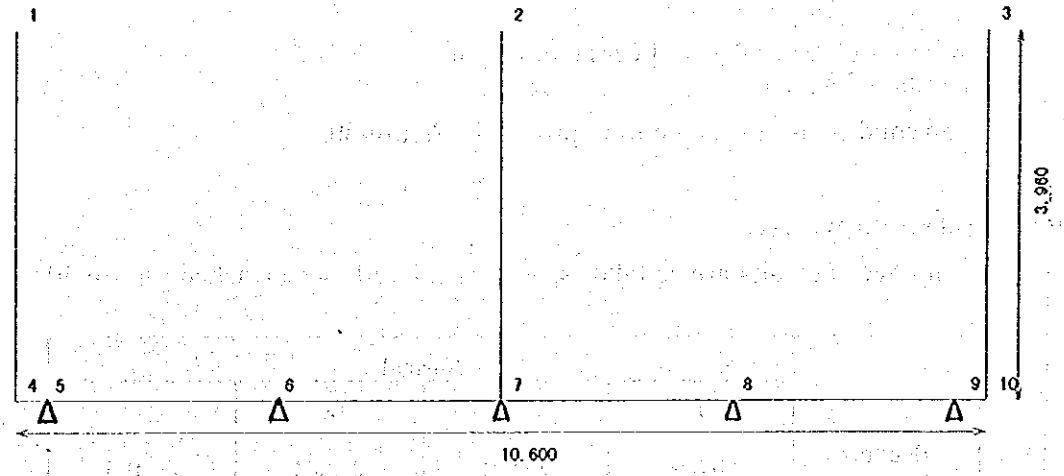
Name of Structure	Asin Gate	Category of calculation	Stress Analysis	Page	75/116



Δ Pile Location

Figure — 31

Case-5: Seismic condition, No water
Case-6: Seismic condition, Water at left
Case-7: Seismic condition, Water at right
Case-8: Seismic condition, Water at both

Loads to be considered are as follows:

- self-weight
- water weight and water pressure
- earth pressure
- weight of O/M bridge and O/M equipment
- earthquake force

Load conditions are shown in Figure-32 to Figure-39.

4) Results of stress analysis

Summary of results are as follows: (details see attached Figure-40 to 47)

	Normal			
	1	2	3	4
Bending Moment	25.828	29.204	29.204	30.186
Shear Stress	41.625	41.625	43.410	41.625
Axial Stress	62.100	62.100	62.100	62.100
Displacement	0.1819	0.2049	0.2101	0.2365
	Seismic			
	5	6	7	8
Bending Moment	33.674	38.961	35.991	41.508
Shear Stress	41.625	41.625	41.625	41.625
Axial Stress	62.100	62.100	62.100	62.100
Displacement	0.2477	0.2324	0.2625	0.2870

3. O/M Bridge

Refer to the results of Baru Gate.

Asin Pier+Footing (Normal)

Case 1 : normal-dry

Load

①	1.285 (tf)
②	0.500 (tf)
③	7.282 (tf)
④	2.885 (tf)
⑤	7.500 (tf)
⑥	22.500 (tf)
⑦	15.000 (tf)

Self-weight included

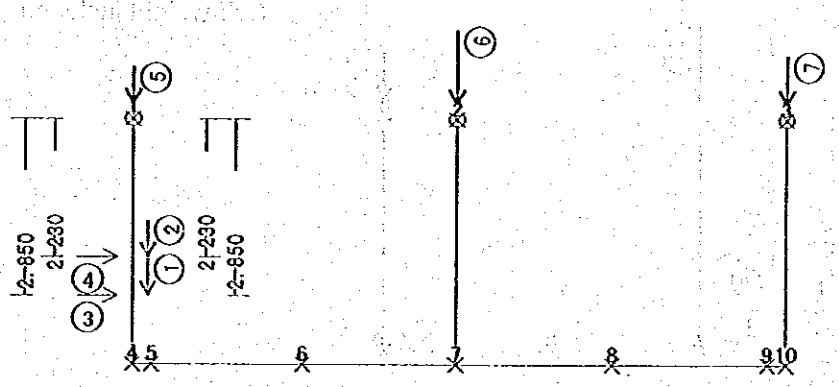


Figure – 32

Asin Pier+Footing (Normal)

Case 2 : normal-left water

Load	
①	7.550 (tf/m)
	7.550 (tf/m)
②	7.550 (tf/m)
	7.550 (tf/m)
③	1.285 (tf)
④	0.500 (tf)
⑤	-11.400 (tf)
⑥	7.282 (tf)
⑦	2.885 (tf)
⑧	11.400 (tf)
⑨	7.500 (tf)
⑩	22.500 (tf)
⑪	15.000 (tf)

Self-weight included

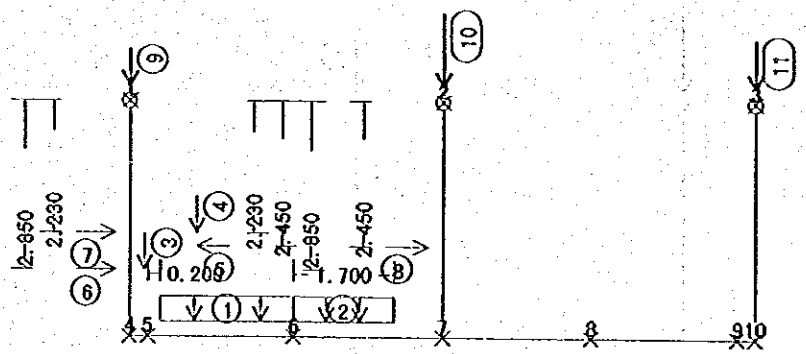


Figure – 33

Asin Pier+Footing (Normal)

Case 3 : normal-right water

	Load
①	7.550 (tf/m)
	7.550 (tf/m)
②	7.550 (tf/m)
	7.550 (tf/m)
③	1.285 (tf)
④	0.500 (tf)
⑤	7.282 (tf)
⑥	2.885 (tf)
⑦	-11.400 (tf)
⑧	11.400 (tf)
⑨	15.000 (tf)
⑩	22.500 (tf)
⑪	7.500 (tf)

Self-weight included

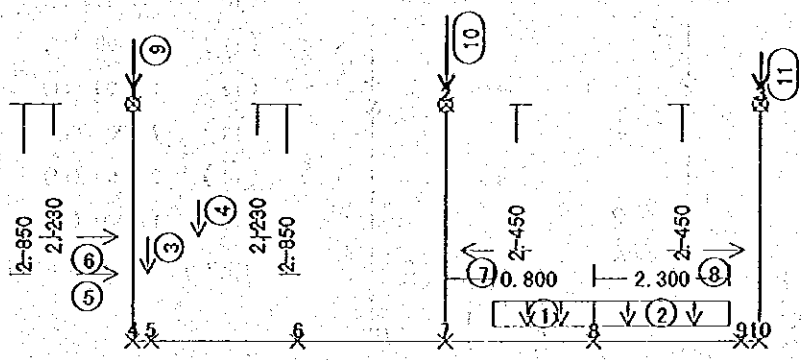
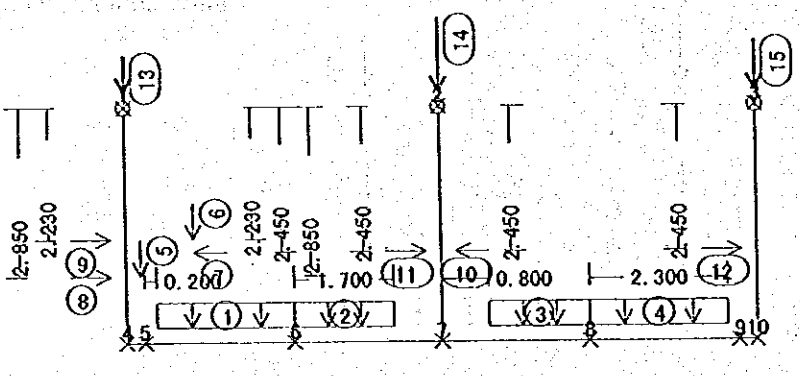


Figure – 34

Asin Pier+Footing (Normal)

Case 4 : normal-wet



	Load
①	7.550 (tf/m)
	7.550 (tf/m)
②	7.550 (tf/m)
	7.550 (tf/m)
③	7.550 (tf/m)
	7.550 (tf/m)
④	7.550 (tf/m)
	7.550 (tf/m)
⑤	1.285 (tf)
⑥	0.500 (tf)
⑦	-11.400 (tf)
⑧	7.282 (tf)
⑨	2.885 (tf)
⑩	-11.400 (tf)
⑪	11.400 (tf)
⑫	11.400 (tf)
⑬	7.500 (tf)
⑭	22.500 (tf)
⑮	15.000 (tf)

Self-weight included

Figure — 35

Asin Pier+Footing (Seismic)

Case 1 : seismic-dry

Load

①	11.625 (tf)
②	0.825 (tf)
③	7.500 (tf)
④	2.475 (tf)
⑤	22.500 (tf)
⑥	1.650 (tf)
⑦	15.000 (tf)

Self-weight included

Seismic Force

KH = 0.11

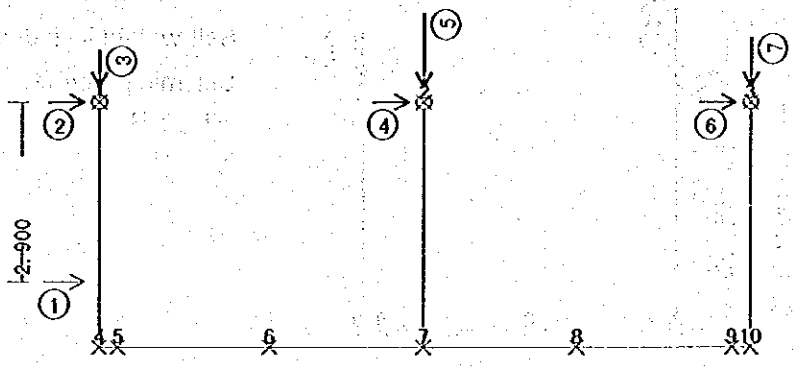


Figure – 36

Asin Pier+Footing (Seismic)

Case 2 : seismic-left water

	Load
①	7.375 (tf/m)
	7.375 (tf/m)
②	7.375 (tf/m)
	7.375 (tf/m)
③	-10.900 (tf)
④	11.625 (tf)
⑤	10.900 (tf)
⑥	0.555 (tf)
⑦	0.825 (tf)
⑧	7.500 (tf)
⑨	2.475 (tf)
⑩	22.500 (tf)
⑪	1.650 (tf)
⑫	15.000 (tf)

Self-weight included

Seismic Force

KH = 0.11

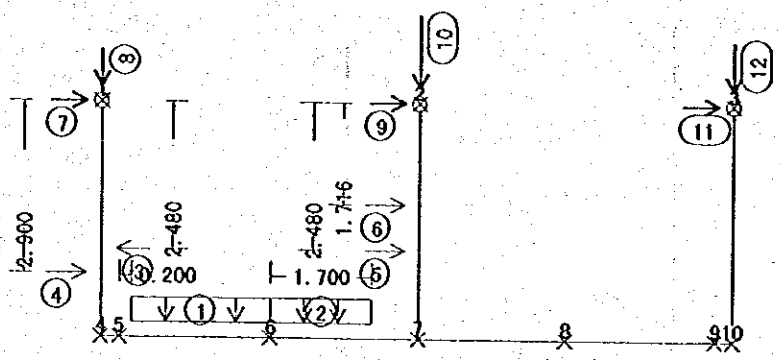


Figure - 37

Asin Pier+Footing (Seismic)

Case 3 : seismic-right water

Load	
①	7.375 (tf/m)
	7.375 (tf/m)
②	7.375 (tf/m)
	7.375 (tf/m)
③	11.625 (tf)
④	-10.900 (tf)
⑤	10.900 (tf)
⑥	0.555 (tf)
⑦	1.650 (tf)
⑧	15.000 (tf)
⑨	2.475 (tf)
⑩	22.500 (tf)
⑪	0.825 (tf)
⑫	7.500 (tf)

Self-weight included

Seismic Force

KH = 0.11

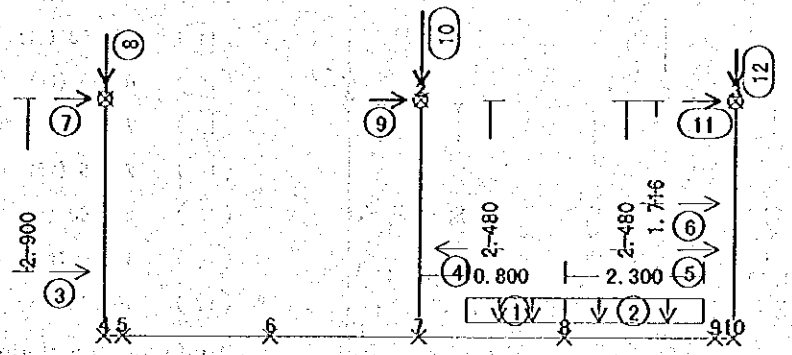
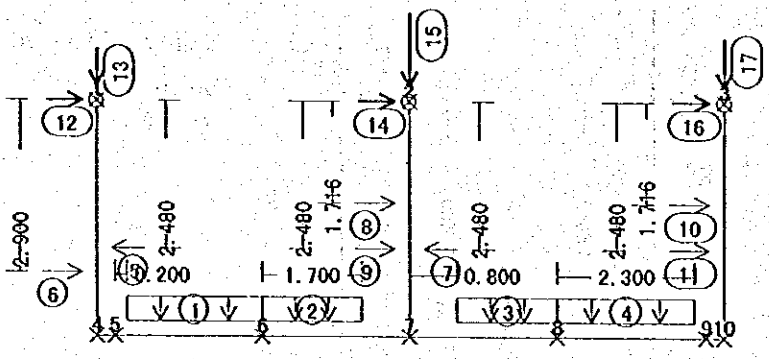


Figure -38

Asin Pier+Footing (Seismic)

Case 4 : seismic-wet



	Load
①	7.375 (tf/m)
	7.375 (tf/m)
②	7.375 (tf/m)
	7.375 (tf/m)
③	7.375 (tf/m)
	7.375 (tf/m)
④	7.375 (tf/m)
	7.375 (tf/m)
⑤	-10.900 (tf)
⑥	11.625 (tf)
⑦	-10.900 (tf)
⑧	0.555 (tf)
⑨	10.900 (tf)
⑩	0.555 (tf)
⑪	10.900 (tf)
⑫	0.825 (tf)
⑬	7.500 (tf)
⑭	2.475 (tf)
⑮	22.500 (tf)
⑯	1.650 (tf)
⑰	15.000 (tf)

Self-weight included

Seismic Force

KH = 0.11

Figure — 39

Asin Pier+Footing (Normal)

Case 1: normal-dry

Deformation Scale |——| : 0.237cm max. : 0.182 cm

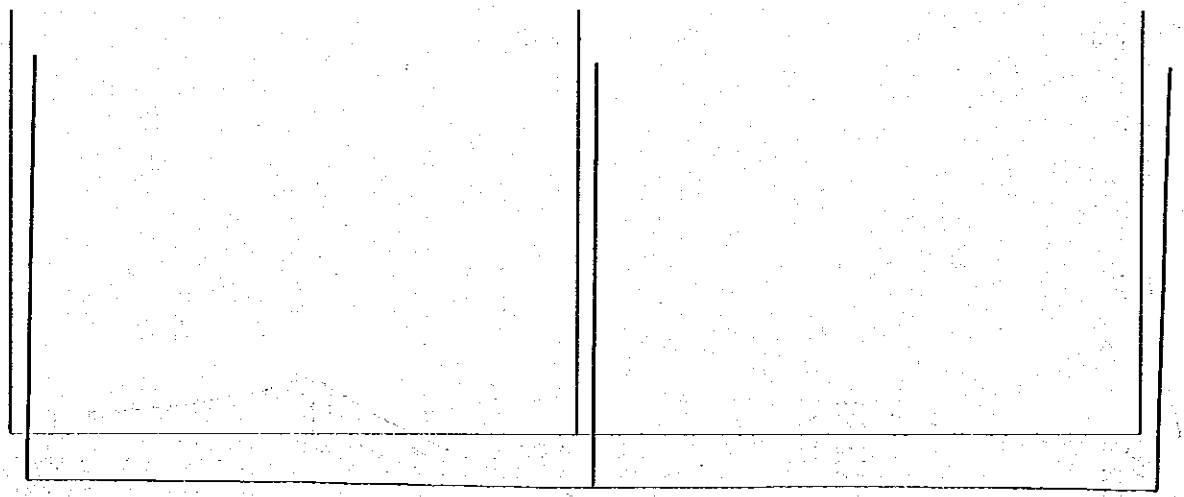


Figure – 40 (1)

Asin Pier+Footing (Normal)

Case 1: normal-dry

Bending Moment Scale ├——┤ : 30.19tf·m max. : -25.83 tf·m

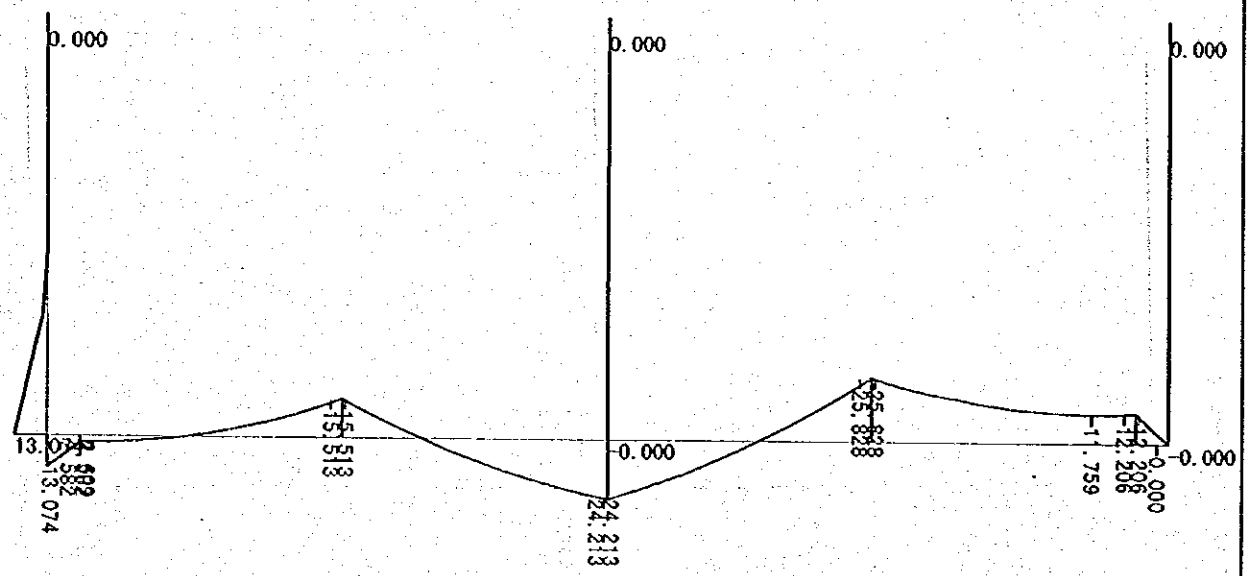


Figure — 40 (2)

Asin Pier+Footing (Normal)

Case 1: normal-dry

Shear Stress Scale |——| : 43.41tf max. : 41.63 tf

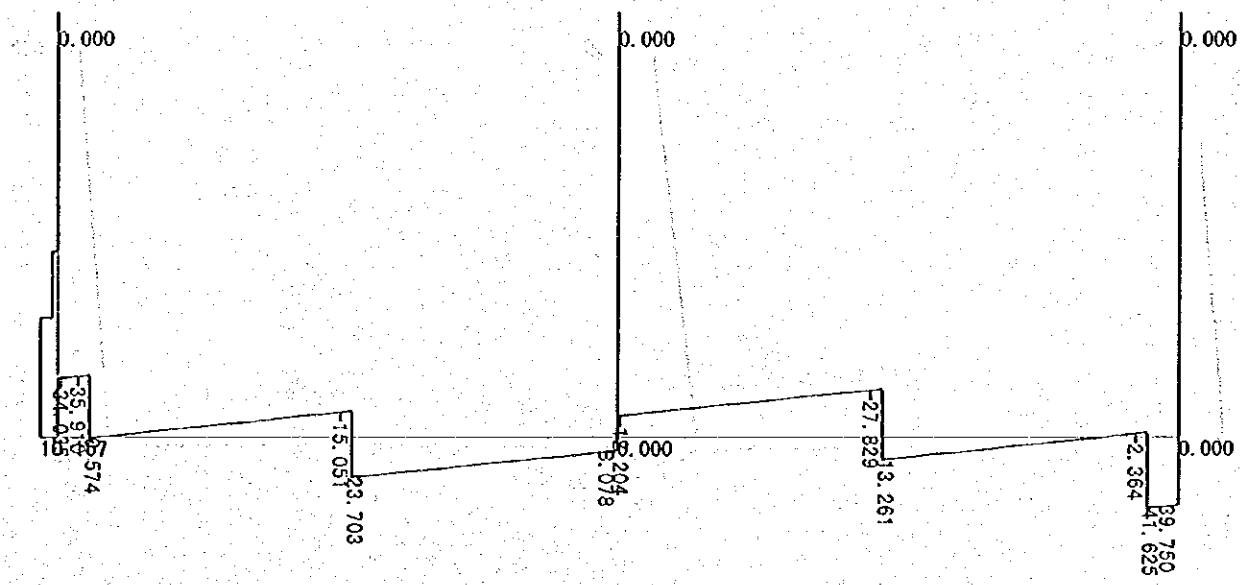


Figure -40 (3)

Asin Pier+Footing (Normal)

Case 1: normal-dry

Axial Stress Scale ⊢——⊣ : 62.10tf max. : 62.10 tf

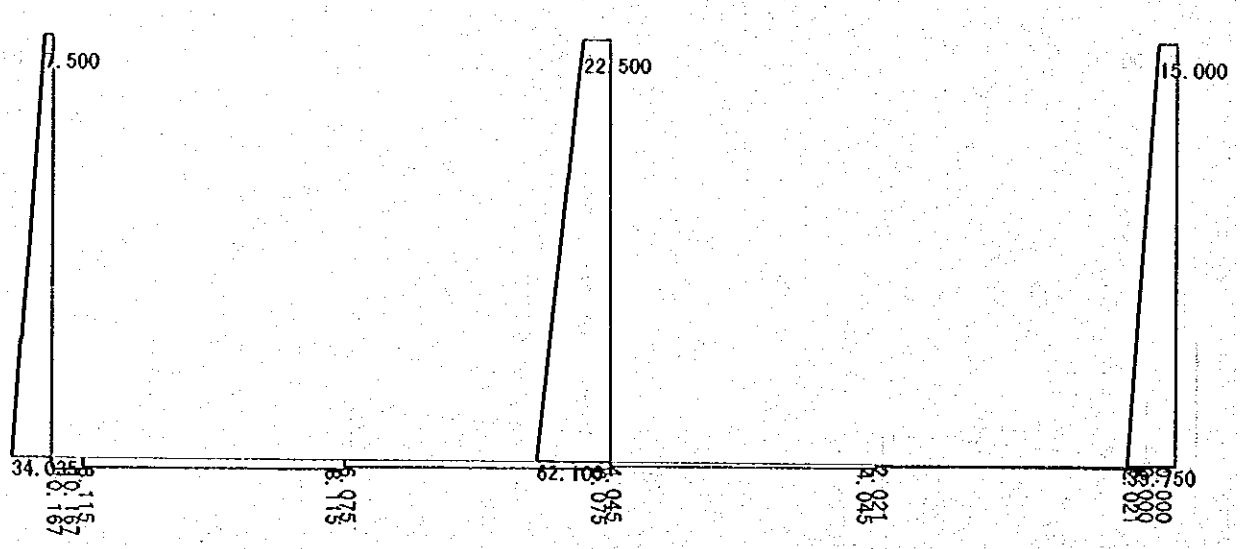


Figure -40(4)

Asin Pier+Footing (Normal)

Case 2: normal-left water

Deformation Scale |——| : 0.237cm max. : 0.205 cm

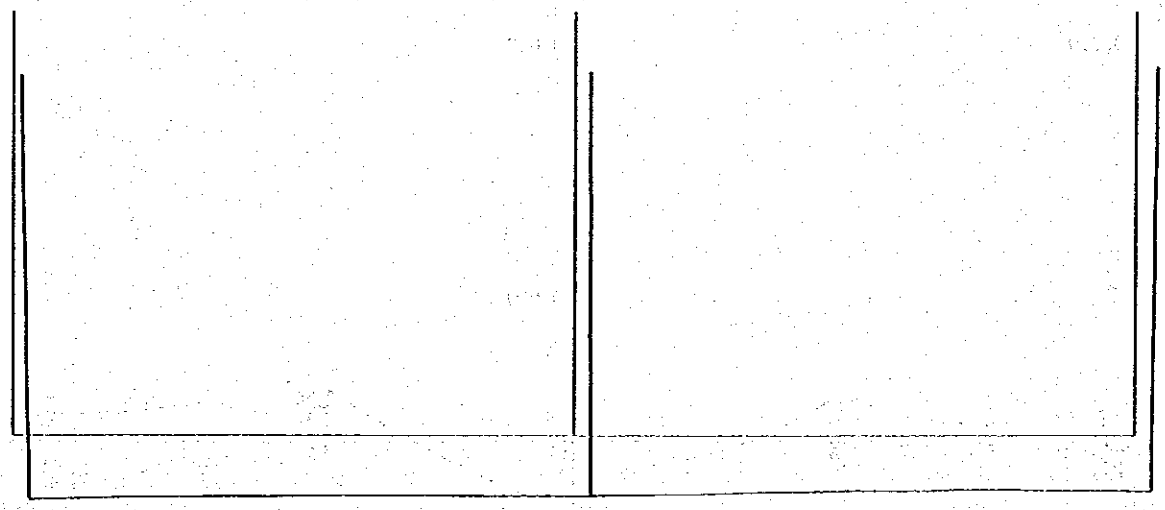


Figure - 41 (1)

Asin Pier+Footing (Normal)

Case 2: normal-left water

Bending Moment Scale |——| : 30.19tf·m max. : 29.20 tf·m

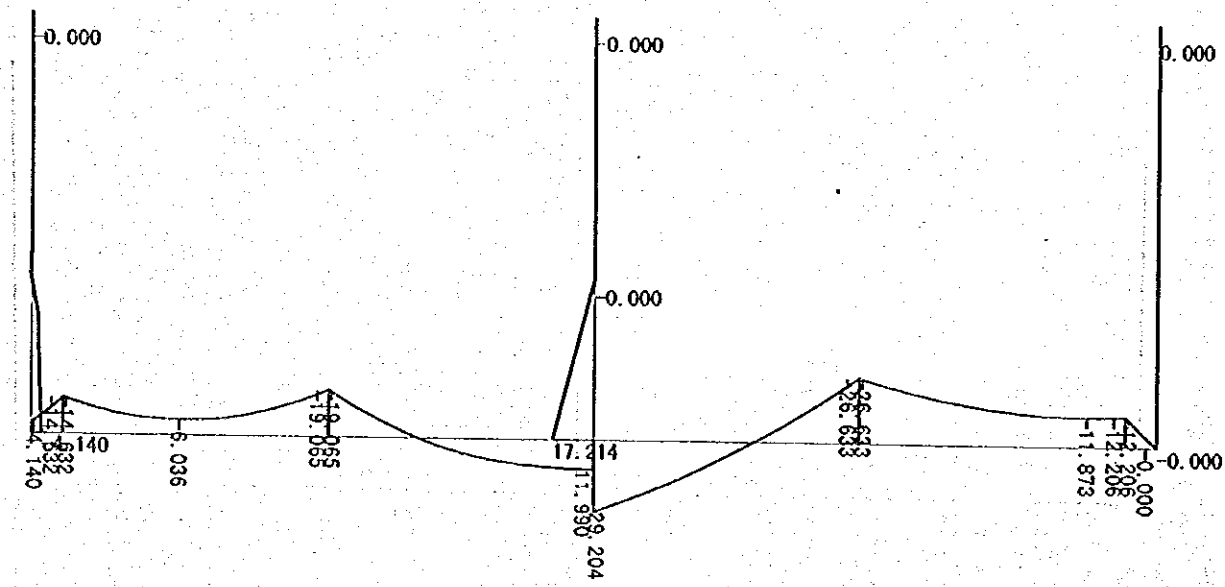


Figure – 41 (2)

Asin Pier+Footing (Normal)

Case 2: normal-left water

Shear Stress Scale ⊢——⊣ : 43.41tf max. : 41.63 tf

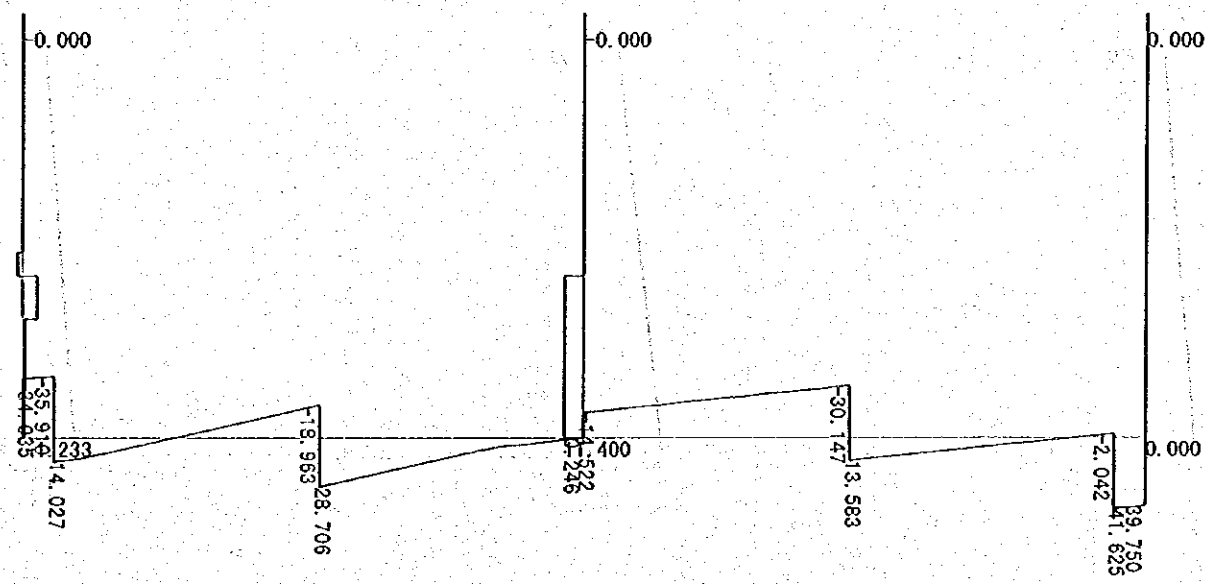


Figure-41 (3)

Asin Pier+Footing (Normal)

Case 2: normal-left water

Axial Stress Scale ⊢——⊣ : 62.10tf max. : 62.10 tf

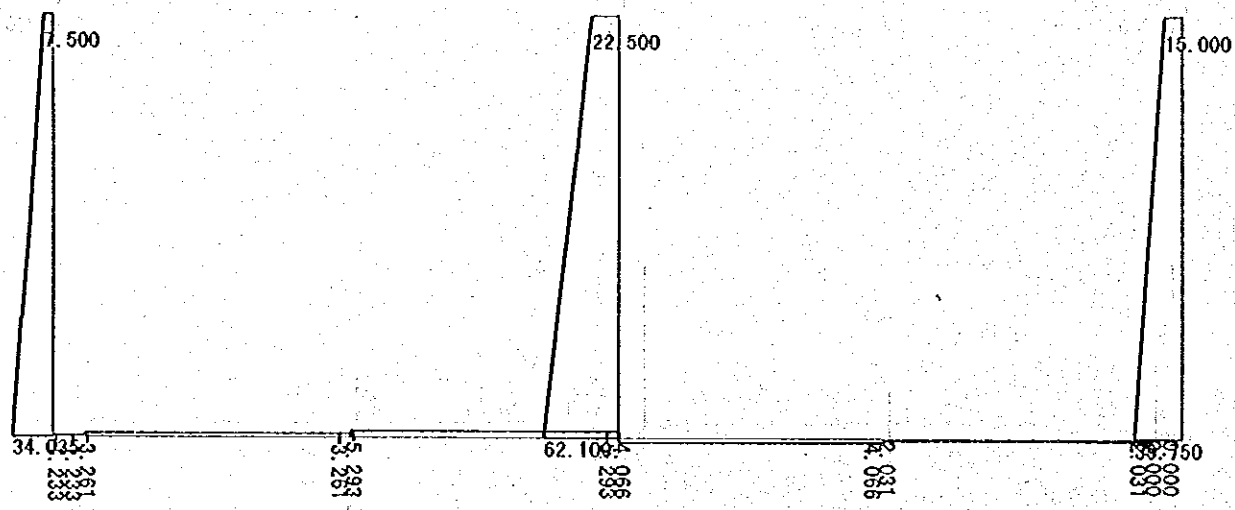


Figure — 41 (4)

Asin Pier+Footing (Normal)

Case 3: normal-right water

Deformation Scale |——| : 0.237cm max. : 0.210 cm

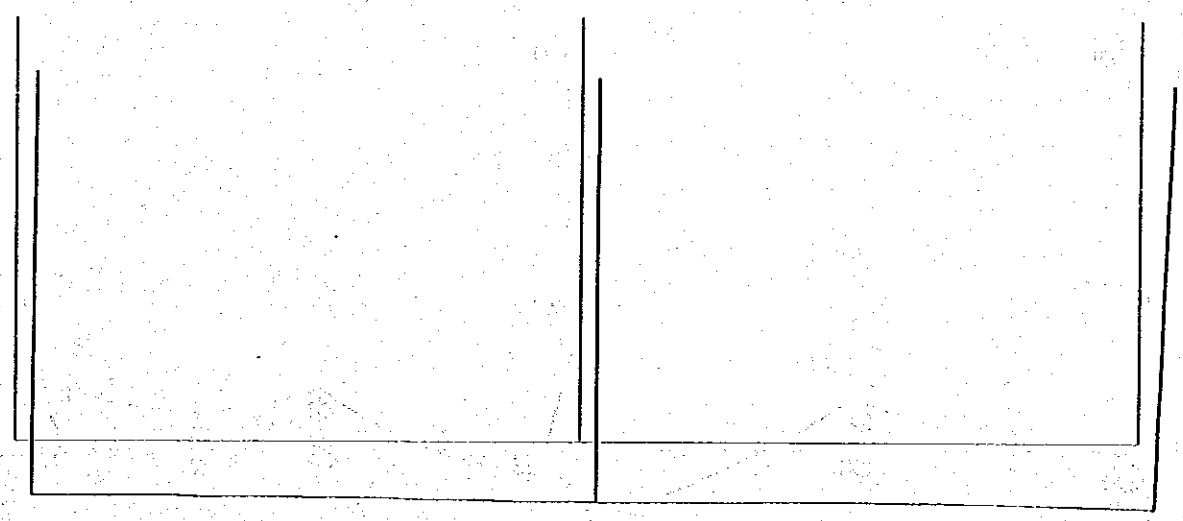


Figure - 42 (1)

Asin Pier+Footing (Normal)

Case 3: normal-right water

Bending Moment Scale ├——┤ : 30.19tf·m max. : 29.20 tf·m

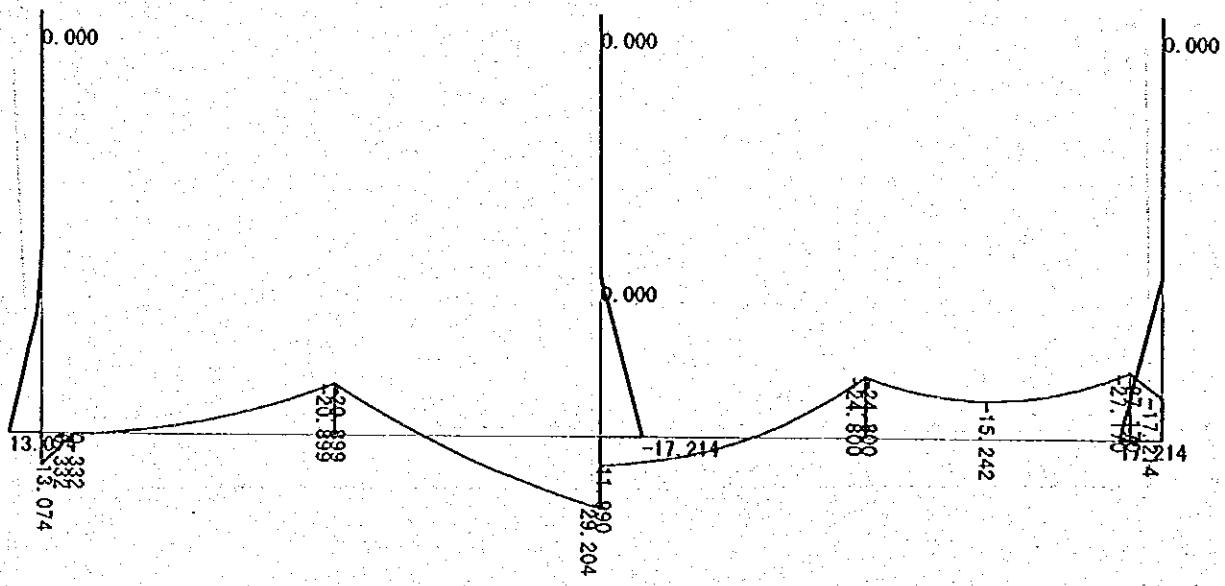


Figure - 42 (2)

Asin Pier+Footing (Normal)

Case 3: normal-right water

Shear Stress Scale ├——┤ : 43.41tf max. : -43.41 tf

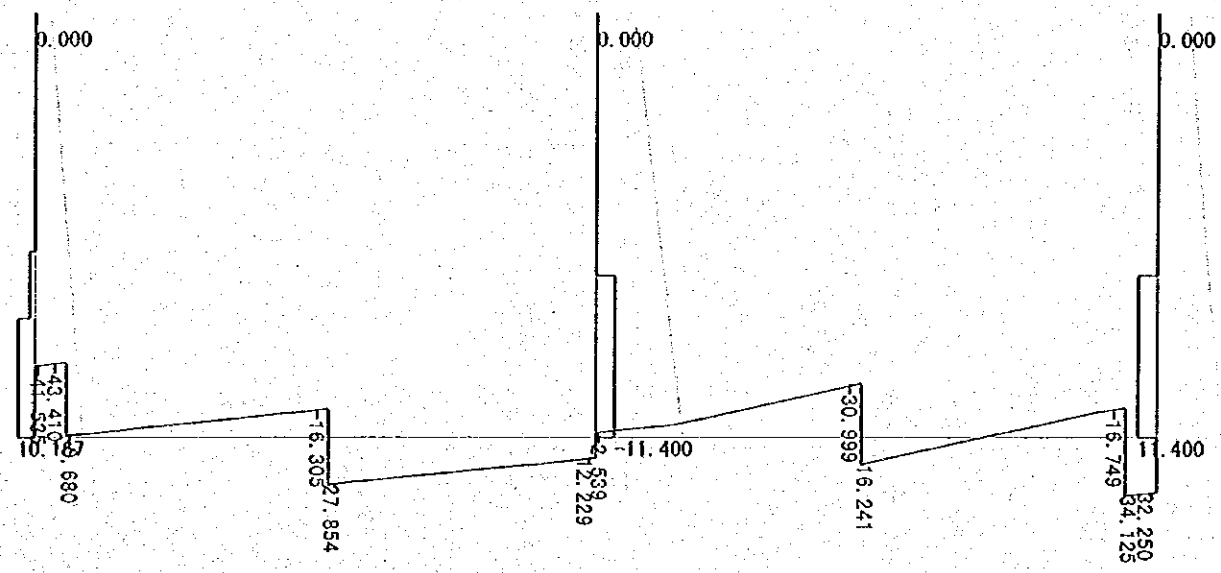


Figure-42 (3)

Asin Pier+Footing (Normal)

Case 3: normal-right water

Axial Stress Scale ⊢——⊣ : 62.10tf max. : 62.10 tf

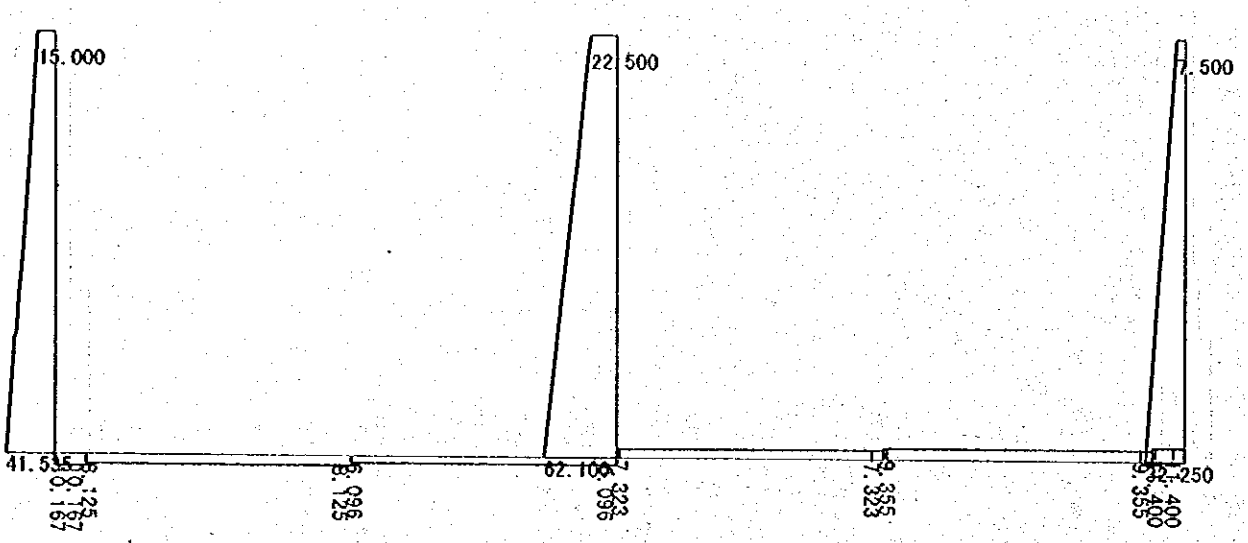


Figure -42(4)

Asin Pier+Footing (Normal)

Case 4: normal-wet

Deformation Scale ⊢——⊣ : 0.237cm max. : 0.237 cm

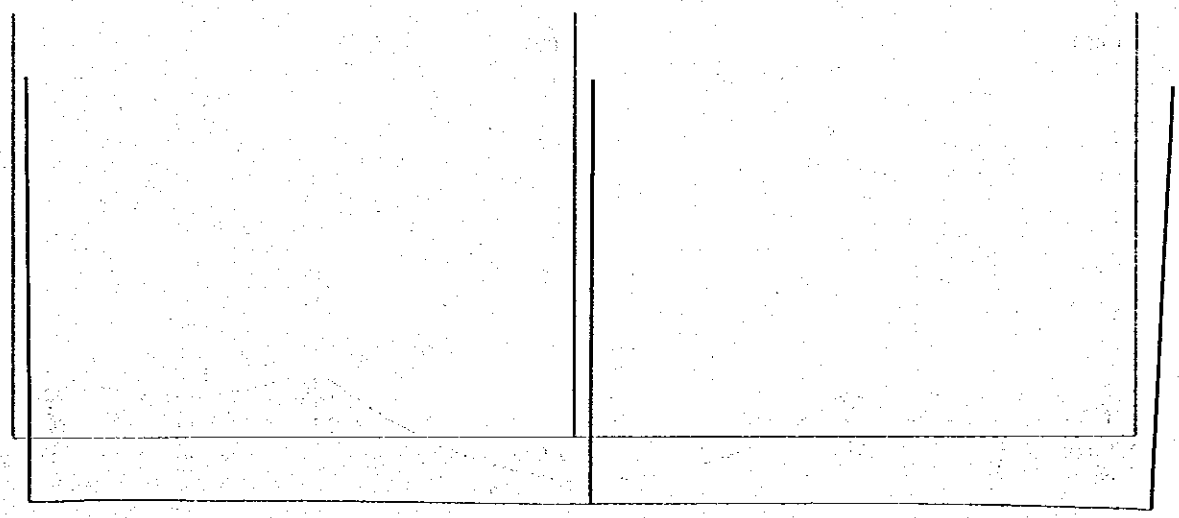
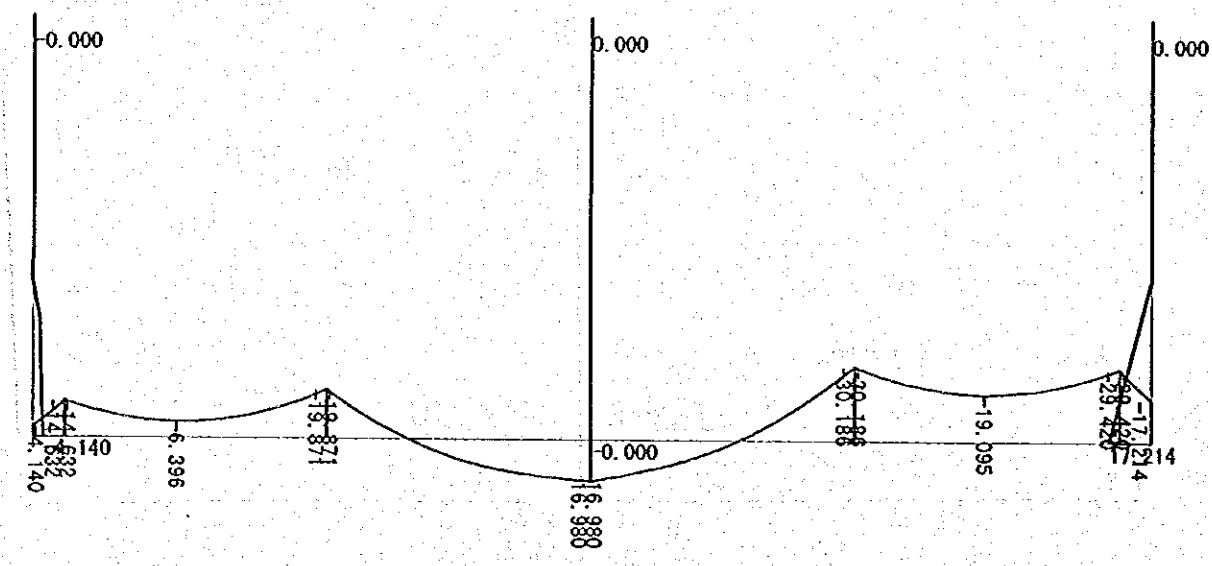


Figure -43 (1)

Asin Pier+Footing (Normal)

Case 4: normal-wet

Bending Moment Scale |——| : 30.19tf·m max. : -30.19 tf·m



Figure— 43 (2)

Asin Pier+Footing (Normal)

Case 4: normal-wet

Shear Stress Scale ⊢——⊣ : 43.41tf max. : 41.63 tf

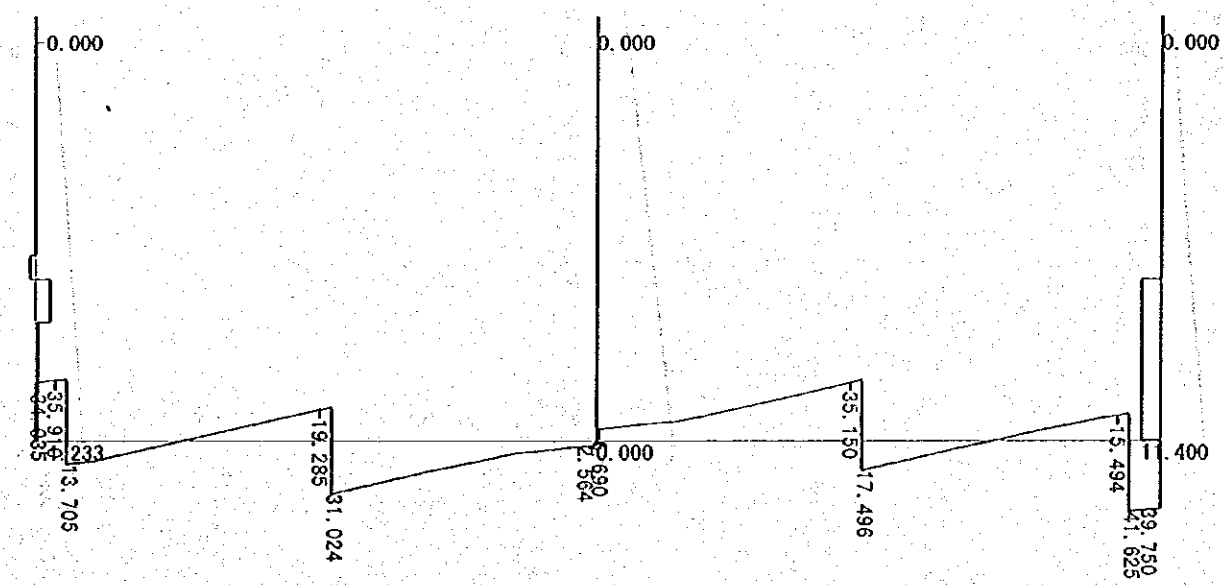


Figure – 43 (3)

Asin Pier+Footing (Normal)

Case 4: normal-wet

Axial Stress Scale |——| : 62.10tf max. : 62.10 tf

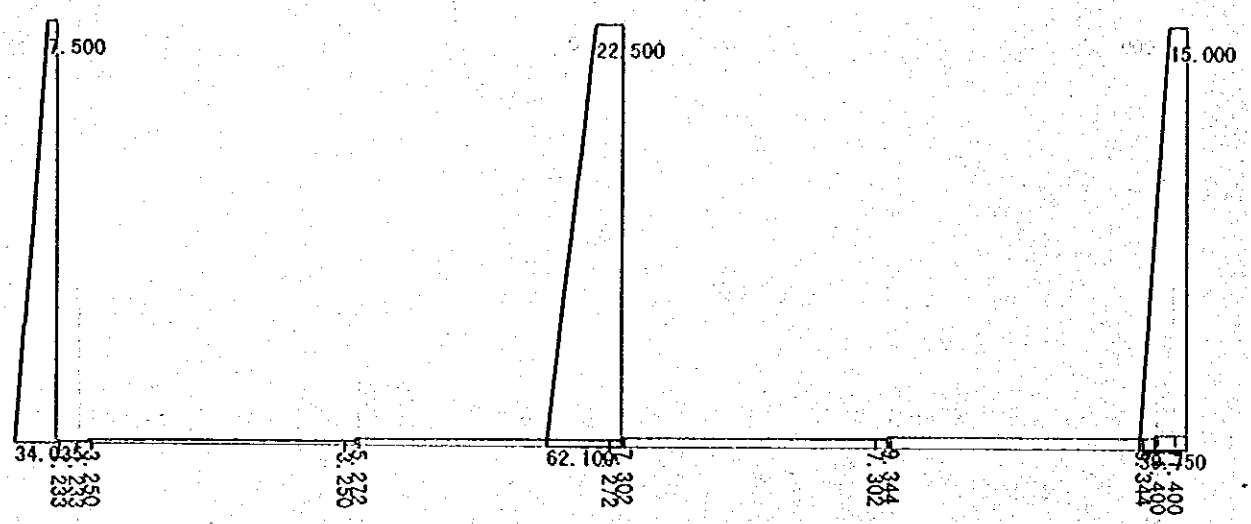


Figure -43(4)

Asin Pier+Footing (Seismic)

Case 1: seismic-dry

Deformation Scale ⊢——⊣ : 0.287cm max. : 0.248 cm

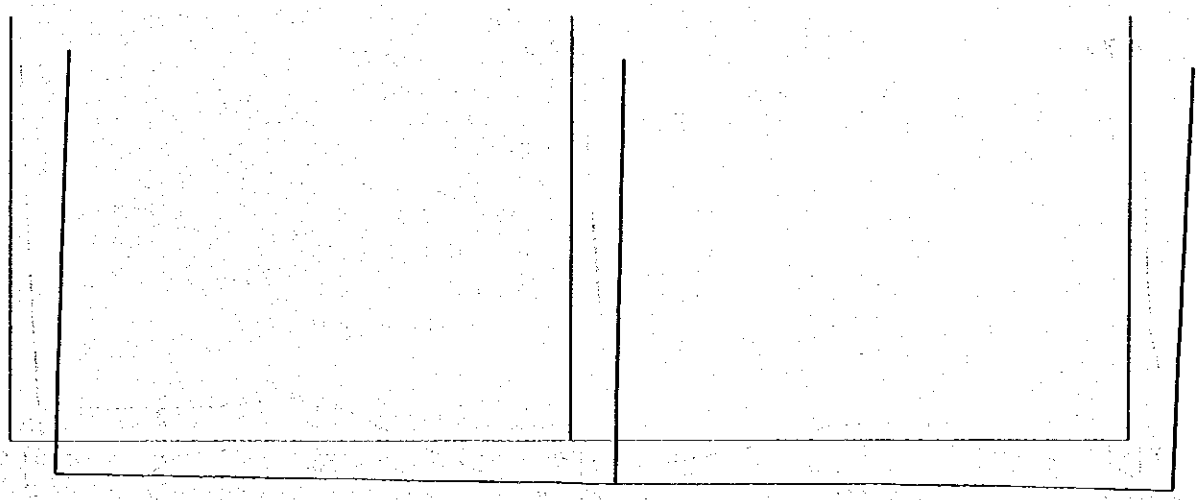


Figure – 44 (1)

Asin Pier+Footing (Seismic)

Case 1: seismic-dry

Bending Moment Scale ⊢——⊣ : 41.51tf·m max. : 33.67 tf·m

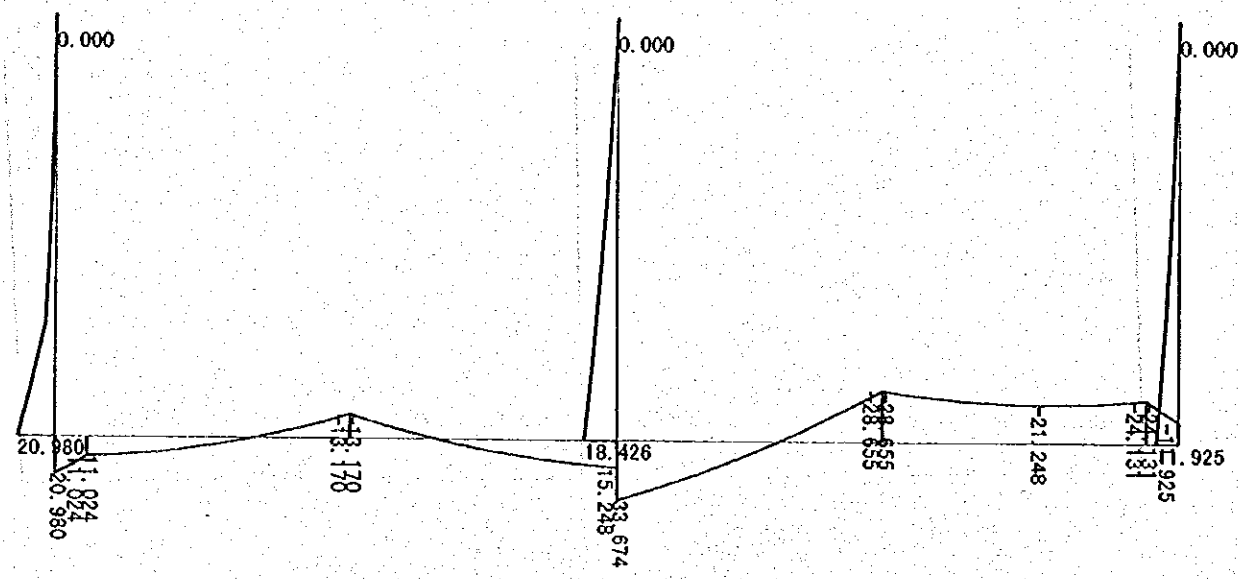


Figure – 44 (2)

Asin Pier+Footing (Seismic)

Case 1: seismic-dry

Shear Stress Scale ⊢——⊣ : 41.63tf max. : 41.63 tf

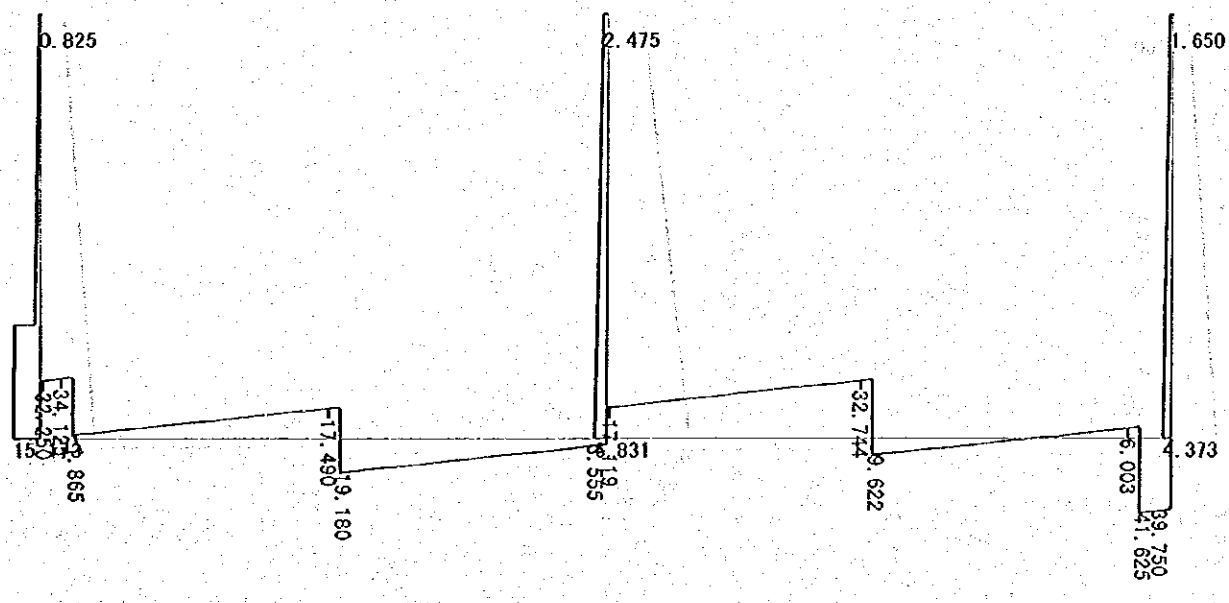


Figure -44 (3)

Asin Pier+Footing (Seismic)

Case 1: seismic-dry

Axial Stress Scale ⊢—⊣ : 62.10tf max. : 62.10 tf

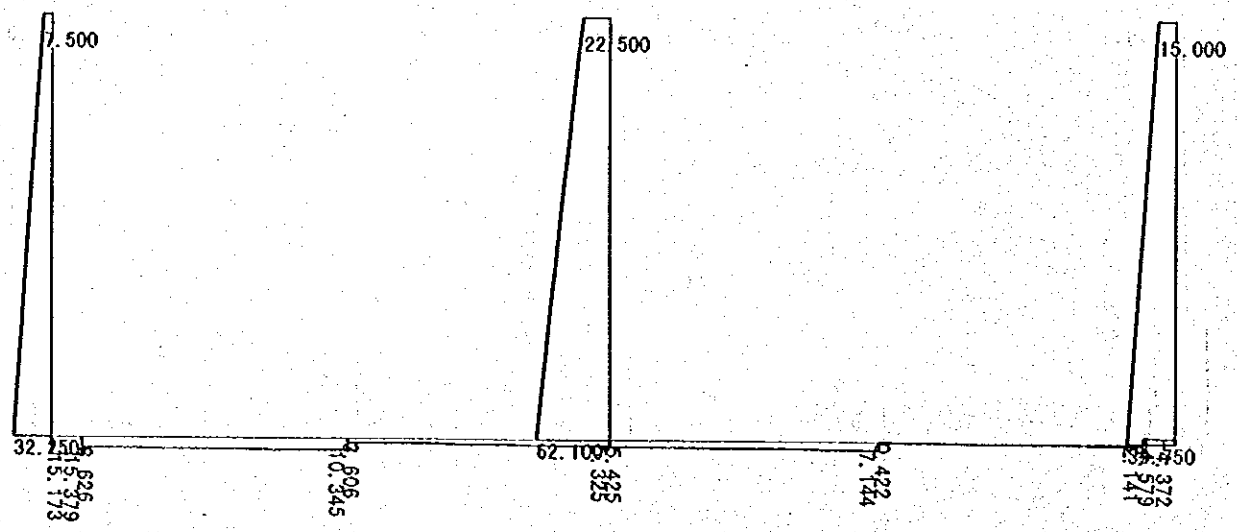


Figure – 44 (4)

Asin Pier+Footing (Seismic)

Case 2: seismic-left water

Deformation Scale ⊢——⊣ : 0.287cm max. : 0.232 cm

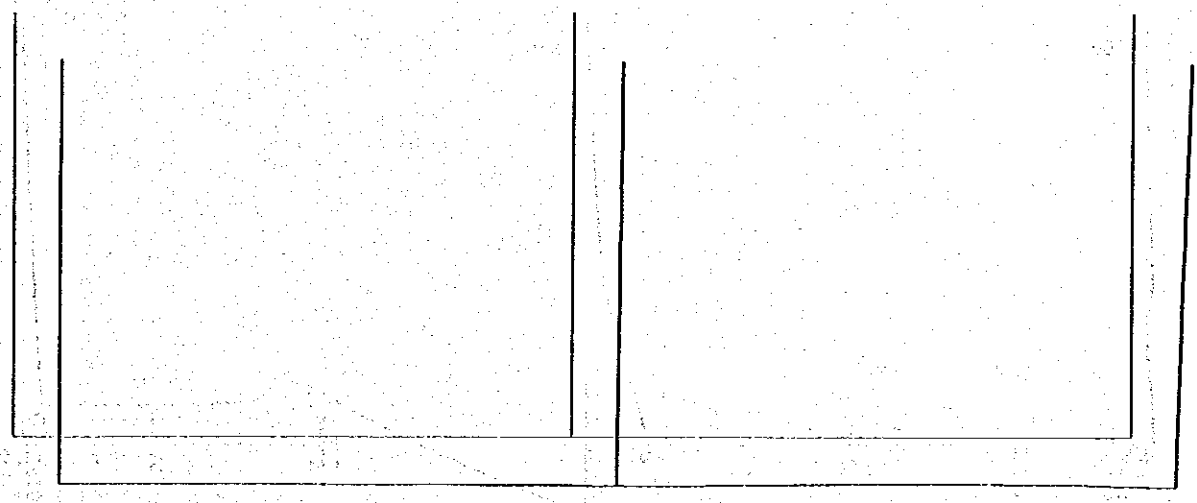


Figure – 45 (1)

Asin Pier+Footing (Seismic)

Case 2: seismic-left water

Bending Moment Scale ⊢——⊣ : 41.51tf·m max. : 38.96 tf·m

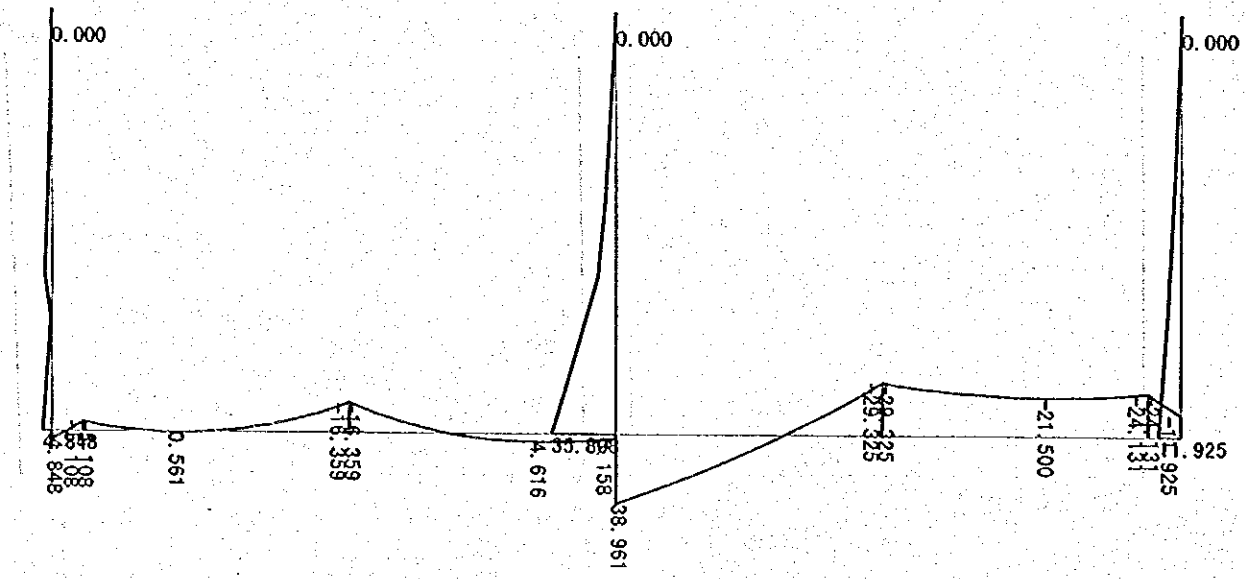


Figure -45 (2)

Asin Pier+Footing (Seismic)

Case 2: seismic-left water

Shear Stress Scale ⊢——⊣ : 41.63tf max. : 41.63 tf

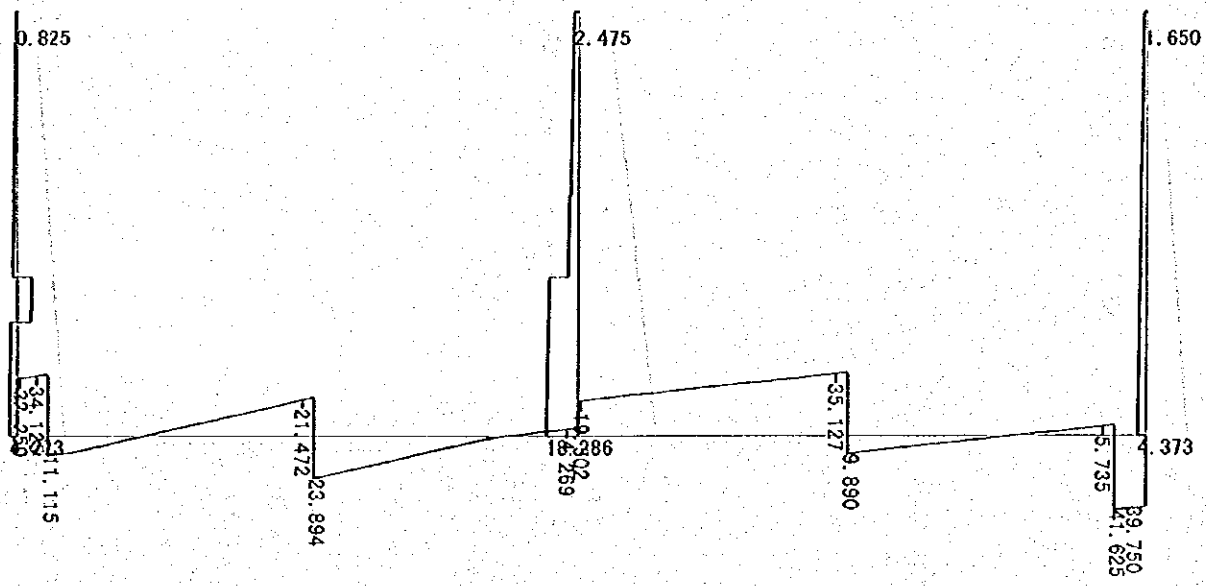


Figure – 45(3)

Asin Pier+Footing (Seismic)

Case 2: seismic-left water

Axial Stress Scale ├──┤ : 62.10tf max. : 62.10 tf

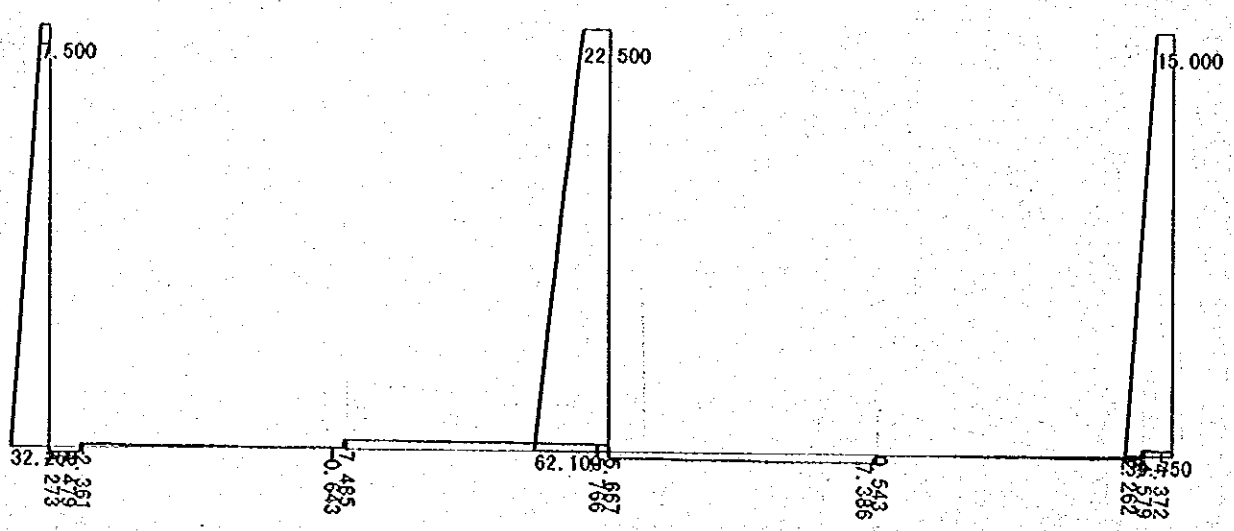


Figure - 45 (4)

Asin Pier+Footing (Seismic)

Case 3: seismic-right water

Deformation Scale ⊢——⊣ : 0.287cm max. : 0.263 cm

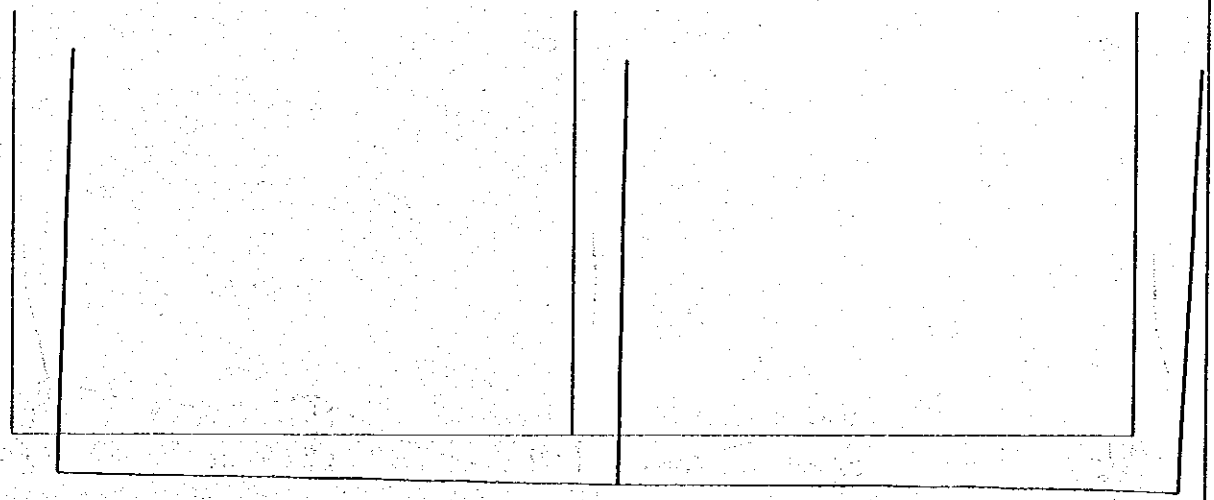


Figure – 46 (1)

Asin Pier+Footing (Seismic)

Case 3: seismic-right water

Bending Moment Scale ├──┤ : 41.51tf·m max. : -35.99 tf·m

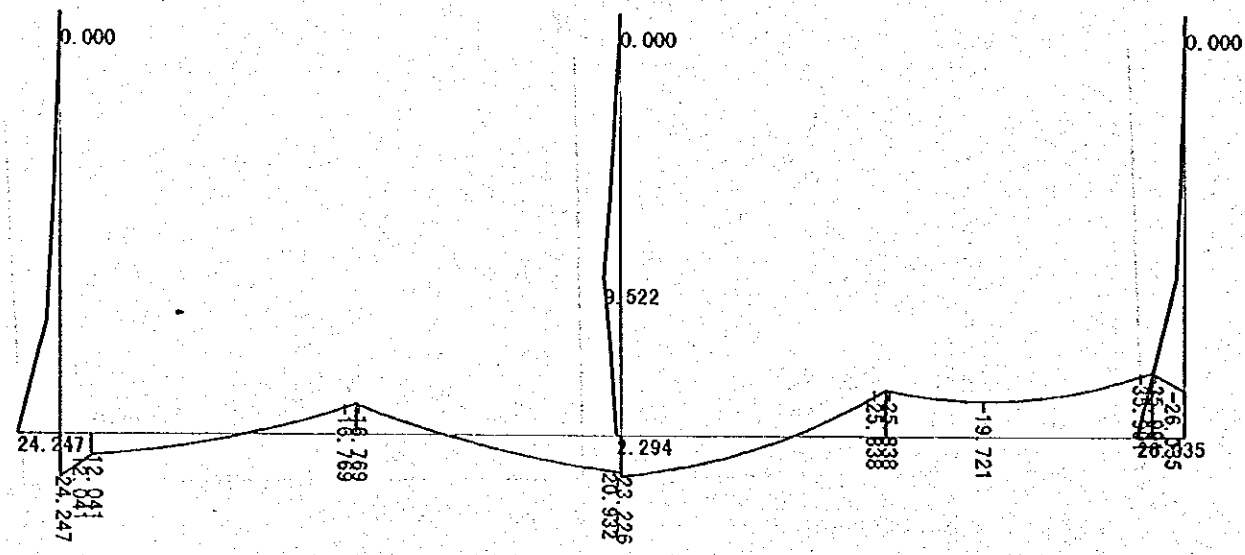


Figure - 46 (2)

Asin Pier+Footing (Seismic)

Case 3: seismic-right water

Shear Stress Scale ├——┤ : 41.63tf max. : -41.62 tf

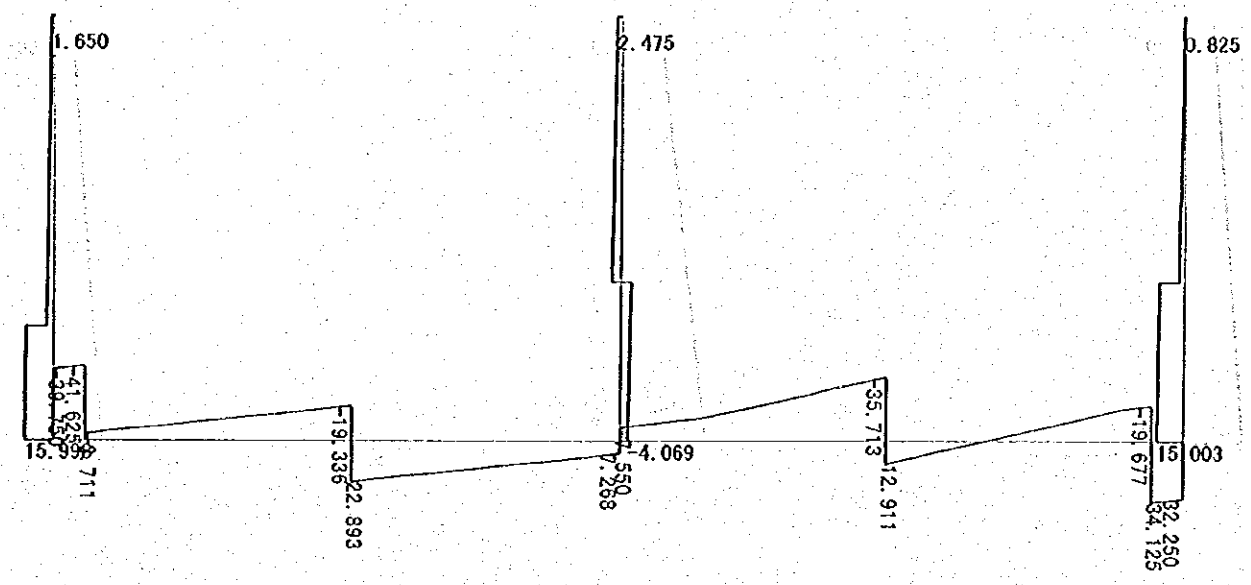


Figure -46 (3)

Asin Pier+Footing (Seismic)

Case 3: seismic-right water

Axial Stress Scale |——| : 62.10tf max. : 62.10 tf

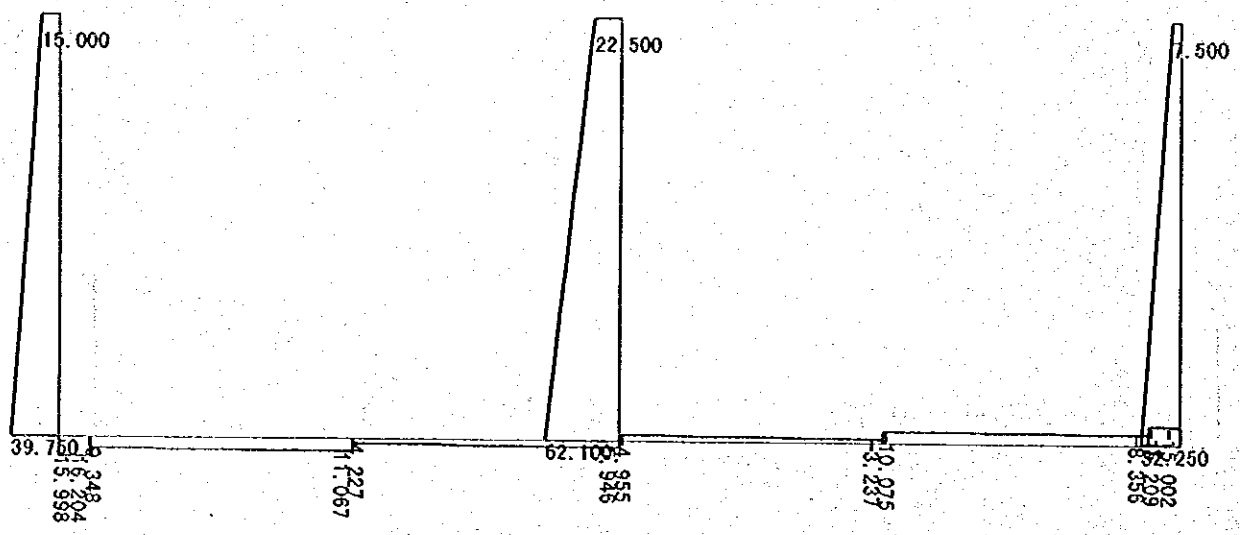


Figure - 46(4)

Asin Pier+Footing (Seismic)

Case 4: seismic-wet

Deformation Scale ⊢——⊣ : 0.287cm max. : 0.287 cm

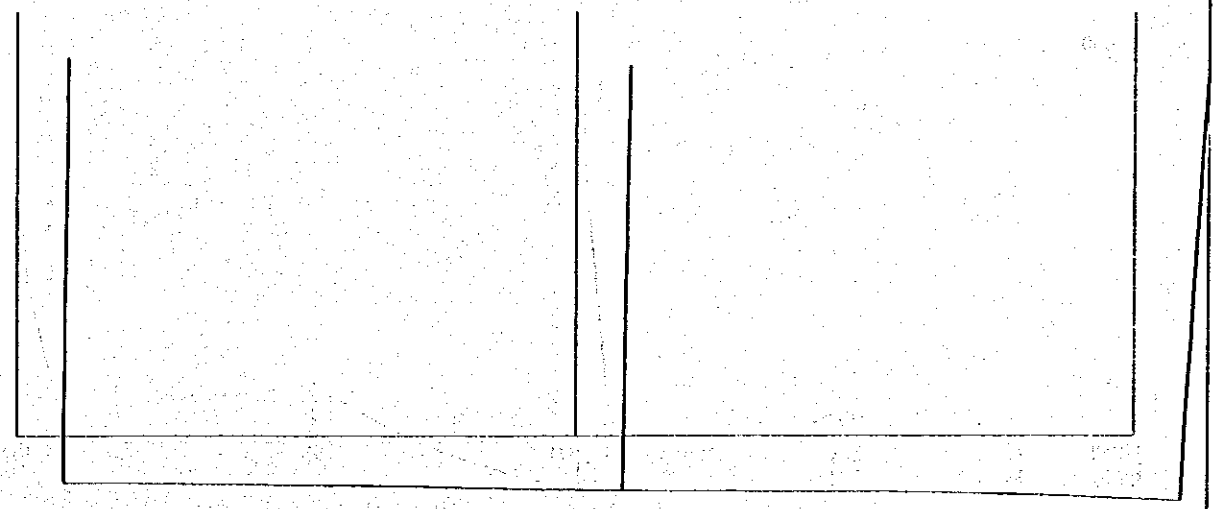


Figure – 47 (1)

Asin Pier+Footing (Seismic)

Case 4: seismic-wet

Bending Moment Scale ⊢——⊣ : 41.51tf·m max. : -41.51 tf·m

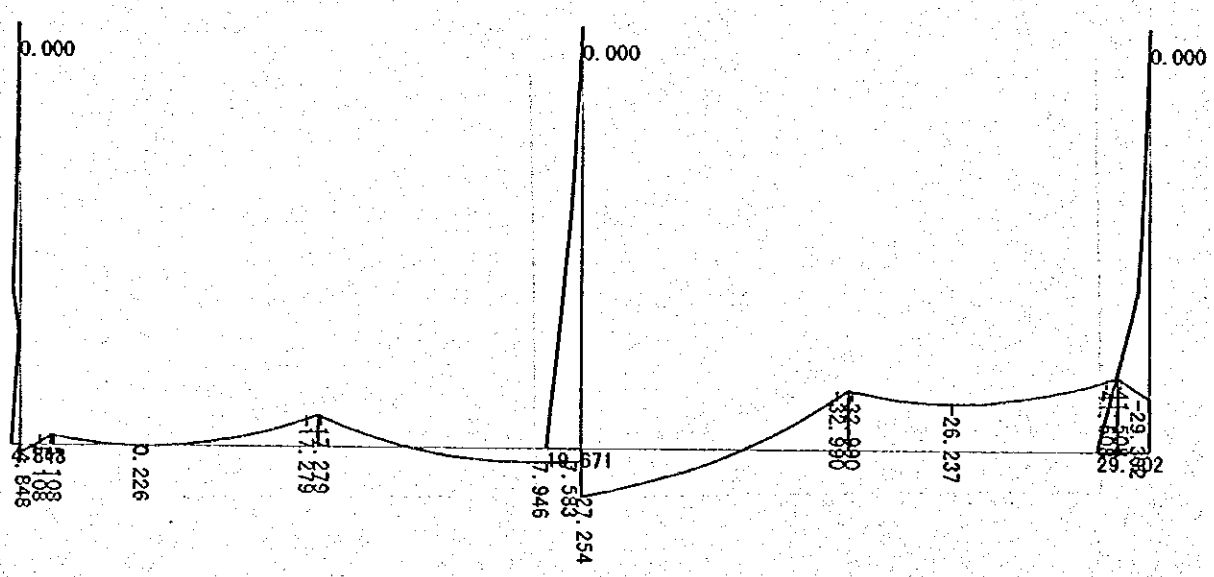


Figure - 47(2)

Asin Pier+Footing (Seismic)

Case 4: seismic-wet

Shear Stress Scale ├──┤ : 41.63tf max. : 41.63 tf

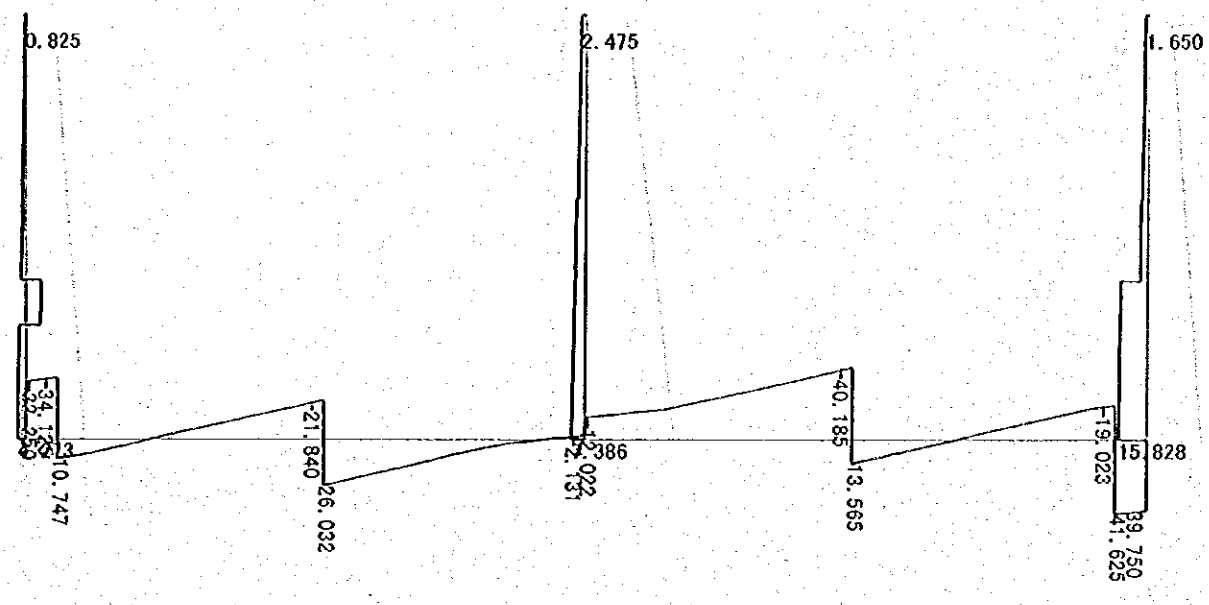
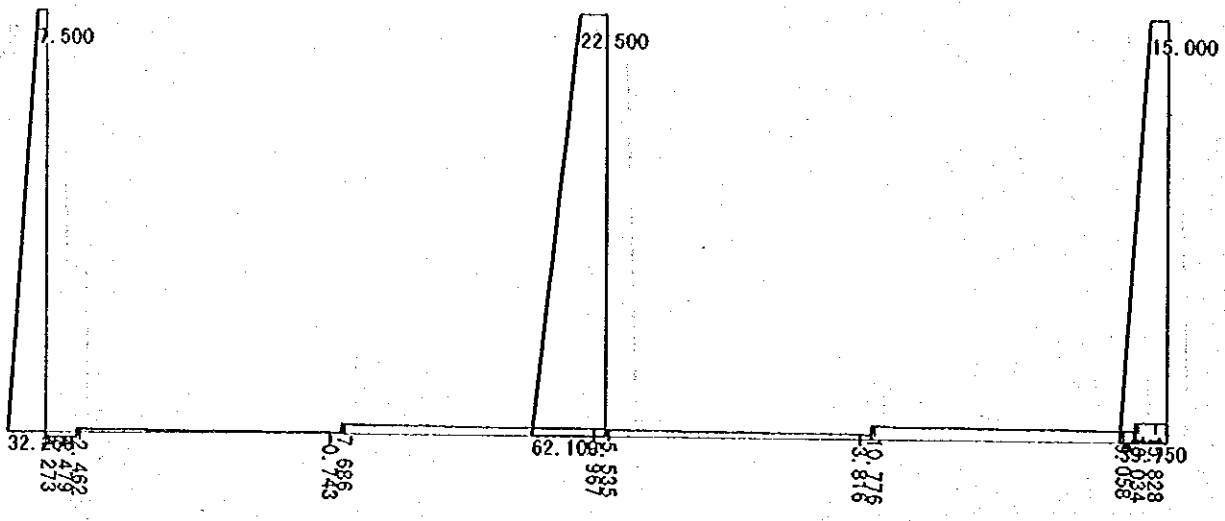


Figure - 47(3)

Asin Pier+Footing (Seismic)

Case 4: seismic-wet

Axial Stress Scale ⊢——⊣ : 62.10tf max. : 62.10 tf



Figure－47 (4)

2.1 Asin Pumping Station

2.1.4 Reinforcing Bar Arrangement Calculation of Gate

Name of Structure	Asin Gate	Category of calculation	Reinforcing bar arrangement	Page	1 / 10

Calculation Part

1) Gate frame 2) Pier and Footing 3) O/M bridge

General condition of calculation

	Normal	Seismic
Allowable compressive stress of concrete:	75 kg/cm^2	112.5 kg/cm^2
Allowable shear stress of concrete:	7.5 kg/cm^2	11.25 kg/cm^2
Allowable tensile stress of reinforcing bar:	1400 kg/cm^2	2100 kg/cm^2

Minimum coverage of concrete: 15 cm at footing bottom, 10 cm at other part
Minimum ratio of reinforcing bar: 0.2% in principle

1) Gate frame

Calculated parts of main reinforcing bar arrangement are classified into four members, such as end column of gate (I, III), center column of gate (IV), footing of gate (V) and slab of control room (II) as shown in following Fig.-1. Stress checkpoints of members for calculation of reinforcing bar arrangement are also shown in Fig-1.

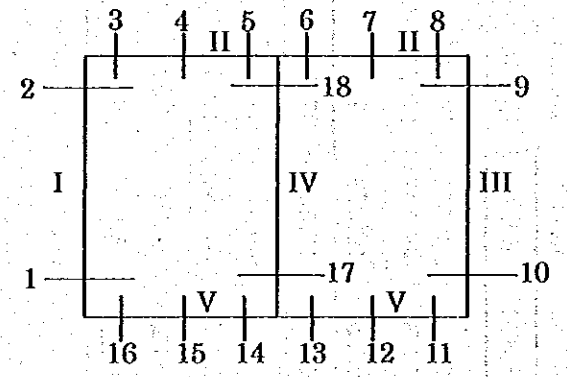


Figure-1

Member I, III: end column of gate frame
Member IV: center column of gate frame
Member V: footing of gate
Member II: slab of control room

1 to 18: checkpoint of member stress

Stresses at each checkpoint are shown in Table-1.

Load for calculation and cross section of each member are shown in Table-2 and Fig-2.

Main reinforcing bar arrangement (calculation results are shown in Table-3)

Member I, III: end column of gate frame

① (outside) : D19@125 mm
② (inside) : D16@125 mm
③ : D13@125 mm

Member IV: center column of gate frame

① : D16@125 mm
② : D13@125 mm

Member IV: footing of gate

① and ② : D22@125 mm

Member II: slab of control room

① : D22@125 mm
② : D19@125 mm

Table-1 (1) Stress at checkpoints (Gate frame-Normal condition)

	Normal											
	FO			FC			LO			RO		
	M	A	S	M	A	S	M	A	S	M	A	S
1	-2.843	52.329	5.635	-3.616	50.039	0.815	3.237	52.402	5.508	-3.697	50.000	0.819
2	15.245	26.432	-2.499	13.812	24.142	-1.996	15.397	26.505	2.536	13.769	24.103	2.000
3	-15.245	2.499	26.432	-13.812	1.996	24.142	-15.397	2.536	26.545	-13.769	2.000	24.103
4	14.645	↑	0	14.296	↑	0	14.667	↑	0	14.245	↑	0
5	-30.983	↑	31.918	-29.085	↑	29.708	-30.750	↑	31.845	-29.251	↑	29.707
6	-30.124	2.213	31.729	-28.255	1.710	29.519	28.168	1.674	29.507	-29.957	2.209	31.689
7	14.956	↑	0	14.606	↑	0	14.630	↑	0	15.008	↑	0
8	-15.388	↑	26.621	-13.954	↑	24.331	-13.959	↑	24.343	-15.431	↑	26.661
9	-15.388	26.621	2.213	-13.954	24.331	1.710	-13.959	34.343	1.674	-15.431	26.661	2.209
10	4.351	51.090	↑	11.379	48.800	8.663	11.054	48.812	8.627	4.270	51.120	↑
11	-49.835	-2.213	52.140	-26.176	-8.663	58.569	-25.855	-8.627	53.458	-19.766	-2.209	52.179
12	-32.434	-0.591	41.290	-31.151	-7.006	49.707	-30.778	-15.903	43.986	-33.659	-0.576	42.658
13	36.319	1.029	23.126	30.882	-5.318	16.978	32.104	-12.024	17.317	37.218	1.054	23.976
14	34.624	2.365	21.684	29.187	-4.032	15.536	37.079	-2.087	22.831	28.288	-4.057	14.686
15	-30.524	3.994	42.041	-29.241	↑	50.457	-30.936	↑	43.274	-28.016	↑	49.089
16	3.412	5.635	53.379	-18.785	0.815	51.089	-12.641	5.598	53.541	-18.854	-2.435	58.095
17	1.695	94.745	0.286	1.695	90.324	0.286	4.975	92.450	6.091	8.931	92.535	6.745
18	-0.860	63.647	↑	-0.860	59.226	↑	-2.581	61.352	0.862	0.706	61.437	-0.028

Table-1 (2) Stress at checkpoints (Gate frame-Seismic condition)

	Seismic											
	FO			FC			LO			RO		
	M	A	S	M	A	S	M	A	S	M	A	S
1	24.132	44.695	11.116	15.901	42.768	4.424	23.513	44.893	10.991	16.968	42.499	4.622
2	-1.186	20.226	1.651	1.662	18.299	1.912	0.683	20.424	4.526	2.360	18.030	2.110
3	1.186	0.195	20.226	1.662	0.066	18.299	↑	0.321	20.424	↑	0.264	18.030
4	18.187	↑	0	17.489	↑	0	17.999	↑	0	17.760	↑	0
5	-47.444	5.447	38.124	-44.582	4.691	35.551	-46.895	5.573	37.926	-45.306	4.494	35.820
6	-13.467	-0.746	25.465	-12.531	0.997	23.616	-12.205	0.936	23.493	-13.347	0.879	25.655
7	15.157	↑	0	14.583	↑	0	14.646	↑	0	15.068	↑	0
8	-39.932	4.506	32.885	-29.542	3.761	30.234	-29.871	3.821	30.357	-31.416	4.373	32.695
9	-31.932	32.885	6.352	-29.542	30.234	5.607	-29.871	30.357	5.688	-31.416	32.695	6.219
10	25.460	57.354	6.517	31.286	54.703	12.725	31.494	54.826	12.786	24.791	57.164	6.384
11	-41.824	-7.838	64.633	-47.854	-14.046	71.001	-48.100	-14.107	67.824	-42.098	-7.705	63.973
12	-38.114	-1.381	45.779	-36.504	-7.838	53.940	-36.279	-7.908	48.992	-38.410	-1.238	46.573
13	59.168	4.649	34.538	52.439	-2.000	27.742	53.444	-2.081	29.029	59.836	4.802	34.923
14	12.252	-0.088	10.216	8.108	-6.232	4.716	14.508	-0.192	11.342	7.529	-6.057	5.568
15	-24.225	5.955	37.257	-23.271	-6.443	45.929	-24.785	5.840	38.336	-23.090	-6.268	41.283
16	24.132	12.437	45.745	15.901	5.745	43.818	23.513	12.312	45.943	16.968	5.943	43.549
17	-46.916	94.687	9.235	44.330	9.266	8.729	38.936	92.516	2.598	52.306	92.573	16.367
18	33.977	63.589	8.995	32.051	59.168	8.339	34.690	61.418	9.221	31.347	61.475	8.084

Table-2 and Figure-2

Table-2 (1)
Member I and III (End column)

	Normal			Seismic		
	①	②	③	①	②	③
Moment	16	12	51	32	32	61
Axial Stress	27	49	54	33	55	54
Shear Stress	3	9	16	7	13	19

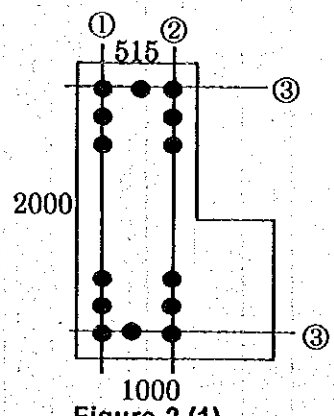


Figure-2 (1)

Table-2 (2)
Member IV (Center column)

	Normal		Seismic	
	①	②	①	②
Moment	9	51	53	61
Axial Stress	93	54	93	54
Shear Stress	7	16	17	19

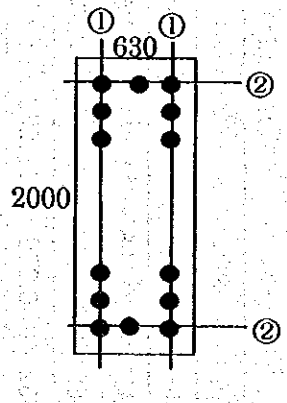


Figure-2 (2)

Table-2 (3)
Member IV (Footing of gate)

	Normal		Seismic	
	①	②	①	②
Moment	34	38	49	60
Axial Stress	-1	-3	-15	4
Shear Stress	43	23	68	35

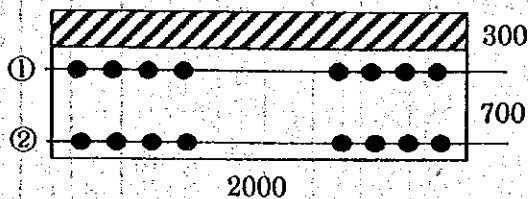


Figure-2 (3)

Table-2 and Figure-2 (continued)

Table-2 (4)
Member II (Slab of control room)

	Normal		Seismic	
	①	②	①	②
Moment	31	16	48	19
Axial Stress	3	2	6	0
Shear Stress	32	0	39	0

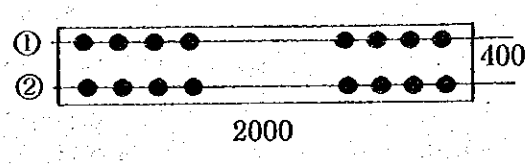
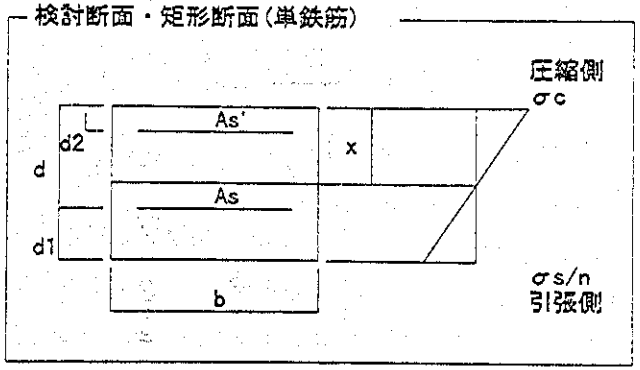


Figure-2 (4)

Table－3

検討断面・矩形断面(単鉄筋)



断面照査位置	断面形状 Condition of Cale										計算結果 Result					
	有効高さ d (cm)	引張鉄筋かぶり d1 (cm)	圧縮鉄筋かぶり d2 (cm)	計算幅 b (cm)	引張鉄筋鉄筋量 As (cm²)	圧縮鉄筋鉄筋量 As' (cm²)	鉄筋比	曲げモーメント M (tf・m)	軸力 N (tf)	せん断力 Q (tf)	コンクリート圧縮応力度 σc (kgf/cm²)	判定	鉄筋引張応力度 σs (kgf/cm²)	判定	コンクリートせん断応力度 τc (kgf/cm²)	判定
1	41.5	10.0	0.0	200.0	45.843	0.000	0.0055	16.000	27.000	3.000	32.2	OK	651.6	OK	0.399	OK
2	41.5	10.0	0.0	200.0	31.769	0.000	0.0038	12.000	49.000	9.000	25.1	OK	296.4	OK	0.977	OK
3	41.5	10.0	0.0	200.0	45.843	0.000	0.0055	32.000	33.000	7.000	64.1	OK	1524.7	OK	0.943	OK
4	41.5	10.0	0.0	200.0	31.769	0.000	0.0038	32.000	55.000	13.000	71.9	OK	1794.1	OK	1.700	OK
5	190.0	10.0	0.0	51.5	5.219	0.000	0.0005	51.000	54.000	16.000	35.1	OK	1001.4	OK	1.207	OK
6	190.0	10.0	0.0	51.5	5.219	0.000	0.0005	61.000	54.000	19.000	46.8	OK	1831.6	OK	1.724	OK
7	60.0	10.0	0.0	200.0	61.932	0.000	0.0052	34.000	-1.000	43.000	32.7	OK	1033.4	OK	4.017	OK
8	55.0	15.0	0.0	200.0	61.932	0.000	0.0056	38.000	-3.000	23.000	42.1	OK	1282.1	OK	2.354	OK
9	60.0	10.0	0.0	200.0	61.932	0.000	0.0052	49.000	-15.000	68.000	46.2	OK	1596.5	OK	6.347	OK
10	55.0	15.0	0.0	200.0	61.932	0.000	0.0056	60.000	4.000	35.000	66.8	OK	1948.1	OK	3.582	OK
11	45.0	10.0	0.0	200.0	61.932	0.000	0.0069	31.000	3.000	32.000	48.2	OK	1241.0	OK	4.044	OK
12	30.0	10.0	0.0	200.0	45.843	0.000	0.0076	16.000	2.000	0.000	53.9	OK	1306.4	OK	0.000	OK
13	45.0	10.0	0.0	200.0	61.932	0.000	0.0069	48.000	6.000	39.000	74.7	OK	1910.5	OK	4.929	OK
14	30.0	10.0	0.0	200.0	45.843	0.000	0.0076	19.000	0.000	0.000	63.9	OK	1580.5	OK	0.000	OK
15	53.0	10.0	0.0	200.0	31.769	0.000	0.0030	9.000	93.000	7.000	14.3	OK	37.7	OK	0.073	OK
16	53.0	10.0	0.0	200.0	31.769	0.000	0.0030	53.000	93.000	17.000	79.8	OK	2021.2	OK	1.697	OK
17	190.0	10.0	0.0	63.0	6.385	0.000	0.0005	51.000	54.000	16.000	28.7	OK	818.6	OK	0.986	OK
18	190.0	10.0	0.0	63.0	6.385	0.000	0.0005	61.000	54.000	19.000	38.3	OK	1497.2	OK	1.409	OK

Area of Reinforcing Bar　Moment　Axial Stress　Shear Stress

2) Pier and Footing

Calculated parts of main reinforcing bar arrangement are classified into three members, such as end pier (I, III), center pier (II) and footing (VI) as shown in Fig.-3. Stress checkpoints of members for calculation of reinforcing bar arrangement are also shown in Fig-3.

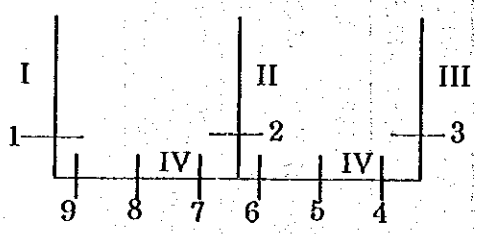


Figure-3

Member I, III: end pier
Member II: center pier
Member IV: footing
1 to 5: checkpoint of member stress

Stresses at each checkpoint are shown in Table-4.

Load for calculation and cross section of each member are shown in Table-5 and Fig-4.

Main reinforcing bar arrangement (calculation results are shown in Table-6)

Member I, III: end pier

① (outside) : D19@125
② (inside) : D16@125

Member II: center pier

① and ② : D16@125

Member IV: footing

① and ② : D19@125

3) O/M bridge

Conditions for analysis assumed as same as for Baru Pumping Station Gate O/M Bridge.

Required reinforcing bar arrangement is D19@125 mm.

Table-4 Stress at checkpoints (Pier and Footing)

		No Water			Water at Left side			Water at Right side			Water at Both side		
		M	A	S	M	A	S	M	A	S	M	A	S
Normal	1	13.074	34.035	10.167	-14.140	34.035	0.233	13.074	41.535	10.167	4.140	34.035	1.233
	2	0	62.100	0	-17.214	62.100	11.400	-17.214	62.100	11.400	0	62.100	0
	3	↑	39.750	↑	0	39.750	0	17.214	32.250	11.400	17.214	39.750	11.400
	4	-12.206	2.021	43.989	-12.206	0.231	43.667	-27.170	-11.400	50.874	-29.420	-11.400	57.119
	5	-25.828	4.045	41.090	-26.633	4.066	43.730	-24.800	-9.355	47.240	-30.186	-9.344	52.646
	6	24.213	↑	12.204	29.204	↑	14.522	11.980	-7.323	2.539	16.980	-7.302	6.690
	7	↑	6.075	8.078	11.990	-5.293	0.246	29.204	6.096	12.229	↑	-5.272	2.564
	8	-15.513	8.115	38.754	-19.065	↑	47.039	-20.899	8.125	44.159	-19.871	↑	50.309
	9	13.074	10.167	35.910	-14.632	-3.261	49.937	13.074	10.167	43.410	-14.632	-3.250	49.615
Seismic	1	20.980	32.250	15.173	4.848	32.250	4.273	24.247	39.750	15.999	4.848	32.250	4.273
	2	18.426	62.100	6.831	35.898	62.100	18.286	9.522	62.100	4.069	19.671	62.100	7.386
	3	11.925	39.750	4.373	11.925	39.750	4.373	26.035	32.250	15.003	29.302	39.750	15.828
	4	-24.131	-4.732	47.628	-24.131	-4.732	47.360	-35.991	-15.002	53.802	-41.508	-15.828	60.648
	5	-28.655	7.144	42.366	-29.325	7.386	45.017	-25.838	-10.075	48.624	-32.990	-10.760	53.750
	6	33.674	5.425	17.119	38.961	5.667	19.502	23.226	-4.955	7.550	27.254	-5.535	2.022
	7	15.248	5.325	5.555	4.616	-5.766	4.269	20.932	5.946	7.268	7.946	-5.967	2.131
	8	-13.170	10.345	36.670	-16.359	-7.485	45.366	-16.769	11.067	42.229	-17.279	-7.686	47.872
	9	-20.980	15.379	34.125	4.848	4.273	45.240	-24.247	16.204	41.625	-6.108	4.479	44.872

Table-5 and Figure-4

Table-5 (1)
Member I and III (End Pier)

	Normal		Seismic	
	①	②	①	②
Moment	14	18	25	30
Axial Stress	42	40	40	40
Shear Stress	11	12	16	16

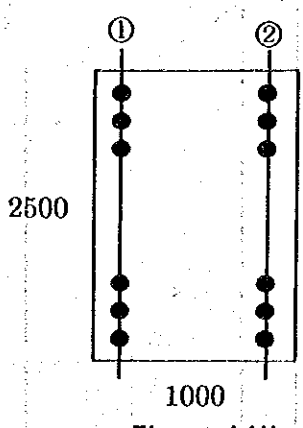


Figure-4 (1)

Table-5 (2)
Member I and III (Center Pier)

	Normal ①	Seismic ①
Moment	18	36
Axial Stress	63	63
Shear Stress	12	19

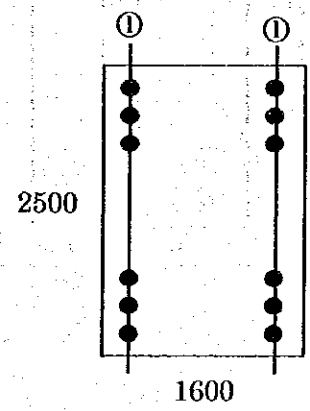


Figure-4 (2)

Table-5 (3)
Member IV (Footing of gate)

	Normal		Seismic	
	①	②	①	②
Moment	31	30	42	39
Axial Stress	-10	4	-16	5
Shear Stress	53	15	61	20

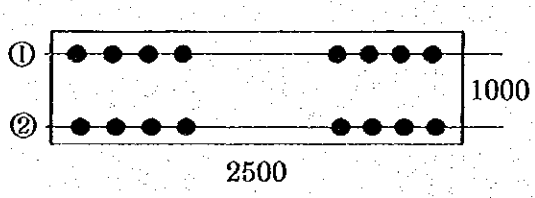
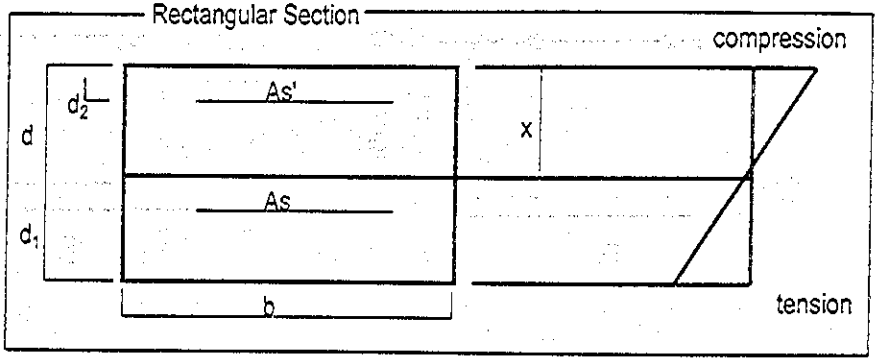


Figure-4 (3)

Table - 6



section number	Condition of Calculation										Result		
	effective height d (cm)	cover d1 (cm)	cover d2 (cm)	calculation width b (cm)	bar area tensile As (cm²)	bar area compression As' (cm²)	bar ratio	bending moment M (tf.m)	axial force N (tf)	shearing force Q (tf)	concrete compression stress σc (kgf/cm²)	bar tensile stress σs (kgf/cm²)	concrete shearing stress τc (kgf/cm²)
1	90.0	10.0	0.0	250.0	57.304	0.000	0.0025	14.000	42.000	11.000	5.8	40.2	0.276
2	90.0	10.0	0.0	250.0	39.711	0.000	0.0018	18.000	40.000	12.000	8.2	129	0.421
3	90.0	10.0	0.0	250.0	57.304	0.000	0.0025	25.000	40.000	16.000	11.1	227.6	0.699
4	90.0	10.0	0.0	250.0	39.711	0.000	0.0018	30.000	40.000	16.000	15.1	443.5	0.719
5	150.0	10.0	0.0	250.0	57.304	0.000	0.0015	18.000	63.000	12.000	3.3	1.4	0.037
6	150.0	10.0	0.0	250.0	57.304	0.000	0.0015	36.000	63.000	19.000	6.0	61.8	0.278
7	90.0	10.0	0.0	250.0	57.304	0.000	0.0025	31.000	-10.000	53.000	13.4	738.3	2.557
8	85.0	15.0	0.0	250.0	57.304	0.000	0.0027	30.000	4.000	15.000	14.7	635.5	0.769
9	90.0	10.0	0.0	250.0	57.304	0.000	0.0025	42.000	-16.000	61.000	18.0	1021.3	2.941
10	85.0	15.0	0.0	250.0	57.304	0.000	0.0027	39.000	5.000	20.000	19.2	828	1.025