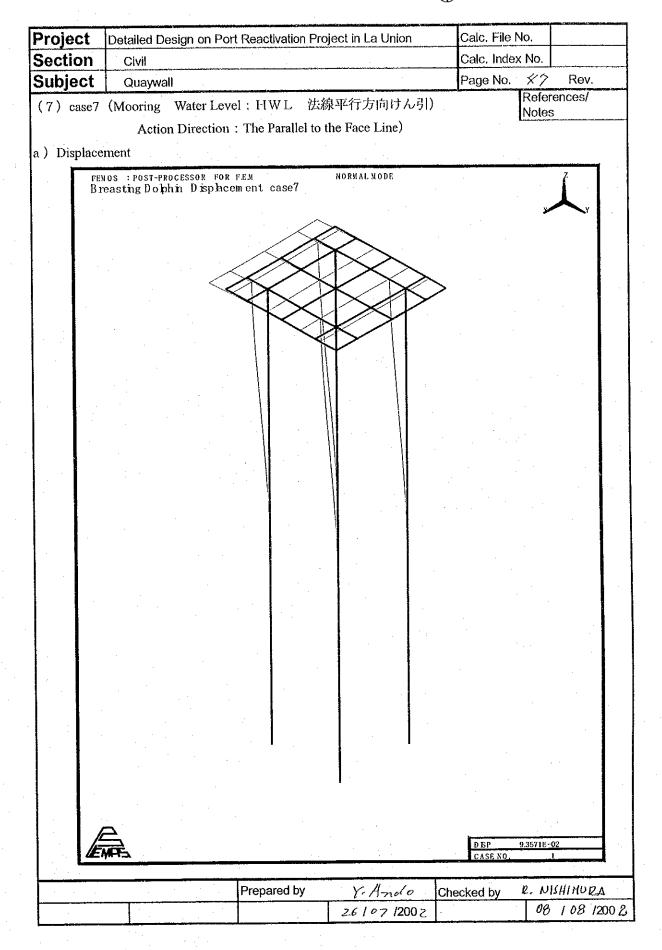
Project	Detailed Design on Port Reactivation Project in La Union	Calc. File	No.	
Section	Civil	Calc. Inde	x No.	
Subject	Quaywall	Page No.	∜ ≥	Rev.
) Axial Fo	rce		Refere Notes	ences/
	nos : post-processor for fem normal mode reasting Dobhin AxialForce case5			x
	-9.3120E+022.3389E+03 4.7646E+02 -9.3199E+02 -9.3376E+02.33415E+0-7390E+02-9.345E+02 -9.3717E+02.3449E+01-7019E+02-9.3797E+02			
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	-9,61,05E+0-2,3688E+03-4,661E+02-9,6185E+02 -9,64,46E+0-2,3732E+03-4,4319E+92-9,6526E+02			
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Project	Detailed Design on Po	rt Reactivation Pr	oject in La Union	Calc. File	No.	
Section	Civil			Calc. Inde	x No.	
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	Moment for Y-Axis				References/ Notes	
1 5	s : Post-Processor for a	1.3920E+03 1.3033E+03 1.306(E+031.2231L+03 1.13571+021.0626E+03 2.6482E+021.0209E+03 7.9394E+0217.4160E+43 1.2306E+025.8111E+04 2.8130E+042.6013E+02 6.0456E+0-6.0847E+0	NORMAL WODE 1.5124E+03 1.4146E+03 1.415 E-02 1.3236E+03 1.2210F-02 1.1417E+03 1.0278F-02 9.5979E+02 8.3396E 027.7788E+02 1.4014E+02 5.9596E+02 1.2.5249E+012.3214E+02 1.1.3516E+0 1.3169E+02 12.8.2899E+0 8.1360E+02		y Lx	
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		1.2389E+0 1.1655E+0 4.6663E+0 4.3801E+0 1.6683E+011.5869E+0 1.8887E+011.6182E+0 5.9999E+015.6618E+0	9.5309E+0 -8.9547E+01 1			
EM	Ē.	3.9109E+01 3.6837E+0 -2.7557E+01-2.5923E+0	1 3.4108E+01 3.2103E+01 01 -2.0880E+0 -1.9613E+01	MOMENT X MOMENT-3 CASE NO.	Y 1.5124E+03 1.5124E+03 1	
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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. 📈 Rev.
	Moment for X-Axis	References/ Notes
FENOS	### POST-PROCESSOR FOR F.E.M	Notes
EM	\$3036E+02 P8055E+02 \$46897E+02 P6894E+02 \$1819E+02 X1832E+02 \$17054E+02 X7052E+02 \$2407E+02 \$2416E+02 \$19760E+01 \$1.6729E+01 \$1.6774E+01 \$1.6774E+01 \$1.6774E+01 \$1.6704E+01 \$1.6806E+0 \$1.6804E+0 \$1.6804E+01 \$1.6804E+0 \$1.6804E+01 \$1.6	MOMENT X2 -1.419E+03 MOMENT-2 -1.419E+03 CASE NO.
	Prepared by Y, Ando C	hecked by P. NISHIMUPA
	261 07 1200 Z	hecked by E. NISHIMUPA 08 / 08 / 2002
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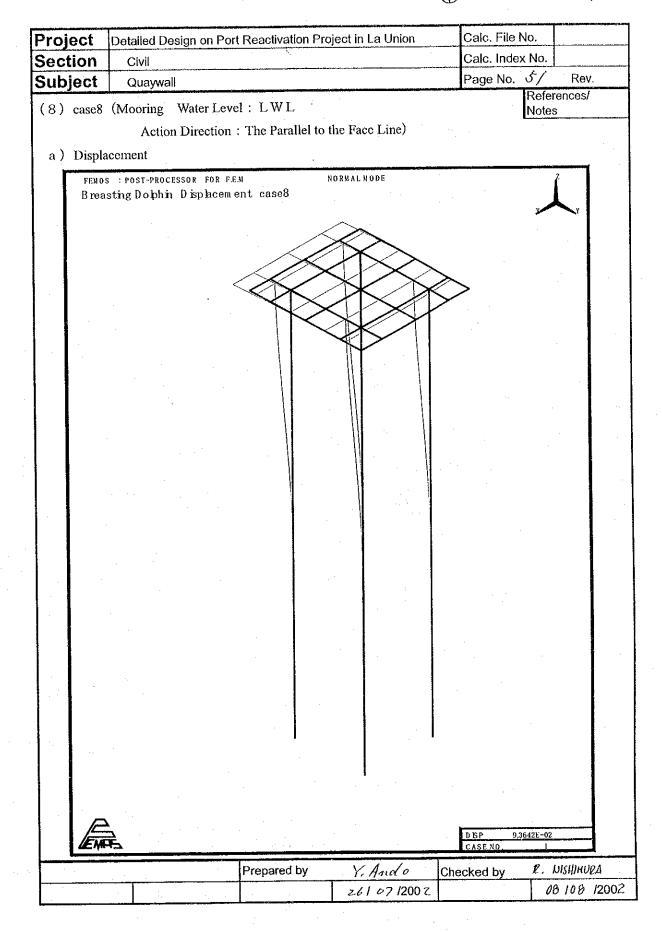
Project i	Detailed Design on Port Reactiv	ation Project in La Union	Calc. File No.	
Section	Civil		Calc. Index No.	
Subject	Quaywall		Page No. X6	Rev.
c) Axial Ford	e		Referen Notes	ces/
ł li	: POST-PROCESSOR FOR F.E.M ting Dolphin AxialForce case6	NORMAL MODE	Z.	_x_
	-1.1526E+03-2	.5604E+03 2.5502E+02-1.1534E+03	÷	
	1 1 1	2.5632F.+03		
		2.5697E+03		
		2.5783E+03 .3711E+02-1:1713E+03		
	t-17746+0	2:585\E+03 ::3028E+02 -t:1782E+03		
		2.5902E+03 : .2517E+02+1.1833E+03 2.593EE+03 : .2175E+02-1.1867E+03		
	1.18935+0	2.5970E+03 : .1848E+02+1-1900E+03 2.6005E+03 : .1493E+03 = 1-1935E+03		
	-1.1954E+0 -1.1971E+0	2.603 E+03		·
		2.6107E+03		
		2.617 5E+03		
	-1.2200640	2.6243E+03		
	-1.22686+0	2.6345E+03		
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EMP.			AXBL FORCE -2.658E+03 AXBL-FORCE -2.658E+03 CASE NO. 1	
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Project	Detailed Design on Po	t Reactivation Pro	oject in La Union	Calc. File No.	
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Subject	Quaywall			Page No ≰∂	
b) Bending	Moment for Y-Axis			Ref Not	erences/ es
	: POST-PROCESSOR FOR F. sting Dolphin Bending M		NORNAL MODE		x x
	T	5,9362E+01 5.87 E+0	1 6.8825E+01 -6.9454E+01 1 3.4628E+01		
		3.7236E+01-3.4791E-0	1-1.7838E+01-4.8 <mark>7</mark> 26E+01 1-3.9443E+01-24.875E+01		
		\	1-3.1048E+01 -51424E+01 -1.4258E+01 -1.4521E+01		
		1 1	1 -2.5321E+0 2.3815E+00 1.0927E+41.0833E+01		
		.4393E+01.4444E+01 -4.1769E 02.1763E+01 -2.0144E-02.9082E+01	-2.7985F-03.79586481		
		20144F-02:9082E+01 2422F03:3328E+01 2424F-03:5127E+01 24255-403:7116E+01 2566-403:4485E+01	-3-10151-403.7132E+01		
		-209601-402.9829E+01 -24424E-02.4311E+01 -48810E-01.8719E+01	28115E-02.8220E+01		
		1.3601E+P1.3531E+01 9.0405E+68.9911E+00	1.1849E++ 1.1904E+01 7.5811E+67.6191E+00		
		5.1994E+0 5.1677E+00 -2.0322E+0 2.0157E+00 5.7372E-01 -5.7726E-0			
		2.3948E+00 -2.3871E+0	0 2.1861E+00 2.1901E+00 0 2.4912E+00 2.4980E+00 0 2.3237E+00 2.3312E+00		
		1.6102E+00-1.5021E+0	0 1.9163E+00 -1.9234E+00 0 1.4147E+00 -1.4211E+00 1 -8.9299E-0 8.9840E-01		
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Section Civil Calc. Index No. Subject Quaywall Page No. ★9 Rev. References/ Notes	Project	Detailed Design on Port Rea	activation Project in La Union	Calc, File No.	
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Beuding Moment for X-Axis	Subject	Quaywall		Page No. ⊀9	Rev.
Breasting Dolphin Bending Moment for X – Axis case?				Refe	
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1.50 1.	Bre	asting Dolphin Bending Mom	ent for X-Axis case7		<u> </u>
1.50 1.		•	107000100 107000102 000000102-200020402		 -
1.500 teach 1,6000 cas 1 1,610 teach 1,61930+03 1.1505 teach 1,3571 teach 1,350 teach 1,35140+03 1.1205 teach 1,1555 teach 1,1005 teach 1,35140+03 8.82777 teach 1,1555 teach 1,1005 teach 1,35140+03 8.82777 teach 1,1555 teach 1,1005 teach 1,35140+02 8.82777 teach 1,1555 teach 1,1005 teach 1,35140+02 4.55562 teach 8,51196+03 4.55562 teach 8,51196+03 4.55562 teach 8,51196+03 4.55562 teach 1,551406+03 4.55562 teach 1,551406 4.55662 teach 1,51406 4.5566				•	
1.12(5 per 1.125 per 1.103) per 1.103 per 1.03 per 1.03 - 8.82772 per 8.316 per 1.2 \$4.500 per 8.45500 per 1.2 \$4.500 per 1.2		_	1 1 1 1 1 1		
			-1.366-6-10-1.3674L-031.360-6-10-1.3614E+03		1
-3.98596-1-3.99876-101-3.29488-1-3.29756-102 -3.565826-101-8.5196-101 -3.565826-101-8.5196-101 -3.98596-1-3.99876-102-3.29488-1-3.29756-102 -3.98596-102-3.27566-102 -3.98596-102-3.27566-102 -3.98596-102-3.27566-102 -3.98596-102-3.27566-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-102-3.1418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.28596-103 -3.98596-103-3.98596-103 -3		<u> </u>	-1,1249\$-0-1,12535-02-1,1031\$-0-1,1035E+03		
-3.98596-1-3.99876-101-3.29488-1-3.29756-102 -3.565826-101-8.5196-101 -3.565826-101-8.5196-101 -3.98596-1-3.99876-102-3.29488-1-3.29756-102 -3.98596-102-3.27566-102 -3.98596-102-3.27566-102 -3.98596-102-3.27566-102 -3.98596-102-3.27566-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-103 -3.98596-102-3.2418-102-3.1418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-102-3.2418-103-3.2418-102 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.2418-103-3.2418-103 -3.98596-103-3.28596-103 -3.98596-103-3.98596-103 -3		Į.			
SSSSE+01 SI196+01 SSC3E+02 SSCSE+02 SSCSE+03			1 11 11 11		. 1
27676-102			-3.9859E+0: 3.9887E+02-3.2948E+0: 3.2975E+02		
27676-102			V		
			8.5582E+01 8.5419E+01		
### ### ### ### ### ### ### ### ### ##			2767E+0212756E+02 41408E+0241399E+02		
1396:103 1496:103 1396:104 139			\$976E+02 \$970E+02 7.1194E+027.1191E+02		
######################################			2.4184E+02 2.4184E+02 2.5017E+02 2.5019E+02		
2015 E + 03 2025 E					
298-03			1613E+031-1614E+03 1.2855E+031-2656E+031-2553E+031-2555E+03	•	
29E+03 + 0 30E+03 + 125E+02 + 1737E+02 + 107E+02 + 114E+02 + 114E+			1.21 6E+03 1.21 7E+03 1.22 7E+03 1.22 8E+03		
### ### ##############################			-2109E+03 -2111E+03 -0(31E+03 -0(32E+03	•	
######################################			A 29E+03 LO 30E+03 D.1 25E+02 D.1 37E+02		
### 13730E+02 ### 13737E+02 ### 13033E+02 ### 13033E+01 ### 13033E+02 ### 13033E+02 ### 13033E+02 ### 13033E+02 ### 13033E+02 ### 13033E+02 ### 13033E+02 ### 13033E+02 ### 13033E+01 ##		•	2.4566E+02 2.4576E+02 7.711E+027.720E+02		
10864E+02 0868E+02			=_935E+02==943E+02 ==4407E+02==4414E+02		
7.551E+02	1.	•	4.5730E+02.45737E+02.28033E+02.28038E+02		
3.6109E+01 3.6125E+01 3.4954E+01 3.4956E+01 -2.3631E+0 -2.3628E+01 3.9114E+0 3.9113E+01 -6.9254E+0 -6.9258E+01 7.3991E+0 7.3996E+01 -8.4997E+0 -8.5004E+01 -8.2957E+0 -8.2955E+01 -8.2658E+0 -8.2667E+01 7.6610E+0 7.6618E+01 -7.0924E+0 -7.0932E+01 -6.2554E+0 -6.2561E+01 -5.5404E+0 -5.5412E+01 -4.5503E+01 1.9040E+01 3.9047E+01 2.7799E+01 2.7805E+01 1.9040E+01 3.9047E+01 2.7799E+01 2.7805E+01 NOMENT			4114E+02 4119E+02		
-2.3631E+0 -2.3628E+01	·		.7551E+02		
-6.9254E+0-6.9258E+01 -7.3991E+0-7.3996E+01 -8.4997E+0-8.5004E+01 -8.2955E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -6.2554E+0-6.2561E+01 -5.5404E+0-5.5412E+01 -4.5496E+0-4.5503E+01 -8.9040E+018.9047E+01 -8.7799E+012.7805E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -6.2554E+0-6.2561E+01 -8.2658E+0-8.2667E+01 -6.2554E+0-6.2561E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -6.2554E+0-6.2561E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -6.2554E+0-6.2561E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -6.2554E+0-6.2561E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -6.2554E+0-6.2561E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -6.2564E+0-6.2561E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-8.2561E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-8.2561E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-8.2561E+01 -8.2658E+0-8.2667E+01 -7.6610E+0-8.2561E+01 -8.2658E+0-8.2667E+01 -7.6618E+01 -8.2658E+0-8.2667E+01			5.6109E+01 5.6125E+01	•	
8.4997E+0-8.5004E+01 -8.2947E+0-8.2955E+01 8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -6.2561E+01 -5.5404E+0-5.5412E+01 -4.5496E+0-4.5503E+01 3.9040E+018.9047E+01 2.7799E+012.7805E+01 MOMENT XZ -2.006E+03 MOMENT-2 -2.006E+03 CASE NO. 1 Prepared by Y, Ando Checked by R. WISHIMURA			-2.3631E+0 -2.3628E+01 -3.9114E+0 -3.9113E+01		
8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01 -7.0924E+0-7.0932E+01 -6.2554E+0-6.2561E+01 -5.5404E+0-5.5412E+01 -4.5496E+0-4.5503E+01 3.9040E+018.9047E+01 2.7799E+012.7805E+01 MOMENT X2 -2.006E+03 MOMENT-2 -2.006E+03 CASE NO. 1 Prepared by Y, Ando Checked by R. WISHIMURA			-6.9254E+6-6.9258E+01 -7.3991E+0-7.3996E±01		
-7.0924E+0-7.0932E+01 -6.2554E+0-6.2561E+01 -5.5404E+0-5.5412E+01 -4.5406E+0-4.5503E+01 8.9040E+01 8.9047E+01 2.7799E+012.7805E+01 МОМЕНТ XZ -2.006E+03 момент-2 -2.006E+03 саse no. 1 Prepared by Y, Ando Checked by R. WISHIMURA			-8.4997E+0-8.5004E+01 -8.2947E+0-8.2955E+01		1.
### A.5404E+0-5.5412E+01			-8.2658E+0-8.2667E+01 -7.6610E+0-7.6618E+01		1
3.9040E+01 8.9047E+01 2.7799E+012.7805E+01 MOMENT X2 -2.006E+03 MOMENT-2 -2.006E+03 CASE NO. 1 Prepared by Υ, Ando Checked by β. ΝΙSΗ[ΜυθΔ			-7.0924E+0-7.0932E+01 -6.2554E+0-6.2561E+01		•
MONENT X2 -2.006E+03 MONENT-2 -2.006E+03 CASE NO. 1			-5.5404E+0-5.5412E+01 -4.5496E+0-4.5503E+01		
Prepared by Y, Ando Checked by R. WISHIMURA			B.9040E+01B.9047E+01 2.7799E+012.7805E+01		
Prepared by Y, Ando Checked by R. WISHIMURA			•	•	
Prepared by Y, Ando Checked by R. WISHIMURA		-		Unurur va co	065103
Prepared by Y, Ando Checked by R. WISHIMURA		‡		MOMENT-2 -2.00	
	LE!	#-12		CASE NO.	1
		Pre	pared by Y Anda C	necked by 12 /	VISHIHDD V

Project De	etailed Design on Port	Reactivation Pro	oject in La Union	Calc, File No.		
Section	Civil		-	Calc. Inde	x No.	
Subject	Quaywall			Page No.	50 Rev.	
c) Axial Force					References/ Notes	
*	post-processor for f.e. ng Dobhin AxialForc		NORNAL MODE		<u>x</u> x	
		5,1438E+01-1,9291E	+03 6.4516E+01 -1.9273E+03 +03 5.1957E+01 -1.929DE+03 +03 5.8546E+01 -1.9338E+03			
		5,1203F+01-1,9396E	+03 5.5133E+01 +4.9367E+03 +03 5.1721E+01 +1.9401E+03			
			+03			
		3,073 0E+01 -1,960 1E	+03			
		2.3906E+01-1.9669E 2.1210E+01-1.9696E 1.9504E+01-1.9713E	+03 2.79/2E+01-L-963bE+03 +03 2.442HE+01-1-965EE+03 +03 2.442HE+01-1-967BE+03 +03 2.1012E+01-1-970BE+03 +03			
		1.3669E±01=1.9772E	+03			
		3.4333 E+00-1.987 4E	+03 7.36 (2E+00 -1.984 5E+03 +03 3.9522E+00 -1.987 9E+03 +03 5.40 1E-01 -1.9913E+03			
		-6.80 29£+0 ►1.9976E	+03 -2.87 19E+0+1.994 7E+03 +03 -6.284 0E+0+1.998 1E+03 +03 -9.696 0E+0+2.001 6E+03			
		-1.7C39 <u>6</u> +0-2.0079E	+03 -1.3108E+0 -2.0050E+03 +03 -1.6520E+0 -2.0084E+03 +03 -1.9532E+0=2.0148E+03			
		-2.3863E+0-2.0147E -2.7275E+0-2.018 E	+03 -2.3344E+0-2.0152E+03 +03 -2.6356E+0 -2.0186E+03			
		-3.4d99E+0 -2.0240E	+03 -3.0168E+0-2.0220E+03 +03 -3.3580E+0-2.0254E+03 03 -3.3580E+01 2.0254E+03	4		
EMPS				AXML FORCE AXML-FORCE CASE NO.	-2.025£+03 -2.025E+03	
		Prepared by	Y. Ando	Checked by	R. NISHIHURA	
			2610712002		08 / 08 /2002	



Pro	ject	Detailed Design on Port F	Reactivation Pr	oject in La U	nion	Calc. File N	lo.	
Sec	tion	Civil				Calc. Index	No.	
Sub	ject	Quaywall				Page No.	<i>5</i> -2 Rev	/.
		g Moment for Y-Axis					References, Notes	
		: POST-PROCESSOR FOR F.E.M sting Dolphin Bending Mon		nornal node case8			y L x	
		3.9435E+0: 	1 - 5.1263 - 101 - 5.6168E 1 - 4.40501 - 1.7780E	+01 6.53(0E+01 +01 6.68 2E+01 +01 4.8 84E+01	·			
		2.9906E+0	1 - 3,4738E 101 - 3,9391E 1 - 2, 9425E + 91 - 3,1003E 1 - 1,4800E + 0 1 - 1,4227E	+01 -3 468E+01				
		7.0050E+1 	1.4450E+01 9327	E+0 E.3636E+00 E+0 1.0822E+01 E+0 1.9280E+01 E+0 2.7061E+01 E+0 2.7722E+01				
		-20152F# -20433F# -20258##	02.9075E+01 3.553 03.3316E+01 03.6113E+01 3.715	2.7722E+01 1-9 3.3632E+01 1-9 3.7842E+01 01 3.7146E+01				
		-2 <i>1</i> 9758 44378	92.98146+01 38102 92.42986+01 42386	18 + 0 3.3460E + 01 18 + 0 2.8233E + 01 16 + 0 2.2497E + 01 16 + 0 1.6926E + 01				
		9.0463E+ 5.2032E1	8.9852E+00 7.5765 06.1640E+00 4.0592	8E+11.1910E+01 5E+07.6236E+00 2E+04.0888E+00 1E+01.2298E+00				
		i.9150E+0 2.3957E+0	1 -5.7768E-01 1.0844F 0 -1.9100E+00 2.1856F 0 -2.3862E+00 2.4904F 0 -2.3422E+00 2.3228F	E+00 -1.0823E+00 E+00 -2.1906E+00 E+00 -2.4988E+00				
·		2.0376E+0 1.6112E+0	0 -2.0267E+00 1.9154[0 -1.6012E+00 1.4140[0 .1510E+00 -8.9234	E+00-1.9242E+00 E+00-1.4218E+00	. * •			
	ENT		 			MOMENT XY MOMENT-3 CASE NO.	-6.953E+01 -6.953E+01 -1	
-		P	repared by	Y. An	10 0	hecked by	, guninira	<u> </u>
				26107		neckeu by <u>k</u>	08 1 08	

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. <i>ර</i> ぴ	Rev.
	Moment for X-Axis	Refe Note	rences/ s
	os : post-processor for f.e.n normal wode easting Dolphin Bending Moment for X-Axis case8	,	<u>y</u> x
	-1.9721E+03 -1.9729E+03 -2.0055E+03 -2.0063E+03 -1.85 0E+04 1.851 0E+02 -1.873EE+04 1.8773E+03 -1.6050E+04 1.6096E+03 -1.6187E+04 1.6194E+03 -1.3668E+04 1.367514-03 -1.3604E+04 1.3615E+03 -1.1248E+04 1.1253E+03 -1.1030E+04 1.1035E+03 -8.8272E+04 8.8319E+12 -8.451611-05 8.4563E+02 -3.9856E+04 3.9890E+03 -3.2945E+12 3.2978E+02		
	\$.5601E+01 \$.5399E+01		
	1.413E+03 1.414E+03 1.25E3E+03 1.25E5E+03 1.25E5E+03 1.25E5E+03 1.25E3E+03 1.25E5E+03 1.25E3E+03 1.25E3E3E+03 1.25E3E3E3E3E3E3E3E3E3E3E3E3E3E3E3E3E3E3E3		
	3.6107E+01 3.6127E+01 3.4952E+01 8.4968E+01 -2.3632E+0+2.3627E+01 -3.9115E+0-3.9113E+01 -6.9254E+0-6.9258E+01 -7.3991E+0 -7.3996E+01 -8.4997E+0-8.5005E+01 -8.2947E+0-8.2956E+01		
	-8.2657E+0 8.2668E+01 -7.6609E+0 -7.6619E+01 -7.0923E+0 -7.0933E+01 -6.2553E+0 -6.2562E+01 -5.6403E+0 -5.5413E+01 -4.5495E+0 -4.5504E+01 3.9039E+01 3.9048E+01 2.7798E+01 2.7805E+01		
Æ			06E+03 1
	Prepared by Y, Ando Che		SHIHURA
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Proj	ect	Detailed Design	on Port	Reactivation Pro	oject in La Union	Calc, File	No.	
Sect	tion	Civil				Calc. Inde	x No.	
Subj	ject	Quaywall				Page No.	グ ∦ Re	٧.
c) /	Axial Fo	orce					References Notes	:/
		: POST-PROCESSOR sting Dolphin Ax			NORMAL MODE		<u>,</u>	
					3 -1.5692E+02-2.1488E+03 3 -1.5948E+0-2-4548E+03			
		•		-1.63 116+0+2.15 42£+0	3 -1,6289£+02-2-1548E+03		•	
				-1.6683 <u>E+0+2-15</u> 76E+0	3-1,6631 E+01-2 ,1582E+03			
			·. ·	-1.70246±0±2.1611E+0	3 -1,69726+0 - 2-16166+03			
				-1.7536E+0+2:1662E+0	3 -1.7484E+0+2.1667E+03			
				1,82 18E+ 0; 2,173 0E+0	3-1.8166E+0 : 2:1735E+03			
					3 - 1.8678E+0 - 2:1785E+03			
		•			3 1.9019E+0+2-1820E+03		100	
					3 -1.9347E+0+2.1858E+03			
					3 1.97 .525 ±0.2.1830E±83			
				2.0104E+0+2.1911E+0	3 -2,00136+0+2,1923E+03 3 3 -2,0384E+0+2,1957E+03			
			. : .		3 - 2.0725E+0 -2.1991E+03			
					33 +2,1066E+0 +2,2025E+03			
					03 -2.1408E+0 -2.2059E+03			
	100				03 - 2.1749E+0 =2.2093E+03			
					03 2.2090E+0 >2.2133E+03	*		
					03 - 2.2431E+0+2.2162E+03			
		•		2.28246+0+2-3191E+0	03 - 2.27 72E+0 -2.219 5E+03			
				2.3166£+0+2.2225E+6	03 - 2.31 <mark>14E+0 - 2.22</mark> 30E+03		•	
				-2.35 07£+ 0 >3.225 9E+0	03		•	
			:	2.3848E+0 >2.2298E+0	03 2.3796E+0 >2.2298E+03			
				2.4189E+0-2.2327E+0	03 2.4137£+022.2332£+03			
				2.4530E+0+2.2361E+0	03 - 2,4 478E+0 +2.236 EE+03		•	
	İ			2.4872E+0+2.2395E+4	03 - 2,4820E+0 -2.240 E+03			
				2.52 13E+0+ 3.2429E+I	03 - 2.51616+0 - 2.2435E+03	•		
				2.5554E+0>2.2464E+	03 -2.5502E+0 +2.2469E+03			
				2.5554E+02 2.2464E+03	3 2.5502E+02 2.2469E+03			
	EMP	7				AXML FORCE AXML-FORCE CASE NO.	-2.247E+03 -2.247E+03	1
				Prepared by	Y. Ando	Checked by	R. NISHIMU	DD A
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