NIPPON KOEI CO.,LTD.

DESIGN CALCULATION COVER SHEET

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

Subject: **Container and Multi-purpose Berth**

Calculation Objective:

Reinforcement of coping

References, Calculation Notes and Comments

Refer to Drawings **QW-01-040～QW-01-055**

Calculation based on

TECHNICAL STANDERDS AND COMMENTARIES

FOR

PORT AND HARBOUR FACILITIES IN JAPAN

Design Load

Crane Foundation Part **Container Crane Lode (Refer Design Condition)**

Yutirity Tonnel Part **Container Berth**

100t TypeTruck crane outrigger 900kN

Multi-purpose Berth

35t Type Fork Rift Wheel 440kN

Rev	Prepared by	Prepared Date	No. of Pages	Checked by	Checked Date	Reviewed by	Reviewed Date	Superseded by Calc No.
0		26/07/02	30		26 July 02		26/08/02	
A								
B								
C								

File in Calc. File

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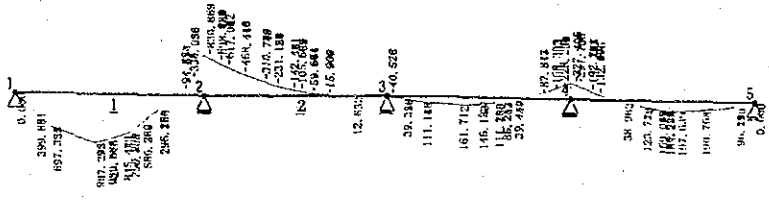
References/ Notes

Figure of Bending Moment



+M (i ——— j) +M

No of Member 1 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	0.000	830.961	0.000	0.000
1	0.500	399.881	768.561	0.000	0.010
2	0.900	697.321	718.641	0.000	0.016
3	0.900	697.355	341.329	0.000	0.016
4	2.000	997.292	204.061	0.000	0.026
5	2.000	997.275	-173.251	0.000	0.026
6	2.300	939.705	-210.679	0.000	0.027
7	2.300	939.683	-210.691	0.000	0.027
8	2.350	929.015	-216.919	0.000	0.027
9	2.700	845.449	-260.599	0.000	0.025
10	2.700	845.423	-260.611	0.000	0.025
11	2.900	790.833	-285.559	0.000	0.023
12	2.900	790.766	-662.871	0.000	0.023
13	3.200	586.360	-700.299	0.000	0.020
14	3.200	586.289	-700.311	0.000	0.020
15	3.600	296.256	-750.219	0.000	0.015

Working Condition

		Prepared by	Y. Ando	Checked by	R. NISHIHURA
			26/07/2002		08/08/2002

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Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-468.279	859.641	0.000	0.000
1	0.400	-134.406	809.721	0.000	0.002
2	0.400	-134.325	809.709	0.000	0.002
3	0.900	254.854	747.321	0.000	0.006
4	0.900	254.892	370.009	0.000	0.006
5	1.800	537.329	257.701	0.000	0.010
6	1.800	537.317	-119.611	0.000	0.010
7	2.300	461.930	-181.999	0.000	0.010
8	2.300	461.912	-182.011	0.000	0.010
9	2.700	379.146	-231.919	0.000	0.008
10	2.700	379.123	-231.931	0.000	0.008
11	2.900	330.267	-256.879	0.000	0.007
12	2.900	330.203	-634.191	0.000	0.007
13	3.200	134.397	-671.619	0.000	0.006
14	3.200	134.329	-671.631	0.000	0.006
15	3.800	-291.038	-746.499	0.000	0.002
16	3.800	-291.152	-1123.811	0.000	0.002
17	4.100	-633.794	-1161.239	0.000	0.000
18	4.100	-633.911	-1161.251	0.000	0.000
19	4.300	-868.538	-1186.199	0.000	0.000
20	4.300	-868.657	-1186.211	0.000	0.000
j	4.600	-1230.013	-1223.639	0.000	0.000

No of Member 4 (4 - 5)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1230.013	1470.138	0.000	0.000
1	0.100	-1083.623	1457.658	0.000	0.000
2	0.100	-1083.476	1457.646	0.000	0.000
3	0.400	-651.942	1420.218	0.000	0.002
4	0.400	-651.837	1042.906	0.000	0.002
5	0.600	-445.854	1017.958	0.000	0.004
6	0.600	-445.752	1017.946	0.000	0.004
7	1.300	236.140	930.598	0.000	0.011
8	1.300	236.196	553.286	0.000	0.011
9	1.800	497.189	490.898	0.000	0.016

Working Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

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Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
20	4.300	-846.640	-1115.024	0.000	0.000
j	4.600	-1186.646	-1152.451	0.000	0.000

No of Member : 4 (4 - 5)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1186.646	1541.188	0.000	0.000
1	0.100	-1033.152	1528.708	0.000	0.000
2	0.100	-1033.035	1151.395	0.000	0.000
3	0.400	-693.345	1113.968	0.000	0.003
4	0.400	-693.233	1113.955	0.000	0.003
5	0.600	-473.048	1089.008	0.000	0.004
6	0.600	-472.938	1088.995	0.000	0.004
7	1.300	258.682	1001.648	0.000	0.012
8	1.300	258.745	624.335	0.000	0.012
9	1.800	555.255	561.948	0.000	0.017
10	1.800	555.312	561.935	0.000	0.017
11	2.200	770.051	512.028	0.000	0.020
12	2.200	770.064	134.715	0.000	0.020
13	2.350	788.856	116.008	0.000	0.021
14	2.400	794.500	109.768	0.000	0.021
15	2.400	794.511	109.755	0.000	0.021
16	2.700	821.814	72.328	0.000	0.021
17	3.300	842.747	-2.552	0.000	0.019
18	3.300	842.709	-379.865	0.000	0.019
19	4.200	450.336	-492.172	0.000	0.008
20	4.200	450.248	-869.485	0.000	0.008
j	4.700	0.000	-931.872	0.000	0.000

Working Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 / 07 / 2002		08 / 08 / 2002

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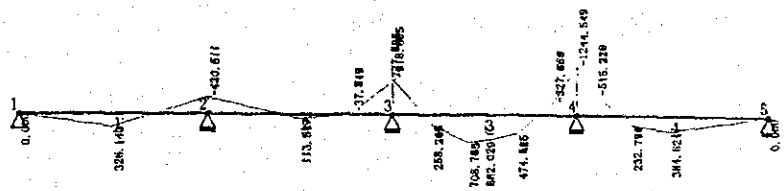
References/ Notes

Figure of Bending Moment



+M i——j +M

No of Member 1 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	0.000	369.166	0.000	0.000
1	2.350	326.143	-91.598	0.000	0.009
j	4.700	-430.511	-552.363	0.000	0.000

No of Member 2 (2 - 3)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-430.511	462.028	0.000	0.000
1	2.300	113.547	11.067	0.000	0.000
2	3.600	-37.745	-243.824	0.000	-0.001
3	3.600	-37.819	-733.844	0.000	-0.001
4	4.500	-777.595	-910.287	0.000	0.000
5	4.500	-777.737	-1400.307	0.000	0.000
j	4.600	-918.605	-1419.894	0.000	0.000

Pausing Condition

		Prepared by	Y. Ando	Checked by	R. NISHIHARA
			26/07/2002		08/08/2002

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No of Member 3 (3 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-918.605	1274.886	0.000	0.000
1	1.000	258.247	1078.816	0.000	0.008
2	1.000	258.306	588.796	0.000	0.008
3	1.900	708.773	412.353	0.000	0.014
4	1.900	708.765	-77.667	0.000	0.014
5	2.300	662.029	-156.075	0.000	0.014
6	3.100	474.426	-312.931	0.000	0.011
7	3.100	474.345	-802.951	0.000	0.011
8	4.000	-327.620	-979.394	0.000	0.003
9	4.000	-327.768	-1469.414	0.000	0.003
j	4.600	-1244.549	-1587.036	0.000	0.000

No of Member 4 (4 - 5)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1244.549	1507.477	0.000	0.000
1	0.500	-515.319	1409.442	0.000	0.001
2	0.500	-515.226	919.422	0.000	0.001
3	1.400	232.771	742.979	0.000	0.006
4	1.400	232.796	252.959	0.000	0.006
5	2.350	384.624	66.712	0.000	0.009
j	4.700	0.000	-394.052	0.000	0.000

Pausing Condition

		Prepared by	Y. Ando	Checked by	E. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

FN: Calculation_Sheet

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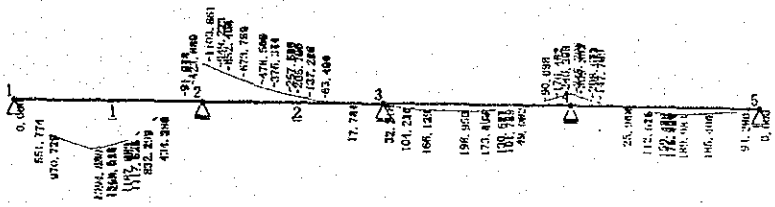
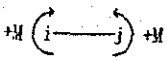
References/ Notes

Figure of Bending Moment





No of Member 1 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	0.000	1134.748	0.000	0.000
1	0.500	551.774	1072.348	0.000	0.013
2	0.900	970.729	1022.428	0.000	0.023
3	0.900	970.775	454.015	0.000	0.023
4	2.000	1394.656	316.748	0.000	0.037
5	2.000	1394.630	-251.665	0.000	0.037
6	2.300	1313.544	-289.092	0.000	0.037
7	2.300	1313.515	-289.105	0.000	0.037
8	2.350	1298.934	-295.332	0.000	0.037
9	2.700	1187.923	-339.012	0.000	0.035
10	2.700	1187.889	-339.025	0.000	0.035
11	2.900	1117.625	-363.972	0.000	0.033
12	2.900	1117.531	-932.385	0.000	0.033
13	3.200	832.297	-969.812	0.000	0.029
14	3.200	832.199	-969.825	0.000	0.029
15	3.600	434.389	-1019.732	0.000	0.022

Seismic Condition

		Prepared by	Y. Ando	Checked by	R. NISHIHORA
			26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
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Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-612.186	1161.522	0.000	0.000
1	0.400	-157.562	1111.602	0.000	0.004
2	0.400	-157.449	1111.589	0.000	0.004
3	0.900	382.639	1049.202	0.000	0.009
4	0.900	382.688	480.789	0.000	0.009
5	1.800	764.817	368.482	0.000	0.014
6	1.800	764.797	-199.931	0.000	0.014
7	2.300	649.258	-262.318	0.000	0.014
8	2.300	649.232	-262.331	0.000	0.014
9	2.700	534.347	-312.238	0.000	0.012
10	2.700	534.315	-312.251	0.000	0.012
11	2.900	469.403	-337.198	0.000	0.011
12	2.900	469.312	-905.611	0.000	0.011
13	3.200	192.108	-943.038	0.000	0.008
14	3.200	192.013	-943.051	0.000	0.008
15	3.800	-396.179	-1017.918	0.000	0.003
16	3.800	-396.339	-1586.331	0.000	0.003
17	4.100	-877.690	-1623.758	0.000	0.001
18	4.100	-877.854	-1623.771	0.000	0.001
19	4.300	-1204.938	-1648.718	0.000	0.000
20	4.300	-1205.105	-1648.731	0.000	0.000
j	4.600	-1705.169	-1686.158	0.000	0.000

No of Member 4 (4 - 5)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1705.169	2034.754	0.000	0.000
1	0.100	-1502.318	2022.274	0.000	0.000
2	0.100	-1502.114	2022.262	0.000	0.000
3	0.400	-901.252	1984.834	0.000	0.003
4	0.400	-901.109	1416.422	0.000	0.003
5	0.600	-620.461	1391.474	0.000	0.005
6	0.600	-620.320	1391.462	0.000	0.005
7	1.300	322.995	1304.114	0.000	0.015
8	1.300	323.070	735.702	0.000	0.015
9	1.800	675.252	673.314	0.000	0.021

Seismic Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

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Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
20	4.300	-1171.935	-1541.487	0.000	-0.001
j	4.600	-1639.838	-1578.915	0.000	0.000

No of Member 4 (4 - 5)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1639.838	2141.790	0.000	0.000
1	0.100	-1426.283	2129.310	0.000	0.001
2	0.100	-1426.125	1560.898	0.000	0.001
3	0.400	-963.626	1523.470	0.000	0.004
4	0.400	-963.472	1523.458	0.000	0.004
5	0.600	-661.427	1498.510	0.000	0.006
6	0.600	-661.276	1498.498	0.000	0.006
7	1.300	356.954	1411.150	0.000	0.017
8	1.300	357.039	842.738	0.000	0.017
9	1.800	762.729	780.350	0.000	0.024
10	1.800	762.807	780.338	0.000	0.024
11	2.200	1064.885	730.430	0.000	0.028
12	2.200	1064.901	162.018	0.000	0.028
13	2.350	1087.785	143.310	0.000	0.029
14	2.400	1094.795	137.070	0.000	0.029
15	2.400	1094.809	137.058	0.000	0.029
16	2.700	1130.300	99.630	0.000	0.029
17	3.300	1167.614	24.750	0.000	0.026
18	3.300	1167.559	-543.662	0.000	0.026
19	4.200	627.785	-655.970	0.000	0.011
20	4.200	627.661	-1224.382	0.000	0.011
j	4.700	0.000	-1286.770	0.000	0.000

Seismic Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

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Serviceability limit state

$$W = k_1 \times \{4C + 0.7 \times (C_\phi - \phi)\} \times (\sigma_s / Es)$$

W : crack width
k_1 : coefficient of adhesive condition of re-bar
C : cover over re-bar
C_ϕ : re-bar pitch
ϕ : re-bar diameter
σ_s : increase of re-bar stress
Es : Young's modulus of re-bar

$$Wa = 0.0035C$$

Wa : acceptable crack width
C : cover over re-bar

Ultimate limit state

1.Examination for moment

$$\varepsilon_y = f_{yk} / (\gamma_{ms} \cdot Es)$$

ε_y : yield strain of re-bar
f_{yk} : yield strength of re-bar
γ_{ms} : material modulus
Es : Young's modulus of re-bar

$$M_{nd} = Ts\,(d - 0.4X) / \gamma_b$$

M_{nd} : bearable moment
Ts : tensile strength
d : effective height
X : effective distance between neutral axis and edge
γ_b : material modulus

2.Examination for shearing force

$$V_{yd} = V_{cd} + V_{sd}$$

V_{yd} : design bearable shearing strength
V_{cd} : design bearable shearing strength without stirrup
V_{sd} : design bearable shearing strength of stirrup

$$V_{yd} = \beta_d \cdot \beta_p \cdot \beta_n \cdot f_{vcd} \cdot b \cdot d / \gamma_b$$

β_d : $(1/d)^{1/4}$
d : effective height
β_p : $(100p_w)^{1/3}$
p_w : ratio of re-bar to concrete
β_n : modulus related to moment
f_{vcd} : $0.2 \cdot (f_{cd})^{1/3}$
f_{cd} : design strength of concrete
γ_b : material modulus

	Prepared by	Y. Ando	Checked by	R. NISHIMURA
		26 / 07 / 2002		08 / 08 / 2002

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Fatigue limit state

1.Examination for moment

a) concrete

$$f_{rd} = k_1 \cdot f_d (1 - \log N / K)$$

f_{rd} : bending and tensile strength of concrete
k_1 : modulus related to strength condition
f_d : design strength of concrete
N : repeated times
K : modulus related to concrete type

b) concrete

$$f_{srd} = 190 \cdot 10^a / N^k (1 - \sigma_{sp} / f_{sd}) / \gamma_s$$

f_{srd} : design strength of re-bar
a : $0.81 - 0.003\phi$
ϕ : diameter of re-bar
N : repeated times
k : 0.12 (constant)
σ_{sp} : permanent load
f_{sd} : design tensile strength of re-bar
γ_s : material modulus

2.Examination for shearing force

$$V_{rcd} = V_{cd} \cdot (1 - \log N / 11)$$

V_{rcd} : design bearable shear strength
V_{cd} : design bearable shear strength without stirrup
N : repeated times

$$V_{cd} = \beta_d \cdot \beta_p \cdot \beta_n \cdot f_{vcd} \cdot b \cdot d / \gamma_b$$

β_d : $(1/d)^{1/4}$
d : effective height
β_p : $(100 p_w)^{1/3}$
p_w : ratio of re-bar to concrete
β_n : modulus related to moment
f_{vcd} : $0.2 \cdot (f_{cd})^{1/3}$
f_{cd} : design strength of concrete
γ_b : material modulus

	Prepared by	Y. Ando	Checked by	R. NISHIHARA
		26 / 07 /2002		08 / 08 /2002

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References/ Notes

Calculation Result of FRAME

Working	moment (upper)	moment (under)	
Max	997.292	-1230.013	kNm
①	997.292	-1230.013	kNm
②			kNm
③			kNm
④			kNm

Working	shearing force	
Max	1541.188	kN
①	1541.188	kN
②		kN
③		kN
④		kN

Mooring	moment (upper)	moment (under)	
Max	708.773	-1244.549	kNm

Mooring	shearing force	
Max	1587.036	kN

Earthquak	moment (upper)	moment (under)	
Max	1394.565	-1705.169	kNm
①	1394.656	-1705.169	kNm
②			kNm
③			kNm
④			kNm

Earthquake	shearing force	
Max	2141.79	kN
①	2141.79	kN
②		kN
③		kN
④		kN

Moment and Shearing Force of Member

		Prepared by	Y. Ando	Checked by	R. NISHIHURA
			26 / 07 /2002		08 / 08 /2002

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Typical section (under)

Case-1			
Re-bar	D22 nos		19
sectional area	3.871 As		73.549
sectional width b	200		
height d'	260 effective height		250
location of re-bar	10		
Es	200		
Ec	25		
n	8		
neutral axis x		35.524 cm	
		355.24 mm	
Md	997.292 kNm		
σs	0.057 kN/mm^2		
cover over re-bar	89 mm		
pitch of re-bar	100 mm		
width of crack w		0.117	
acceptable width of crack wa		0.312	OK !

Typical section (upper)

Case-1			
Re-bar	D22 nos		19
sectional area	3.871 As		73.549
sectional width b	200		
height d'	260 effective height		250
location of re-bar	10		
Es	200		
Ec	25		
n	8		
neutral axis x		35.524 cm	
		355.24 mm	
Md	1230.013 kNm		
σs	0.070 kN/mm^2		
cover over re-bar	89 mm		
pitch of re-bar	100 mm		
width of crack w		0.144	
acceptable width of crack wa		0.312	OK !

Serviceability Limit State : Working Condition :

		Prepared by	Y. Ando	Checked by	R. NISHIHARA
			26 / 07 /2002		08 / 08 /2002

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

Wide section (under)

Case-1				
Re-bar	D22	nos		24
sectional area	3.871	As		92.904
sectional width b	250			
height d'	260	effective heigh		250
location of re-ba	10			
Es	200			
Ec	25			
n	8			
neutral axis x			35.696 cm	
			356.96 mm	
Md	708.773	kNm		
σs	0.032	kN/mm^2		
cover over re-ba	89	mm		
pitch of re-bar	100	mm		
width of crack w			0.066	
acceptable width of crack w:			0.312	OK !

Wide section (upper)

Case-1				
Re-bar	D22	nos		24
sectional area	3.871	As		92.904
sectional width b	250			
height d'	260	effective heigh		250
location of re-ba	10			
Es	200			
Ec	25			
n	8			
neutral axis x			35.696 cm	
			356.96 mm	
Md	1244.549	kNm		
σs	0.056	kN/mm^2		
cover over re-ba	89	mm		
pitch of re-bar	100	mm		
width of crack w			0.115	
acceptable width of crack w:			0.312	OK !

Ultimate Limit State Pausing Condition

		Prepared by	Y. Ando	Checked by	R. NISHIHARA
			26 / 07 / 2002		08 / 08 / 2002

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References/ Notes

Typical section

examination for moment

Re-bar	D22	nos	19
sectional area	3.871	As	73.549
sectional width b	200		
height d'	260	effective heigh	250
location of re-ba	10		
Es	200	kN/mm^2	
γ_{ms}	1.0		
f_{yk}	345	N/mm^2	
ε y	0.00173		
Ts	2,537.441	N	
f'cd	18.5	N/mm^2	
x	100.85	mm	
ε s	0.06591	OK !	
γ_b	1.15		
M_{rd}	5427.2	kNm	
γ_t	1.0		
M_d	997.292	kNm	
F	0.18	OK !	

examination for shearing force

1) main re-bar

Re-bar	D22	nos	19
sectional area	3.871	As	73.549
sectional width b	200		
height d'	260	effective heigh	250
location of re-ba	10		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.795		
β_p	0.528		
γ_b	1.3		
V_{cd}	854.34	kN	

2) stirrup

Re-bar	D9	pitch	15
sectional area	7.942	Aw	15.884
fwyd	345	N/mm^2	
z	217.391	cm	
γ_b	1.15		
V_{sd}	6906.08	kN	
V_{yd}	7760.42	kN	
γ_t	1.0		
V_d	1541.188	kN	
F	0.2	OK !	

Fatigue Limit State | Working Condition

		Prepared by	Y. Ando	Checked by	R. NISHIHURA
			26 / 07 /2002		08 / 08 /2002

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Wide section

examination for moment

Re-bar	D22	nos	24
sectional area	3.871	As	92.904
sectional width b	250		
height d'	260	effective height	250
location of re-ba	10		
Es	200 kN/mm^2		
γ_{ms}	1.0		
f_{yk}	345 N/mm^2		
εy	0.00173		
Ts	3,205.188 N		
fcd	18.5 N/mm^2		
x	101.91 mm		
εs	0.08236	OK !	
γ_b	1.15		
M_{nd}	6854.2 kNm		
γ_t	1.0		
M_d	708.773 kNm		
F	0.1	OK !	

examination for shearing force

1) main re-bar			
Re-bar	D22	nos	24
sectional area	3.871	As	92.904
sectional width b	250		
height d'	260	effective heigh	250
location of re-ba	10		
fcd	18.5 N/mm^2		
fvcd	0.529 N/mm^2		
β_d	0.795		
β_p	0.530		
γ_b	1.3		
V_{cd}	1071.97 kN		
2) stirrup			
Re-bar	D9	pitch	20
sectional area	7.942	Aw	15.884
fwyd	345 N/mm^2		
z	217.391 cm		
γ_b	1.15		
V_{sd}	5179.56 kN		
V_{yd}	6251.53 kN		
γ_t	1.0		
V_d	1587.036 kN		
F	0.25	OK !	

Fatigue Limit State Pausing Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

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References/ Notes

Typical section

examination for moment			
Re-bar	D22	*nos*	19
sectional area	3.871	As	73.549
sectional width b	200		
height d'	260	effective heigh	250
location of re-ba	10		
Es	200	kN/mm^2	
γ_{ms}	1.0		
f_{yk}	345	N/mm^2	
εy	0.00173		
Ts	2,537.441	N	
f'cd	18.5	N/mm^2	
x	100.85	mm	
εs	0.06591	OK !	
γ_b	1.0		
M_{nd}	6241.2	kNm	
γ_t	1.0		
M_d	1394.565	kNm	
F	0.22	OK !	

examination for shearing force			
1) main re-bar			
Re-bar	D22	nos	19
sectional area	3.871	As	73.549
sectional width b	200		
height d'.	260	effective heigh	250
location of re-ba	10		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.795		
β_p	0.528		
γ_b	1.15		
V_{cd}	965.78	kN	
2) stirrup			
Re-bar	D9	pitch	20
sectional area	7.942	Aw	15.884
fwyd	345	N/mm^2	
z	217.391	cm	
γ_b	1.0		
V_{sd}	5956.49	kN	
V_{yd}	6922.27	kN	
γ_t	1.0		
V_d	2141.79	kN	
F	0.31	OK !	

Ultimate Limit State Seismic Condition I. C.

	Prepared by	Y. Ando	Checked by	R. NISHIHURA
		26 / 07 /2002		08 / 08 /2002

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References/ Notes

Wide section

examination for moment

Re-bar	D22	nos	24
sectional area	3.871	As	92.904
sectional width b	250		
height d'	260	effective heigh	250
location of re-ba	10		
Es	200	kN/mm^2	
γ_{ms}	1.0		
f_{yk}	345	N/mm^2	
εy	0.00173		
Ts	3,205,188	N	
f'cd	18.5	N/mm^2	
x	101.91	mm	
εs	0.08236	OK !	
γ_b	1.15		
M_{nd}	6854.2	kNm	
γ_i	1.0		
M_d	1394.565	kNm	
F	0.2	OK !	

examination for shearing force

1) main re-bar

Re-bar	D22	nos	24
sectional area	3.871	As	92.904
sectional width b	250		
height d'	260	effective heigh	250
location of re-ba	10		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.795		
β_p	0.530		
γ_b	1.3		
V_{cd}	1071.97	kN	

2) stirrup

Re-bar	D9	pitch	20
sectional area	7.942	Aw	15.884
fwyd	345	N/mm^2	
z	217.391	cm	
γ_b	1.15		
V_{sd}	5179.56	kN	
V_{yd}	6251.53	kN	
γ_i	1.0		
V_d	2141.79	kN	
F	0.34	OK !	

Ultimate Limit State : Seismic Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

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References/ Notes

Typical section

examination for moment

1) concrete			
Re-bar	D22	nos	19
sectional area	3.871	As	73.549
sectional width b	200		
height d'	260	effective height	250
location of re-ba	10		
N	30,000	times	
K	10		
k1	0.85		
fd	18.5	kN/mm^2	
frd	8,685.0	kN/mm^2	
γ_c	1.3		
σ_{rd}	385	kN	
F	0.05763	OK !	
2) re-bar			
γ_s	1.05		
ϕ	22	mm	
a	0.744		
k	0.12		
fsrd	291280	kN/m^2	
F	0.00139	OK !	

examination for shearing force

Re-bar	D22	nos	19
sectional area	3.871	As	73.549
sectional width b	200		
height d'	260	effective heigh	250
location of re-ba	10		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.795		
β_p	0.528		
γ_b	1.0		
V_{cd}	1110.64	kN	
N	30,000	times	
σ_{rd}	385	kN	
V_{rcd}	658.6	kN	
F	0.585	OK !	

Fatigue Limit State : Working Condition .

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 / 07 /2002		08 /08 /2002

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References/ Notes

Wide section

examination for moment

1) concrete

Re-bar	D22	nos	19
sectional area	3.871	As	73.549
sectional width b	200		
height d'	260	effective heigh	250
location of re-bar	10		
N	30,000	times	
K	10		
k1	0.85		
fd	18.5	kN/mm^2	
frd	8,685.0	kN/mm^2	
γ_c	1.3		
σ_{rd}	500	kN	
F	0.07484	OK !	

2) re-bar

γ_s	1.05	
ϕ	22	mm
a	0.744	
k	0.12	
fsrd	291280	kN/m^2
F	0.0018	OK !

examination for shearing force

Re-bar	D22	nos	19
sectional area	3.871	As	73.549
sectional width b	200		
height d'	260	effective height	250
location of re-bar	10		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.795		
β_p	0.528		
γ_b	1.0		
V_{cd}	1110.64	kN	
N	30,000	times	
σ_{rd}	500	kN	
V_{rcd}	658.6	kN	
F	0.759	OK !	

Fatigue Limit State Pausing Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

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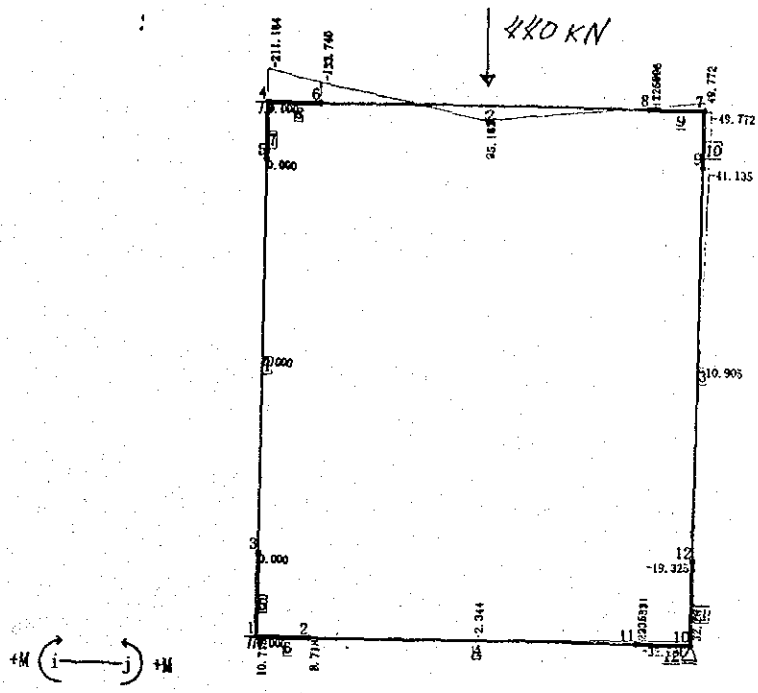
References/ Notes

Figure of Bending Moment



No of Member 1 (3 - 5)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	0.000	0.000	0.000	0.000
1	0.875	0.000	0.000	0.000	0.000
j	1.750	0.000	0.000	0.000	0.000
MAX	0.000	0.000	0.000	0.000	—
MIN	1.750	0.000	0.000	0.000	—

No of Member 2 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-133.740	309.696	-34.549	0.000
1	0.750	95.157	300.696	-34.549	0.043
2	0.750	95.143	-139.305	-34.549	0.043
j	1.500	-12.696	-148.304	-34.549	0.000
MAX	0.750	95.157	300.696	-34.549	—

		Prepared by	Y. Ando	Checked by	R. NISHIHARA
			29/1 07 /2002		08 /08 /2002

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No of Member 7 (5 - 6)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-7.526	-0.419	-793.818	0.000
l	4.900	-9.580	-0.419	-793.818	-0.288
j	9.800	-11.634	-0.419	-793.818	0.000

No of Member 8 (7 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-5.824	-0.065	-1138.140	0.000
l	4.900	-6.141	-0.065	-1138.140	-0.184
j	9.800	-6.457	-0.065	-1138.140	0.000

No of Member 9 (9 - 10)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1.197	0.900	-1304.538	0.000
l	4.900	3.212	0.900	-1304.538	0.096
j	9.800	7.620	0.900	-1304.538	0.000

No of Member 10 (1 - 11)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	6.525	-0.442	-149.157	0.000
j	15.200	-0.187	-0.442	-149.157	0.000

No of Member 11 (3 - 12)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	6.500	-0.438	-458.947	0.000
j	15.200	-0.154	-0.438	-458.947	0.000

No of Member 12 (5 - 13)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	7.526	-0.592	-793.818	0.000
j	15.200	-1.466	-0.592	-793.818	0.000

Working Condition Vertical Load

	Prepared by	Y. Ando	Checked by	D. NISHIMURA
		26/07/2002		08/08/2002

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Calculation Result of FRAME

Working	moment (upper)	moment (under)	
Max	95.157	-133.74	kNm
①	95.157	-133.74	kNm
②			kNm
③			kNm
④			kNm

Working	shearing force	
Max	309.696	kN
①	309.696	kN
②		kN
③		kN
④		kN

Mooring	moment (upper)	moment (under)	
Max			kNm

Mooring	shearing force	
Max		kN

Earthquak	moment (upper)	moment (under)	
Max			kNm
①			kNm
②			kNm
③			kNm
④			kNm

Earthquake	shearing force	
Max		kN
①		kN
②		kN
③		kN
④		kN

Moment and Shearing Force of Member

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

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Serviceability limit state

$$W = k_1 \times \{4C + 0.7 \times (C_\phi - \phi)\} \times (\sigma_s / Es)$$

W : crack width
k_1 : coefficient of adhesive condition of re-bar
C : cover over re-bar
C_ϕ : re-bar pitch
ϕ : re-bar diameter
σ_s : increase of re-bar stress
Es : Young's modulus of re-bar

$$Wa = 0.0035C$$

Wa : acceptable crack width
C : cover over re-bar

Ultimate limit state

1.Examination for moment

$$\varepsilon_y = f_{yk} / (\gamma_{ms} \cdot Es)$$

ε_y : yield strain of re-bar
f_{yk} : yield strength of re-bar
γ_{ms} : material modulus
Es : Young's modulus of re-bar

$$M_{nd} = Ts\,(d - 0.4X) / \gamma_b$$

M_{nd} : bearable moment
Ts : tensile strength
d : effective height
X : effective distance between neutral axis and edge
γ_b : material modulus

2.Examination for shearing force

$$V_{yd} = V_{cd} + V_{sd}$$

V_{yd} : design bearable shearing strength
V_{cd} : design bearable shearing strength without stirrup
V_{sd} : design bearable shearing strength of stirrup

$$V_{yd} = \beta_d \cdot \beta_p \cdot \beta_n \cdot f_{vcd} \cdot b \cdot d / \gamma_b$$

β_d : $(1/d)^{1/4}$
d : effective height
β_p : $(100p_w)^{1/3}$
p_w : ratio of re-bar to concrete
β_n : modulus related to moment
f_{vcd} : $0.2 \cdot (f'_{cd})^{1/3}$
f_{cd} : design strength of concrete
γ_b : material modulus

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

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References/ Notes

Typical section (under)

Case-1				
Re-bar	D19	nos		15
sectional area	2.865	As		42.975
sectional width b	150			
height d'	40	effective height		30
location of re-bar	10			
Es	200			
Ec	25			
n	8			
neutral axis x			9.657 cm	
			96.57 mm	
Md	95.157 kNm			
σs	0.083 kN/mm^2			
cover over re-bar	90.5 mm			
pitch of re-bar	100 mm			
width of crack w			0.174	
acceptable width of crack wa			0.317	OK !

Typical section (upper)

Case-1				
Re-bar	D19	nos		15
sectional area	2.865	As		42.975
sectional width b	150			
height d'	40	effective height		30
location of re-bar	10			
Es	200			
Ec	25			
n	8			
neutral axis x			9.657 cm	
			96.57 mm	
Md	133.74 kNm			
σs	0.116 kN/mm^2			
cover over re-bar	90.5 mm			
pitch of re-bar	100 mm			
width of crack w			0.243	
acceptable width of crack wa			0.317	OK !

Serviceability Limit State Working Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

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References/ Notes

Typical section

examination for moment

Re-bar	D19	nos	29
sectional area	2.865	As	83.085
sectional width b	300		
height d'	40	effective heigh	30
location of re-ba	10		
Es	200	kN/mm^2	
γ_{ms}	1.0		
f_{yk}	345	N/mm^2	
εy	0.00173		
Ts	2,866,433	N	
f'cd	18.5	N/mm^2	
x	75.95	mm	
εs	0.13475	OK !	
γ_b	1.15		
M_{nd}	672	kNm	
γ_i	1.0		
M_d	95.157	kNm	
F	0.14	OK !	

examination for shearing force

1) main re-bar			
Re-bar	D19	nos	15
sectional area	2.865	As	42.975
sectional width b	150		
height d'	40	effective heigh	30
location of re-ba	10		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	1.351		
β_p	0.985		
γ_b	1.3		
V_{cd}	243.71	kN	
2) stirrup			
Re-bar	D9	pitch	15
sectional area	7.942	Aw	15.884
fwyd	345	N/mm^2	
z	26.087	cm	
γ_b	1.15		
V_{sd}	828.73	kN	
V_{yd}	1072.44	kN	
γ_i	1.0		
V_d	309.696	kN	
F	0.3	OK !	

Ultimate Limit State **Working Condition**

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 / 07 / 2002		08 / 08 / 2002

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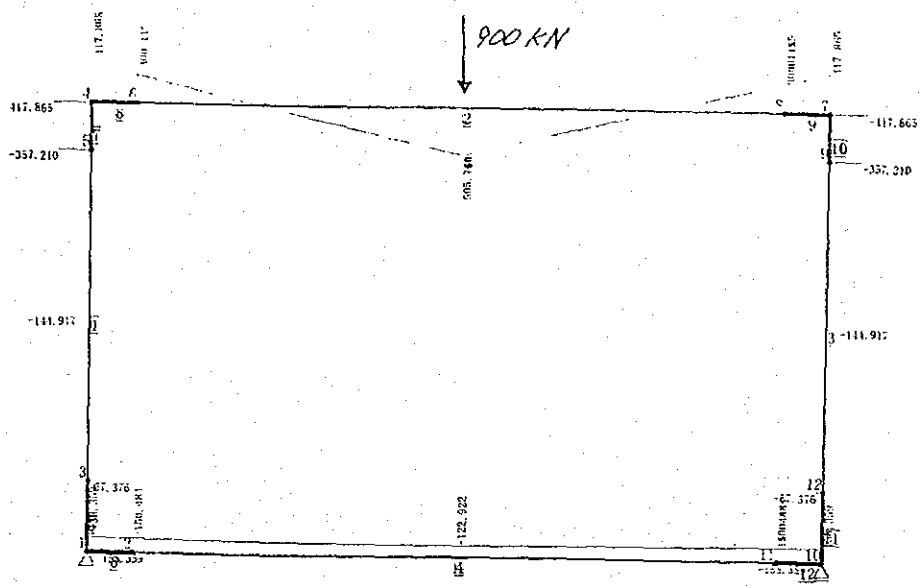
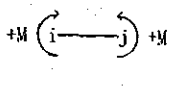
References/ Notes

Figure of Bending Moment





No of Member 1 (3 - 5)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	67.376	-242.621	-471.000	0.000
1	0.875	-144.917	-242.621	-471.000	-0.213
j	1.750	-357.210	-242.621	-471.000	0.000
MAX	0.000	67.376	-242.621	-471.000	—
MIN	1.750	-357.210	-242.621	-471.000	—

No of Member 2 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-300.115	471.000	-242.621	0.000
1	1.750	505.760	450.000	-242.621	1.415
2	1.750	505.714	-450.001	-242.621	1.415
j	3.500	-300.115	-471.000	-242.621	0.000
MAX	1.750	505.760	450.000	-242.621	—

	Prepared by	Y. Ando	Checked by	R. NISHIHURA
		26/07/2002		08/08/2002

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

Serviceability limit state

$$W = k_1 \times \{4C + 0.7 \times (C_o - \phi)\} \times (\sigma_s / Es)$$

W : crack width
k_1 : coefficient of adhesive condition of re-bar
C : cover over re-bar
C_o : re-bar pitch
ϕ : re-bar diameter
σ_s : increase of re-bar stress
Es : Young's modulus of re-bar

$$Wa = 0.0035C$$

Wa : acceptable crack width
C : cover over re-bar

Ultimate limit state

1.Examination for moment

$$\epsilon_y = f_{yk} / (\gamma_{ms} \cdot Es)$$

ϵ_y : yield strain of re-bar
f_{yk} : yield strength of re-bar
γ_{ms} : material modulus
Es : Young's modulus of re-bar

$$M_{nd} = Ts\,(d - 0.4X) / \gamma_b$$

M_{nd} : bearable moment
Ts : tensile strength
d : effective height
X : effective distance between neutral axis and edge
γ_b : material modulus

2.Examination for shearing force

$$V_{yd} = V_{cd} + V_{sd}$$

V_{yd} : design bearable shearing strength
V_{cd} : design bearable shearing strength without stirrup
V_{sd} : design bearable shearing strength of stirrup

$$V_{yd} = \beta_d \cdot \beta_p \cdot \beta_n \cdot f_{vcd} \cdot b \cdot d / \gamma_b$$

β_d : $(1/d)^{1/4}$
d : effective height
β_p : $(100p_w)^{1/3}$
p_w : ratio of re-bar to concrete
β_n : modulus related to moment
f_{vcd} : $0.2 \cdot (f'_{cd})^{1/3}$
f_{cd} : design strength of concrete
γ_b : material modulus

	Prepared by	Y. Ando	Checked by	T. NISHIMURA
		26 / 07 / 2002		08 / 08 / 2002

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References/ Notes

Calculation Result of FRAME

Working	moment (upper)	moment (under)	
Max	505.76	-300.115	kNm
①	505.76	-300.115	kNm
②			kNm
③			kNm
④			kNm

Working	shearing force	
Max	471	kN
①	471	kN
②		kN
③		kN
④		kN

Mooring	moment (upper)	moment (under)	
Max			kNm

Mooring	shearing force	
Max		kN

Earthquak	moment (upper)	moment (under)	
Max			kNm
①			kNm
②			kNm
③			kNm
④			kNm

Earthquake	shearing force	
Max		kN
①		kN
②		kN
③		kN
④		kN

Moment and Shearing Force of Member

		Prepared by	Y. Ando	Checked by	R. NISHIHURA
			26 / 07 /2002		08 / 08 /2002

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

Typical section (under)

Case-1				
Re-bar	D25	nos		29
sectional area	5.067	As		146.943
sectional width b	300			
height d'	40	effective height		30
location of re-bar	10			
Es	200			
Ec	25			
n	8			
neutral axis x			11.908 cm	
			119.08 mm	
Md	505.76 kNm			
σs	0.132 kN/mm²			
cover over re-bar	87.5 mm			
pitch of re-bar	100 mm			
width of crack w			0.266	
acceptable width of crack wa			0.306	OK !

Typical section (upper)

Case-1				
Re-bar	D25	nos		29
sectional area	5.067	As		146.943
sectional width b	300			
height d'	40	effective height		30
location of re-bar	10			
Es	200			
Ec	25			
n	8			
neutral axis x			11.908 cm	
			119.08 mm	
Md	300.115 kNm			
σs	0.078 kN/mm²			
cover over re-bar	87.5 mm			
pitch of re-bar	100 mm			
width of crack w			0.157	
acceptable width of crack wa			0.306	OK !

Serviceability Limit State : Working Condition

		Prepared by	Y. Ando	Checked by	E. OHIMURA
			26/07/2002		08/08/2002

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

Typical section

examination for moment

Re-bar	D25	nos	29
sectional area	5.067	As	146.943
sectional width b	300		
height d'	40	effective heigh	30
location of re-ba	10		
Es	200	kN/mm^2	
γ_{ms}	1.0		
f_{yk}	345	N/mm^2	
ε y	0.00173		
Ts	5,069,534	N	
f'cd	18.5	N/mm^2	
x	134.33	mm	
ε s	0.07467	OK !	
γ_b	1.15		
M_{nd}	1085.6	kNm	
γ_t	1.0		
M_d	505.76	kNm	
F	0.47	OK !	

examination for shearing force

1) main re-bar

Re-bar	D25	nos	29
sectional area	5.067	As	146.943
sectional width b	300		
height d'	40	effective heigh	30
location of re-ba	10		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	1.351		
β_p	1.178		
γ_b	1.3		
V_{cd}	582.93	kN	

2) stirrup

Re-bar	D9	pitch	30
sectional area	7.942	Aw	15.884
fwyd	345	N/mm^2	
z	26.087	cm	
γ_b	1.15		
V_{sd}	414.37	kN	
V_{yd}	997.3	kN	
γ_t	1.0		
V_d	471	kN	
F	0.5	OK !	

Ultimate Limit State : Working Condition

	Prepared by	Checked by
	Y. Ando	R. NISHIMURA
	26 / 07 /2002	08 / 08 /2002

DESIGN CALCULATION COVER SHEET

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

Subject: **Container and Multi-purpose Berth**

Calculation Objective:

Randside Crane Foundation Pile

References, Calculation Notes and Comments

Refer to Drawings QW-01-001～QW-01-006
QW-01-040～QW-01-044
QW-01-056

Calculation based on

TECHNICAL STANDERDS AND COMMENTARIES
FOR
PORT AND HARBOUR FACILITIES IN JAPAN

Design Load **Container Crane(Refer to Design Condition)**

Rev	Prepared by	Prepared Date	No. of Pages	Checked by	Checked Date	Reviewed by	Reviewed Date	Superseded by Calc No.
O		26/07/02	9		26 July 02		26/08/02	
A								
B								
C								

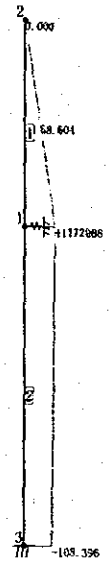
File in Calc. File

FN : Calculation_Cover_Sheet

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. /	Rev.

References/ Notes

Figure of Bending Moment



+M (i ——— j) +M

No of Member 1 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	117.208	-11.960	0.000	0.000
1	4.900	58.604	-11.960	0.000	1.759
j	9.800	0.000	-11.960	0.000	0.000
MAX	0.000	117.208	-11.960	0.000	—
MIN	9.800	0.000	-11.960	0.000	—

No of Member 2 (1 - 3)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-117.208	0.580	0.000	0.000
j	15.200	-108.396	0.580	0.000	0.000
MAX	15.200	-108.396	0.580	0.000	—
MIN	0.000	-117.208	0.580	0.000	—

Working Condition Horizontal Load

		Prepared by	Y. Ando	Checked by	E. NISHIMURA
			26/07/2002		08/08/2002

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

No of Member 7 (5 - 6)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-7.526	-0.419	-793.818	0.000
l	4.900	-9.580	-0.419	-793.818	-0.288
j	9.800	-11.634	-0.419	-793.818	0.000

No of Member 8 (7 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-5.824	-0.065	-1138.140	0.000
l	4.900	-6.141	-0.065	-1138.140	-0.184
j	9.800	-6.457	-0.065	-1138.140	0.000

No of Member 9 (9 - 10)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1.197	0.900	-1304.538	0.000
l	4.900	3.212	0.900	-1304.538	0.096
j	9.800	7.620	0.900	-1304.538	0.000

No of Member 10 (1 - 11)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	6.525	-0.442	-149.157	0.000
j	15.200	-0.187	-0.442	-149.157	0.000

No of Member 11 (3 - 12)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	6.500	-0.438	-458.947	0.000
j	15.200	-0.154	-0.438	-458.947	0.000

No of Member 12 (5 - 13)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
j	0.000	7.526	-0.592	-793.818	0.000
j	15.200	-1.466	-0.592	-793.818	0.000

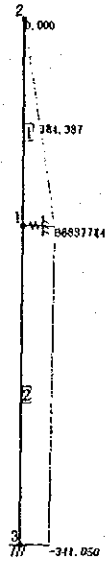
Working Condition : Vertical Load

	Prepared by	Y. Ando	Checked by	E. NISHIMURA
		26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 3	Rev.

References/ Notes

Figure of Bending Moment



+M (i ——— j) +M

No of Member 1 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	368.774	-37.630	0.000	0.000
1	4.900	184.387	-37.630	0.000	5.534
j	9.800	0.000	-37.630	0.000	0.000
MAX	0.000	368.774	-37.630	0.000	—
MIN	9.800	0.000	-37.630	0.000	—

No of Member 2 (1 - 3)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-368.774	1.824	0.000	0.000
j	15.200	-341.050	1.824	0.000	0.000
MAX	15.200	-341.050	1.824	0.000	—
MIN	0.000	-368.774	1.824	0.000	—

Pausing Condition · Horizontal Load

		Prepared by	Y. Ando	Checked by	R. NISHIHORA
			26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
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Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-11.422	-0.894	-1731.329	0.000
l	4.900	-15.801	-0.894	-1731.329	-0.474
j	9.800	-20.181	-0.894	-1731.329	0.000

No of Member 8 (7 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-0.288	1.426	-2026.945	0.000
l	4.900	6.700	1.426	-2026.945	0.201
j	9.800	13.688	1.426	-2026.945	0.000

No of Member 9 (9 - 10)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	7.640	3.078	-1845.913	0.000
l	4.900	22.723	3.078	-1845.913	0.682
j	9.800	37.806	3.078	-1845.913	0.000

No of Member 10 (1 - 11)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	16.164	-1.729	-326.556	0.000
j	15.200	-10.115	-1.729	-326.556	0.000

No of Member 11 (3 - 12)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	15.432	-1.619	-1071.257	0.000
j	15.200	-9.179	-1.619	-1071.257	0.000

No of Member 12 (5 - 13)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	11.422	-1.018	-1731.329	0.000
j	15.200	-4.054	-1.018	-1731.329	0.000

Pausing Condition - Vertical Load

		Prepared by	Y. Ando	Checked by	E. NISHIMURA
			26/07/2002		08/08/2002

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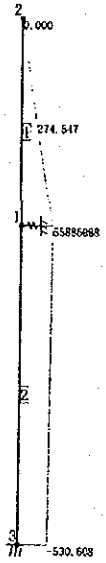
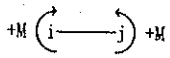
References/ Notes

Figure of Bending Moment





No of Member 1 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	558.698	-58.970	0.000	0.000
1	4.900	274.547	-57.010	0.000	8.264
j	9.800	0.000	-55.050	0.000	0.000

No of Member 2 (1 - 3)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-558.698	1.848	0.000	0.000
j	15.200	-530.608	1.848	0.000	0.000

Seismic Condition · Horizontal Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

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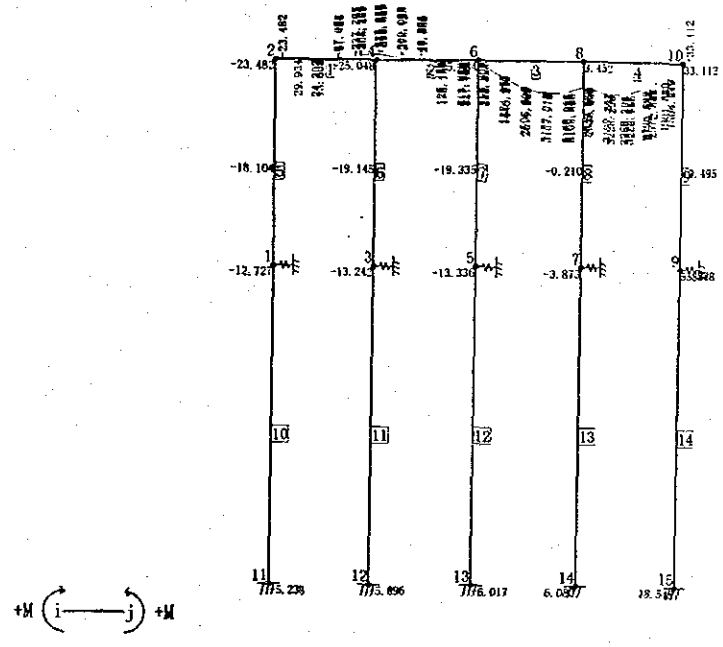
References/ Notes

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	9.288	-0.480	-1803.182	0.000
j	15.200	1.998	-0.480	-1803.182	0.000

No of Member 14 (9 - 15)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	1.444	0.696	-2053.256	0.000
j	15.200	12.028	0.696	-2053.256	0.000

Figure of Bending Moment



+M (i ——— j) +M

No of Member 1 (2 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-23.482	101.126	-1.097	0.000
1	0.800	29.931	32.406	-1.097	-0.002
2	0.800	29.934	32.397	-1.097	-0.002
3	1.700	24.307	-44.904	-1.097	-0.006
4	1.700	24.302	-44.913	-1.097	-0.006

Seismic Condition Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 7	Rev.

References/ Notes

Check of stress of sheet pipe pile

$$\frac{\sigma_c}{\sigma_{ca}} + \frac{\sigma_b}{\sigma_{ba}} < 1$$

σ_c = R / A
R : axial force
A : sectional area
σ_{ca}、σ_{ba} : acceptable stress

σ_{ba} = M / Z
M : moment
Z : section modulus

Calculation Result

Working	moment	117.208 kNm
	axial force	1304.538 kN
Mooring	moment	kNm
	axial force	kN
Earthquak	moment	558.698 kNm
	axial force	2053.256 kN

Stress

σ_{ca}		140 N/mm²
σ_{ba}		140 N/mm²
Working		
σ_c	= R/A	50.6 N/mm²
σ_b	= M/Z	23.4 N/mm²
f	0.53	OK !

σ_{ca}		210 N/mm²
σ_{ba}		210 N/mm²
Earthquake		
σ_c	= R/A	79.7 N/mm²
σ_b	= M/Z	111.5 N/mm²
f	0.91	OK !

σ_{ca}		140 N/mm²
σ_{ba}		140 N/mm²
Mooring		
σ_c	= R/A	0 N/mm²
σ_b	= M/Z	0 N/mm²
f	0.00	OK !

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 8	Rev.

References/ Notes

Calculation Result

Working	moment	117.208 kNm
	axial force	1304.538 kN
Mooring	moment	368.774 kNm
	axial force	2026.945 kN
Earthquak	moment	558.698 kNm
	axial force	2053.256 kN

Stress

σ_{ca}	140 N/mm^2	
σ_{ba}	140 N/mm^2	
Working		
σ_c	= R/A	39.4 N/mm^2
σ_b	= M/Z	18.4 N/mm^2
f	0.41	OK !

σ_{ca}	210 N/mm^2	
σ_{ba}	210 N/mm^2	
Earthquake		
σ_c	= R/A	62.1 N/mm^2
σ_b	= M/Z	87.6 N/mm^2
f	0.71	OK !

σ_{ca}	140 N/mm^2	
σ_{ba}	140 N/mm^2	
Mooring		
σ_c	= R/A	61.3 N/mm^2
σ_b	= M/Z	57.8 N/mm^2
f	0.85	OK !

		Prepared by	Y. Ando	Checked by	K. Nishihara
			26 / 07 /2002		08 / 08 /2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quay Wall	Page No. 9	Rev.

References/ Notes

End-bearing power : $R_u = 300 N A_p \cdot n$

average N value 50

Section area of pile A_p

$$A_p = \frac{\pi \times 0.8^2}{4} = 0.5024\ m^2$$

$n = 0.5$

$$= 300 \times 50 \times 0.5024 \times 0.5$$

$R_u = 3768$ KN

case	axial force	F
Working	1304.58 KN	2.89 > 2.5 O.K.
Earthquake	2053.25 KN	1.84 > 1.5 O.K.

	Prepared by	Checked by
	/ /200	/ /200

DESIGN CALCULATION COVER SHEET

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

Subject: **Container and Multi-purpose Berth**

Calculation Objective:

Rainforcement of cran foundation

References, Calculation Notes and Comments

Refer to Drawings **QW-01-057**

Calculation based on

TECHNICAL STANDERDS AND COMMENTARIES

FOR

PORT AND HARBOUR FACILITIES IN JAPAN

Design Load **Container Crane**

(Refer to Design Condition & Crane Foundation Pile)

Rev	Prepared		No. of	Checked		Reviewed		Superseded
	by	Date	Pages	by	Date	by	Date	by Calc No.
O		26/07/02	35				26/08/02	
A								
B								
C								

File in Calc. File

FN : Calculation_Cover_Sheet

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. /	Rev.

References/ Notes

No of Member /

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
5	1.900	2037.197	1002.136	-1.657	0.220
6	1.900	2037.268	698.327	-1.657	0.220
7	2.500	2440.737	646.796	-1.657	0.248
8	2.800	2630.910	621.026	-1.657	0.251
9	2.800	2630.942	317.217	-1.657	0.251
10	2.900	2662.203	308.636	-1.657	0.250
11	3.700	2881.624	239.916	-1.657	0.207
12	3.700	2881.648	239.907	-1.657	0.207
13	3.900	2927.889	222.736	-1.657	0.187
14	3.900	2927.881	-81.073	-1.657	0.187
15	4.000	2919.353	-89.654	-1.657	0.175
16	4.000	2919.344	-89.663	-1.657	0.175
17	4.800	2820.141	-158.374	-1.657	0.043
18	4.800	2819.972	-1677.383	-1.657	0.043
19	4.900	2651.975	-1685.964	-1.657	0.022
20	4.900	2651.804	-1685.973	-1.657	0.022
j	5.000	2482.949	-1694.554	-1.657	0.000

No of Member 2 (4 - 6)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	2486.018	-421.003	-1.602	0.000
1	0.900	2072.325	-498.313	-1.602	0.094
2	1.000	2022.065	-506.903	-1.602	0.101
3	1.000	2022.013	-506.912	-1.602	0.101
4	1.900	1531.063	-584.213	-1.602	0.130
5	1.900	1531.004	-584.222	-1.602	0.130
6	2.000	1472.212	-592.803	-1.602	0.130
7	2.000	1472.152	-592.812	-1.602	0.130
8	2.500	1165.073	-635.753	-1.602	0.124
9	2.900	903.900	-670.113	-1.602	0.111
10	2.900	903.832	-670.122	-1.602	0.111
11	3.000	836.459	-678.703	-1.602	0.108
12	3.000	836.390	-678.712	-1.602	0.108
13	3.900	190.837	-756.013	-1.602	0.061
14	3.900	190.760	-756.022	-1.602	0.061

Working Condition Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIHURA
			26 / 07 /2002		08 / 08 /2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 2	Rev.

References/ Notes

No of Member 1

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
5	1.900	119.760	-14.053	-0.211	0.006
6	1.900	119.759	-14.061	-0.211	0.006
7	2.500	95.867	-65.593	-0.211	0.006
8	2.800	72.323	-91.363	-0.211	0.005
9	2.800	72.314	-91.371	-0.211	0.005
10	2.900	62.758	-99.953	-0.211	0.004
11	3.700	-44.692	-168.673	-0.211	0.001
12	3.700	-44.709	-168.681	-0.211	0.001
13	3.900	-80.145	-185.853	-0.211	0.000
14	3.900	-80.164	-185.861	-0.211	0.000
15	4.000	-99.160	-194.443	-0.211	0.000
16	4.000	-99.179	-194.451	-0.211	0.000
17	4.800	-282.202	-263.163	-0.211	-0.001
18	4.800	-282.228	-263.171	-0.211	-0.001
19	4.900	-308.948	-271.753	-0.211	0.000
20	4.900	-308.975	-271.761	-0.211	0.000
j	5.000	-336.552	-280.343	-0.211	0.000

No of Member 2 (4 - 6)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-345.064	178.605	-0.416	0.000
1	0.900	-219.109	101.295	-0.416	-0.014
2	1.000	-209.409	92.705	-0.416	-0.015
3	1.000	-209.400	92.696	-0.416	-0.015
4	1.900	-160.764	15.395	-0.416	-0.022
5	1.900	-160.763	15.386	-0.416	-0.022
6	2.000	-159.654	6.805	-0.416	-0.022
7	2.000	-159.654	6.796	-0.416	-0.022
8	2.500	-166.990	-36.145	-0.416	-0.023
9	2.900	-188.320	-70.505	-0.416	-0.023
10	2.900	-188.327	-70.514	-0.416	-0.023
11	3.000	-195.800	-79.095	-0.416	-0.023
12	3.000	-195.808	-79.104	-0.416	-0.023
13	3.900	-301.775	-156.405	-0.416	-0.018
14	3.900	-301.791	-156.414	-0.416	-0.018

Working Condition - Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

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

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
5	1.900	921.409	425.074	-2.898	0.108
6	1.900	921.452	425.066	-2.898	0.108
7	2.500	1160.991	373.534	-2.898	0.123
8	2.800	1269.186	347.764	-2.898	0.126
9	2.800	1269.221	347.756	-2.898	0.126
10	2.900	1303.533	339.174	-2.898	0.126
11	3.700	1547.385	270.454	-2.898	0.107
12	3.700	1547.412	270.446	-2.898	0.107
13	3.900	1599.758	253.274	-2.898	0.097
14	3.900	1599.783	253.266	-2.898	0.097
15	4.000	1624.656	244.684	-2.898	0.091
16	4.000	1624.680	244.676	-2.898	0.091
17	4.800	1792.915	175.964	-2.898	0.023
18	4.800	1792.933	175.956	-2.898	0.023
19	4.900	1810.082	167.374	-2.898	0.012
20	4.900	1810.099	167.366	-2.898	0.012
j	5.000	1826.390	158.784	-2.898	0.000

No of Member 2 (4 - 6)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	1798.153	958.615	-4.902	0.000
1	0.900	2626.116	881.305	-4.902	0.192
2	1.000	2683.437	568.915	-4.902	0.209
3	1.000	2683.495	568.906	-4.902	0.209
4	1.900	3160.671	491.605	-4.902	0.319
5	1.900	3160.721	491.596	-4.902	0.319
6	2.000	3209.402	483.015	-4.902	0.325
7	2.000	3209.420	179.206	-4.902	0.325
8	2.500	3288.272	136.265	-4.902	0.342
9	2.900	3335.906	101.905	-4.902	0.334
10	2.900	3335.885	-201.904	-4.902	0.334
11	3.000	3315.287	-210.485	-4.902	0.330
12	3.000	3315.265	-210.494	-4.902	0.330
13	3.900	3091.060	-287.795	-4.902	0.234
14	3.900	3091.031	-287.804	-4.902	0.234

Working Condition : Vertical Load

		Prepared by	Y. Ando	Checked by	E. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No.	8 Rev.

References/ Notes

No of Member

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
15	4.000	-814.397	-388.507	-0.024	-0.037
16	4.000	-814.436	-388.515	-0.024	-0.037
17	4.100	-853.677	-397.097	-0.024	-0.035
18	4.100	-853.717	-397.105	-0.024	-0.035
19	4.900	-1198.843	-465.817	-0.024	-0.005
20	4.900	-1198.890	-465.825	-0.024	-0.005
j	5.000	-1245.854	-474.407	-0.024	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1245.137	494.976	-0.054	0.000
1	0.900	-834.448	417.666	-0.054	-0.032
2	1.000	-793.111	409.076	-0.054	-0.034
3	1.000	-793.070	409.067	-0.054	-0.034
4	1.900	-459.732	331.766	-0.054	-0.040
5	1.900	-459.699	331.757	-0.054	-0.040
6	2.000	-426.985	323.176	-0.054	-0.039
7	2.000	-426.952	323.167	-0.054	-0.039
8	2.500	-276.135	280.226	-0.054	-0.035
9	2.900	-170.916	245.866	-0.054	-0.031
10	2.900	-170.891	245.857	-0.054	-0.031
11	3.000	-146.759	237.276	-0.054	-0.029
12	3.000	-146.735	237.267	-0.054	-0.029
13	3.900	32.000	159.966	-0.054	-0.015
14	3.900	32.016	159.957	-0.054	-0.015
15	4.000	47.567	151.376	-0.054	-0.014
16	4.000	47.582	151.367	-0.054	-0.014
17	4.100	62.275	142.786	-0.054	-0.012
18	4.100	62.289	142.777	-0.054	-0.012
19	4.900	149.016	74.066	-0.054	-0.001
20	4.900	149.023	74.057	-0.054	-0.001
j	5.000	155.993	65.476	-0.054	0.000

Working Condition : Vertical Load

		Prepared by	Y. Ando	Checked by	E. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 5	Rev.

References/ Notes

No of Member 2

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
15	4.000	2112.585	-850.678	-3.524	0.171
16	4.000	2112.499	-850.687	-3.524	0.171
17	4.100	2027.088	-859.268	-3.524	0.157
18	4.100	2027.001	-859.277	-3.524	0.157
19	4.900	1281.805	-1231.788	-3.524	0.020
20	4.900	1281.681	-1231.797	-3.524	0.020
j	5.000	1158.197	-1240.378	-3.524	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	1172.202	-96.175	-2.665	0.000
1	0.900	1050.855	-173.485	-2.665	0.050
2	1.000	1033.077	-182.075	-2.665	0.054
3	1.000	1033.059	-182.083	-2.665	0.054
4	1.900	834.420	-259.385	-2.665	0.071
5	1.900	834.394	-259.393	-2.665	0.071
6	2.000	808.053	-267.975	-2.665	0.071
7	2.000	808.025	-267.983	-2.665	0.071
8	2.500	663.328	-310.925	-2.665	0.068
9	2.900	532.086	-345.285	-2.665	0.062
10	2.900	532.051	-345.293	-2.665	0.062
11	3.000	497.128	-353.875	-2.665	0.060
12	3.000	497.092	-353.883	-2.665	0.060
13	3.900	143.851	-431.185	-2.665	0.035
14	3.900	143.808	-431.193	-2.665	0.035
15	4.000	100.303	-439.775	-2.665	0.032
16	4.000	100.259	-439.783	-2.665	0.032
17	4.100	55.896	-448.365	-2.665	0.028
18	4.100	55.851	-448.373	-2.665	0.028
19	4.900	-330.284	-517.085	-2.665	0.003
20	4.900	-330.336	-517.093	-2.665	0.003
j	5.000	-382.421	-525.675	-2.665	0.000

Working Condition · Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 6	Rev.

References/ Notes

No of Member

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
15	4.000	2661.337	-162.294	-4.493	0.162
16	4.000	2661.320	-162.303	-4.493	0.162
17	4.100	2644.678	-170.884	-4.493	0.150
18	4.100	2644.661	-170.893	-4.493	0.150
19	4.900	2480.483	-239.604	-4.493	0.020
20	4.900	2480.458	-239.613	-4.493	0.020
j	5.000	2456.093	-248.194	-4.493	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	2449.096	686.085	-4.902	0.000
1	0.900	3031.783	608.775	-4.902	0.201
2	1.000	3061.851	296.385	-4.902	0.218
3	1.000	3061.881	296.377	-4.902	0.218
4	1.900	3293.809	219.075	-4.902	0.324
5	1.900	3293.831	219.067	-4.902	0.324
6	2.000	3315.287	210.485	-4.902	0.330
7	2.000	3315.308	210.477	-4.902	0.330
8	2.500	3288.272	-136.265	-4.902	0.342
9	2.900	3226.894	-170.625	-4.902	0.331
10	2.900	3226.877	-170.633	-4.902	0.331
11	3.000	3209.402	-179.215	-4.902	0.325
12	3.000	3209.353	-483.023	-4.902	0.325
13	3.900	2739.899	-560.325	-4.902	0.226
14	3.900	2739.843	-560.333	-4.902	0.226
15	4.000	2683.437	-568.915	-4.902	0.209
16	4.000	2683.380	-568.923	-4.902	0.209
17	4.100	2626.116	-577.505	-4.902	0.192
18	4.100	2626.027	-881.313	-4.902	0.192
19	4.900	1893.585	-950.025	-4.902	0.024
20	4.900	1893.489	-950.033	-4.902	0.024
j	5.000	1798.153	-958.615	-4.902	0.000

Working Condition Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 7	Rev.

References/ Notes

— No of Member

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
15	4.000	-632.942	-518.432	-0.260	-0.015
16	4.000	-632.994	-518.441	-0.260	-0.015
17	4.100	-685.214	-527.022	-0.260	-0.015
18	4.100	-685.268	-527.031	-0.260	-0.015
19	4.900	-1134.320	-595.742	-0.260	-0.003
20	4.900	-1134.380	-595.751	-0.260	-0.003
j	5.000	-1194.324	-604.332	-0.260	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1190.604	372.943	0.007	0.000
1	0.900	-889.745	295.633	0.007	-0.044
2	1.000	-860.611	287.043	0.007	-0.047
3	1.000	-860.582	287.034	0.007	-0.047
4	1.900	-637.062	209.733	0.007	-0.063
5	1.900	-637.040	209.724	0.007	-0.063
6	2.000	-616.518	201.143	0.007	-0.064
7	2.000	-616.497	201.134	0.007	-0.064
8	2.500	-526.684	158.193	0.007	-0.063
9	2.900	-470.278	123.833	0.007	-0.059
10	2.900	-470.266	123.824	0.007	-0.059
11	3.000	-458.325	115.243	0.007	-0.058
12	3.000	-458.313	115.234	0.007	-0.058
13	3.900	-389.395	37.933	0.007	-0.039
14	3.900	-389.391	37.924	0.007	-0.039
15	4.000	-386.032	29.343	0.007	-0.036
16	4.000	-386.029	29.334	0.007	-0.036
17	4.100	-383.527	20.753	0.007	-0.033
18	4.100	-383.525	20.744	0.007	-0.033
19	4.900	-394.412	-47.967	0.007	-0.004
20	4.900	-394.417	-47.976	0.007	-0.004
j	5.000	-399.638	-56.557	0.007	0.000

Working Condition Vertical Load

		Prepared by	Y. Ando	Checked by	E. NISHIMURA
			26/07/2002		08/08/2002

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

No of Member

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
15	4.000	2988.360	-15.011	-4.823	0.193
16	4.000	2988.328	-318.820	-4.823	0.193
17	4.100	2956.050	-327.401	-4.823	0.178
18	4.100	2956.017	-327.410	-4.823	0.178
19	4.900	2666.641	-396.121	-4.823	0.024
20	4.900	2666.570	-699.930	-4.823	0.024
j	5.000	2596.219	-708.511	-4.823	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	2593.828	550.142	-4.965	0.000
1	0.900	3054.167	472.832	-4.965	0.196
2	1.000	3101.021	464.242	-4.965	0.212
3	1.000	3101.068	464.234	-4.965	0.212
4	1.900	3241.009	83.132	-4.965	0.311
5	1.900	3241.018	83.124	-4.965	0.311
6	2.000	3248.893	74.542	-4.965	0.316
7	2.000	3248.870	-229.266	-4.965	0.316
8	2.500	3123.527	-272.208	-4.965	0.325
9	2.900	3007.772	-306.568	-4.965	0.313
10	2.900	3007.741	-306.576	-4.965	0.313
11	3.000	2976.686	-315.158	-4.965	0.307
12	3.000	2976.654	-315.166	-4.965	0.307
13	3.900	2415.214	-696.268	-4.965	0.209
14	3.900	2415.144	-696.276	-4.965	0.209
15	4.000	2345.158	-704.858	-4.965	0.194
16	4.000	2345.056	-1008.666	-4.965	0.194
17	4.100	2243.863	-1017.248	-4.965	0.178
18	4.100	2243.760	-1017.256	-4.965	0.178
19	4.900	1402.577	-1085.968	-4.965	0.022
20	4.900	1402.467	-1085.976	-4.965	0.022
j	5.000	1293.551	-1094.558	-4.965	0.000

Working Condition : Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIHURA
			26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 9	Rev.

References/ Notes

— No of Member 4 —

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	2158.582	194.861	-2.719	0.000
1	0.900	2299.168	117.551	-2.719	0.124
2	0.900	2299.179	117.542	-2.719	0.124
3	1.100	2320.960	100.371	-2.719	0.143
4	1.100	2320.939	-203.438	-2.719	0.143
5	1.800	2157.514	-263.559	-2.719	0.183
6	1.800	2157.487	-263.568	-2.719	0.183
7	2.000	2103.084	-280.739	-2.719	0.187
8	2.000	2103.025	-584.548	-2.719	0.187
9	2.100	2044.200	-593.129	-2.719	0.188
10	2.100	2044.140	-593.138	-2.719	0.188
11	2.500	1800.077	-627.489	-2.719	0.186
12	2.900	1542.209	-661.849	-2.719	0.173
13	2.900	1542.142	-661.858	-2.719	0.173
14	3.000	1475.594	-670.439	-2.719	0.168
15	3.000	1475.527	-670.448	-2.719	0.168
16	3.200	1339.788	-687.619	-2.719	0.158
17	3.800	911.755	-739.159	-2.719	0.115
18	3.800	911.680	-739.168	-2.719	0.115
19	4.100	686.142	-764.929	-2.719	0.089
20	4.100	686.064	-764.938	-2.719	0.089
j	5.000	-37.084	-842.239	-2.719	0.000

No of Member 5 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-11.079	-1.764	-231.134	0.000
1	4.900	-19.725	-1.764	-231.134	-0.592
j	9.800	-28.370	-1.764	-231.134	0.000

No of Member 6 (3 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-10.313	-1.605	-728.839	0.000
1	4.900	-18.176	-1.605	-728.839	-0.545
j	9.800	-26.039	-1.605	-728.839	0.000

Working Condition : Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

FN: Calculation_Sheet

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

No of Member. 4

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-974.838	463.239	-0.242	0.000
1	0.900	-592.712	385.929	-0.242	-0.019
2	0.900	-592.673	385.920	-0.242	-0.019
3	1.100	-517.244	368.749	-0.242	-0.020
4	1.100	-517.207	368.740	-0.242	-0.020
5	1.800	-280.166	308.619	-0.242	-0.020
6	1.800	-280.134	308.610	-0.242	-0.020
7	2.000	-220.160	291.439	-0.242	-0.019
8	2.000	-220.130	291.430	-0.242	-0.019
9	2.100	-191.445	282.849	-0.242	-0.018
10	2.100	-191.417	282.840	-0.242	-0.018
11	2.500	-85.178	248.489	-0.242	-0.015
12	2.900	7.346	214.129	-0.242	-0.011
13	2.900	7.367	214.120	-0.242	-0.011
14	3.000	28.329	205.539	-0.242	-0.010
15	3.000	28.350	205.530	-0.242	-0.010
16	3.200	67.719	188.359	-0.242	-0.009
17	3.800	165.272	136.819	-0.242	-0.004
18	3.800	165.286	136.810	-0.242	-0.004
19	4.100	202.452	111.049	-0.242	-0.002
20	4.100	202.433	-192.760	-0.242	-0.002
j	5.000	-5.813	-270.061	-0.242	0.000

No of Member 5 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-5.676	-1.657	-1165.346	0.000
1	4.900	-13.793	-1.657	-1165.346	-0.414
j	9.800	-21.910	-1.657	-1165.346	0.000

No of Member 6 (3 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	2.536	0.054	-1273.551	0.000
1	4.900	2.802	0.054	-1273.551	0.084
j	9.800	3.069	0.054	-1273.551	0.000

Working Condition Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIHORA
			26 / 07 /2002		08 / 08 /2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
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— No of Member : 4 —

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	1639.054	477.651	-1.933	0.000
1	0.900	2034.150	400.341	-1.933	0.124
2	0.900	2034.190	400.332	-1.933	0.124
3	1.100	2112.500	383.161	-1.933	0.144
4	1.100	2112.508	79.352	-1.933	0.144
5	1.800	2147.007	19.231	-1.933	0.190
6	1.800	2147.009	19.222	-1.933	0.190
7	2.000	2149.135	2.051	-1.933	0.197
8	2.000	2149.105	-301.758	-1.933	0.197
9	2.100	2118.531	-310.339	-1.933	0.199
10	2.100	2118.500	-310.348	-1.933	0.199
11	2.500	1987.523	-344.699	-1.933	0.200
12	2.900	1842.772	-379.059	-1.933	0.189
13	2.900	1842.733	-379.068	-1.933	0.189
14	3.000	1804.436	-387.649	-1.933	0.185
15	3.000	1804.397	-387.658	-1.933	0.185
16	3.200	1694.808	-708.629	-1.933	0.174
17	3.800	1254.169	-760.169	-1.933	0.130
18	3.800	1254.092	-760.178	-1.933	0.130
19	4.100	991.873	-1089.739	-1.933	0.101
20	4.100	991.763	-1089.748	-1.933	0.101
j	5.000	-23.682	-1167.049	-1.933	0.000

No of Member : 5 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-8.905	-0.911	-166.583	0.000
1	4.900	-13.367	-0.911	-166.583	-0.401
j	9.800	-17.828	-0.911	-166.583	0.000

No of Member : 6 (3 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-8.742	-0.877	-580.037	0.000
1	4.900	-13.037	-0.877	-580.037	-0.391
j	9.800	-17.333	-0.877	-580.037	0.000

Working Condition : Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 / 07 / 2002		08 / 08 / 2002

FN: Calculation_Sheet

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
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No of Member 4

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
3	1.300	4254.672	1173.780	-4.504	0.250
4	1.300	4254.733	605.367	-4.504	0.250
5	2.400	4846.332	470.366	-4.504	0.333
6	2.400	4846.322	-98.047	-4.504	0.333
7	3.300	4708.392	-208.500	-4.504	0.298
8	3.300	4708.313	-776.913	-4.504	0.298
j	5.000	3210.302	-985.558	-4.504	0.000

No of Member 4 (8 - 10)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	3223.990	1041.387	-3.078	0.000
1	0.500	3729.341	980.017	-3.078	0.095
2	0.500	3729.382	411.605	-3.078	0.095
3	1.400	4050.086	301.151	-3.078	0.209
4	1.400	4050.059	-267.261	-3.078	0.209
5	2.500	3681.855	-402.263	-3.078	0.245
6	2.500	3681.757	-970.675	-3.078	0.245
7	3.400	2758.548	-1081.129	-3.078	0.196
8	3.400	2758.381	-1649.541	-3.078	0.196
j	5.000	-37.806	-1845.913	-3.078	0.000

No of Member 5 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-16.164	-1.882	-326.556	0.000
1	4.900	-25.383	-1.882	-326.556	-0.762
j	9.800	-34.603	-1.882	-326.556	0.000

No of Member 6 (3 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-15.432	-1.729	-1071.257	0.000
1	4.900	-23.904	-1.729	-1071.257	-0.717
j	9.800	-32.376	-1.729	-1071.257	0.000

Pausing Condition - Vertical Load

		Prepared by	Y. Ando	Checked by	D. NISHIMURA
			26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
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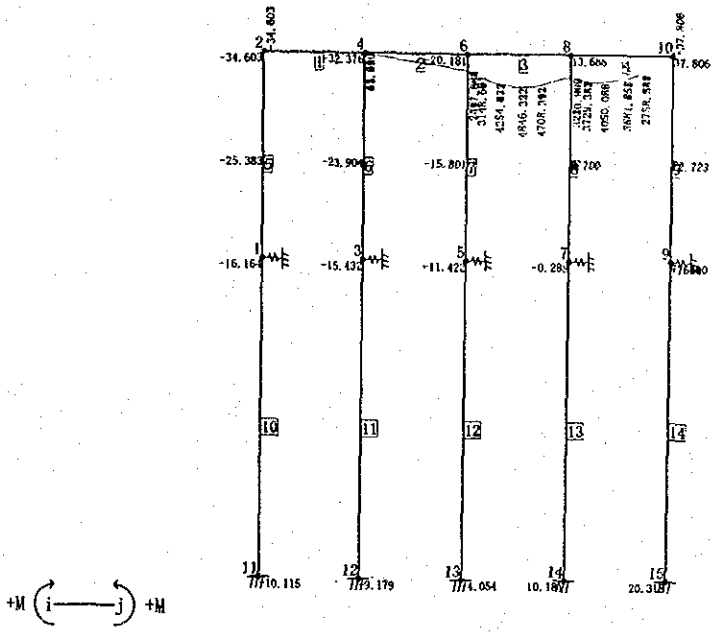
Figure of Bending Moment



No of Member 1 (2 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-34.603	326.556	-1.882	0.000
j	5.000	63.926	-287.144	-1.882	0.000

No of Member 2 (4 - 6)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	31.550	784.113	-3.611	0.000
j	5.000	2417.864	170.413	-3.611	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	2397.683	1901.742	-4.504	0.000
1	0.400	3148.561	1852.646	-4.504	0.091
2	0.400	3148.691	1284.233	-4.504	0.091

Pausing Condition · Vertical Load

	Prepared by	Y.Ando	Checked by	R. NISHIHARA
		26/07/2002		08/08/2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 15	Rev.

References/ Notes

No of Member 1

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
5	1.900	2123.329	1061.949	-3.550	0.246
6	1.900	2123.437	1061.940	-3.550	0.246
7	2.800	3044.294	984.639	-3.550	0.284
8	2.800	3044.343	484.830	-3.550	0.284
9	2.900	3092.348	476.249	-3.550	0.283
10	2.900	3092.396	476.240	-3.550	0.283
11	3.700	3445.859	407.529	-3.550	0.238
12	3.700	3445.850	-92.280	-3.550	0.238
13	3.900	3425.687	-109.451	-3.550	0.214
14	3.900	3425.676	-109.460	-3.550	0.214
15	4.000	3414.312	-118.041	-3.550	0.201
16	4.000	3414.300	-118.050	-3.550	0.201
17	4.800	3292.391	-186.761	-3.550	0.050
18	4.800	3292.322	-686.570	-3.550	0.050
19	4.900	3223.306	-695.151	-3.550	0.025
20	4.900	3223.236	-695.160	-3.550	0.025
j	5.000	3153.361	-703.741	-3.550	0.000

No of Member 2 (4 - 6)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	3132.271	1023.706	-5.159	0.000
1	0.900	3918.857	446.596	-5.159	0.258
2	0.900	3918.902	446.587	-5.159	0.258
3	1.000	3963.087	438.006	-5.159	0.280
4	1.000	3963.131	437.997	-5.159	0.280
5	1.900	4322.503	360.696	-5.159	0.413
6	1.900	4322.488	-139.113	-5.159	0.413
7	2.000	4308.163	-147.694	-5.159	0.420
8	2.000	4308.148	-147.703	-5.159	0.420
9	2.900	4090.468	-724.804	-5.159	0.418
10	2.900	4090.395	-724.813	-5.159	0.418
11	3.000	4017.558	-733.394	-5.159	0.411
12	3.000	4017.484	-733.403	-5.159	0.411
13	3.900	3322.714	-810.704	-5.159	0.281
14	3.900	3322.582	-1310.513	-5.159	0.281

Seismic Condition Vertical Load

		Prepared by	Y. Ando	Checked by	E. NISHIHARA
			26/07/2002		08/08/2002

FN: Calculation_Sheet

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
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No of Member /

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
5	1.900	-45.941	-98.679	-0.282	-0.014
6	1.900	-45.951	-98.688	-0.282	-0.014
7	2.800	-169.541	-175.989	-0.282	-0.020
8	2.800	-169.559	-175.998	-0.282	-0.020
9	2.900	-187.569	-184.579	-0.282	-0.020
10	2.900	-187.588	-184.588	-0.282	-0.020
11	3.700	-362.721	-253.299	-0.282	-0.020
12	3.700	-362.746	-253.308	-0.282	-0.020
13	3.900	-415.098	-270.479	-0.282	-0.019
14	3.900	-415.126	-270.488	-0.282	-0.019
15	4.000	-442.576	-279.069	-0.282	-0.018
16	4.000	-442.604	-279.078	-0.282	-0.018
17	4.800	-693.319	-347.789	-0.282	-0.005
18	4.800	-693.354	-347.798	-0.282	-0.005
19	4.900	-728.527	-356.379	-0.282	-0.003
20	4.900	-728.563	-356.388	-0.282	-0.003
j	5.000	-764.595	-364.969	-0.282	0.000

No of Member 2 (4 - 6)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-780.653	227.123	-0.740	0.000
1	0.900	-611.032	149.813	-0.740	-0.036
2	0.900	-611.017	149.804	-0.740	-0.036
3	1.000	-596.480	141.223	-0.740	-0.039
4	1.000	-596.466	141.214	-0.740	-0.039
5	1.900	-504.169	63.913	-0.740	-0.055
6	1.900	-504.163	63.904	-0.740	-0.055
7	2.000	-498.207	55.323	-0.740	-0.056
8	2.000	-498.202	55.314	-0.740	-0.056
9	2.900	-483.206	-21.987	-0.740	-0.057
10	2.900	-483.208	-21.996	-0.740	-0.057
11	3.000	-485.834	-30.577	-0.740	-0.056
12	3.000	-485.838	-30.586	-0.740	-0.056
13	3.900	-548.143	-107.887	-0.740	-0.041
14	3.900	-548.154	-107.896	-0.740	-0.041

Seismic Condition Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIHARA
			26 / 07 / 2002		08 / 08 / 2002

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 16	Rev.

References/ Notes

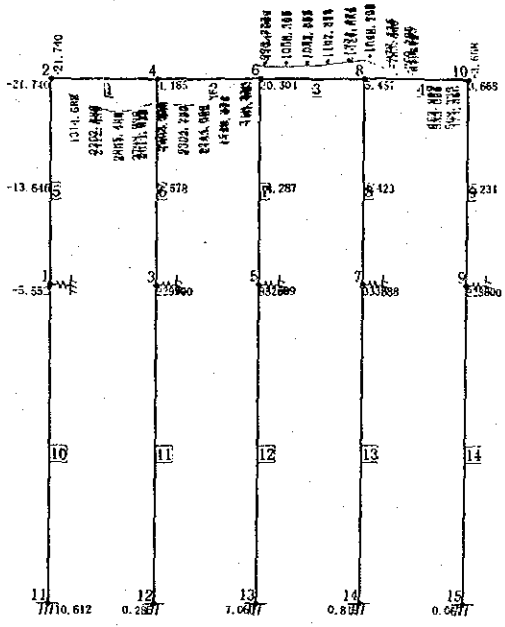
No of Member

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-7.484	0.934	-1139.754	0.000
j	15.200	6.712	0.934	-1139.754	0.000

No of Member 14 (9 - 15)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-6.114	0.729	-847.944	0.000
j	15.200	4.959	0.729	-847.944	0.000

Figure of Bending Moment



+M i——j +M

No of Member 1 (2 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-21.740	1704.744	-1.652	0.000
1	0.800	1314.568	1636.024	-1.652	0.124
2	0.800	1314.682	1136.215	-1.652	0.124
3	1.700	2302.380	1058.914	-1.652	0.229
4	1.700	2302.436	559.105	-1.652	0.229

Seismic Condition : Vertical Load

		Prepared by	Y. Ando	Checked by	K. NISHIMURA
			26 07 12002		08 / 08 / 12002

FN: Calculation_Sheet

Project	Detailed Design on Port Reactivation Project in La Union	Calc. File No.	
Section	Civil	Calc. Index No.	
Subject	Quaywall	Page No. 17	Rev.

References/ Notes

No of Member

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
5	1.900	1293.180	631.683	-4.367	0.156
6	1.900	1293.244	631.674	-4.367	0.156
7	2.800	1826.905	554.373	-4.367	0.182
8	2.800	1826.961	554.364	-4.367	0.182
9	2.900	1881.913	545.783	-4.367	0.182
10	2.900	1881.968	545.774	-4.367	0.182
11	3.700	2291.052	477.063	-4.367	0.156
12	3.700	2291.100	477.054	-4.367	0.156
13	3.900	2384.746	459.883	-4.367	0.142
14	3.900	2384.793	459.874	-4.367	0.142
15	4.000	2430.305	451.293	-4.367	0.134
16	4.000	2430.350	451.284	-4.367	0.134
17	4.800	2763.851	382.573	-4.367	0.034
18	4.800	2763.890	382.564	-4.367	0.034
19	4.900	2801.679	373.983	-4.367	0.018
20	4.900	2801.717	373.974	-4.367	0.018
j	5.000	2838.648	365.393	-4.367	0.000

No of Member 2 (4 - 6)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	2795.661	1435.807	-7.426	0.000
1	0.900	4053.098	1358.497	-7.426	0.297
2	0.900	4053.185	858.689	-7.426	0.297
3	1.000	4138.538	850.107	-7.426	0.323
4	1.000	4138.624	850.099	-7.426	0.323
5	1.900	4868.845	772.797	-7.426	0.492
6	1.900	4868.923	772.789	-7.426	0.492
7	2.000	4945.695	764.207	-7.426	0.502
8	2.000	4945.722	264.399	-7.426	0.502
9	2.900	5148.872	187.097	-7.426	0.517
10	2.900	5148.841	-312.711	-7.426	0.517
11	3.000	5117.173	-321.293	-7.426	0.509
12	3.000	5117.140	-321.301	-7.426	0.509
13	3.900	4793.220	-398.603	-7.426	0.362
14	3.900	4793.179	-398.611	-7.426	0.362

Seismic Condition · Vertical Load

	Prepared by	Y. Ando	Checked by	R. NISHIHURA
		26/07/2002		08/08/2002

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No of Member 2

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
15	4.000	-1624.124	-558.747	0.599	-0.082
16	4.000	-1624.180	-558.756	0.599	-0.082
17	4.100	-1680.428	-567.337	0.599	-0.077
18	4.100	-1680.485	-567.346	0.599	-0.077
19	4.900	-2161.786	-636.057	0.599	-0.011
20	4.900	-2161.850	-636.066	0.599	-0.011
j	5.000	-2225.821	-644.647	0.599	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-2224.641	678.487	0.549	0.000
1	0.900	-1648.793	601.177	0.549	-0.072
2	0.900	-1648.732	601.168	0.549	-0.072
3	1.000	-1589.104	592.587	0.549	-0.077
4	1.000	-1589.045	592.578	0.549	-0.077
5	1.900	-1090.566	515.277	0.549	-0.098
6	1.900	-1090.514	515.268	0.549	-0.098
7	2.000	-1039.468	506.687	0.549	-0.098
8	2.000	-1039.417	506.678	0.549	-0.098
9	2.900	-618.239	429.377	0.549	-0.084
10	2.900	-618.196	429.368	0.549	-0.084
11	3.000	-575.731	420.787	0.549	-0.081
12	3.000	-575.688	420.778	0.549	-0.081
13	3.900	-231.812	343.477	0.549	-0.049
14	3.900	-231.778	343.468	0.549	-0.049
15	4.000	-197.894	334.887	0.549	-0.044
16	4.000	-197.860	334.878	0.549	-0.044
17	4.100	-164.835	326.297	0.549	-0.040
18	4.100	-164.802	326.288	0.549	-0.040
19	4.900	68.714	257.577	0.549	-0.004
20	4.900	68.740	257.568	0.549	-0.004
j	5.000	94.043	248.987	0.549	0.000

Seismic Condition · Vertical Load

		Prepared by	Y. Ando	Checked by	E. NISHIHORA
			26/07/2002		08/08/2002

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– No of Member 2

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
15	4.000	3191.234	-1319.094	-5.159	0.261
16	4.000	3191.101	-1319.103	-5.159	0.261
17	4.100	3058.895	-1327.684	-5.159	0.239
18	4.100	3058.761	-1327.693	-5.159	0.239
19	4.900	1919.280	-1896.204	-5.159	0.030
20	4.900	1919.088	-1896.213	-5.159	0.030
j	5.000	1729.230	-1904.794	-5.159	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	1752.271	-294.051	-3.746	0.000
1	0.900	1452.835	-371.361	-3.746	0.063
2	0.900	1452.798	-371.370	-3.746	0.063
3	1.000	1415.269	-379.951	-3.746	0.067
4	1.000	1415.231	-379.960	-3.746	0.067
5	1.900	1038.524	-457.261	-3.746	0.084
6	1.900	1038.478	-457.270	-3.746	0.084
7	2.000	992.368	-465.851	-3.746	0.084
8	2.000	992.321	-465.860	-3.746	0.084
9	2.900	538.313	-543.161	-3.746	0.068
10	2.900	538.258	-543.170	-3.746	0.068
11	3.000	483.567	-551.751	-3.746	0.066
12	3.000	483.511	-551.760	-3.746	0.066
13	3.900	-47.799	-629.061	-3.746	0.034
14	3.900	-47.862	-629.070	-3.746	0.034
15	4.000	-111.134	-637.651	-3.746	0.031
16	4.000	-111.199	-637.660	-3.746	0.031
17	4.100	-175.329	-646.241	-3.746	0.027
18	4.100	-175.394	-646.250	-3.746	0.027
19	4.900	-719.810	-714.961	-3.746	0.002
20	4.900	-719.882	-714.970	-3.746	0.002
j	5.000	-791.735	-723.551	-3.746	0.000

Seismic Condition · Vertical Load

		Prepared by	Y.Ando	Checked by	R. NISHIHARA
			26/07/2002		08/08/2002

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No of Member

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
15	4.000	4094.019	-186.591	-6.753	0.246
16	4.000	4094.000	-186.600	-6.753	0.246
17	4.100	4074.931	-195.181	-6.753	0.227
18	4.100	4074.911	-195.190	-6.753	0.227
19	4.900	3891.298	-263.901	-6.753	0.031
20	4.900	3891.271	-263.910	-6.753	0.031
j	5.000	3864.478	-272.491	-6.753	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	3852.967	992.893	-7.426	0.000
1	0.900	4711.781	915.583	-7.426	0.311
2	0.900	4711.823	415.774	-7.426	0.311
3	1.000	4752.930	407.193	-7.426	0.337
4	1.000	4752.971	407.184	-7.426	0.338
5	1.900	5084.614	329.883	-7.426	0.500
6	1.900	5084.647	329.874	-7.426	0.500
7	2.000	5117.173	321.293	-7.426	0.509
8	2.000	5117.205	321.284	-7.426	0.509
9	2.900	4971.707	-255.817	-7.426	0.511
10	2.900	4971.681	-255.826	-7.426	0.511
11	3.000	4945.695	-264.407	-7.426	0.502
12	3.000	4945.618	-764.216	-7.426	0.502
13	3.900	4223.119	-841.517	-7.426	0.348
14	3.900	4223.034	-841.526	-7.426	0.348
15	4.000	4138.538	-850.107	-7.426	0.323
16	4.000	4138.452	-850.116	-7.426	0.323
17	4.100	4053.098	-858.697	-7.426	0.297
18	4.100	4052.961	-1358.506	-7.426	0.297
19	4.900	2938.812	-1427.217	-7.426	0.038
20	4.900	2938.668	-1427.226	-7.426	0.038
j	5.000	2795.661	-1435.807	-7.426	0.000

Seismic Condition · Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

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Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
15	4.000	4632.026	55.713	-7.297	0.296
16	4.000	4631.981	-444.095	-7.297	0.296
17	4.100	4587.188	-452.677	-7.297	0.273
18	4.100	4587.142	-452.685	-7.297	0.273
19	4.900	4197.558	-521.397	-7.297	0.036
20	4.900	4197.455	-1021.205	-7.297	0.036
j	5.000	4095.009	-1029.787	-7.297	0.000

No of Member 3 (6 - 8)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	4091.075	769.245	-7.529	0.000
1	0.900	4748.606	691.935	-7.529	0.302
2	0.900	4748.676	691.926	-7.529	0.302
3	1.000	4817.370	683.345	-7.529	0.327
4	1.000	4817.439	683.336	-7.529	0.327
5	1.900	4997.751	106.235	-7.529	0.478
6	1.900	4997.762	106.226	-7.529	0.478
7	2.000	5007.945	97.645	-7.529	0.486
8	2.000	5007.904	-402.164	-7.529	0.486
9	2.900	4611.215	-479.465	-7.529	0.481
10	2.900	4611.167	-479.474	-7.529	0.481
11	3.000	4562.839	-488.055	-7.529	0.472
12	3.000	4562.790	-488.064	-7.529	0.472
13	3.900	3688.960	-1065.165	-7.529	0.321
14	3.900	3688.853	-1065.174	-7.529	0.321
15	4.000	3582.014	-1073.755	-7.529	0.298
16	4.000	3581.855	-1573.564	-7.529	0.298
17	4.100	3424.229	-1582.145	-7.529	0.273
18	4.100	3424.069	-1582.154	-7.529	0.273
19	4.900	2131.025	-1650.865	-7.529	0.034
20	4.900	2130.858	-1650.874	-7.529	0.034
j	5.000	1965.509	-1659.455	-7.529	0.000

Seismic Condition - Vertical Load

		Prepared by	Y.Ando	Checked by	R. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

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— No of Member 4 —

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	3385.158	216.410	-4.072	0.000
1	0.900	3545.138	139.100	-4.072	0.189
2	0.900	3545.152	139.092	-4.072	0.189
3	1.100	3571.240	121.920	-4.072	0.217
4	1.100	3571.201	-377.888	-4.072	0.217
5	1.800	3285.678	-438.010	-4.072	0.277
6	1.800	3285.634	-438.018	-4.072	0.277
7	2.000	3196.358	-455.190	-4.072	0.284
8	2.000	3196.262	-954.998	-4.072	0.284
9	2.100	3100.430	-963.580	-4.072	0.285
10	2.100	3100.333	-963.588	-4.072	0.285
11	2.900	2302.078	-1032.300	-4.072	0.261
12	2.900	2301.974	-1032.308	-4.072	0.261
13	3.000	2198.418	-1040.890	-4.072	0.254
14	3.000	2198.313	-1040.898	-4.072	0.254
15	3.200	1988.523	-1058.070	-4.072	0.238
16	3.200	1988.416	-1058.078	-4.072	0.238
17	3.800	1338.219	-1109.610	-4.072	0.172
18	3.800	1338.107	-1109.618	-4.072	0.172
19	4.100	1001.470	-1135.380	-4.072	0.133
20	4.100	1001.356	-1135.388	-4.072	0.133
j	5.000	-55.161	-1212.690	-4.072	0.000

No of Member 5 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-16.305	-2.502	-207.323	0.000
1	4.900	-28.565	-2.502	-207.323	-0.857
j	9.800	-40.825	-2.502	-207.323	0.000

No of Member 6 (3 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-15.826	-2.402	-953.622	0.000
1	4.900	-27.598	-2.402	-953.622	-0.828
j	9.800	-39.370	-2.402	-953.622	0.000

Seismic Condition · Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIHARA
			26/07/2002		08/08/2002

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No of Member : 4

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-1676.741	859.241	-0.089	0.000
1	0.900	-938.214	781.931	-0.089	-0.018
2	0.900	-938.135	781.922	-0.089	-0.018
3	1.100	-783.546	764.751	-0.089	-0.018
4	1.100	-783.469	764.742	-0.089	-0.018
5	1.800	-269.266	704.621	-0.089	-0.009
6	1.800	-269.195	704.612	-0.089	-0.009
7	2.000	-130.060	687.441	-0.089	-0.006
8	2.000	-129.990	687.432	-0.089	-0.006
9	2.100	-61.745	678.851	-0.089	-0.004
10	2.100	-61.677	678.842	-0.089	-0.004
11	2.900	453.847	610.131	-0.089	0.010
12	2.900	453.909	610.122	-0.089	0.010
13	3.000	514.431	601.541	-0.089	0.012
14	3.000	514.441	101.732	-0.089	0.012
15	3.200	533.061	84.561	-0.089	0.014
16	3.200	533.070	84.552	-0.089	0.014
17	3.800	568.335	33.021	-0.089	0.015
18	3.800	568.339	33.012	-0.089	0.015
19	4.100	474.416	-492.549	-0.089	0.013
20	4.100	474.366	-492.558	-0.089	0.013
j	5.000	-3.668	-569.859	-0.089	0.000

No of Member 5 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-5.552	-1.652	-1704.744	0.000
1	4.900	-13.646	-1.652	-1704.744	-0.410
j	9.800	-21.740	-1.652	-1704.744	0.000

No of Member 6 (3 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	2.970	0.124	-1784.200	0.000
1	4.900	3.578	0.124	-1784.200	0.107
j	9.800	4.185	0.124	-1784.200	0.000

Seismic Condition : Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26 07 12002		08 08 12002

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No of Member 4

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	2530.449	681.646	-2.779	0.000
1	0.900	3109.141	604.336	-2.779	0.189
2	0.900	3109.202	604.327	-2.779	0.189
3	1.100	3228.290	587.156	-2.779	0.219
4	1.100	3228.299	87.347	-2.779	0.219
5	1.800	3268.394	27.226	-2.779	0.289
6	1.800	3268.396	27.217	-2.779	0.289
7	2.000	3272.121	10.046	-2.779	0.299
8	2.000	3272.071	-489.763	-2.779	0.299
9	2.100	3222.716	-498.344	-2.779	0.302
10	2.100	3222.665	-498.353	-2.779	0.302
11	2.900	2796.552	-567.064	-2.779	0.288
12	2.900	2796.495	-567.073	-2.779	0.288
13	3.000	2739.416	-575.654	-2.779	0.281
14	3.000	2739.358	-575.663	-2.779	0.281
15	3.200	2572.588	-1092.634	-2.779	0.265
16	3.200	2572.477	-1092.643	-2.779	0.265
17	3.800	1901.545	-1144.174	-2.779	0.197
18	3.800	1901.429	-1144.183	-2.779	0.197
19	4.100	1504.447	-1669.744	-2.779	0.153
20	4.100	1504.279	-1669.753	-2.779	0.153
j	5.000	-33.112	-1747.054	-2.779	0.000

No of Member 5 (1 - 2)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-12.727	-1.097	-101.126	0.000
1	4.900	-18.104	-1.097	-101.126	-0.543
j	9.800	-23.482	-1.097	-101.126	0.000

No of Member 6 (3 - 4)

Point	Distance (m)	Bending moment Mz (kN·m)	Shearing force Sy (kN)	Axial force Nx (kN)	Deflection δ (mm)
i	0.000	-13.242	-1.205	-708.820	0.000
1	4.900	-19.145	-1.205	-708.820	-0.575
j	9.800	-25.048	-1.205	-708.820	0.000

Seismic Condition Vertical Load

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

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Serviceability limit state

$$W = k_1 \times \{4C + 0.7 \times (C_\phi - \phi)\} \times (\sigma_s / Es)$$

W : crack width
k_1 : coefficient of adhesive condition of re-bar
C : cover over re-bar
C_ϕ : re-bar pitch
ϕ : re-bar diameter
σ_s : increase of re-bar stress
Es : Young's modulus of re-bar

$$Wa = 0.0035C$$

Wa : acceptable crack width
C : cover over re-bar

Ultimate limit state

1.Examination for moment

$$\varepsilon_y = f_{yk} / (\gamma_{ms} \cdot Es)$$

ε_y : yield strain of re-bar
f_{yk} : yield strength of re-bar
γ_{ms} : material modulus
Es : Young's modulus of re-bar

$$M_{ud} = Ts\,(d - 0.4X) / \gamma_b$$

M_{ud} : bearable moment
Ts : tensile strength
d : effective height
X : effective distance between neutral axis and edge
γ_b : material modulus

2.Examination for shearing force

$$V_{yd} = V_{cd} + V_{sd}$$

V_{yd} : design bearable shearing strength
V_{cd} : design bearable shearing strength without stirrup
V_{sd} : design bearable shearing strength of stirrup

$$V_{yd} = \beta_d \cdot \beta_p \cdot \beta_n \cdot f_{vcd} \cdot b \cdot d / \gamma_b$$

β_d : $(1/d)^{1/4}$
d : effective height
β_p : $(100p_w)^{1/3}$
p_w : ratio of re-bar to concrete
β_n : modulus related to moment
f_{vcd} : $0.2 \cdot (f_{cd})^{1/3}$
f_{cd} : design strength of concrete
γ_b : material modulus

		Prepared by	Y.Ando	Checked by	E. NISHIMURA
			26 / 07 /2002		08 / 08 /2002

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Fatigue limit state

1.Examination for moment

a) concrete

$$f_{rd} = k_1 \cdot f_d (1 - \log N / K)$$

f_{rd} : bending and tensile strength of concrete
k_1 : modulus related to strength condition
f_d : design strength of concrete
N : repeated times
K : modulus related to concrete type

b) concrete

$$f_{srd} = 190 \cdot 10^a / N^k (1 - \sigma_{sp} / f_{sd}) / \gamma_s$$

f_{srd} : design strength of re-bar
a : $0.81 - 0.003\phi$
ϕ : diameter of re-bar
N : repeated times
k : 0.12 (constant)
σ_{sp} : permanent load
f_{sd} : design tensile strength of re-bar
γ_s : material modulus

2.Examination for shearing force

$$V_{rcd} = V_{cd} \cdot (1 - \log N / 11)$$

V_{rcd} : design bearable shear strength
V_{cd} : design bearable shear strength without stirrup
N : repeated times

$$V_{cd} = \beta_d \cdot \beta_p \cdot \beta_n \cdot f_{vcd} \cdot b \cdot d / \gamma_b$$

β_d : $(1/d)^{1/4}$
d : effective height
β_p : $(100 p_w)^{1/3}$
p_w : ratio of re-bar to concrete
β_n : modulus related to moment
f_{vcd} : $0.2 \cdot (f_{cd})^{1/3}$
f_{cd} : design strength of concrete
γ_b : material modulus

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Calculation Result of FRAME

Working	moment (upper)	moment (under)
Max	3335.906	-1245.854 kNm
①	2927.889	-336.552 kNm
②	3335.906	-1245.854 kNm
③	3315.308	-1190.604 kNm
④	2320.96	-974.838 kNm

Working	shearing force
Max	1694.554 kN
①	1694.554 kN
②	1240.378 kN
③	1094.558 kN
④	1167.049 kN

Mooring	moment (upper)	moment (under)
Max	4846.332	-37.806 kNm

Mooring	shearing force
Max	1901.742 kN

Earthquak	moment (upper)	moment (under)
Max	5148.872	-2225.821 kNm
①	3445.859	-764.595 kNm
②	5148.872	-2225.821 kNm
③	5117.205	-2224.641 kNm
④	3571.24	-1676.741 kNm

Earthquake	shearing force
Max	1904.794 kN
①	1704.744 kN
②	1904.794 kN
③	1659.455 kN
④	1747.054 kN

Moment and Shearing Force of Member

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Typical section (under)

Case-1				Case-2			
Re-bar	D29	nos	16	Re-bar	D25	nos	32
sectional area	6.424	As	102.784	sectional area	5.067	As	162.144
sectional width b	170			sectional width	170		
height d'	200	effective height	190	height d'	200	effective heigh	185
location of re-bar	10			location of re-b	15	10	
Es	200			Es	200		
Ec	25			Ec	25		
n	8			n	8		
neutral axis x		38.307 cm		neutral axis x		46.049 cm	
		383.07 mm				460.49 mm	
Md	3335.906 kNm			Md	3335.906 kNm		
σs	0.183 kN/mm^2			σs	0.121 kN/mm^2		
cover over re-bar	85.5 mm			cover over re-b	87.5 mm		
pitch of re-bar	100 mm			pitch of re-bar	100 mm		
width of crack w		0.358		width of crack w		0.244	
acceptable width of crack wa		*0.299*	NG !!	acceptable width of crack w		*0.306*	OK !

Typical section (upper)

Case-1				Case-2			
Re-bar	D22	nos	16	Re-bar	D25	nos	11
sectional area	3.871	As	61.936	sectional area	5.067	As	55.737
sectional width b	170			sectional width	170		
height d'	200	effective height	190	height d'	200	effective heigh	190
location of re-bar	10			location of re-b	10		
Es	200			Es	200		
Ec	25			Ec	25		
n	8			n	8		
neutral axis x		30.493 cm		neutral axis x		29.057 cm	
		304.93 mm				290.57 mm	
Md	1245.854 kNm			Md	1245.854 kNm		
σs	0.112 kN/mm^2			σs	0.124 kN/mm^2		
cover over re-bar	89 mm			cover over re-b	87.5 mm		
pitch of re-bar	100 mm			pitch of re-bar	150 mm		
width of crack w		0.23		width of crack w		0.271	
acceptable width of crack wa		*0.312*	OK !	acceptable width of crack w		*0.306*	OK !

Serviceability Limit State Working Condition

	Prepared by	Y.Ando	Checked by	E. NISHIMURA
		26 / 07 /2002		08 / 08 /2002

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Wide section (under)

Case-1				Case-2			
Re-bar	D29 nos	29		Re-bar	D25 nos	32	
					D22 nos	24	
sectional area	6.424 As	186.296		sectional area	5.067 As	162.144	
					3.871	92.904	
sectional width b	300			sectional width b	300		
height d'	200 effective heigh	190		height d'	200 effective height	185	
location of re-ba	10			location of re-ba	15 10		
Es	200			Es	200		
Ec	25			Ec	25		
n	8			n	8		
neutral axis x	38.764 cm			neutral axis x	43.822 cm		
	387.64 mm				438.22 mm		
Md	4846.332 kNm			Md	4846.332 kNm		
σs	0.147 kN/mm²			σs	0.112 kN/mm²		
cover over re-ba	85.5 mm			cover over re-ba	87.5 mm		
pitch of re-bar	100 mm			pitch of re-bar	100 mm		
width of crack w	0.288			width of crack w	0.225		
acceptable width of crack wa	0.299	OK !		acceptable width of crack wa	0.306	OK !	

Wide section (upper)

Case-1				Case-2			
Re-bar	D22 nos	11		Re-bar	D22 nos	16	
sectional area	3.871 As	42.581		sectional area	3.871 As	61.936	
sectional width b	250			sectional width b	250		
height d'	200 effective heigh	190		height d'	200 effective height	190	
location of re-ba	10			location of re-ba	10		
Es	200			Es	200		
Ec	25			Ec	25		
n	8			n	8		
neutral axis x	21.433 cm			neutral axis x	25.533 cm		
	214.33 mm				255.33 mm		
Md	37.806 kNm			Md	37.806 kNm		
σs	0.005 kN/mm²			σs	0.003 kN/mm²		
cover over re-ba	89 mm			cover over re-ba	89 mm		
pitch of re-bar	200 mm			pitch of re-bar	100 mm		
width of crack w	0.012			width of crack w	0.006		
acceptable width of crack wa	0.312	OK !		acceptable width of crack wa	0.312	OK !	

Serviceability Limit State . Pausing Condition

		Prepared by	Y. Ando	Checked by	E. NISHIMURA
			26 / 07 / 2002		08 / 08 / 2002

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References/ Notes

Typical section

examination for moment

Re-bar	D25	nos	32
sectional area	5.067	As	162.144
sectional width b	170		
height d'	200	effective heigh	185
location of re-ba	15		
Es	200	kN/mm^2	
γ_{ms}	1.0		
f_{yk}	345	N/mm^2	
ε y	0.00173		
Ts	5,593,968	N	
f'cd	18.5	N/mm^2	
x	261.57	mm	
ε s	0.01925	OK !	
γ_b	1.15		
M_{nd}	8490	kNm	
γ_t	1.0		
M_d	3335.906	kNm	
F	0.39	OK !	

examination for shearing force

1) main re-bar

Re-bar	D25	nos	32
sectional area	5.067	As	162.144
sectional width b	170		
height d'	200	effective heigh	185
location of re-ba	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.802		
γ_b	1.3		
V_{cd}	880.06	kN	

2) stirrup

Re-bar	D13	pitch	20
sectional area	1.267	Aw	2.534
fwyd	345	N/mm^2	
z	160.87	cm	
γ_b	1.15		
V_{sd}	611.47	kN	
V_{yd}	1491.53	kN	
γ_t	1.0		
V_d	1694.554	kN	
F	1.1	NG !!	

examination for shearing force

1) main re-bar

Re-bar	D25	nos	32
sectional area	5.067	As	162.144
sectional width b	170		
height d'	200	effective height	185
location of re-ba	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.802		
γ_b	1.3		
V_{cd}	880.06	kN	

2) stirrup

Re-bar	D16	pitch	20
sectional area	1.986	Aw	3.972
fwyd	345	N/mm^2	
z	160.87	cm	
γ_b	1.15		
V_{sd}	958.46	kN	
V_{yd}	1838.52	kN	
γ_t	1.0		
V_d	1694.554	kN	
F	0.92	OK !	

Ultimate Limit State : Working Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
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References/ Notes

Wide section

examination for moment

Re-bar	D25	nos	48
sectional area	5.067	As	243.216
sectional width b	250		
height d'	200	effective height	190
location of re-ba	10		
Es	200	kN/mm^2	
γ_{ms}	1.0		
f_{yk}	345	N/mm^2	
εy	0.00173		
Ts	8,390,952	N	
f'cd	18.5	N/mm^2	
x	266.8	mm	
εs	0.0293	OK !	
γ_b	1.15		
M_{nd}	13084.6	kNm	
γ_t	1.0		
M_d	4846.332	kNm	
F	0.37	OK !	

examination for shearing force

1) main re-bar

Re-bar	D25	nos	48
sectional area	5.067	As	243.216
sectional width b	250		
height d'	200	effective height	185
location of re-ba	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.807		
γ_b	1.3		
V_{cd}	1302.28	kN	

2) stirrup

Re-bar	D13	pitch	20
sectional area	1.267	Aw	2.534
fwyd	345	N/mm^2	
z	160.87	cm	
γ_b	1.15		
V_{sd}	611.47	kN	
V_{yd}	1913.75	kN	
γ_t	1.0		
V_d	1901.742	kN	
F	0.99	OK !	

examination for shearing force

1) main re-bar

Re-bar	D25	nos	48
sectional area	5.067	As	243.216
sectional width b	250		
height d'	200	effective height	185
location of re-ba	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.807		
γ_b	1.3		
V_{cd}	1302.28	kN	

2) stirrup

Re-bar	D16	pitch	20
sectional area	1.986	Aw	3.972
fwyd	345	N/mm^2	
z	160.87	cm	
γ_b	1.15		
V_{sd}	958.46	kN	
V_{yd}	2260.74	kN	
γ_t	1.0		
V_d	1901.742	kN	
F	0.84	OK !	

Ultimate Limit State : Pausing Condition

		Prepared by	Y. Ando	Checked by	K. NISHIHORA
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References/ Notes

Typical section

examination for moment			
Re-bar	D25	nos	32
sectional area	5.067	As	162.144
sectional width b	170		
height d'	200	effective heigh	185
location of re-ba	15		
Es	200	kN/mm^2	
γ_{ms}	1.0		
f_{yk}	345	N/mm^2	
ε y	0.00173		
Ts	5,593,968	N	
f'cd	18.5	N/mm^2	
x	261.57	mm	
ε s	0.01925	OK !	
γ_b	1.0		
M_{nd}	9763.6	kNm	
γ_t	1.0		
M_d	5148.872	kNm	
F	0.53	OK !	

examination for shearing force			
1) main re-bar			
Re-bar	D25	nos	32
sectional area	5.067	As	162.144
sectional width b	170		
height d'	200	effective heigh	185
location of re-ba	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.802		
γ_b	1.15		
V_{cd}	994.86	kN	
2) stirrup			
Re-bar	D13	pitch	20
sectional area	1.267	Aw	2.534
fwyd	345	N/mm^2	
z	160.87	cm	
γ_b	1.0		
V_{sd}	703.19	kN	
V_{yd}	1698.05	kN	
γ_t	1.0		
V_d	1904.794	kN	
F	1.12	NG !!	

examination for shearing force			
1) main re-bar			
Re-bar	D25	nos	32
sectional ar	5.067	As	162.144
sectional w	170		
height d'	200	effective height	185
location of	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.802		
γ_b	1.15		
V_{cd}	994.86	kN	
2) stirrup			
Re-bar	D16	pitch	20
sectional ar	1.986	Aw	3.972
fwyd	345	N/mm^2	
z	160.87	cm	
γ_b	1.0		
V_{sd}	1102.23	kN	
V_{yd}	2097.09	kN	
γ_t	1.0		
V_d	1904.794	kN	
F	0.91	OK !	

Ultimate Limit State · Seismic Condition

		Prepared by	Y. Ando	Checked by	R. NISHIMURA
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References/ Notes

Wide section

examination for moment

Re-bar	D25, D22	nos	32, 24
sectional area		As	255.048
sectional width b	300		
height d'	200	effective heigh	185
location of re-ba	15		
Es	200	kN/mm^2	
γ_{ms}	1.0		
f_{yk}	345	N/mm^2	
εy	0.00173		
Ts	8,799,156	N	
f'cd	18.5	N/mm^2	
x	233.15	mm	
εs	0.04154	OK !	
γ_b	1.15		
M_{nd}	22240.7	kNm	
γ_t	1.0		
M_d	5148.872	kNm	
F	0.23	OK !	

examination for shearing force

1) main re-bar

Re-bar	D25, D22	nos	32, 24
sectional area		As	255.048
sectional width b	300		
height d'	200	effective heigh	185
location of re-ba	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.772		
γ_b	1.3		
V_{cd}	1494.96	kN	

2) stirrup

Re-bar	D13	pitch	20
sectional area	1.267	Aw	2.534
fwyd	345	N/mm^2	
z	160.87	cm	
γ_b	1.15		
V_{sd}	611.47	kN	
V_{yd}	2106.43	kN	
γ_t	1.0		
V_d	1904.794	kN	
F	0.90	OK !	

examination for shearing force

1) main re-bar

Re-bar	D25, D22	nos	32, 24
sectional area		As	255.048
sectional w	300		
height d'	200	effective height	185
location of	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.772		
γ_b	1.3		
V_{cd}	1494.96	kN	

2) stirrup

Re-bar	D16	pitch	20
sectional ar	1.986	Aw	3.972
fwyd	345	N/mm^2	
z	160.87	cm	
γ_b	1.15		
V_{sd}	958.46	kN	
V_{yd}	2453.42	kN	
γ_t	1.0		
V_d	1904.794	kN	
F	0.78	OK !	

Ultimate Limit State Seismic Condition

	Prepared by	Y.Ando	Checked by	E. NISHIMURA
	26/07/2002			08/08/2002

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Typical section

examination for moment

1) concrete			
Re-bar	D25	nos	32
sectional area	5,067	As	162.144
sectional width b	170		
height d'	200	effective height	185
location of re-ba	15		
N	30.000	times	
K	10		
k1	0.85		
fd	18.5	kN/mm^2	
frd	8,685.0	kN/mm^2	
γ_c	1.3		
σ_{rd}	303.8	kN	
F	0.04547	OK !	
2) re-bar			
γ_s	1.05		
ϕ	25	mm	
a	0.735		
k	0.12		
fsrd	285310	kN/m^2	
F	0.00112	OK !	

examination for shearing force

Re-bar	D25	nos	32
sectional area	5,067	As	162.144
sectional width b	170		
height d'	200	effective heigh	185
location of re-ba	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.802		
γ_b	1.0		
V_{cd}	1144.08	kN	
N	30,000	times	
σ_{rd}	303.8	kN	
V_{rcd}	678.43	kN	
F	0.448	OK !	

Fatigue Limit State : Working Condition

		Prepared by	Y.Ando	Checked by	R. NISHIMURA
			26/07/2002		08/08/2002

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References/ Notes

Wide section

examination for moment

1) concrete

Re-bar	D25	nos	48
sectional area	5.067	As	243.216
sectional width b	250		
height d'	200	effective heigh	185
location of re-bar	15		
N	30,000	times	
K	10		
k1	0.85		
fd	18.5	kN/mm^2	
frd	8,685.0	kN/mm^2	
γ_c	1.3		
σ_{rd}	580	kN	
F	0.08682	OK !	

2) re-bar

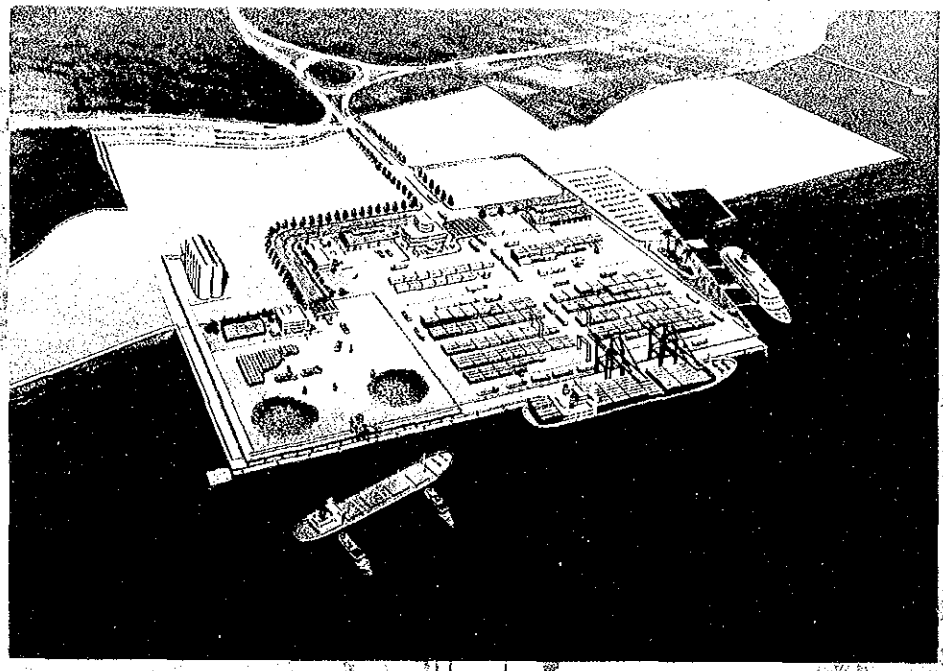
γ_s	1.05	
ϕ	25	mm
a	0.735	
k	0.12	
fsrd	285310	kN/m^2
F	0.00213	OK !

Examination for Shearing force

Re-bar	D25	nos	48
sectional area	5.067	As	243.216
sectional width b	250		
height d'	200	effective height	185
location of re-bar	15		
f'cd	18.5	N/mm^2	
fvcd	0.529	N/mm^2	
β_d	0.857		
β_p	0.807		
γ_b	1.0		
V_{cd}	1692.97	kN	
N	30,000	times	
σ_{rd}	580	kN	
V_{rcd}	1003.91	kN	
F	0.578	OK !	

Fatigue Limit State Pausing Condition

		Prepared by	Y. Ando	Checked by	R. NISHINURA
			26/07/2002		08/08/2002



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