REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF CONSTRUCTION
DEPARTMENT OF BRIDGE

DETAILED DESIGN STUDY ON THE BAGO RIVER BRIDGE CONSTRUCTION PROJECT

FINAL REPORT ATTACHMENTS

VOLUME II DESIGN REPORT
Part II Steel Cable Stayed Bridge

DECEMBER 2017

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NIPPON KOEI CO., LTD.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
METROPOLITAN EXPRESSWAY COMPANY LIMITED.
CHODAI CO., LTD.
NIPPON ENGINEERING CONSULTANTS CO., LTD.

EI
CR(3)
17-136

Cable Stayed Bridge

1) Alignment Calculation

- Contents -

1. Alignment Condition

1. 1. Alignment Component

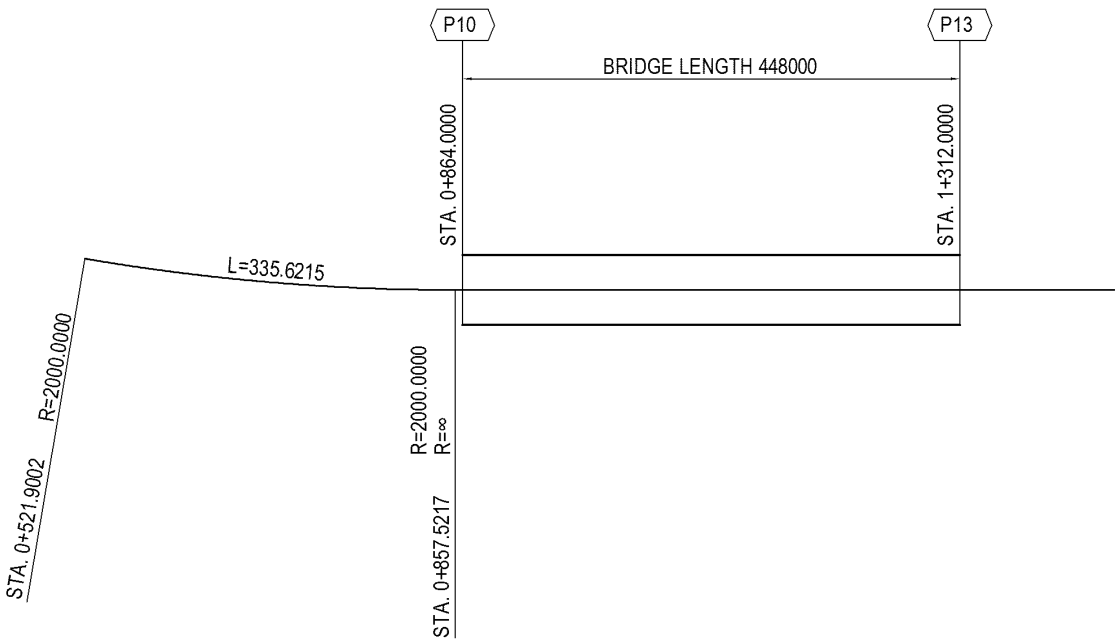
(1) Plan Component

■Standard Line

(Line Name：CL) WGS

Stations	X Coordinate	Y Coordinate	Component
STA. 0 + 521.9002	1,857,597.92761	205,434.02491	R= 2000
STA. 0 + 857.5217	1,857,873.07320	205,242.52404	R= ∞
STA. 2 + 627.4204	1,859,405.38022	204,356.76080	—

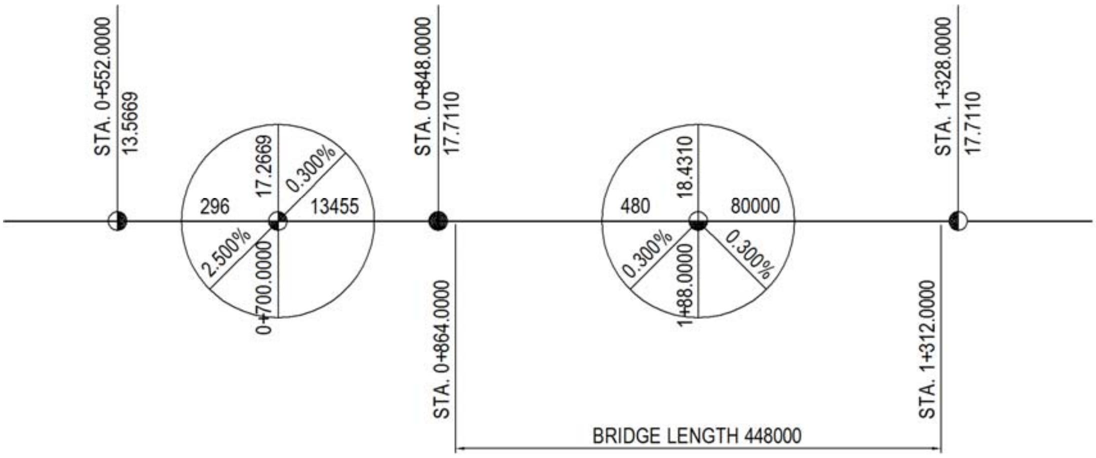
PLAN



(2)Vertical and Horizontal Alignment Component

1） Vertical Alignment:″CL″ is standars line.
2） Alignment at the standard line is shown.

PROFILE



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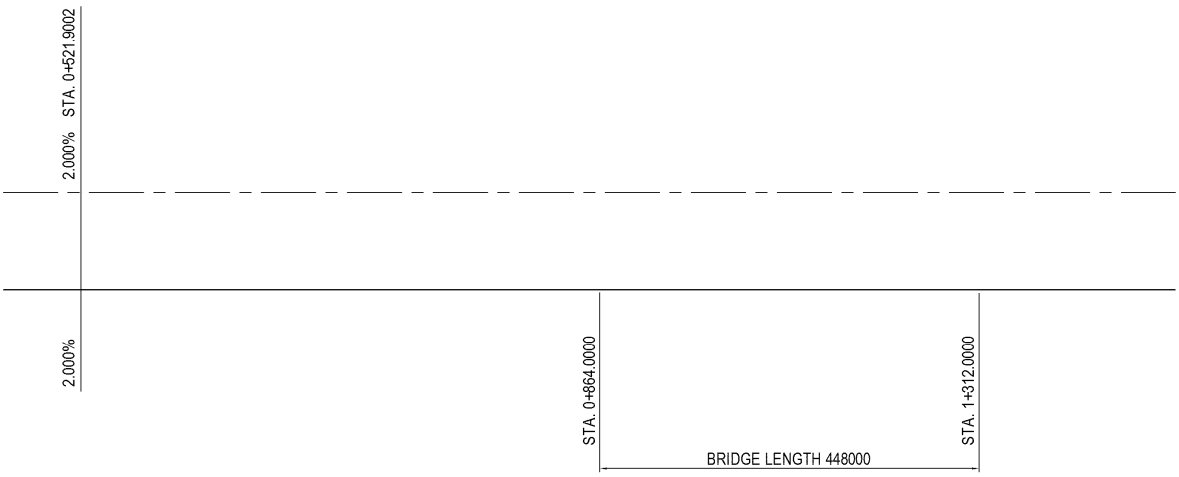
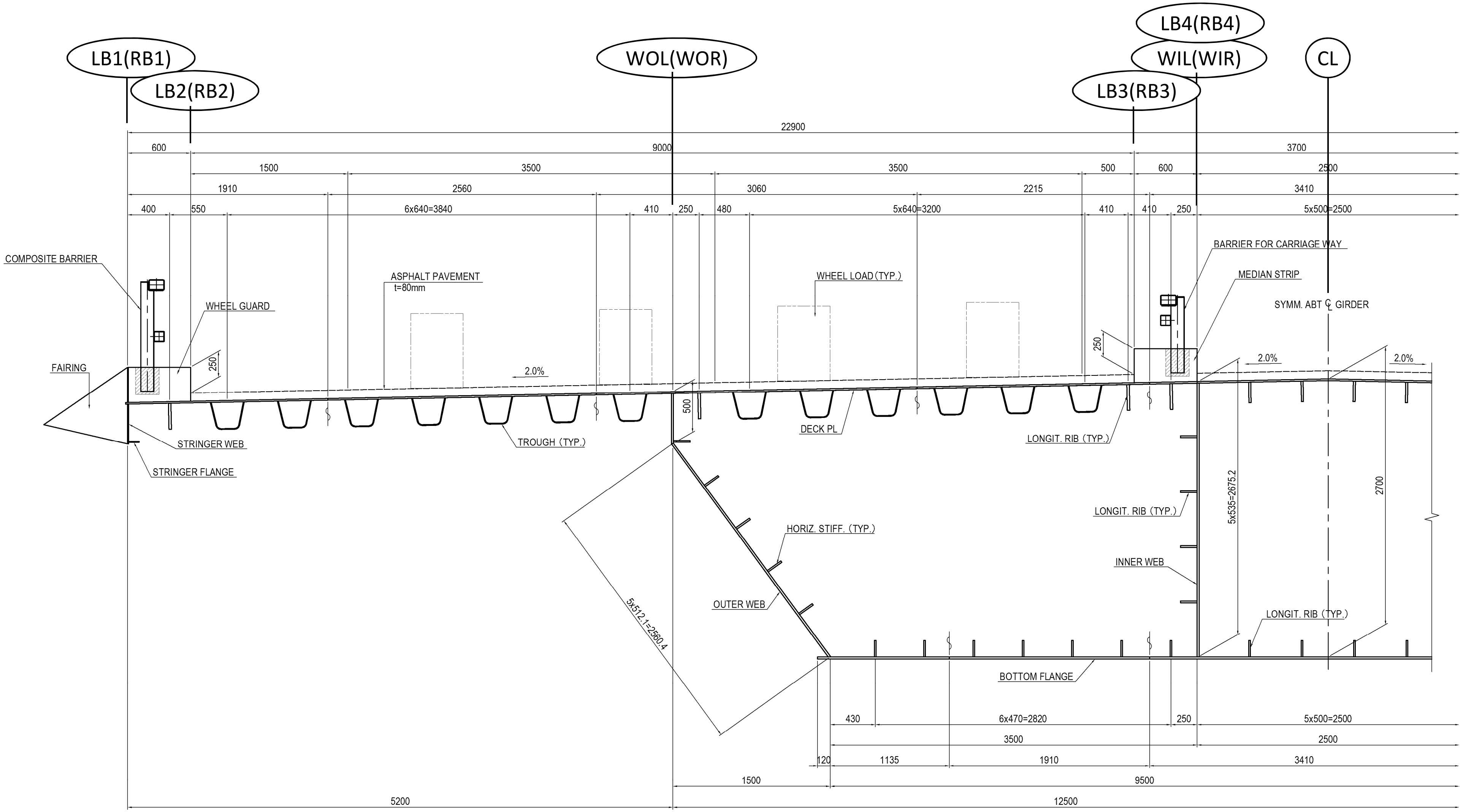


1. 2. Line Name setting

(1) Line Name

Line name and curb shape are shown in the figure below.
Right side: Symmetric at CL.



(2)Pier Loaction :Station pitch is 1000m

Pier	Station				Angle	Main Line
P10	STA.	0	+	864.00	90° 00'00″	CL
P11	STA.	0	+	976.00	90° 00'00″	
P12	STA.	1	+	200.00	90° 00'00″	
P13	STA.	1	+	312.00	90° 00'00″	

(3)Longi. Line: Name for bridge surface line

1) Curb outside(LB1):Parallel to the CL. 11.450m (left side) from the CL.

2) Curb inside(LB2):Parallel to the CL. 10.850m (left side) from the CL.

3) Inside curb inside(LB3):Parallel to the CL. 1.850m (left side) from the CL.

4) Inside curb outside(LB4):Parallel to the CL. 1.250m (left side) from the CL.

5) Inside curb outside(RB4):Parallel to the CL. 1.250m (right side) from the CL.

6) Inside curb inside(RB3):Parallel to the CL. 1.850m (right side) from the CL.

7) Curb inside(RB2):Parallel to the CL. 10.850m (right side) from the CL.

8) Curb outside(RB1):Parallel to the CL. 11.450m (right side) from the CL.

(4)Longi. Line: Girder name and girder line

1) Outer Web(WOL):Parallel to the CL. 6.250m (left side) from the CL.

2) Inner Web(WIL):Parallel to the CL. 1.250m (left side) from the CL.

3) Inner Web(WIR):Parallel to the CL. 1.250m (Right side) from the CL.

4) Outer Web(WOR):Parallel to the CL. 6.250m (right side) from the CL.

(5)Trans. Line: Girder end line and support line name

1) Girdr end line(GE1):Parallel to the P10 line. 0.200m from the P10.

2) Support line(S1):Parallel to the P10 line. 1.000m from the P10.

3) Girdr end line(GE2):Parallel to the P13 line. 0.200m from the P13.

4) Support line(S2):Parallel to the P13 line. 1.000m from the P13.

（6）Trans. Line: Diaphragm line（D）name

1) Diaphragm (D1～D24):From S1 to P11. Each distance is 2.750m, 22@4.500m, 4.0833m, 5.1667m. Normal line of CL.

2) Diaphragm (C25～C74):From P11 to P12. Each distance is 5.1667m, 4.0833m, 22@4.500m, 2.250m, 3.000m, 2.250m, 22@4.500m, 4.0833m, 5.1667m. Normal line to CL.

3) Diaphragm (C74～C98):From P12 to S2. Each distance is 5.1667m, 4.0833m, 22@4.500m, 2.750m. Normal line of CL.

（7）Trans. Line:　Cross beam WEB line name

1) Crossbeam WEB (P11L):Parallel to the P11 line. 1.500m from P11.

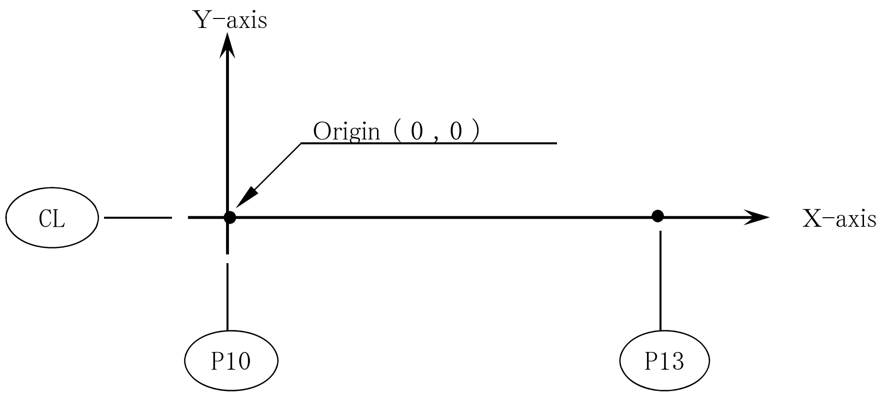
2) Crossbeam WEB (P11R):Parallel to the P11 line. 1.500m from P11.

3) Crossbeam WEB (P12L):Parallel to the P12 line. 1.500m from P12.

4) Crossbeam WEB (P12R):Parallel to the P12 line. 1.500m from P12.

1. 3. Local Coordinate

Local coordinate is follows;

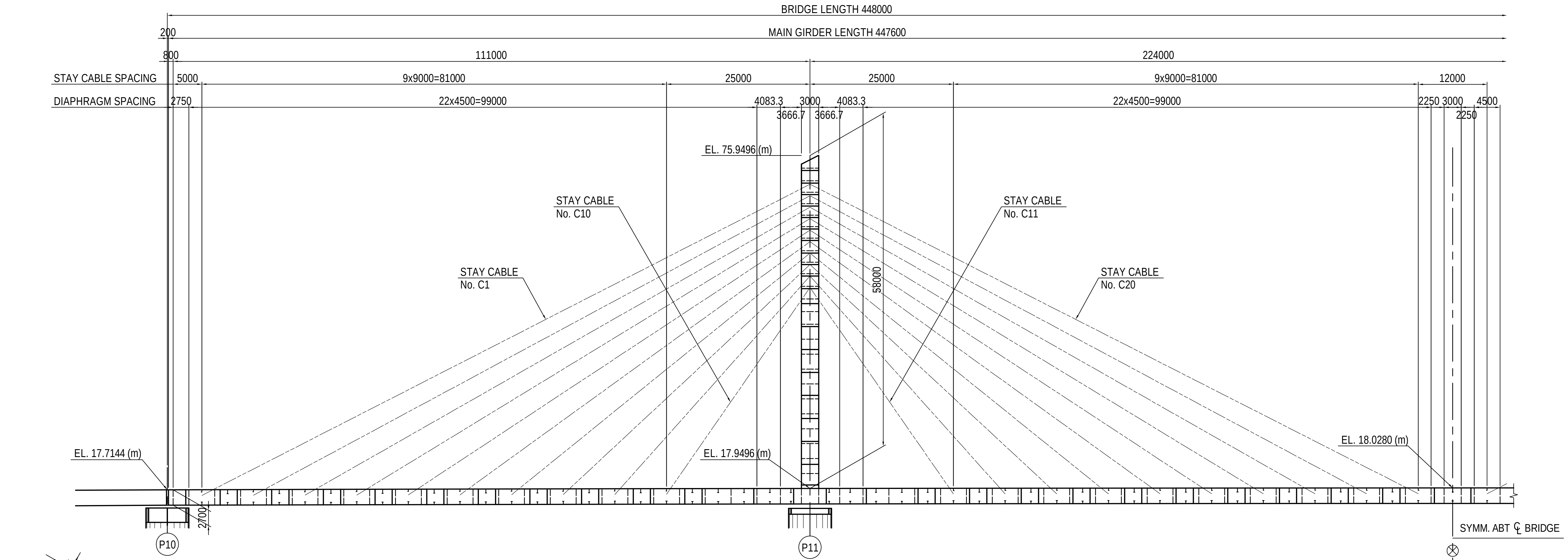


Origin (0,0): intersection point of P10 and CL.
X-axis: Longitudinal direction
Y-axis: Transverse direction

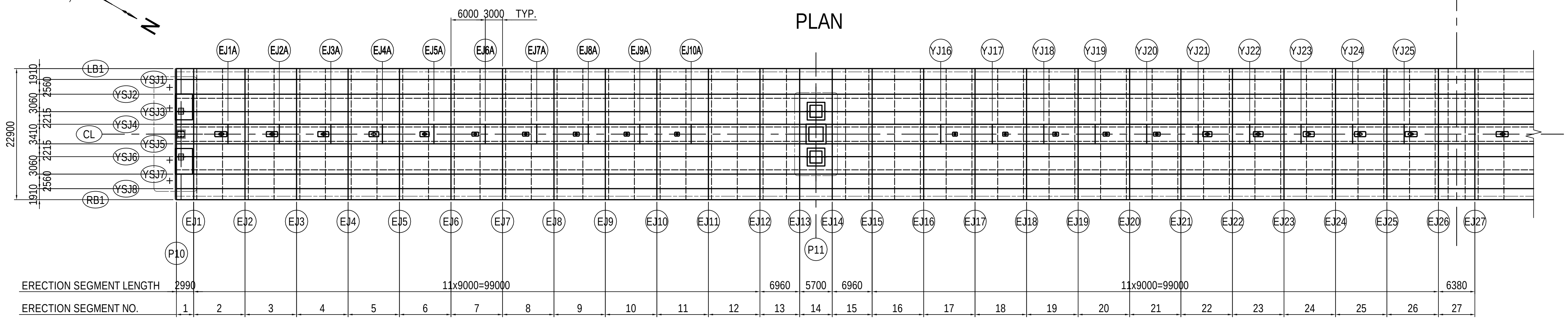
２. Alignment Summary

GENERAL VIEW OF MAIN GIRDER (1) S=1:800

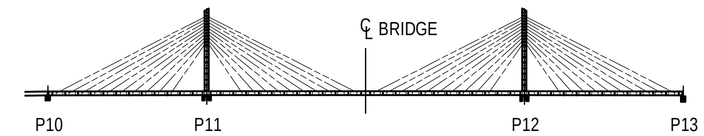
ELEVATION



PLAN

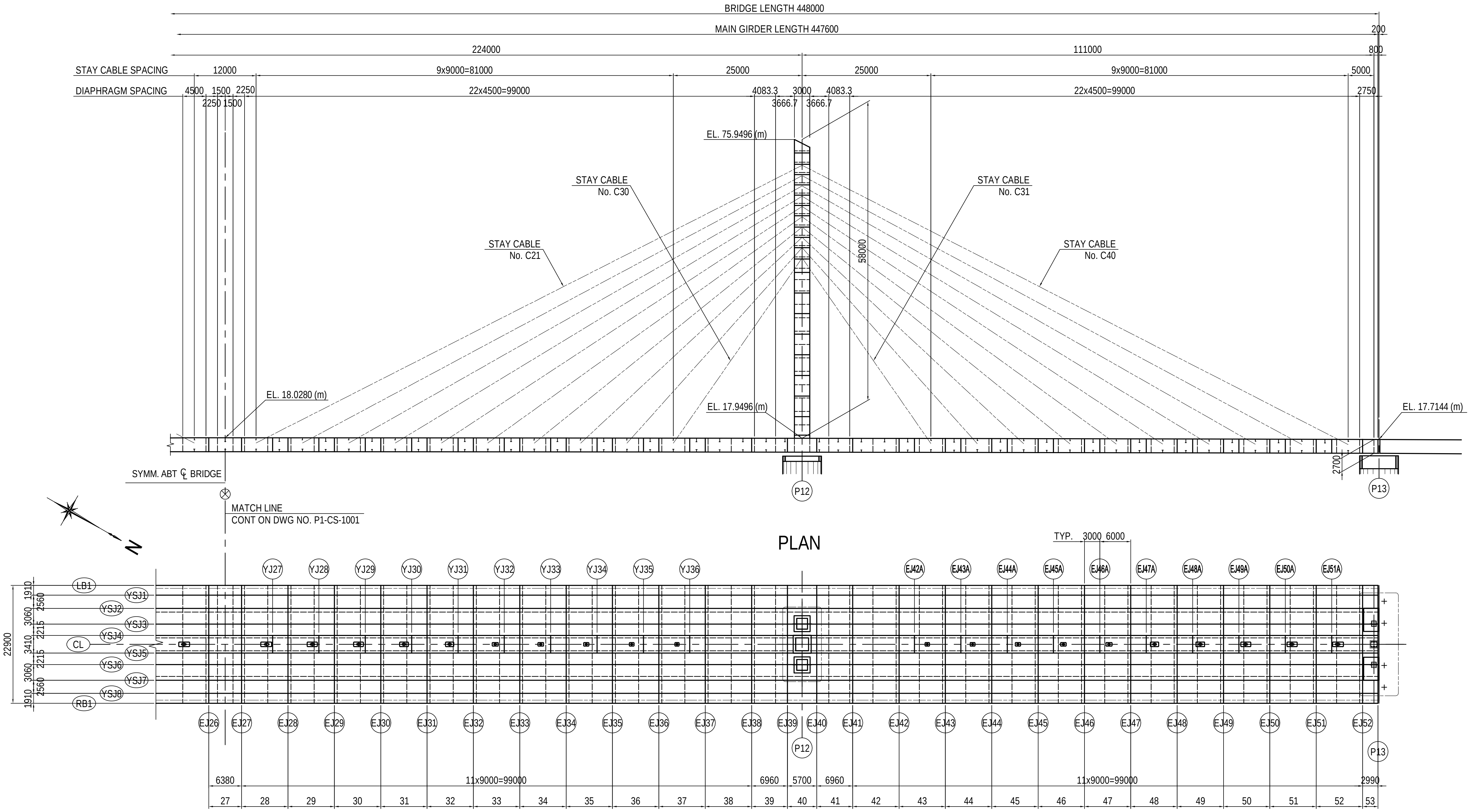


KEY PLAN



PROJECT NAME	FINANCED BY	COUNTERPART	JICA STUDY TEAM		NAME	SIGNATURE	DATE	DRAWING TITLE	PACKAGE
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	REPUBLIC OF THE UNION OF MYANMAR MINISTRY OF CONSTRUCTION DEPARTMENT OF BRIDGE	NIPPON KOEI CO., LTD. ORIENTAL CONSULTANTS GLOBAL CO., LTD. METROPOLITAN EXPRESSWAY COMPANY LIMITED CHODAI CO.,LTD. NIPPON ENGINEERING CONSULTANTS CO.,LTD.	PREPARED BY	T.TOMODA			GENERAL VIEW OF MAIN GIRDER (1)	1
				CHECKED BY	T. HAYAKAWA				DWG No.
				APPROVED BY	Y. SANO				P1-CS-1001

GENERAL VIEW OF MAIN GIRDER (2) S=1:800



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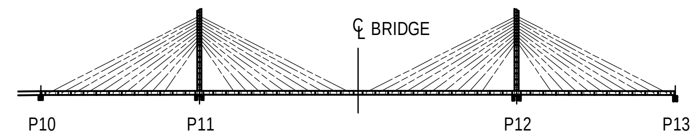

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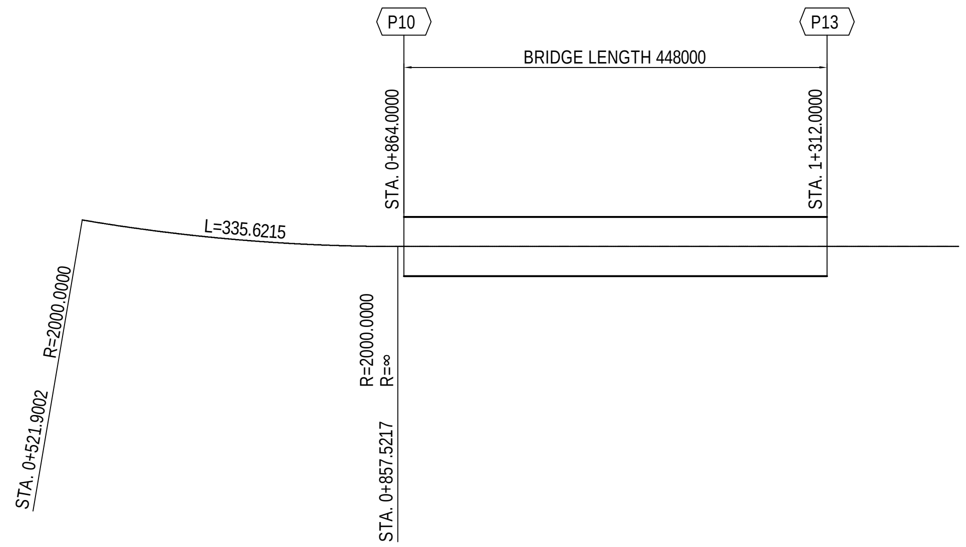
				CHECKED BY	T. HAYAKAWA				DWG No.
				APPROVED BY	Y. SANO				P1-CS-1002

GENERAL VIEW OF MAIN GIRDER (3)

LINEAR ELEMENT

PLAN



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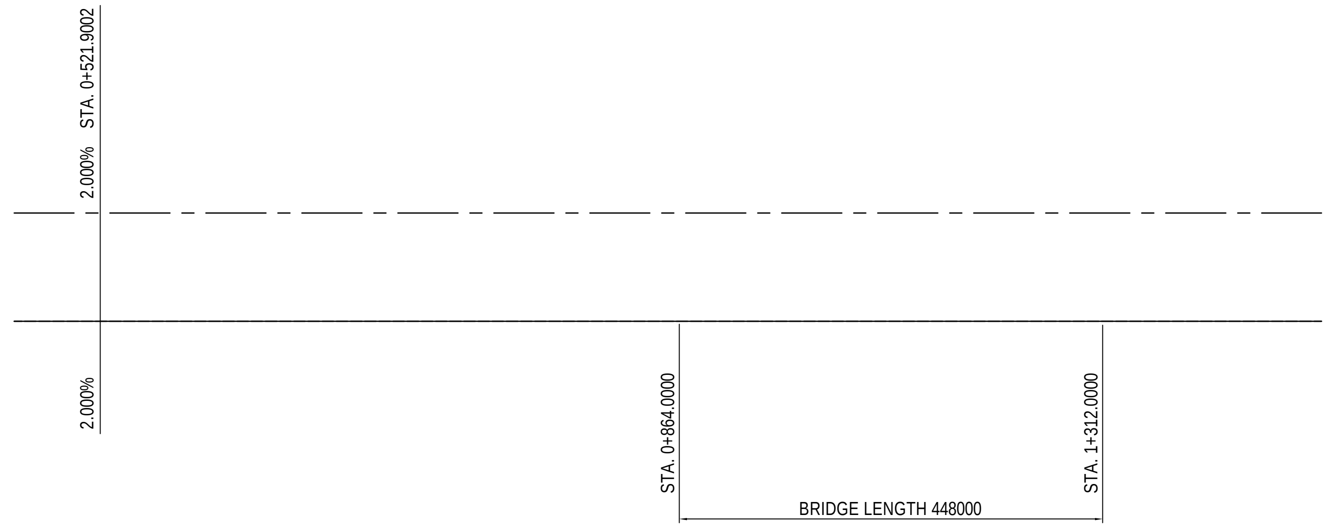
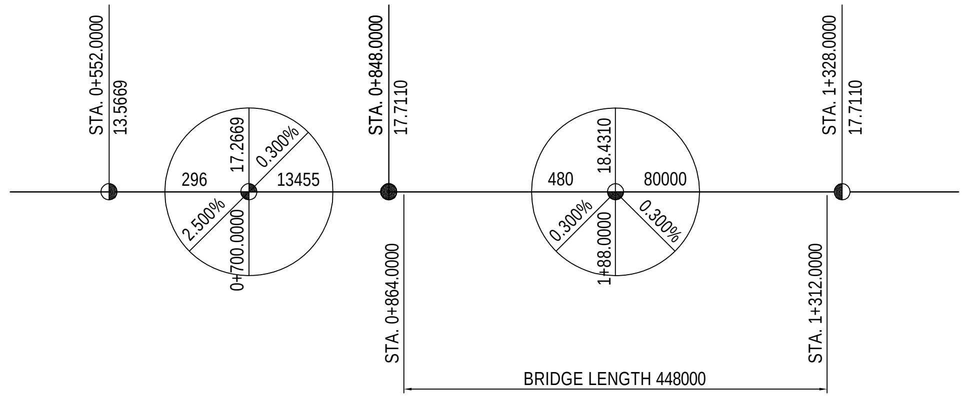
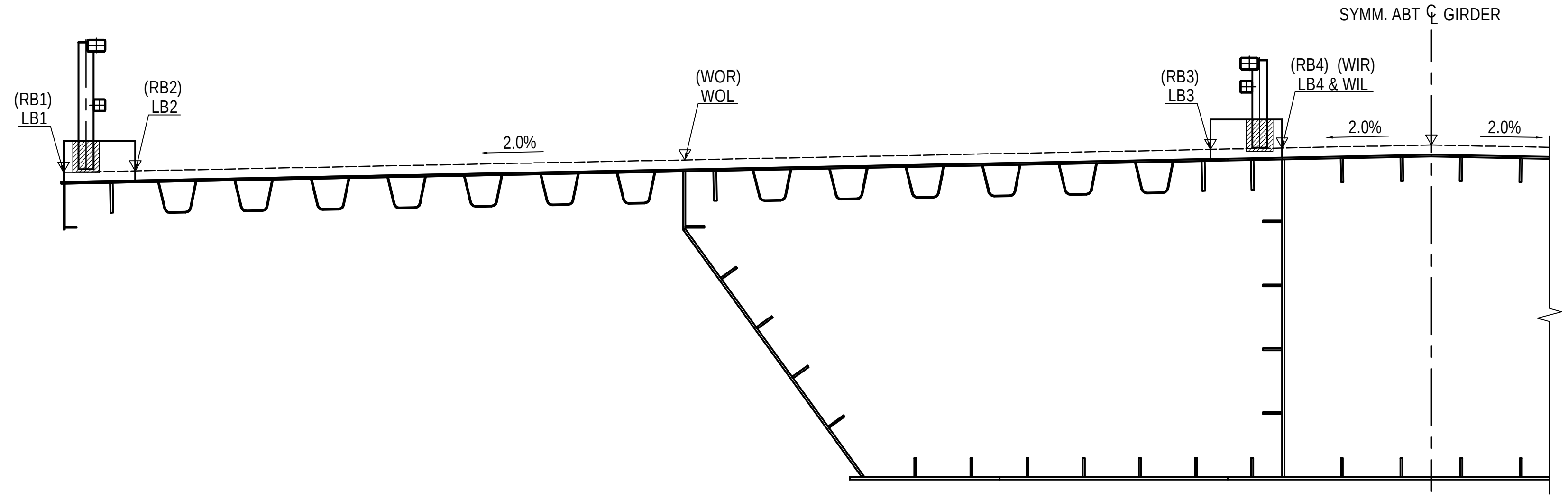


PROFILE



TYPICAL CROSS SECTION



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				CHECKED BY	T. HAYAKAWA				DWG No.
				APPROVED BY	Y. SANO				P1-CS-1003

GENERAL VIEW OF MAIN GIRDER (4)

		P10	GE1	S1	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12
LB1	X	1857872.9516	1857873.1247	1857873.8174	1857876.1982	1857880.0941	1857883.9900	1857887.8859	1857891.7819	1857895.6778	1857899.5737	1857903.4696	1857907.3655	1857911.2615	1857915.1574	1857919.0533
	Y	205229.3690	205229.2689	205228.8685	205227.4922	205225.2402	205222.9881	205220.7360	205218.4840	205216.2319	205213.9798	205211.7277	205209.4757	205207.2236	205204.9715	205202.7195
	Z	17.5654	17.5659	17.5682	17.5758	17.5880	17.6000	17.6118	17.6233	17.6346	17.6456	17.6563	17.6668	17.6770	17.6870	17.6967
LB2	X	1857873.2519	1857873.4250	1857874.1176	1857876.4985	1857880.3944	1857884.2903	1857888.1862	1857892.0821	1857895.9781	1857899.8740	1857903.7699	1857907.6658	1857911.5617	1857915.4577	1857919.3536
	Y	205229.8884	205229.7883	205229.3880	205228.0117	205225.7596	205223.5076	205221.2555	205219.0034	205216.7513	205214.4993	205212.2472	205209.9951	205207.7431	205205.4910	205203.2389
	Z	17.5774	17.5779	17.5802	17.5878	17.6000	17.6120	17.6238	17.6353	17.6466	17.6576	17.6683	17.6788	17.6890	17.6990	17.7087
WOL	X	1857875.5540	1857875.7271	1857876.4197	1857878.8006	1857882.6965	1857886.5924	1857890.4883	1857894.3843	1857898.2802	1857902.1761	1857906.0720	1857909.9679	1857913.8639	1857917.7598	1857921.6557
	Y	205233.8709	205233.7708	205233.3705	205231.9942	205229.7421	205227.4900	205225.2380	205222.9859	205220.7338	205218.4818	205216.2297	205213.9776	205211.7256	205209.4735	205207.2214
	Z	17.6694	17.6699	17.6722	17.6798	17.6920	17.7040	17.7158	17.7273	17.7386	17.7496	17.7603	17.7708	17.7810	17.7910	17.8007
LB3	X	1857877.7560	1857877.9292	1857878.6218	1857881.0026	1857884.8985	1857888.7944	1857892.6904	1857896.5863	1857900.4822	1857904.3781	1857908.2740	1857912.1700	1857916.0659	1857919.9618	1857923.8577
	Y	205237.6803	205237.5802	205237.1798	205235.8035	205233.5515	205231.2994	205229.0473	205226.7953	205224.5432	205222.2911	205220.0390	205217.7870	205215.5349	205213.2828	205211.0308
	Z	17.7574	17.7579	17.7602	17.7678	17.7800	17.7920	17.8038	17.8153	17.8266	17.8376	17.8483	17.8588	17.8690	17.8790	17.8887
LB4	X	1857878.0563	1857878.2294	1857878.9220	1857881.3029	1857885.1988	1857889.0947	1857892.9906	1857896.8866	1857900.7825	1857904.6784	1857908.5743	1857912.4702	1857916.3661	1857920.2621	1857924.1580
	Y	205238.1997	205238.0996	205237.6992	205236.3230	205234.0709	205231.8188	205229.5668	205227.3147	205225.0626	205222.8106	205220.5585	205218.3064	205216.0544	205213.8023	205211.5502
	Z	17.7694	17.7699	17.7722	17.7798	17.7920	17.8040	17.8158	17.8273	17.8386	17.8496	17.8603	17.8708	17.8810	17.8910	17.9007
WIL	X	1857878.0563	1857878.2294	1857878.9220	1857881.3029	1857885.1988	1857889.0947	1857892.9906	1857896.8866	1857900.7825	1857904.6784	1857908.5743	1857912.4702	1857916.3661	1857920.2621	1857924.1580
	Y	205238.1997	205238.0996	205237.6992	205236.3230	205234.0709	205231.8188	205229.5668	205227.3147	205225.0626	205222.8106	205220.5585	205218.3064	205216.0544	205213.8023	205211.5502
	Z	17.7694	17.7699	17.7722	17.7798	17.7920	17.8040	17.8158	17.8273	17.8386	17.8496	17.8603	17.8708	17.8810	17.8910	17.9007
CL	X	1857878.6819	1857878.8550	1857879.5476	1857881.9285	1857885.8244	1857889.7203	1857893.6162	1857897.5121	1857901.4080	1857905.3040	1857909.1999	1857913.0958	1857916.9917	1857920.8876	1857924.7836
	Y	205239.2819	205239.1818	205238.7814	205237.4052	205235.1531	205232.9010	205230.6490	205228.3969	205226.1448	205223.8928	205221.6407	205219.3886	205217.1366	205214.8845	205212.6324
	Z	17.7944	17.7949	17.7972	17.8048	17.8170	17.8290	17.8408	17.8523	17.8636	17.8746	17.8853	17.8958	17.9060	17.9160	17.9257
WIR	X	1857879.3074	1857879.4806	1857880.1732	1857882.5540	1857886.4499	1857890.3459	1857894.2418	1857898.1377	1857902.0336	1857905.9295	1857909.8255	1857913.7214	1857917.6173	1857921.5132	1857925.4091
	Y	205240.3641	205240.2640	205239.8636	205238.4874	205236.2353	205233.9832	205231.7312	205229.4791	205227.2270	205224.9750	205222.7229	205220.4708	205218.2188	205215.9667	205213.7146
	Z	17.7694	17.7699	17.7722	17.7798	17.7920	17.8040	17.8158	17.8273	17.8386	17.8496	17.8603	17.8708	17.8810	17.8910	17.9007
RB4	X	1857879.3074	1857879.4806	1857880.1732	1857882.5540	1857886.4499	1857890.3459	1857894.2418	1857898.1377	1857902.0336	1857905.9295	1857909.8255	1857913.7214	1857917.6173	1857921.5132	1857925.4091
	Y	205240.3641	205240.2640	205239.8636	205238.4874	205236.2353	205233.9832	205231.7312	205229.4791	205227.2270	205224.9750	205222.7229	205220.4708	205218.2188	205215.9667	205213.7146
	Z	17.7694	17.7699	17.7722	17.7798	17.7920	17.8040	17.8158	17.8273	17.8386	17.8496	17.8603	17.8708	17.8810	17.8910	17.9007
RB3	X	1857879.6077	1857879.7809	1857880.4735	1857882.8543	1857886.7502	1857890.6461	1857894.5421	1857898.4380	1857902.3339	1857906.2298	1857910.1257	1857914.0217	1857917.9176	1857921.8135	1857925.7094
	Y	205240.8836	205240.7835	205240.3831	205239.0068	205236.7548	205234.5027	205232.2506	205229.9986	205227.7465	205225.4944	205223.2424	205220.9903	205218.7382	205216.4861	205214.2341
	Z	17.7574	17.7579	17.7602	17.7678	17.7800	17.7920	17.8038	17.8153	17.8266	17.8376	17.8483	17.8588	17.8690	17.8790	17.8887
WOR	X	1857881.8097	1857881.9829	1857882.6755	1857885.0563	1857888.9522	1857892.8482	1857896.7441	1857900.6400	1857904.5359	1857908.4318	1857912.3278	1857916.2237	1857920.1196	1857924.0155	1857927.9114
	Y	205244.6929	205244.5928	205244.1924	205242.8162	205240.5641	205238.3120	205236.0600	205233.8079	205231.5558	205229.3038	205227.0517	205224.7996	205222.5476	205220.2955	205218.0434
	Z	17.6694	17.6699	17.6722	17.6798	17.6920	17.7040	17.7158	17.7273	17.7386	17.7496	17.7603	17.7708	17.7810	17.7910	17.8007
RB2	X	1857884.1118	1857884.2850	1857884.9776	1857887.3584	1857891.2544	1857895.1503	1857899.0462	1857902.9421	1857906.8380	1857910.7340	1857914.6299	1857918.5258	1857922.4217	1857926.3176	1857930.2136
	Y	205248.6754	205248.5753	205248.1749	205246.7987	205244.5466	205242.2945	205240.0425	205237.7904	205235.5383	205233.2863	205231.0342	205228.7821	205226.5301	205224.2780	205222.0259
	Z	17.5774	17.5779	17.5802	17.5878	17.6000	17.6120	17.6238	17.6353	17.6466	17.6576	17.6683	17.6788	17.6890	17.6990	17.7087
RB1	X	1857884.4121	1857884.5853	1857885.2779	1857887.6587	1857891.5546	1857895.4506	1857899.3465	1857903.2424	1857907.1383	1857911.0342	1857914.9302	1857918.8261	1857922.7220	1857926.6179	1857930.5138
	Y	205249.1949	205249.0948	205248.6944	205247.3181	205245.0661	205242.8140	205240.5619	205238.3099	205236.0578	205233.8057	205231.5536	205229.3016	205227.0495	205224.7974	205222.5454
	Z	17.5654	17.5659	17.5682	17.5758	17.5880	17.6000	17.6118	17.6233	17.6346	17.6456	17.6563	17.6668	17.6770	17.6870	17.6967

		D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	P11L	P11	P11R
LB1	X	1857922.9492	1857926.8451	1857930.7411	1857934.6370	1857938.5329	1857942.4288	1857946.3247	1857950.2206	1857954.1166	1857958.0125	1857961.9084	1857965.4436	1857968.6180	1857969.9167	1857971.2153
	Y	205200.4674	205198.2153	205195.9633	205193.7112	205191.4591	205189.2071	205186.9550	205184.7029	205182.4508	205180.1988	205177.9467	205175.9032	205174.0681	205173.3175	205172.5668
	Z	17.7062	17.7155	17.7244	17.7331	17.7416	17.7498	17.7578	17.7655	17.7729	17.7801	17.7871	17.7932	17.7985	17.8006	17.8027
LB2	X	1857923.2495	1857927.1454	1857931.0413	1857934.9372	1857938.8332	1857942.7291	1857946.6250	1857950.5209	1857954.4168	1857958.3128	1857962.2087	1857965.7439	1857968.9183	1857970.2170	1857971.5156
	Y	205200.9869	205198.7348	205196.4827	205194.2307	205191.9786	205189.7265	205187.4744	205185.2224	205182.9703	205180.7182	205178.4662	205176.4226	205174.5876	205173.8369	205173.0862
	Z	17.7182	17.7275	17.7364	17.7451	17.7536	17.7618	17.7698	17.7775	17.7849	17.7921	17.7991	17.8052	17.8105	17.8126	17.8147
WOL	X	1857925.5516	1857929.4475	1857933.3434	1857937.2394	1857941.1353	1857945.0312	1857948.9271	1857952.8230	1857956.7190	1857960.6149	1857964.5108	1857968.0460	1857971.2204	1857972.5191	1857973.8177
	Y	205204.9694	205202.7173	205200.4652	205198.2131	205195.9611	205193.7090	205191.4569	205189.2049	205186.9528	205184.7007	205182.4487	205180.4051	205178.5701	205177.8194	205177.0687
	Z	17.8102	17.8195	17.8284	17.8371	17.8456	17.8538	17.8618	17.8695	17.8769	17.8841	17.8911	17.8972	17.9025	17.9046	17.9067
LB3	X	1857927.7536	1857931.6495	1857935.5455	1857939.4414	1857943.3373	1857947.2332	1857951.1291	1857955.0251	1857958.9210	1857962.8169	1857966.7128	1857970.2480	1857973.4225	1857974.7211	1857976.0197
	Y	205208.7787	205206.5266	205204.2746	205202.0225	205199.7704	205197.5183	205195.2663	205193.0142	205190.7621	205188.5101	205186.2580	205184.2145	205182.3794	205181.6287	205180.8781
	Z	17.8982	17.9075	17.9164	17.9251	17.9336	17.9418	17.9498	17.9575	17.9649	17.9721	17.9791	17.9852	17.9905	17.9926	17.9947
LB4	X	1857928.0539	1857931.9498	1857935.8457	1857939.7417	1857943.6376	1857947.5335	1857951.4294	1857955.3253	1857959.2213	1857963.1172	1857967.0131	1857970.5483	1857973.7227	1857975.0214	1857976.3200
	Y	205209.2982	205207.0461	205204.7940	205202.5419	205200.2899	205198.0378	205195.7857	205193.5337	205191.2816	205189.0295	205186.7775	205184.7339	205182.8989	205182.1482	205181.3975
	Z	17.9102	17.9195	17.9284	17.9371	17.9456	17.9538	17.9618	17.9695	17.9769	17.9841	17.9911	17.9972	18.0025	18.0046	18.0067
WIL	X	1857928.0539	1857931.9498	1857935.8457	1857939.7417	1857943.6376	1857947.5335	1857951.4294	1857955.3253	1857959.2213	1857963.1172	1857967.0131	1857970.5483	1857973.7227	1857975.0214	1857976.3200
	Y	205209.2982	205207.0461	205204.7940	205202.5419	205200.2899	205198.0378	205195.7857	205193.5337	205191.2816	205189.0295	205186.7775	205184.7339	205182.8989	205182.1482	205181.3975
	Z	17.9102	17.9195	17.9284	17.9371	17.9456	17.9538	17.9618	17.9695	17.9769	17.9841	17.9911	17.9972	18.0025	18.0046	18.0067
CL	X	1857928.6795	1857932.5754	1857936.4713	1857940.3672	1857944.2632	1857948.1591	1857952.0550	1857955.9509	1857959.8468	1857963.7428	1857967.6387	1857971.1739	1857974.3483	1857975.6469	1857976.9456
	Y	205210.3804	205208.1283	205205.8762	205203.6241	205201.3721	205199.1200	205196.8679	205194.6159	205192.3638	205190.1117	205187.8597	205185.8161	205183.9811	205183.2304	205182.4797
	Z	17.9352	17.9445	17.9534	17.9621	17.9706	17.9788	17.9868	17.9945	18.0019	18.0091	18.0161	18.0222	18.0275	18.0296	18.0317
WIR	X	1857929.3051	1857933.2010	1857937.0969	1857940.9928	1857944.8887	1857948.7846	1857952.6806	1857956.5765	1857960.4724	1857964.3683	1857968.2642	1857971.7994	1857974.9739	1857976.2725	1857977.5712
	Y	205211.4626	205209.2105	205206.9584	205204.7063	205202.4543	205200.2022	205197.9501	205195.6981	205193.4460	205191.1939	205188.9419	205186.8983	205185.0633	205184.3126	205183.5619
	Z	17.9102	17.9195	17.9284	17.9371	17.9456	17.9538	17.9618	17.9695	17.9769	17.9841	17.9911	17.9972	18.0025	18.0046	18.0067
RB4	X	1857929.3051	1857933.2010	1857937.0969	1857940.9928	1857944.8887	1857948.7846	1857952.6806	1857956.5765	1857960.4724	1857964.3683	1857968.2642	1857971.7994	1857974.9739	1857976.2725	1857977.5712
	Y	205211.4626	205209.2105	205206.9584	205204.7063	205202.4543	205200.2022	205197.9501	205195.6981	205193.4460	205191.1939	205188.9419	205186.8983	205185.0633	205184.3126	205183.5619
	Z	17.9102	17.9195	17.9284	17.9371	17.9456	17.9538	17.9618	17.9695	17.9769	17.9841	17.9911	17.9972	18.0025	18.0046	18.0067
RB3	X	1857929.6053	1857933.5013	1857937.3972	1857941.2931	1857945.1890	1857949.0849	1857952.9808	1857956.8768	1857960.7727	1857964.6686	1857968.5645	1857972.0997	1857975.2742	1857976.5728	1857977.8714
	Y	205211.9820	205209.7299	205207.4779	205205.2258	205202.9737	205200.7217	205198.4696	205196.2175	205193.9655	205191.7134	205189.4613	205187.4178	205185.5827	205184.8321	205184.0814
	Z	17.8982	17.9075	17.9164	17.9251	17.9336	17.9418	17.9498	17.9575	17.9649	17.9721	17.9791	17.9852	17.9905	17.9926	17.9947
WOR	X	1857931.8074	1857935.7033	1857939.5992	1857943.4951	1857947.3910	1857951.2869	1857955.1829	1857959.0788	1857962.9747	1857966.8706	1857970.7665	1857974.3017	1857977.4762	1857978.7748	1857980.0735
	Y	205215.7913	205213.5393	205211.2872	205209.0351	205206.7831	205204.5310	205202.2789	205200.0269	205197.7748	205195.5227	205193.2707	205191.2271	205189.3921	205188.6414	205187.8907
	Z	17.8102	17.8195	17.8284	17.8371	17.8456	17.8538	17.8618	17.8695	17.8769	17.8841	17.8911	17.8972	17.9025	17.9046	17.9067
RB2	X	1857934.1095	1857938.0054	1857941.9013	1857945.7972	1857949.6931	1857953.5891	1857957.4850	1857961.3809	1857965.2768	1857969.1727	1857973.0687	1857976.6038	1857979.7783	1857981.0769	1857982.3756
	Y	205219.7738	205217.5218	205215.2697	205213.0176	205210.7656	205208.5135	205206.2614	205204.0094	205201.7573	205199.5052	205197.2532	205195.2096	205193.3746	205192.6239	205191.8732
	Z	17.7182	17.7275	17.7364	17.7451	17.7536	17.7618	17.7698	17.7775	17.7849	17.7921	17.7991	17.8052	17.8105	17.8126	17.8147
RB1	X	1857934.4097	1857938.3057	1857942.2016	1857946.0975	1857949.9934	1857953.8893	1857957.7853	1857961.6812	1857965.5771	1857969.4730	1857973.3689	1857976.9041	1857980.0786	1857981.3772	1857982.6759
	Y	205220.2933	205218.0412	205215.7892	205213.5371	205211.2850	205209.0330	205206.7809	205204.5288	205202.2767	205200.0247	205197.7726	205195.7291	205193.8940	205193.1434	205192.3927
	Z	17.7062	17.7155	17.7244	17.7331	17.7416	17.7498	17.7578	17.7655	17.7729	17.7801	17.7871	17.7932	17.7985	17.8006	17.8027

PROJECT NAME: DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT

FINANCED BY: JAPAN INTERNATIONAL COOPERATION AGENCY

COUNTERPART: REPUBLIC OF THE UNION OF MYANMAR, MINISTRY OF CONSTRUCTION, DEPARTMENT OF BRIDGE

JICA STUDY TEAM: NIPPON KOEI CO., LTD. / ORIENTAL CONSULTANTS GLOBAL CO., LTD. / METROPOLITAN EXPRESSWAY COMPANY LIMITED / CHODAI CO.,LTD. / NIPPON ENGINEERING CONSULTANTS CO.,LTD.

	NAME	SIGNATURE	DATE
PREPARED BY	T.TOMODA		
CHECKED BY	T. HAYAKAWA		
APPROVED BY	Y. SANO		

DRAWING TITLE: GENERAL VIEW OF MAIN GIRDER (4)

PACKAGE: 1

DWG No.: P1-CS-1004

GENERAL VIEW OF MAIN GIRDER (5)

		D25	D26	D27	D28	D29	D30	D31	D32	D33	D34	D35	D36	D37	D38
LB1	X	1857974.3898	1857977.9250	1857981.8209	1857985.7168	1857989.6127	1857993.5086	1857997.4045	1858001.3005	1858005.1964	1858009.0923	1858012.9882	1858016.8841	1858020.7801	1858024.6760
	Y	205170.7317	205168.6882	205166.4361	205164.1841	205161.9320	205159.6799	205157.4279	205155.1758	205152.9237	205150.6717	205148.4196	205146.1675	205143.9154	205141.6634
	Z	17.8076	17.8130	17.8186	17.8240	17.8292	17.8341	17.8387	17.8431	17.8473	17.8511	17.8548	17.8581	17.8613	17.8641
LB2	X	1857974.6900	1857978.2252	1857982.1211	1857986.0171	1857989.9130	1857993.8089	1857997.7048	1858001.6007	1858005.4967	1858009.3926	1858013.2885	1858017.1844	1858021.0803	1858024.9763
	Y	205171.2512	205169.2077	205166.9556	205164.7035	205162.4515	205160.1994	205157.9473	205155.6952	205153.4432	205151.1911	205148.9390	205146.6870	205144.4349	205142.1828
	Z	17.8196	17.8250	17.8306	17.8360	17.8412	17.8461	17.8507	17.8551	17.8593	17.8631	17.8668	17.8701	17.8733	17.8761
WOL	X	1857976.9922	1857980.5273	1857984.4233	1857988.3192	1857992.2151	1857996.1110	1858000.0069	1858003.9029	1858007.7988	1858011.6947	1858015.5906	1858019.4865	1858023.3824	1858027.2784
	Y	205175.2337	205173.1902	205170.9381	205168.6860	205166.4339	205164.1819	205161.9298	205159.6777	205157.4257	205155.1736	205152.9215	205150.6695	205148.4174	205146.1653
	Z	17.9116	17.9170	17.9226	17.9280	17.9332	17.9381	17.9427	17.9471	17.9513	17.9551	17.9588	17.9621	17.9653	17.9681
LB3	X	1857979.1942	1857982.7294	1857986.6253	1857990.5212	1857994.4171	1857998.3130	1858002.2090	1858006.1049	1858010.0008	1858013.8967	1858017.7926	1858021.6886	1858025.5845	1858029.4804
	Y	205179.0430	205176.9995	205174.7474	205172.4954	205170.2433	205167.9912	205165.7392	205163.4871	205161.2350	205158.9829	205156.7309	205154.4788	205152.2267	205149.9747
	Z	17.9996	18.0050	18.0106	18.0160	18.0212	18.0261	18.0307	18.0351	18.0393	18.0431	18.0468	18.0501	18.0533	18.0561
LB4	X	1857979.4945	1857983.0296	1857986.9256	1857990.8215	1857994.7174	1857998.6133	1858002.5092	1858006.4052	1858010.3011	1858014.1970	1858018.0929	1858021.9888	1858025.8847	1858029.7807
	Y	205179.5625	205177.5190	205175.2669	205173.0148	205170.7627	205168.5107	205166.2586	205164.0065	205161.7545	205159.5024	205157.2503	205154.9983	205152.7462	205150.4941
	Z	18.0116	18.0170	18.0226	18.0280	18.0332	18.0381	18.0427	18.0471	18.0513	18.0551	18.0588	18.0621	18.0653	18.0681
WIL	X	1857979.4945	1857983.0296	1857986.9256	1857990.8215	1857994.7174	1857998.6133	1858002.5092	1858006.4052	1858010.3011	1858014.1970	1858018.0929	1858021.9888	1858025.8847	1858029.7807
	Y	205179.5625	205177.5190	205175.2669	205173.0148	205170.7627	205168.5107	205166.2586	205164.0065	205161.7545	205159.5024	205157.2503	205154.9983	205152.7462	205150.4941
	Z	18.0116	18.0170	18.0226	18.0280	18.0332	18.0381	18.0427	18.0471	18.0513	18.0551	18.0588	18.0621	18.0653	18.0681
CL	X	1857980.1200	1857983.6552	1857987.5511	1857991.4471	1857995.3430	1857999.2389	1858003.1348	1858007.0307	1858010.9266	1858014.8226	1858018.7185	1858022.6144	1858026.5103	1858030.4062
	Y	205180.6447	205178.6012	205176.3491	205174.0970	205171.8449	205169.5929	205167.3408	205165.0887	205162.8367	205160.5846	205158.3325	205156.0805	205153.8284	205151.5763
	Z	18.0366	18.0420	18.0476	18.0530	18.0582	18.0631	18.0677	18.0721	18.0763	18.0801	18.0838	18.0871	18.0903	18.0931
WIR	X	1857980.7456	1857984.2808	1857988.1767	1857992.0726	1857995.9685	1857999.8645	1858003.7604	1858007.6563	1858011.5522	1858015.4481	1858019.3441	1858023.2400	1858027.1359	1858031.0318
	Y	205181.7269	205179.6834	205177.4313	205175.1792	205172.9271	205170.6751	205168.4230	205166.1709	205163.9189	205161.6668	205159.4147	205157.1627	205154.9106	205152.6585
	Z	18.0116	18.0170	18.0226	18.0280	18.0332	18.0381	18.0427	18.0471	18.0513	18.0551	18.0588	18.0621	18.0653	18.0681
RB4	X	1857980.7456	1857984.2808	1857988.1767	1857992.0726	1857995.9685	1857999.8645	1858003.7604	1858007.6563	1858011.5522	1858015.4481	1858019.3441	1858023.2400	1858027.1359	1858031.0318
	Y	205181.7269	205179.6834	205177.4313	205175.1792	205172.9271	205170.6751	205168.4230	205166.1709	205163.9189	205161.6668	205159.4147	205157.1627	205154.9106	205152.6585
	Z	18.0116	18.0170	18.0226	18.0280	18.0332	18.0381	18.0427	18.0471	18.0513	18.0551	18.0588	18.0621	18.0653	18.0681
RB3	X	1857981.0459	1857984.5811	1857988.4770	1857992.3729	1857996.2688	1858000.1647	1858004.0607	1858007.9566	1858011.8525	1858015.7484	1858019.6443	1858023.5403	1858027.4362	1858031.3321
	Y	205182.2464	205180.2028	205177.9507	205175.6987	205173.4466	205171.1945	205168.9425	205166.6904	205164.4383	205162.1863	205159.9342	205157.6821	205155.4300	205153.1780
	Z	17.9996	18.0050	18.0106	18.0160	18.0212	18.0261	18.0307	18.0351	18.0393	18.0431	18.0468	18.0501	18.0533	18.0561
WOR	X	1857983.2479	1857986.7831	1857990.6790	1857994.5749	1857998.4708	1858002.3668	1858006.2627	1858010.1586	1858014.0545	1858017.9504	1858021.8464	1858025.7423	1858029.6382	1858033.5341
	Y	205186.0557	205184.0122	205181.7601	205179.5080	205177.2559	205175.0039	205172.7518	205170.4997	205168.2477	205165.9956	205163.7435	205161.4915	205159.2394	205156.9873
	Z	17.9116	17.9170	17.9226	17.9280	17.9332	17.9381	17.9427	17.9471	17.9513	17.9551	17.9588	17.9621	17.9653	17.9681
RB2	X	1857985.5500	1857989.0852	1857992.9811	1857996.8770	1858000.7730	1858004.6689	1858008.5648	1858012.4607	1858016.3566	1858020.2526	1858024.1485	1858028.0444	1858031.9403	1858035.8362
	Y	205190.0382	205187.9946	205185.7426	205183.4905	205181.2384	205178.9864	205176.7343	205174.4822	205172.2302	205169.9781	205167.7260	205165.4740	205163.2219	205160.9698
	Z	17.8196	17.8250	17.8306	17.8360	17.8412	17.8461	17.8507	17.8551	17.8593	17.8631	17.8668	17.8701	17.8733	17.8761
RB1	X	1857985.8503	1857989.3855	1857993.2814	1857997.1773	1858001.0732	1858004.9692	1858008.8651	1858012.7610	1858016.6569	1858020.5528	1858024.4488	1858028.3447	1858032.2406	1858036.1365
	Y	205190.5576	205188.5141	205186.2620	205184.0100	205181.7579	205179.5058	205177.2538	205175.0017	205172.7496	205170.4975	205168.2455	205165.9934	205163.7413	205161.4893
	Z	17.8076	17.8130	17.8186	17.8240	17.8292	17.8341	17.8387	17.8431	17.8473	17.8511	17.8548	17.8581	17.8613	17.8641

		D39	D40	D41	D42	D43	D44	D45	D46	D47	D48	D49	D50	D51	D52
LB1	X	1858028.5719	1858032.4678	1858036.3637	1858040.2597	1858044.1556	1858048.0515	1858051.9474	1858055.8433	1858059.7392	1858063.6352	1858065.5831	1858068.1804	1858070.1284	1858074.0243
	Y	205139.4113	205137.1592	205134.9072	205132.6551	205130.4030	205128.1510	205125.8989	205123.6468	205121.3947	205119.1427	205118.0166	205116.5153	205115.3892	205113.1372
	Z	17.8667	17.8691	17.8712	17.8731	17.8747	17.8760	17.8771	17.8780	17.8786	17.8789	17.8790	17.8790	17.8789	17.8786
LB2	X	1858028.8722	1858032.7681	1858036.6640	1858040.5599	1858044.4558	1858048.3518	1858052.2477	1858056.1436	1858060.0395	1858063.9354	1858065.8834	1858068.4807	1858070.4286	1858074.3246
	Y	205139.9308	205137.6787	205135.4266	205133.1746	205130.9225	205128.6704	205126.4183	205124.1663	205121.9142	205119.6621	205118.5361	205117.0347	205115.9087	205113.6566
	Z	17.8787	17.8811	17.8832	17.8851	17.8867	17.8880	17.8891	17.8900	17.8906	17.8909	17.8910	17.8910	17.8909	17.8906
WOL	X	1858031.1743	1858035.0702	1858038.9661	1858042.8620	1858046.7580	1858050.6539	1858054.5498	1858058.4457	1858062.3416	1858066.2376	1858068.1855	1858070.7828	1858072.7308	1858076.6267
	Y	205143.9133	205141.6612	205139.4091	205137.1570	205134.9050	205132.6529	205130.4008	205128.1488	205125.8967	205123.6446	205122.5186	205121.0172	205119.8912	205117.6391
	Z	17.9707	17.9731	17.9752	17.9771	17.9787	17.9800	17.9811	17.9820	17.9826	17.9829	17.9830	17.9830	17.9829	17.9826
LB3	X	1858033.3763	1858037.2722	1858041.1681	1858045.0641	1858048.9600	1858052.8559	1858056.7518	1858060.6477	1858064.5437	1858068.4396	1858070.3875	1858072.9848	1858074.9328	1858078.8287
	Y	205147.7226	205145.4705	205143.2185	205140.9664	205138.7143	205136.4623	205134.2102	205131.9581	205129.7060	205127.4540	205126.3279	205124.8266	205123.7005	205121.4485
	Z	18.0587	18.0611	18.0632	18.0651	18.0667	18.0680	18.0691	18.0700	18.0706	18.0709	18.0710	18.0710	18.0709	18.0706
LB4	X	1858033.6766	1858037.5725	1858041.4684	1858045.3643	1858049.2603	1858053.1562	1858057.0521	1858060.9480	1858064.8439	1858068.7399	1858070.6878	1858073.2851	1858075.2331	1858079.1290
	Y	205148.2421	205145.9900	205143.7379	205141.4858	205139.2338	205136.9817	205134.7296	205132.4776	205130.2255	205127.9734	205126.8474	205125.3460	205124.2200	205121.9679
	Z	18.0707	18.0731	18.0752	18.0771	18.0787	18.0800	18.0811	18.0820	18.0826	18.0829	18.0830	18.0830	18.0829	18.0826
WIL	X	1858033.6766	1858037.5725	1858041.4684	1858045.3643	1858049.2603	1858053.1562	1858057.0521	1858060.9480	1858064.8439	1858068.7399	1858070.6878	1858073.2851	1858075.2331	1858079.1290
	Y	205148.2421	205145.9900	205143.7379	205141.4858	205139.2338	205136.9817	205134.7296	205132.4776	205130.2255	205127.9734	205126.8474	205125.3460	205124.2200	205121.9679
	Z	18.0707	18.0731	18.0752	18.0771	18.0787	18.0800	18.0811	18.0820	18.0826	18.0829	18.0830	18.0830	18.0829	18.0826
CL	X	1858034.3022	1858038.1981	1858042.0940	1858045.9899	1858049.8858	1858053.7818	1858057.6777	1858061.5736	1858065.4695	1858069.3654	1858071.3134	1858073.9107	1858075.8586	1858079.7545
	Y	205149.3243	205147.0722	205144.8201	205142.5680	205140.3160	205138.0639	205135.8118	205133.5598	205131.3077	205129.0556	205127.9296	205126.4282	205125.3022	205123.0501
	Z	18.0957	18.0981	18.1002	18.1021	18.1037	18.1050	18.1061	18.1070	18.1076	18.1079	18.1080	18.1080	18.1079	18.1076
WIR	X	1858034.9277	1858038.8237	1858042.7196	1858046.6155	1858050.5114	1858054.4073	1858058.3032	1858062.1992	1858066.0951	1858069.9910	1858071.9390	1858074.5362	1858076.4842	1858080.3801
	Y	205150.4065	205148.1544	205145.9023	205143.6502	205141.3982	205139.1461	205136.8940	205134.6420	205132.3899	205130.1378	205129.0118	205127.5104	205126.3844	205124.1323
	Z	18.0707	18.0731	18.0752	18.0771	18.0787	18.0800	18.0811	18.0820	18.0826	18.0829	18.0830	18.0830	18.0829	18.0826
RB4	X	1858034.9277	1858038.8237	1858042.7196	1858046.6155	1858050.5114	1858054.4073	1858058.3032	1858062.1992	1858066.0951	1858069.9910	1858071.9390	1858074.5362	1858076.4842	1858080.3801
	Y	205150.4065	205148.1544	205145.9023	205143.6502	205141.3982	205139.1461	205136.8940	205134.6420	205132.3899	205130.1378	205129.0118	205127.5104	205126.3844	205124.1323
	Z	18.0707	18.0731	18.0752	18.0771	18.0787	18.0800	18.0811	18.0820	18.0826	18.0829	18.0830	18.0830	18.0829	18.0826
RB3	X	1858035.2280	1858039.1239	1858043.0198	1858046.9158	1858050.8117	1858054.7076	1858058.6035	1858062.4994	1858066.3954	1858070.2913	1858072.2392	1858074.8365	1858076.7845	1858080.6804
	Y	205150.9259	205148.6738	205146.4218	205144.1697	205141.9176	205139.6656	205137.4135	205135.1614	205132.9094	205130.6573	205129.5313	205128.0299	205126.9038	205124.6518
	Z	18.0587	18.0611	18.0632	18.0651	18.0667	18.0680	18.0691	18.0700	18.0706	18.0709	18.0710	18.0710	18.0709	18.0706
WOR	X	1858037.4300	1858041.3260	1858045.2219	1858049.1178	1858053.0137	1858056.9096	1858060.8055	1858064.7015	1858068.5974	1858072.4933	1858074.4413	1858077.0385	1858078.9865	1858082.8824
	Y	205154.7353	205152.4832	205150.2311	205147.9790	205145.7270	205143.4749	205141.2228	205138.9708	205136.7187	205134.4666	205133.3406	205131.8392	205130.7132	205128.4611
	Z	17.9707	17.9731	17.9752	17.9771	17.9787	17.9800	17.9811	17.9820	17.9826	17.9829	17.9830	17.9830	17.9829	17.9826
RB2	X	1858039.7322	1858043.6281	1858047.5240	1858051.4199	1858055.3158	1858059.2117	1858063.1077	1858067.0036	1858070.8995	1858074.7954	1858076.7434	1858079.3407	1858081.2886	1858085.1845
	Y	205158.7177	205156.4657	205154.2136	205151.9615	205149.7095	205147.4574	205145.2053	205142.9533	205140.7012	205138.4491	205137.3231	205135.8217	205134.6957	205132.4436
	Z	17.8787	17.8811	17.8832	17.8851	17.8867	17.8880	17.8891	17.8900	17.8906	17.8909	17.8910	17.8910	17.8909	17.8906
RB1	X	1858040.0324	1858043.9283	1858047.8243	1858051.7202	1858055.6161	1858059.5120	1858063.4079	1858067.3039	1858071.1998	1858075.0957	1858077.0437	1858079.6409	1858081.5889	1858085.4848
	Y	205159.2372	205156.9851	205154.7331	205152.4810	205150.2289	205147.9769	205145.7248	205143.4727	205141.2206	205138.9686	205137.8425	205136.3412	205135.2151	205132.9631
	Z	17.8667	17.8691	17.8712	17.8731	17.8747	17.8760	17.8771	17.8780	17.8786	17.8789	17.8790	17.8790	17.8789	17.8786

PROJECT NAME
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT

FINANCED BY
JAPAN INTERNATIONAL COOPERATION AGENCY

COUNTERPART
REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF CONSTRUCTION
DEPARTMENT OF BRIDGE

JICA STUDY TEAM
NIPPON KOEI CO., LTD.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
METROPOLITAN EXPRESSWAY COMPANY LIMITED
CHODAI CO.,LTD.
NIPPON ENGINEERING CONSULTANTS CO.,LTD.

	NAME	SIGNATURE	DATE
PREPARED BY	T.TOMODA		
CHECKED BY	T. HAYAKAWA		
APPROVED BY	Y. SANO		

DRAWING TITLE: GENERAL VIEW OF MAIN GIRDER (5)

PACKAGE: 1

DWG No.: P1-CS-1005

GENERAL VIEW OF MAIN GIRDER (6)

		D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63	D64	D65	D66
LB1	X	1858077.9202	1858081.8161	1858085.7120	1858089.6080	1858093.5039	1858097.3998	1858101.2957	1858105.1916	1858109.0876	1858112.9835	1858116.8794	1858120.7753	1858124.6712	1858128.5671
	Y	205110.8851	205108.6330	205106.3810	205104.1289	205101.8768	205099.6247	205097.3727	205095.1206	205092.8685	205090.6165	205088.3644	205086.1123	205083.8603	205081.6082
	Z	17.8780	17.8771	17.8760	17.8747	17.8731	17.8712	17.8691	17.8668	17.8641	17.8613	17.8581	17.8548	17.8511	17.8473
LB2	X	1858078.2205	1858082.1164	1858086.0123	1858089.9082	1858093.8042	1858097.7001	1858101.5960	1858105.4919	1858109.3878	1858113.2837	1858117.1797	1858121.0756	1858124.9715	1858128.8674
	Y	205111.4045	205109.1525	205106.9004	205104.6483	205102.3963	205100.1442	205097.8921	205095.6401	205093.3880	205091.1359	205088.8839	205086.6318	205084.3797	205082.1276
	Z	17.8900	17.8891	17.8880	17.8867	17.8851	17.8832	17.8811	17.8788	17.8761	17.8733	17.8701	17.8668	17.8631	17.8593
WOL	X	1858080.5226	1858084.4185	1858088.3144	1858092.2103	1858096.1063	1858100.0022	1858103.8981	1858107.7940	1858111.6899	1858115.5859	1858119.4818	1858123.3777	1858127.2736	1858131.1695
	Y	205115.3870	205113.1350	205110.8829	205108.6308	205106.3788	205104.1267	205101.8746	205099.6226	205097.3705	205095.1184	205092.8663	205090.6143	205088.3622	205086.1101
	Z	17.9820	17.9811	17.9800	17.9787	17.9771	17.9752	17.9731	17.9708	17.9681	17.9653	17.9621	17.9588	17.9551	17.9513
LB3	X	1858082.7246	1858086.6205	1858090.5165	1858094.4124	1858098.3083	1858102.2042	1858106.1001	1858109.9960	1858113.8920	1858117.7879	1858121.6838	1858125.5797	1858129.4756	1858133.3716
	Y	205119.1964	205116.9443	205114.6922	205112.4402	205110.1881	205107.9360	205105.6840	205103.4319	205101.1798	205098.9278	205096.6757	205094.4236	205092.1716	205089.9195
	Z	18.0700	18.0691	18.0680	18.0667	18.0651	18.0632	18.0611	18.0588	18.0561	18.0533	18.0501	18.0468	18.0431	18.0393
LB4	X	1858083.0249	1858086.9208	1858090.8167	1858094.7126	1858098.6086	1858102.5045	1858106.4004	1858110.2963	1858114.1922	1858118.0882	1858121.9841	1858125.8800	1858129.7759	1858133.6718
	Y	205119.7158	205117.4638	205115.2117	205112.9596	205110.7076	205108.4555	205106.2034	205103.9514	205101.6993	205099.4472	205097.1951	205094.9431	205092.6910	205090.4389
	Z	18.0820	18.0811	18.0800	18.0787	18.0771	18.0752	18.0731	18.0708	18.0681	18.0653	18.0621	18.0588	18.0551	18.0513
WIL	X	1858083.0249	1858086.9208	1858090.8167	1858094.7126	1858098.6086	1858102.5045	1858106.4004	1858110.2963	1858114.1922	1858118.0882	1858121.9841	1858125.8800	1858129.7759	1858133.6718
	Y	205119.7158	205117.4638	205115.2117	205112.9596	205110.7076	205108.4555	205106.2034	205103.9514	205101.6993	205099.4472	205097.1951	205094.9431	205092.6910	205090.4389
	Z	18.0820	18.0811	18.0800	18.0787	18.0771	18.0752	18.0731	18.0708	18.0681	18.0653	18.0621	18.0588	18.0551	18.0513
CL	X	1858083.6505	1858087.5464	1858091.4423	1858095.3382	1858099.2341	1858103.1301	1858107.0260	1858110.9219	1858114.8178	1858118.7137	1858122.6097	1858126.5056	1858130.4015	1858134.2974
	Y	205120.7980	205118.5460	205116.2939	205114.0418	205111.7898	205109.5377	205107.2856	205105.0336	205102.7815	205100.5294	205098.2773	205096.0253	205093.7732	205091.5211
	Z	18.1070	18.1061	18.1050	18.1037	18.1021	18.1002	18.0981	18.0958	18.0931	18.0903	18.0871	18.0838	18.0801	18.0763
WIR	X	1858084.2760	1858088.1720	1858092.0679	1858095.9638	1858099.8597	1858103.7556	1858107.6516	1858111.5475	1858115.4434	1858119.3393	1858123.2352	1858127.1311	1858131.0271	1858134.9230
	Y	205121.8802	205119.6282	205117.3761	205115.1240	205112.8720	205110.6199	205108.3678	205106.1158	205103.8637	205101.6116	205099.3595	205097.1075	205094.8554	205092.6033
	Z	18.0820	18.0811	18.0800	18.0787	18.0771	18.0752	18.0731	18.0708	18.0681	18.0653	18.0621	18.0588	18.0551	18.0513
RB4	X	1858084.2760	1858088.1720	1858092.0679	1858095.9638	1858099.8597	1858103.7556	1858107.6516	1858111.5475	1858115.4434	1858119.3393	1858123.2352	1858127.1311	1858131.0271	1858134.9230
	Y	205121.8802	205119.6282	205117.3761	205115.1240	205112.8720	205110.6199	205108.3678	205106.1158	205103.8637	205101.6116	205099.3595	205097.1075	205094.8554	205092.6033
	Z	18.0820	18.0811	18.0800	18.0787	18.0771	18.0752	18.0731	18.0708	18.0681	18.0653	18.0621	18.0588	18.0551	18.0513
RB3	X	1858084.5763	1858088.4722	1858092.3682	1858096.2641	1858100.1600	1858104.0559	1858107.9518	1858111.8477	1858115.7437	1858119.6396	1858123.5355	1858127.4314	1858131.3273	1858135.2233
	Y	205122.3997	205120.1476	205117.8956	205115.6435	205113.3914	205111.1394	205108.8873	205106.6352	205104.3831	205102.1311	205099.8790	205097.6269	205095.3749	205093.1228
	Z	18.0700	18.0691	18.0680	18.0667	18.0651	18.0632	18.0611	18.0588	18.0561	18.0533	18.0501	18.0468	18.0431	18.0393
WOR	X	1858086.7783	1858090.6743	1858094.5702	1858098.4661	1858102.3620	1858106.2579	1858110.1539	1858114.0498	1858117.9457	1858121.8416	1858125.7375	1858129.6334	1858133.5294	1858137.4253
	Y	205126.2090	205123.9570	205121.7049	205119.4528	205117.2008	205114.9487	205112.6966	205110.4446	205108.1925	205105.9404	205103.6883	205101.4363	205099.1842	205096.9321
	Z	17.9820	17.9811	17.9800	17.9787	17.9771	17.9752	17.9731	17.9708	17.9681	17.9653	17.9621	17.9588	17.9551	17.9513
RB2	X	1858089.0805	1858092.9764	1858096.8723	1858100.7682	1858104.6641	1858108.5600	1858112.4560	1858116.3519	1858120.2478	1858124.1437	1858128.0396	1858131.9356	1858135.8315	1858139.7274
	Y	205130.1915	205127.9395	205125.6874	205123.4353	205121.1833	205118.9312	205116.6791	205114.4270	205112.1750	205109.9229	205107.6708	205105.4188	205103.1667	205100.9146
	Z	17.8900	17.8891	17.8880	17.8867	17.8851	17.8832	17.8811	17.8788	17.8761	17.8733	17.8701	17.8668	17.8631	17.8593
RB1	X	1858089.3807	1858093.2767	1858097.1726	1858101.0685	1858104.9644	1858108.8603	1858112.7562	1858116.6522	1858120.5481	1858124.4440	1858128.3399	1858132.2358	1858136.1318	1858140.0277
	Y	205130.7110	205128.4589	205126.2069	205123.9548	205121.7027	205119.4506	205117.1986	205114.9465	205112.6944	205110.4424	205108.1903	205105.9382	205103.6862	205101.4341
	Z	17.8780	17.8771	17.8760	17.8747	17.8731	17.8712	17.8691	17.8668	17.8641	17.8613	17.8581	17.8548	17.8511	17.8473

		D67	D68	D69	D70	D71	D72	D73	D74	P12L	P12	P12R	D75	D76	D77
LB1	X	1858132.4631	1858136.3590	1858140.2549	1858144.1508	1858148.0467	1858151.9427	1858155.8386	1858159.3738	1858162.5482	1858163.8469	1858165.1455	1858168.3199	1858171.8551	1858175.7511
	Y	205079.3561	205077.1041	205074.8520	205072.5999	205070.3478	205068.0958	205065.8437	205063.8002	205061.9651	205061.2144	205060.4638	205058.6287	205056.5852	205054.3331
	Z	17.8431	17.8387	17.8341	17.8292	17.8241	17.8187	17.8130	17.8077	17.8027	17.8006	17.7985	17.7932	17.7871	17.7802
LB2	X	1858132.7633	1858136.6593	1858140.5552	1858144.4511	1858148.3470	1858152.2429	1858156.1389	1858159.6740	1858162.8485	1858164.1471	1858165.4458	1858168.6202	1858172.1554	1858176.0513
	Y	205079.8756	205077.6235	205075.3714	205073.1194	205070.8673	205068.6152	205066.3632	205064.3196	205062.4846	205061.7339	205060.9832	205059.1482	205057.1047	205054.8526
	Z	17.8551	17.8507	17.8461	17.8412	17.8361	17.8307	17.8250	17.8197	17.8147	17.8126	17.8105	17.8052	17.7991	17.7922
WOL	X	1858135.0655	1858138.9614	1858142.8573	1858146.7532	1858150.6491	1858154.5450	1858158.4410	1858161.9762	1858165.1506	1858166.4493	1858167.7479	1858170.9223	1858174.4575	1858178.3534
	Y	205083.8581	205081.6060	205079.3539	205077.1019	205074.8498	205072.5977	205070.3457	205068.3021	205066.4671	205065.7164	205064.9657	205063.1307	205061.0871	205058.8351
	Z	17.9471	17.9427	17.9381	17.9332	17.9281	17.9227	17.9170	17.9117	17.9067	17.9046	17.9025	17.8972	17.8911	17.8842
LB3	X	1858137.2675	1858141.1634	1858145.0593	1858148.9552	1858152.8512	1858156.7471	1858160.6430	1858164.1782	1858167.3526	1858168.6513	1858169.9499	1858173.1244	1858176.6595	1858180.5555
	Y	205087.6674	205085.4153	205083.1633	205080.9112	205078.6591	205076.4071	205074.1550	205072.1115	205070.2764	205069.5257	205068.7751	205066.9400	205064.8965	205062.6444
	Z	18.0351	18.0307	18.0261	18.0212	18.0161	18.0107	18.0050	17.9997	17.9947	17.9926	17.9905	17.9852	17.9791	17.9722
LB4	X	1858137.5678	1858141.4637	1858145.3596	1858149.2555	1858153.1514	1858157.0473	1858160.9433	1858164.4785	1858167.6529	1858168.9516	1858170.2502	1858173.4246	1858176.9598	1858180.8557
	Y	205088.1869	205085.9348	205083.6827	205081.4307	205079.1786	205076.9265	205074.6745	205072.6309	205070.7959	205070.0452	205069.2945	205067.4595	205065.4159	205063.1639
	Z	18.0471	18.0427	18.0381	18.0332	18.0281	18.0227	18.0170	18.0117	18.0067	18.0046	18.0025	17.9972	17.9911	17.9842
WIL	X	1858137.5678	1858141.4637	1858145.3596	1858149.2555	1858153.1514	1858157.0473	1858160.9433	1858164.4785	1858167.6529	1858168.9516	1858170.2502	1858173.4246	1858176.9598	1858180.8557
	Y	205088.1869	205085.9348	205083.6827	205081.4307	205079.1786	205076.9265	205074.6745	205072.6309	205070.7959	205070.0452	205069.2945	205067.4595	205065.4159	205063.1639
	Z	18.0471	18.0427	18.0381	18.0332	18.0281	18.0227	18.0170	18.0117	18.0067	18.0046	18.0025	17.9972	17.9911	17.9842
CL	X	1858138.1933	1858142.0892	1858145.9852	1858149.8811	1858153.7770	1858157.6729	1858161.5688	1858165.1040	1858168.2785	1858169.5771	1858170.8758	1858174.0502	1858177.5854	1858181.4813
	Y	205089.2691	205087.0170	205084.7649	205082.5129	205080.2608	205078.0087	205075.7567	205073.7131	205071.8781	205071.1274	205070.3767	205068.5417	205066.4981	205064.2461
	Z	18.0721	18.0677	18.0631	18.0582	18.0531	18.0477	18.0420	18.0367	18.0317	18.0296	18.0275	18.0222	18.0161	18.0092
WIR	X	1858138.8189	1858142.7148	1858146.6107	1858150.5067	1858154.4026	1858158.2985	1858162.1944	1858165.7296	1858168.9041	1858170.2027	1858171.5013	1858174.6758	1858178.2110	1858182.1069
	Y	205090.3513	205088.0992	205085.8471	205083.5951	205081.3430	205079.0909	205076.8389	205074.7953	205072.9603	205072.2096	205071.4589	205069.6239	205067.5803	205065.3283
	Z	18.0471	18.0427	18.0381	18.0332	18.0281	18.0227	18.0170	18.0117	18.0067	18.0046	18.0025	17.9972	17.9911	17.9842
RB4	X	1858138.8189	1858142.7148	1858146.6107	1858150.5067	1858154.4026	1858158.2985	1858162.1944	1858165.7296	1858168.9041	1858170.2027	1858171.5013	1858174.6758	1858178.2110	1858182.1069
	Y	205090.3513	205088.0992	205085.8471	205083.5951	205081.3430	205079.0909	205076.8389	205074.7953	205072.9603	205072.2096	205071.4589	205069.6239	205067.5803	205065.3283
	Z	18.0471	18.0427	18.0381	18.0332	18.0281	18.0227	18.0170	18.0117	18.0067	18.0046	18.0025	17.9972	17.9911	17.9842
RB3	X	1858139.1192	1858143.0151	1858146.9110	1858150.8069	1858154.7029	1858158.5988	1858162.4947	1858166.0299	1858169.2043	1858170.5030	1858171.8016	1858174.9761	1858178.5112	1858182.4072
	Y	205090.8707	205088.6187	205086.3666	205084.1145	205081.8624	205079.6104	205077.3583	205075.3148	205073.4797	205072.7291	205071.9784	205070.1433	205068.0998	205065.8477
	Z	18.0351	18.0307	18.0261	18.0212	18.0161	18.0107	18.0050	17.9997	17.9947	17.9926	17.9905	17.9852	17.9791	17.9722
WOR	X	1858141.3212	1858145.2171	1858149.1130	1858153.0090	1858156.9049	1858160.8008	1858164.6967	1858168.2319	1858171.4064	1858172.7050	1858174.0036	1858177.1781	1858180.7133	1858184.6092
	Y	205094.6801	205092.4280	205090.1759	205087.9239	205085.6718	205083.4197	205081.1677	205079.1241	205077.2891	205076.5384	205075.7877	205073.9527	205071.9091	205069.6571
	Z	17.9471	17.9427	17.9381	17.9332	17.9281	17.9227	17.9170	17.9117	17.9067	17.9046	17.9025	17.8972	17.8911	17.8842
RB2	X	1858143.6233	1858147.5192	1858151.4152	1858155.3111	1858159.2070	1858163.1029	1858166.9988	1858170.5340	1858173.7085	1858175.0071	1858176.3058	1858179.4802	1858183.0154	1858186.9113
	Y	205098.6626	205096.4105	205094.1584	205091.9064	205089.6543	205087.4022	205085.1501	205083.1066	205081.2716	205080.5209	205079.7702	205077.9352	205075.8916	205073.6396
	Z	17.8551	17.8507	17.8461	17.8412	17.8361	17.8307	17.8250	17.8197	17.8147	17.8126	17.8105	17.8052	17.7991	17.7922
RB1	X	1858143.9236	1858147.8195	1858151.7154	1858155.6114	1858159.5073	1858163.4032	1858167.2991	1858170.8343	1858174.0088	1858175.3074	1858176.6060	1858179.7805	1858183.3157	1858187.2116
	Y	205099.1820	205096.9300	205094.6779	205092.4258	205090.1737	205087.9217	205085.6696	205083.6261	205081.7910	205081.0403	205080.2897	205078.4546	205076.4111	205074.1590
	Z	17.8431	17.8387	17.8341	17.8292	17.8241	17.8187	17.8130	17.8077	17.8027	17.8006	17.7985	17.7932	17.7871	17.7802

PROJECT NAME	FINANCED BY	COUNTERPART	JICA STUDY TEAM
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	REPUBLIC OF THE UNION OF MYANMAR MINISTRY OF CONSTRUCTION DEPARTMENT OF BRIDGE	NIPPON KOEI CO., LTD. ORIENTAL CONSULTANTS GLOBAL CO., LTD. METROPOLITAN EXPRESSWAY COMPANY LIMITED CHODAI CO.,LTD. NIPPON ENGINEERING CONSULTANTS CO.,LTD.

	NAME	SIGNATURE	DATE	DRAWING TITLE	PACKAGE
PREPARED BY	T.TOMODA			GENERAL VIEW OF MAIN GIRDER (6)	1
CHECKED BY	T. HAYAKAWA				DWG No.
APPROVED BY	Y. SANO				P1-CS-1006

GENERAL VIEW OF MAIN GIRDER (7)

		D78	D79	D80	D81	D82	D83	D84	D85	D86	D87	D88	D89	D90	D91
LB1	X	1858179.6470	1858183.5429	1858187.4388	1858191.3347	1858195.2306	1858199.1266	1858203.0225	1858206.9184	1858210.8143	1858214.7102	1858218.6062	1858222.5021	1858226.3980	1858230.2939
	Y	205052.0811	205049.8290	205047.5769	205045.3249	205043.0728	205040.8207	205038.5686	205036.3166	205034.0645	205031.8124	205029.5604	205027.3083	205025.0562	205022.8042
	Z	17.7730	17.7655	17.7578	17.7498	17.7416	17.7332	17.7245	17.7155	17.7063	17.6968	17.6870	17.6771	17.6668	17.6563
LB2	X	1858179.9472	1858183.8432	1858187.7391	1858191.6350	1858195.5309	1858199.4268	1858203.3228	1858207.2187	1858211.1146	1858215.0105	1858218.9064	1858222.8024	1858226.6983	1858230.5942
	Y	205052.6005	205050.3484	205048.0964	205045.8443	205043.5922	205041.3402	205039.0881	205036.8360	205034.5840	205032.3319	205030.0798	205027.8278	205025.5757	205023.3236
	Z	17.7850	17.7775	17.7698	17.7618	17.7536	17.7452	17.7365	17.7275	17.7183	17.7088	17.6990	17.6891	17.6788	17.6683
WOL	X	1858182.2494	1858186.1453	1858190.0412	1858193.9371	1858197.8330	1858201.7290	1858205.6249	1858209.5208	1858213.4167	1858217.3126	1858221.2085	1858225.1045	1858229.0004	1858232.8963
	Y	205056.5830	205054.3309	205052.0789	205049.8268	205047.5747	205045.3227	205043.0706	205040.8185	205038.5665	205036.3144	205034.0623	205031.8102	205029.5582	205027.3061
	Z	17.8770	17.8695	17.8618	17.8538	17.8456	17.8372	17.8285	17.8195	17.8103	17.8008	17.7910	17.7811	17.7708	17.7603
LB3	X	1858184.4514	1858188.3473	1858192.2432	1858196.1391	1858200.0351	1858203.9310	1858207.8269	1858211.7228	1858215.6187	1858219.5147	1858223.4106	1858227.3065	1858231.2024	1858235.0983
	Y	205060.3924	205058.1403	205055.8882	205053.6361	205051.3841	205049.1320	205046.8799	205044.6279	205042.3758	205040.1237	205037.8717	205035.6196	205033.3675	205031.1155
	Z	17.9650	17.9575	17.9498	17.9418	17.9336	17.9252	17.9165	17.9075	17.8983	17.8888	17.8790	17.8691	17.8588	17.8483
LB4	X	1858184.7517	1858188.6476	1858192.5435	1858196.4394	1858200.3353	1858204.2313	1858208.1272	1858212.0231	1858215.9190	1858219.8149	1858223.7108	1858227.6068	1858231.5027	1858235.3986
	Y	205060.9118	205058.6597	205056.4077	205054.1556	205051.9035	205049.6515	205047.3994	205045.1473	205042.8953	205040.6432	205038.3911	205036.1390	205033.8870	205031.6349
	Z	17.9770	17.9695	17.9618	17.9538	17.9456	17.9372	17.9285	17.9195	17.9103	17.9008	17.8910	17.8811	17.8708	17.8603
WIL	X	1858184.7517	1858188.6476	1858192.5435	1858196.4394	1858200.3353	1858204.2313	1858208.1272	1858212.0231	1858215.9190	1858219.8149	1858223.7108	1858227.6068	1858231.5027	1858235.3986
	Y	205060.9118	205058.6597	205056.4077	205054.1556	205051.9035	205049.6515	205047.3994	205045.1473	205042.8953	205040.6432	205038.3911	205036.1390	205033.8870	205031.6349
	Z	17.9770	17.9695	17.9618	17.9538	17.9456	17.9372	17.9285	17.9195	17.9103	17.9008	17.8910	17.8811	17.8708	17.8603
CL	X	1858185.3772	1858189.2732	1858193.1691	1858197.0650	1858200.9609	1858204.8568	1858208.7527	1858212.6487	1858216.5446	1858220.4405	1858224.3364	1858228.2323	1858232.1283	1858236.0242
	Y	205061.9940	205059.7419	205057.4899	205055.2378	205052.9857	205050.7337	205048.4816	205046.2295	205043.9775	205041.7254	205039.4733	205037.2212	205034.9692	205032.7171
	Z	18.0020	17.9945	17.9868	17.9788	17.9706	17.9622	17.9535	17.9445	17.9353	17.9258	17.9160	17.9061	17.8958	17.8853
WIR	X	1858186.0028	1858189.8987	1858193.7946	1858197.6906	1858201.5865	1858205.4824	1858209.3783	1858213.2742	1858217.1702	1858221.0661	1858224.9620	1858228.8579	1858232.7538	1858236.6498
	Y	205063.0762	205060.8241	205058.5721	205056.3200	205054.0679	205051.8159	205049.5638	205047.3117	205045.0597	205042.8076	205040.5555	205038.3034	205036.0514	205033.7993
	Z	17.9770	17.9695	17.9618	17.9538	17.9456	17.9372	17.9285	17.9195	17.9103	17.9008	17.8910	17.8811	17.8708	17.8603
RB4	X	1858186.0028	1858189.8987	1858193.7946	1858197.6906	1858201.5865	1858205.4824	1858209.3783	1858213.2742	1858217.1702	1858221.0661	1858224.9620	1858228.8579	1858232.7538	1858236.6498
	Y	205063.0762	205060.8241	205058.5721	205056.3200	205054.0679	205051.8159	205049.5638	205047.3117	205045.0597	205042.8076	205040.5555	205038.3034	205036.0514	205033.7993
	Z	17.9770	17.9695	17.9618	17.9538	17.9456	17.9372	17.9285	17.9195	17.9103	17.9008	17.8910	17.8811	17.8708	17.8603
RB3	X	1858186.3031	1858190.1990	1858194.0949	1858197.9908	1858201.8868	1858205.7827	1858209.6786	1858213.5745	1858217.4704	1858221.3664	1858225.2623	1858229.1582	1858233.0541	1858236.9500
	Y	205063.5957	205061.3436	205059.0915	205056.8395	205054.5874	205052.3353	205050.0832	205047.8312	205045.5791	205043.3270	205041.0750	205038.8229	205036.5708	205034.3188
	Z	17.9650	17.9575	17.9498	17.9418	17.9336	17.9252	17.9165	17.9075	17.8983	17.8888	17.8790	17.8691	17.8588	17.8483
WOR	X	1858188.5051	1858192.4010	1858196.2969	1858200.1929	1858204.0888	1858207.9847	1858211.8806	1858215.7765	1858219.6725	1858223.5684	1858227.4643	1858231.3602	1858235.2561	1858239.1521
	Y	205067.4050	205065.1529	205062.9009	205060.6488	205058.3967	205056.1447	205053.8926	205051.6405	205049.3885	205047.1364	205044.8843	205042.6322	205040.3802	205038.1281
	Z	17.8770	17.8695	17.8618	17.8538	17.8456	17.8372	17.8285	17.8195	17.8103	17.8008	17.7910	17.7811	17.7708	17.7603
RB2	X	1858190.8072	1858194.7031	1858198.5991	1858202.4950	1858206.3909	1858210.2868	1858214.1827	1858218.0787	1858221.9746	1858225.8705	1858229.7664	1858233.6623	1858237.5583	1858241.4542
	Y	205071.3875	205069.1354	205066.8834	205064.6313	205062.3792	205060.1272	205057.8751	205055.6230	205053.3709	205051.1189	205048.8668	205046.6147	205044.3627	205042.1106
	Z	17.7850	17.7775	17.7698	17.7618	17.7536	17.7452	17.7365	17.7275	17.7183	17.7088	17.6990	17.6891	17.6788	17.6683
RB1	X	1858191.1075	1858195.0034	1858198.8993	1858202.7953	1858206.6912	1858210.5871	1858214.4830	1858218.3789	1858222.2749	1858226.1708	1858230.0667	1858233.9626	1858237.8585	1858241.7544
	Y	205071.9070	205069.6549	205067.4028	205065.1507	205062.8987	205060.6466	205058.3945	205056.1425	205053.8904	205051.6383	205049.3863	205047.1342	205044.8821	205042.6301
	Z	17.7730	17.7655	17.7578	17.7498	17.7416	17.7332	17.7245	17.7155	17.7063	17.6968	17.6870	17.6771	17.6668	17.6563

		D92	D93	D94	D95	D96	D97	D98	S2	GE2	P13
LB1	X	1858234.1898	1858238.0858	1858241.9817	1858245.8776	1858249.7735	1858253.6694	1858257.5653	1858259.9462	1858260.6388	1858260.8120
	Y	205020.5521	205018.3000	205016.0479	205013.7959	205011.5438	205009.2917	205007.0397	205005.6634	205005.2630	205005.1629
	Z	17.6456	17.6346	17.6233	17.6118	17.6001	17.5881	17.5758	17.5682	17.5660	17.5654
LB2	X	1858234.4901	1858238.3860	1858242.2819	1858246.1779	1858250.0738	1858253.9697	1858257.8656	1858260.2465	1858260.9391	1858261.1122
	Y	205021.0715	205018.8195	205016.5674	205014.3153	205012.0633	205009.8112	205007.5591	205006.1829	205005.7825	205005.6824
	Z	17.6576	17.6466	17.6353	17.6238	17.6121	17.6001	17.5878	17.5802	17.5780	17.5774
WOL	X	1858236.7922	1858240.6881	1858244.5841	1858248.4800	1858252.3759	1858256.2718	1858260.1677	1858262.5486	1858263.2412	1858263.4143
	Y	205025.0540	205022.8020	205020.5499	205018.2978	205016.0458	205013.7937	205011.5416	205010.1654	205009.7650	205009.6649
	Z	17.7496	17.7386	17.7273	17.7158	17.7041	17.6921	17.6798	17.6722	17.6700	17.6694
LB3	X	1858238.9942	1858242.8902	1858246.7861	1858250.6820	1858254.5779	1858258.4738	1858262.3698	1858264.7506	1858265.4432	1858265.6164
	Y	205028.8634	205026.6113	205024.3592	205022.1072	205019.8551	205017.6030	205015.3510	205013.9747	205013.5743	205013.4742
	Z	17.8376	17.8266	17.8153	17.8038	17.7921	17.7801	17.7678	17.7602	17.7580	17.7574
LB4	X	1858239.2945	1858243.1904	1858247.0864	1858250.9823	1858254.8782	1858258.7741	1858262.6700	1858265.0509	1858265.7435	1858265.9166
	Y	205029.3828	205027.1308	205024.8787	205022.6266	205020.3746	205018.1225	205015.8704	205014.4942	205014.0938	205013.9937
	Z	17.8496	17.8386	17.8273	17.8158	17.8041	17.7921	17.7798	17.7722	17.7700	17.7694
WIL	X	1858239.2945	1858243.1904	1858247.0864	1858250.9823	1858254.8782	1858258.7741	1858262.6700	1858265.0509	1858265.7435	1858265.9166
	Y	205029.3828	205027.1308	205024.8787	205022.6266	205020.3746	205018.1225	205015.8704	205014.4942	205014.0938	205013.9937
	Z	17.8496	17.8386	17.8273	17.8158	17.8041	17.7921	17.7798	17.7722	17.7700	17.7694
CL	X	1858239.9201	1858243.8160	1858247.7119	1858251.6079	1858255.5038	1858259.3997	1858263.2956	1858265.6765	1858266.3691	1858266.5422
	Y	205030.4650	205028.2130	205025.9609	205023.7088	205021.4568	205019.2047	205016.9526	205015.5764	205015.1760	205015.0759
	Z	17.8746	17.8636	17.8523	17.8408	17.8291	17.8171	17.8048	17.7972	17.7950	17.7944
WIR	X	1858240.5457	1858244.4416	1858248.3375	1858252.2334	1858256.1293	1858260.0253	1858263.9212	1858266.3020	1858266.9946	1858267.1678
	Y	205031.5472	205029.2952	205027.0431	205024.7910	205022.5390	205020.2869	205018.0348	205016.6586	205016.2582	205016.1581
	Z	17.8496	17.8386	17.8273	17.8158	17.8041	17.7921	17.7798	17.7722	17.7700	17.7694
RB4	X	1858240.5457	1858244.4416	1858248.3375	1858252.2334	1858256.1293	1858260.0253	1858263.9212	1858266.3020	1858266.9946	1858267.1678
	Y	205031.5472	205029.2952	205027.0431	205024.7910	205022.5390	205020.2869	205018.0348	205016.6586	205016.2582	205016.1581
	Z	17.8496	17.8386	17.8273	17.8158	17.8041	17.7921	17.7798	17.7722	17.7700	17.7694
RB3	X	1858240.8459	1858244.7419	1858248.6378	1858252.5337	1858256.4296	1858260.3255	1858264.2215	1858266.6023	1858267.2949	1858267.4681
	Y	205032.0667	205029.8146	205027.5626	205025.3105	205023.0584	205020.8063	205018.5543	205017.1780	205016.7776	205016.6775
	Z	17.8376	17.8266	17.8153	17.8038	17.7921	17.7801	17.7678	17.7602	17.7580	17.7574
WOR	X	1858243.0480	1858246.9439	1858250.8398	1858254.7357	1858258.6316	1858262.5276	1858266.4235	1858268.8043	1858269.4969	1858269.6701
	Y	205035.8760	205033.6240	205031.3719	205029.1198	205026.8678	205024.6157	205022.3636	205020.9874	205020.5870	205020.4869
	Z	17.7496	17.7386	17.7273	17.7158	17.7041	17.6921	17.6798	17.6722	17.6700	17.6694
RB2	X	1858245.3501	1858249.2460	1858253.1419	1858257.0378	1858260.9338	1858264.8297	1858268.7256	1858271.1064	1858271.7991	1858271.9722
	Y	205039.8585	205037.6065	205035.3544	205033.1023	205030.8503	205028.5982	205026.3461	205024.9698	205024.5695	205024.4694
	Z	17.6576	17.6466	17.6353	17.6238	17.6121	17.6001	17.5878	17.5802	17.5780	17.5774
RB1	X	1858245.6504	1858249.5463	1858253.4422	1858257.3381	1858261.2340	1858265.1300	1858269.0259	1858271.4067	1858272.0993	1858272.2725
	Y	205040.3780	205038.1259	205035.8738	205033.6218	205031.3697	205029.1176	205026.8656	205025.4893	205025.0889	205024.9888
	Z	17.6456	17.6346	17.6233	17.6118	17.6001	17.5881	17.5758	17.5682	17.5660	17.5654

PROJECT NAME
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT

FINANCED BY
JAPAN INTERNATIONAL COOPERATION AGENCY

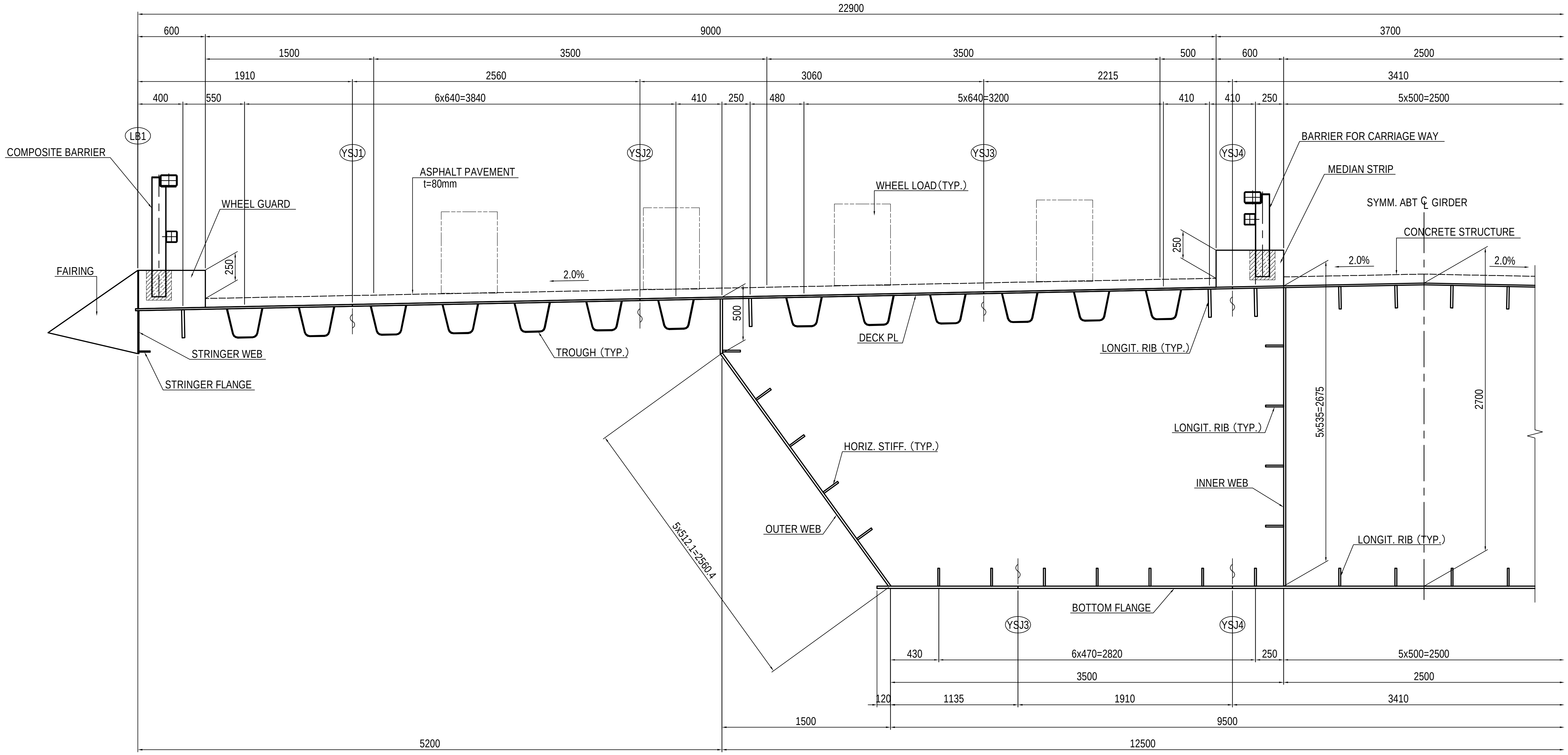
COUNTERPART
REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF CONSTRUCTION
DEPARTMENT OF BRIDGE

JICA STUDY TEAM
NIPPON KOEI CO., LTD.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
METROPOLITAN EXPRESSWAY COMPANY LIMITED
CHODAI CO.,LTD.
NIPPON ENGINEERING CONSULTANTS CO.,LTD.

	NAME	SIGNATURE	DATE	DRAWING TITLE	PACKAGE
PREPARED BY	T.TOMODA			GENERAL VIEW OF MAIN GIRDER (7)	1
CHECKED BY	T. HAYAKAWA				DWG No.
APPROVED BY	Y. SANO				P1-CS-1007

GENERAL VIEW OF MAIN GIRDER (9) S=1:40

SECTION OUTLINES
TYPICAL SECTION



PROJECT NAME	FINANCED BY	COUNTERPART	JICA STUDY TEAM
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	REPUBLIC OF THE UNION OF MYANMAR MINISTRY OF CONSTRUCTION DEPARTMENT OF BRIDGE	NIPPON KOEI CO., LTD. ORIENTAL CONSULTANTS GLOBAL CO., LTD. METROPOLITAN EXPRESSWAY COMPANY LIMITED CHODAI CO.,LTD. NIPPON ENGINEERING CONSULTANTS CO.,LTD.

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PREPARED BY	T.TOMODA			GENERAL VIEW OF MAIN GIRDER (9)	1
CHECKED BY	T. HAYAKAWA				DWG No.
APPROVED BY	Y. SANO				P1-CS-1009

Cable Stayed Bridge

2) Static Structure Analysis

- Contents -

1. Analysis Principle

- The superstructure and pier were modeled and the 3D frame analysis was performed.

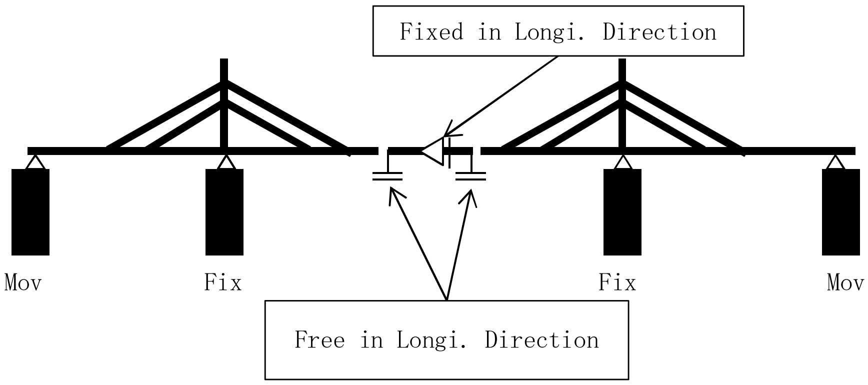
- Midas Civil (developed by MIDAS IT Co.,) was employed as the analysis software.

- Following loads shall be applied

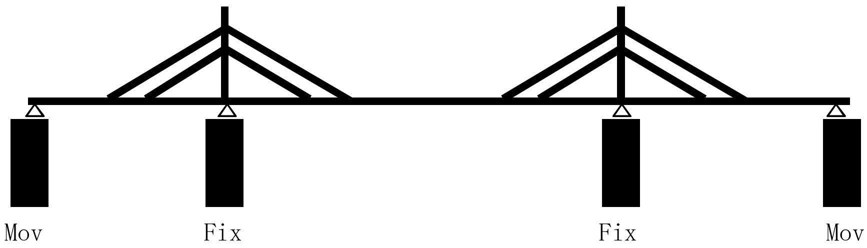
  ① Dead Load
  ② Live Load
  ③ Temprature Change Effect
  ④ Wind Load
  ⑤ Seismic Load
  ⑥ Pre-stressing

- Considering the bridge construction steps, two analysis models were utilized, i.e., before girder closing and after girder closing.

＜Beforr Closing Model＞



＜After Closing Model＞



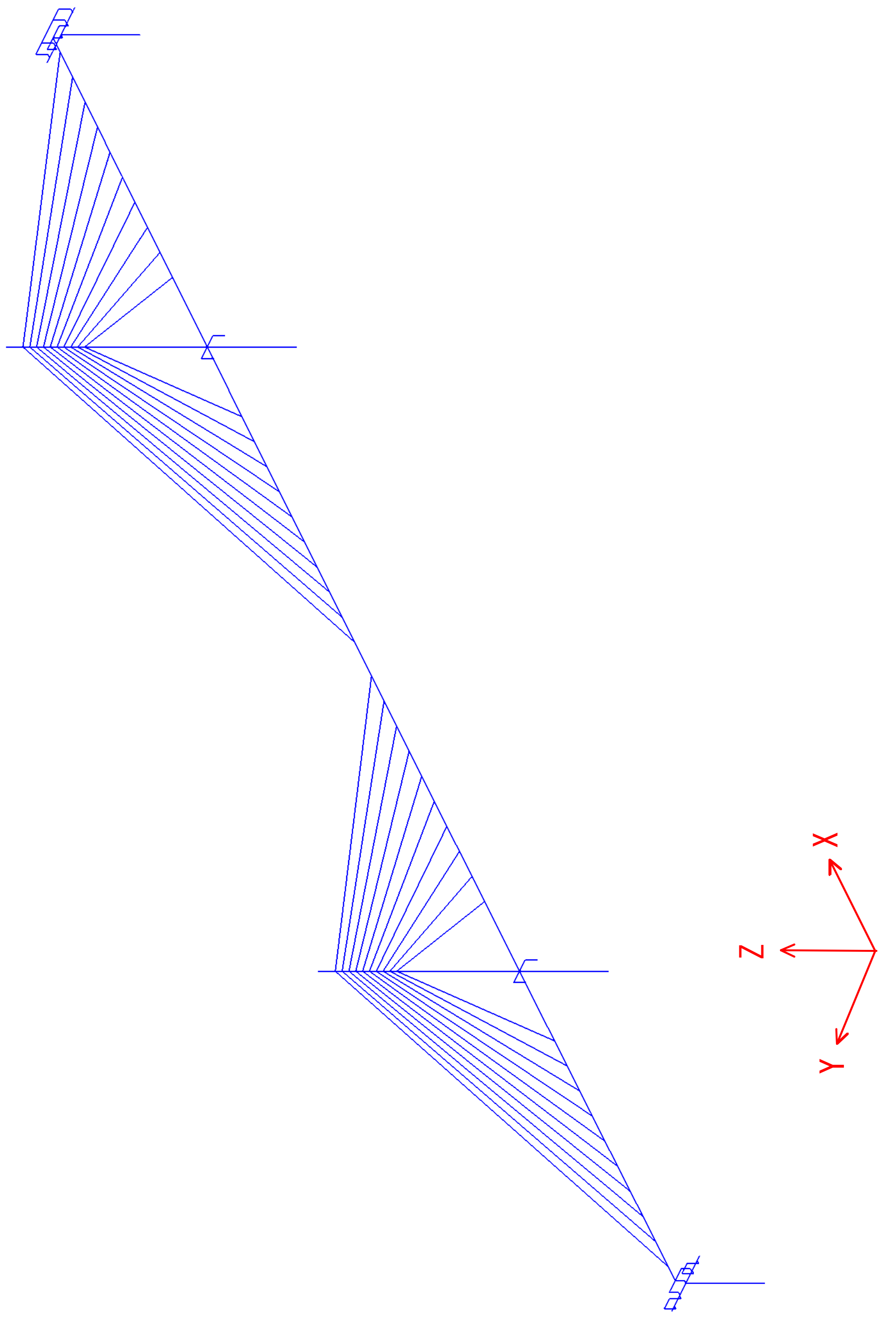
- For cables, the equivalent modulus of elasticity (EFFF) calculated by the Ernest Equation was employed to take into consideration the effect of sag. It should be noted that the tension force caused by the dead load at the completed stage (D+PS) was employed to calculate the stress σ.

$$E_{EFF} = E0 / \{1+\gamma^2 \cdot l^2 \cdot E0 / (12 \cdot \sigma^3)\}$$

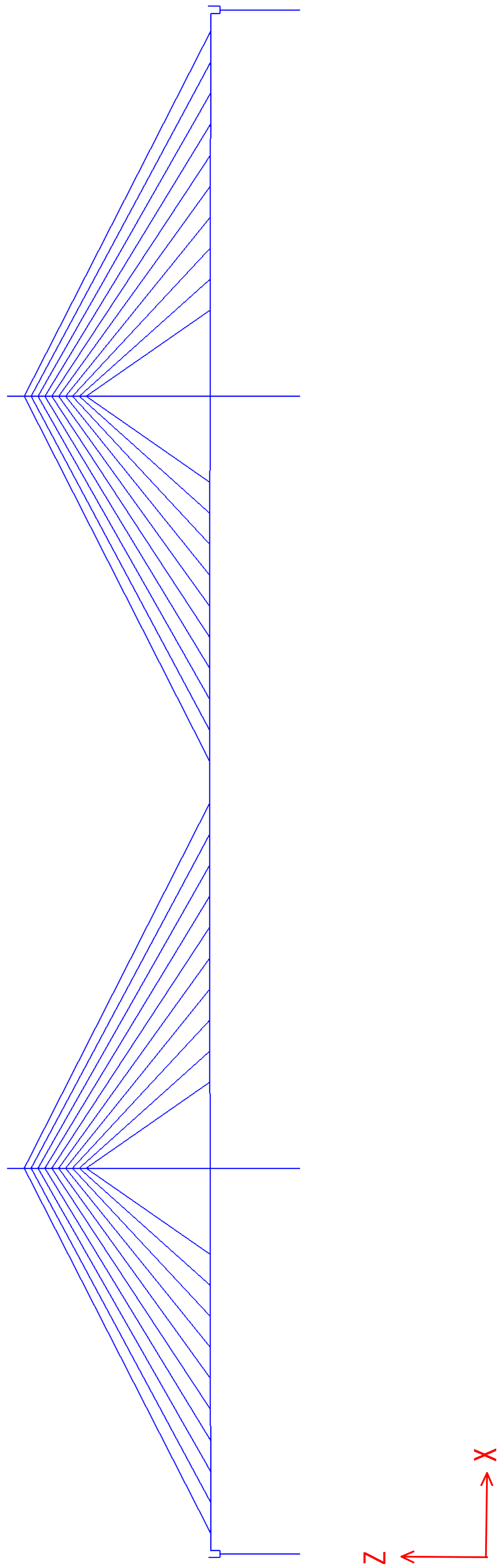
Where,
- E_{EFF} : Modulus of elasticity of cable with sag (Equivalent modulus of elasticity)
- E0 : Modulus of elasticity for straight cable
- γ : Weight of cable per unit length
- l : Horizontal projected length of cable
- σ : Tensile stress of cable (Dead load + Pre-stress)

2. Frame Model

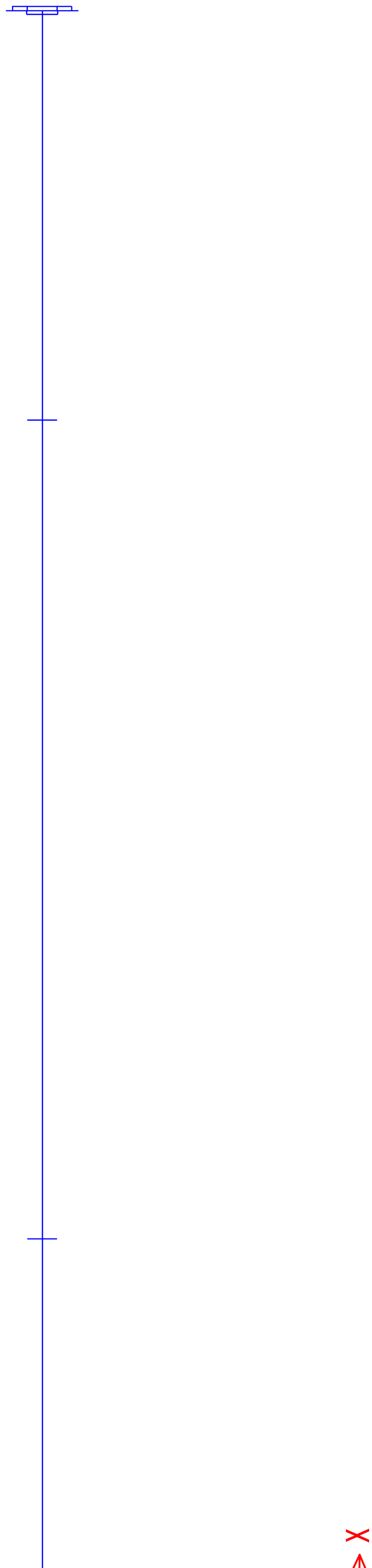
(1)Whole View



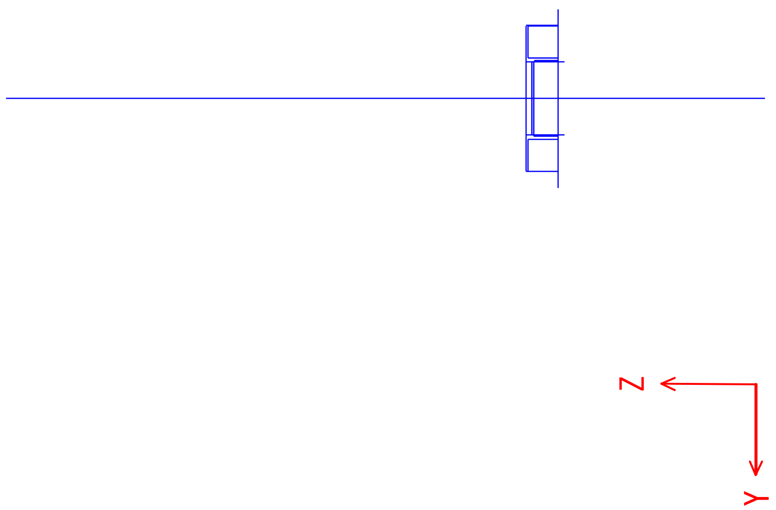
(2)Side View



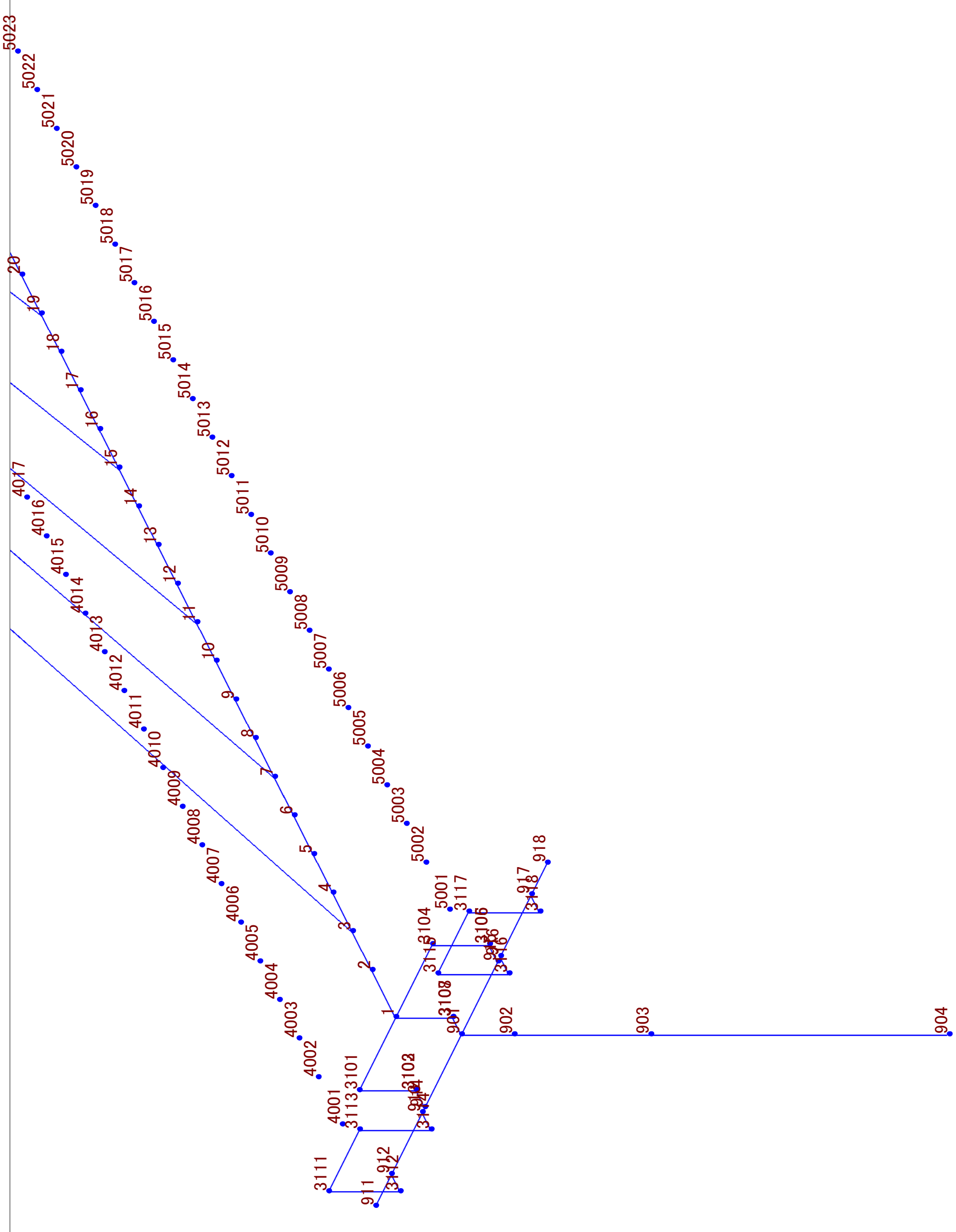
(3)Plan View

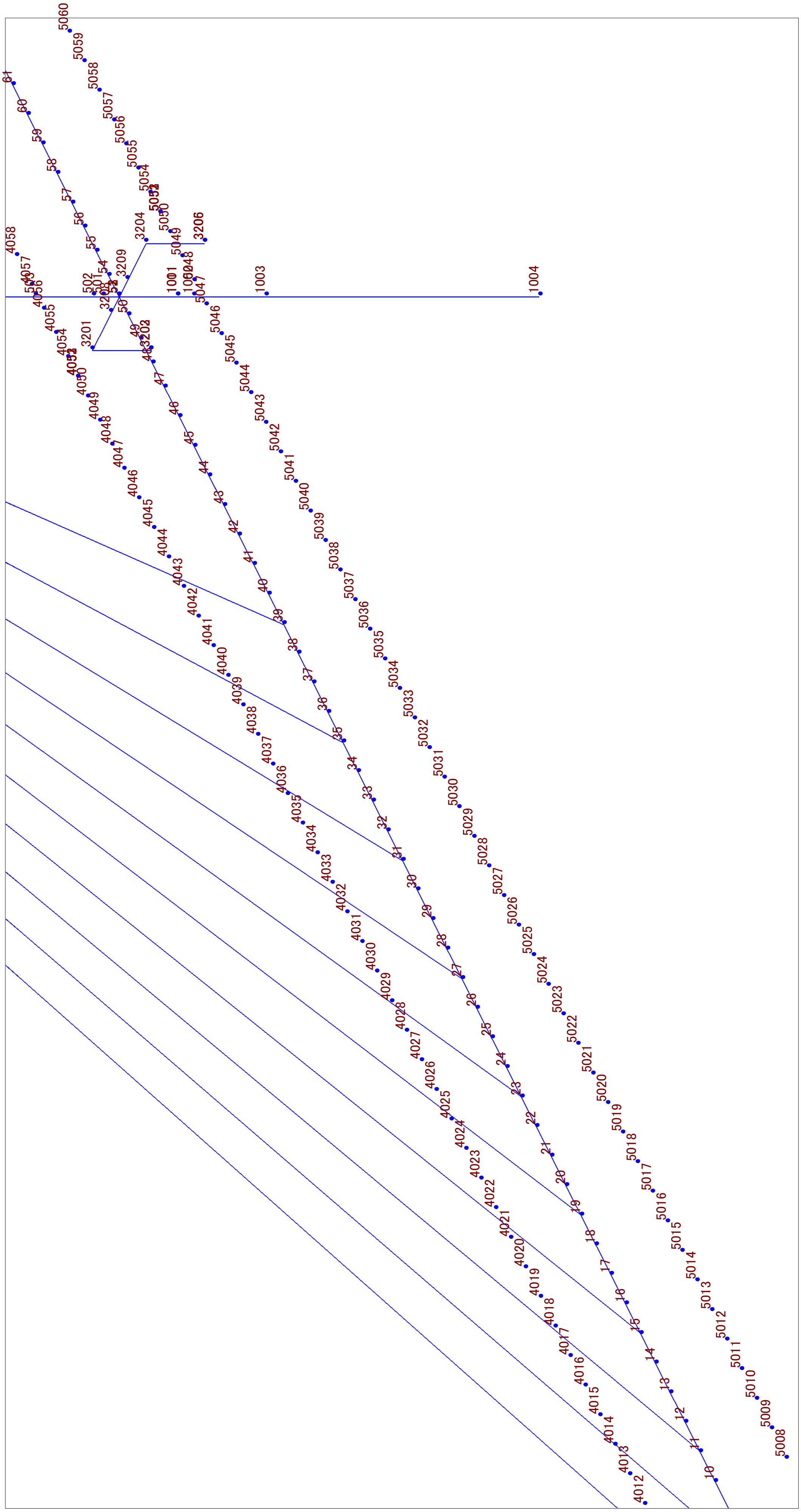


(4)Front View



(5)Node Number





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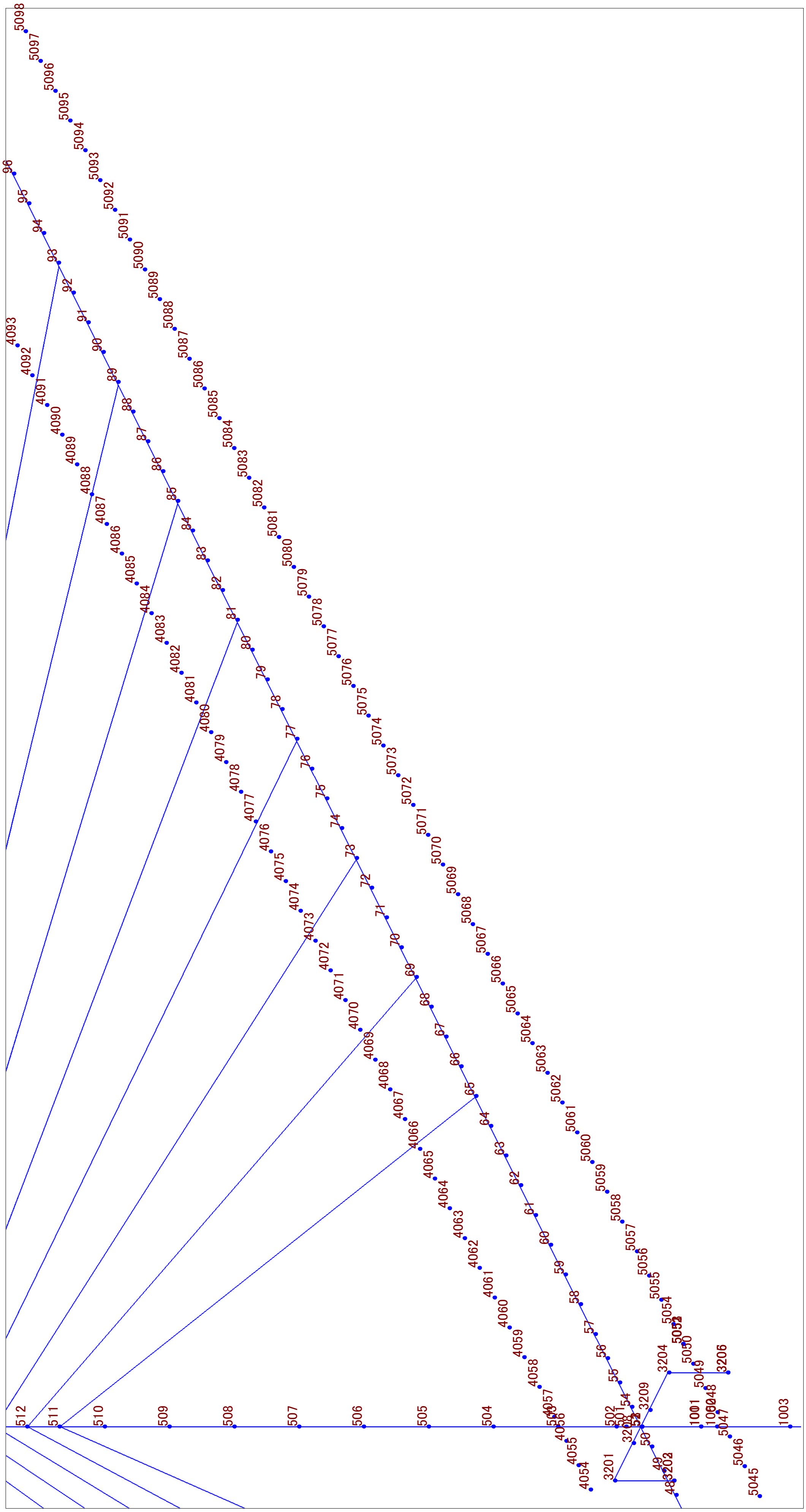

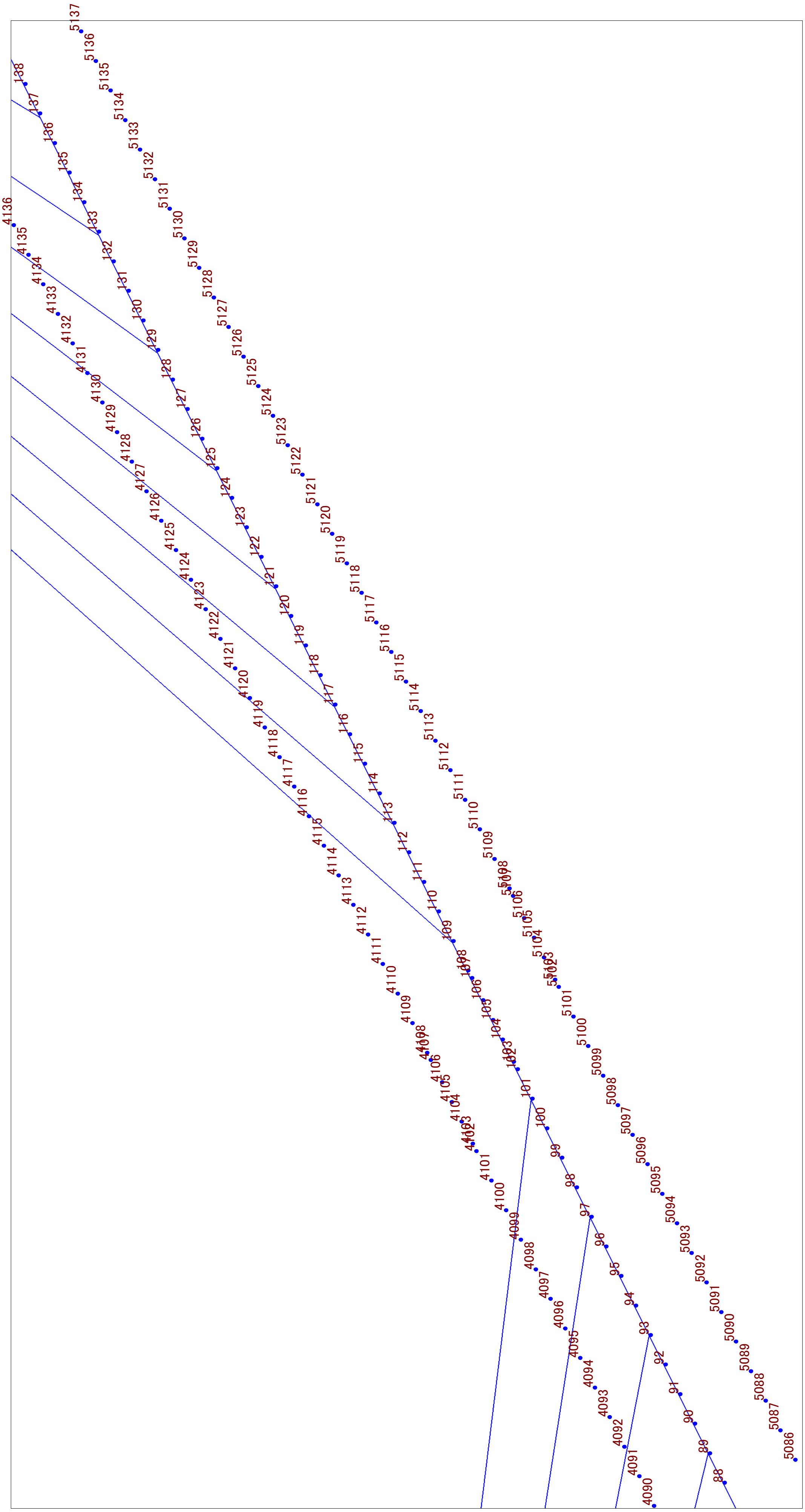
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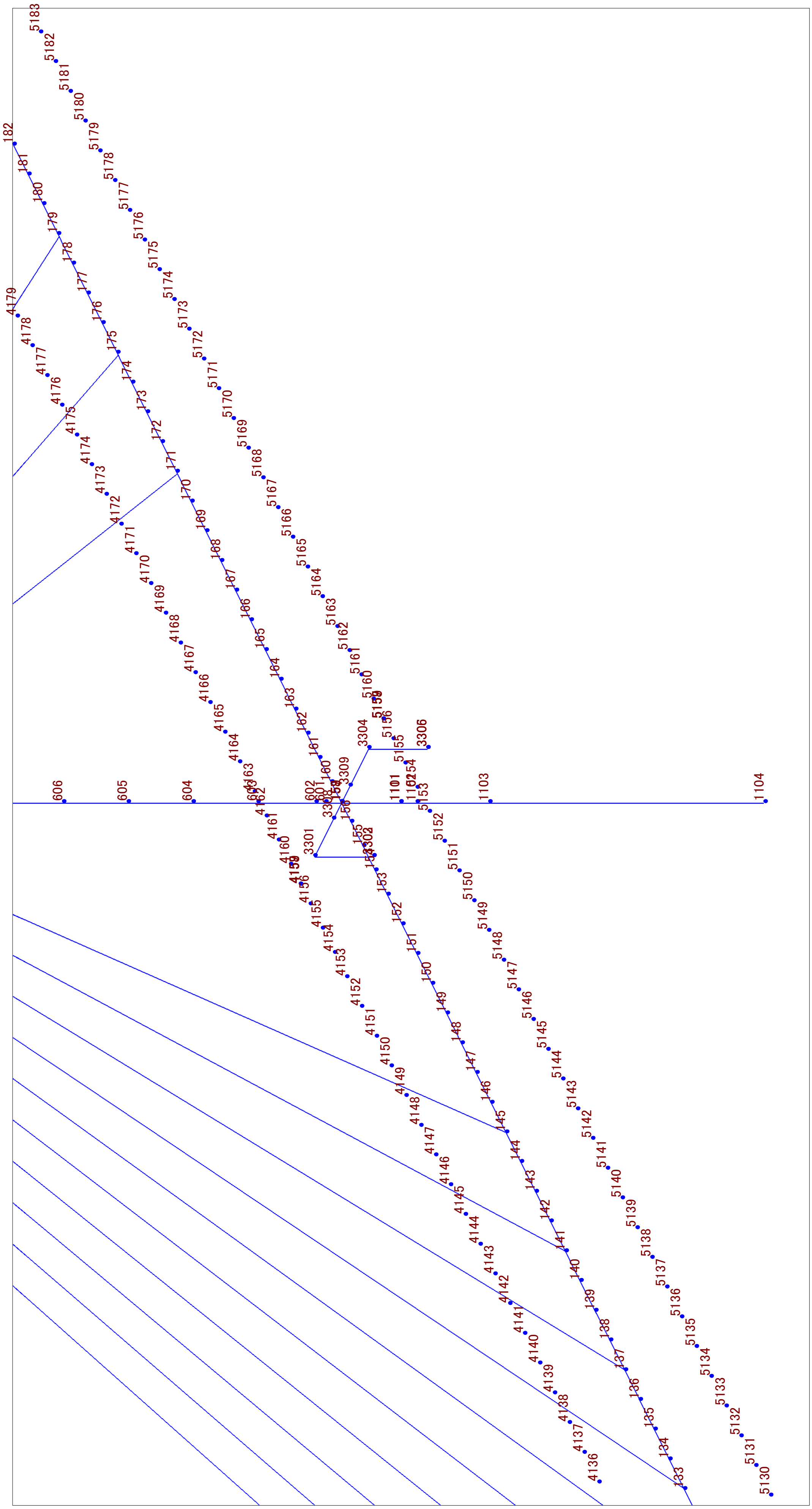

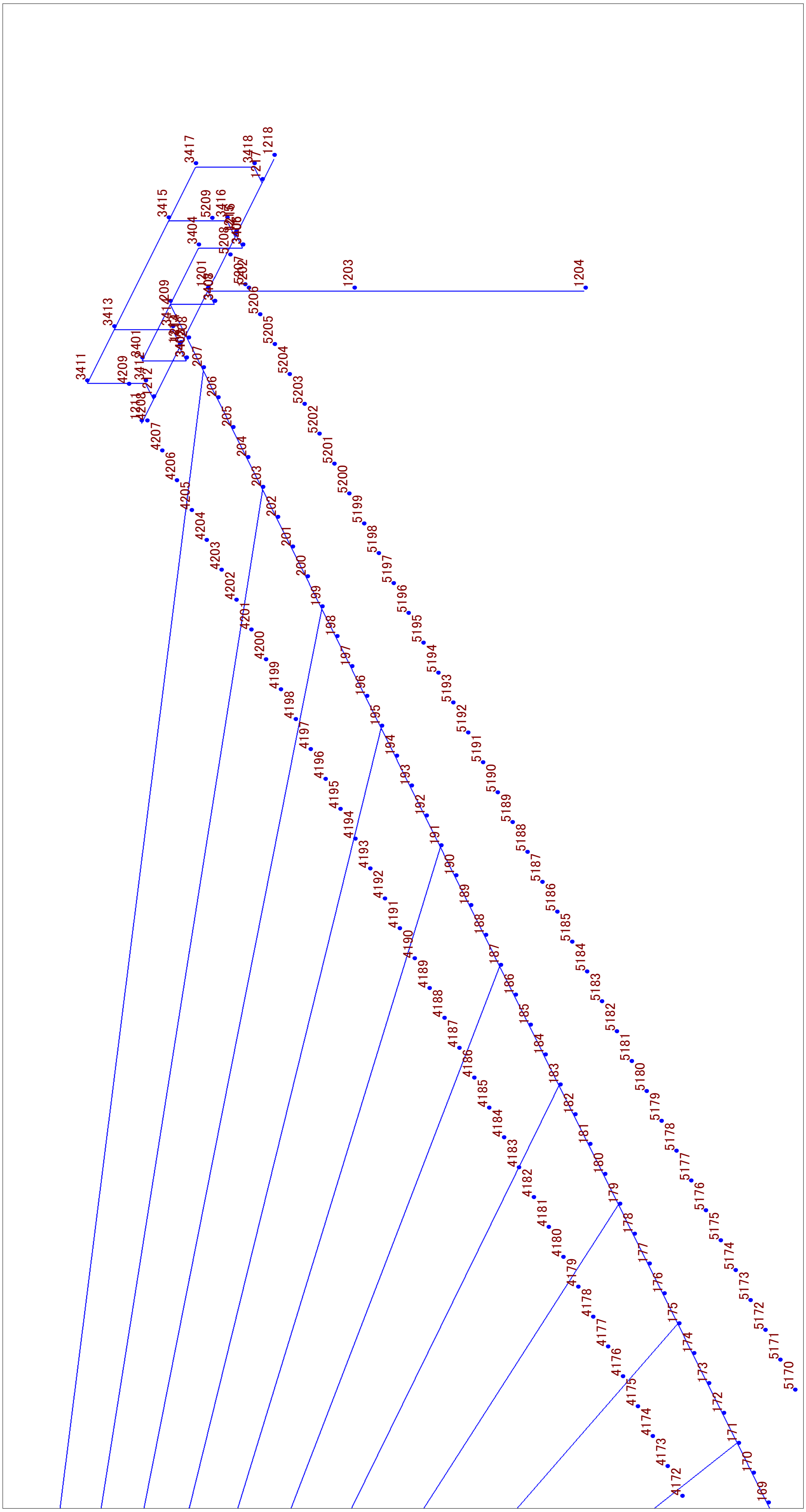

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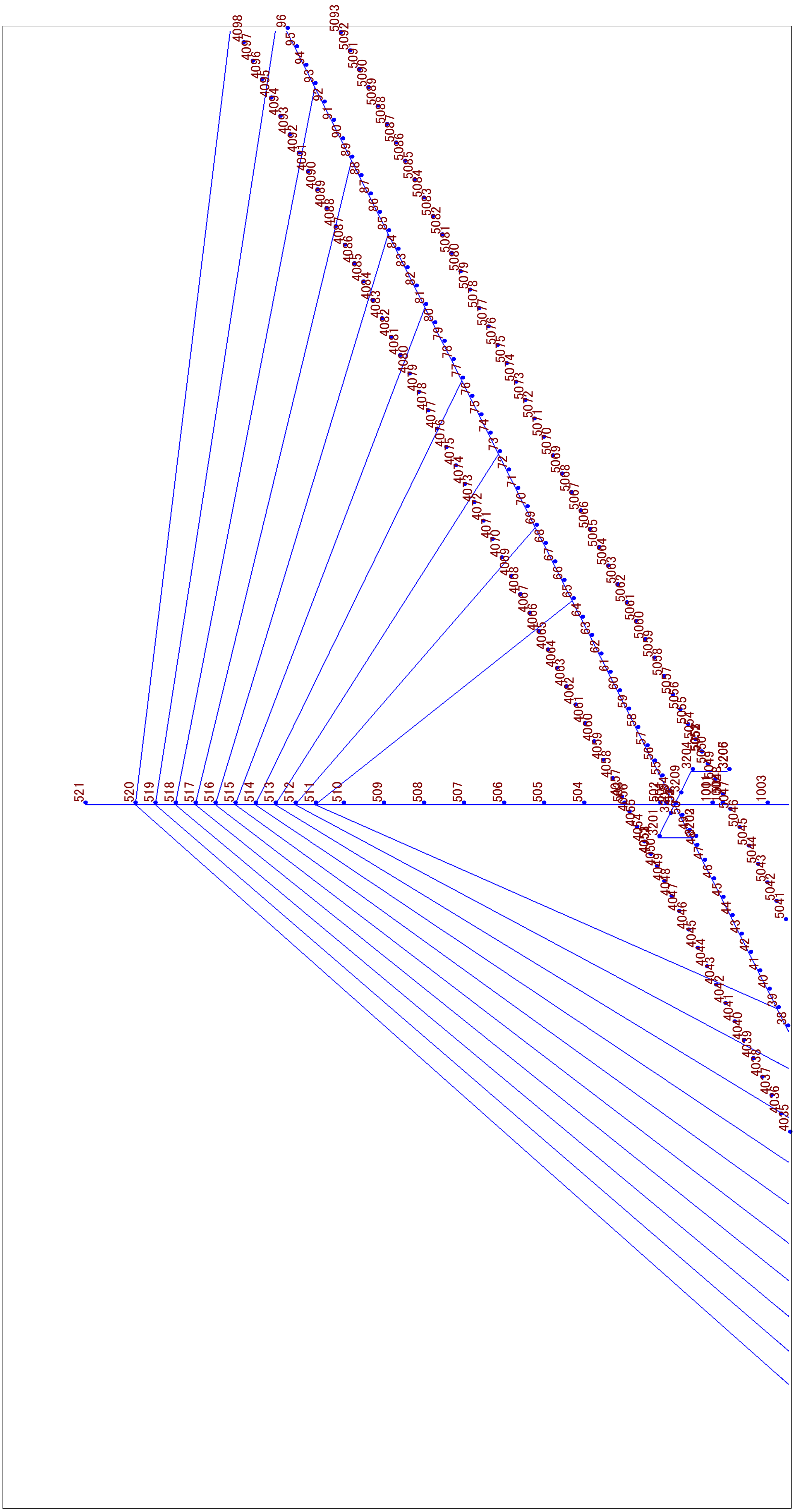

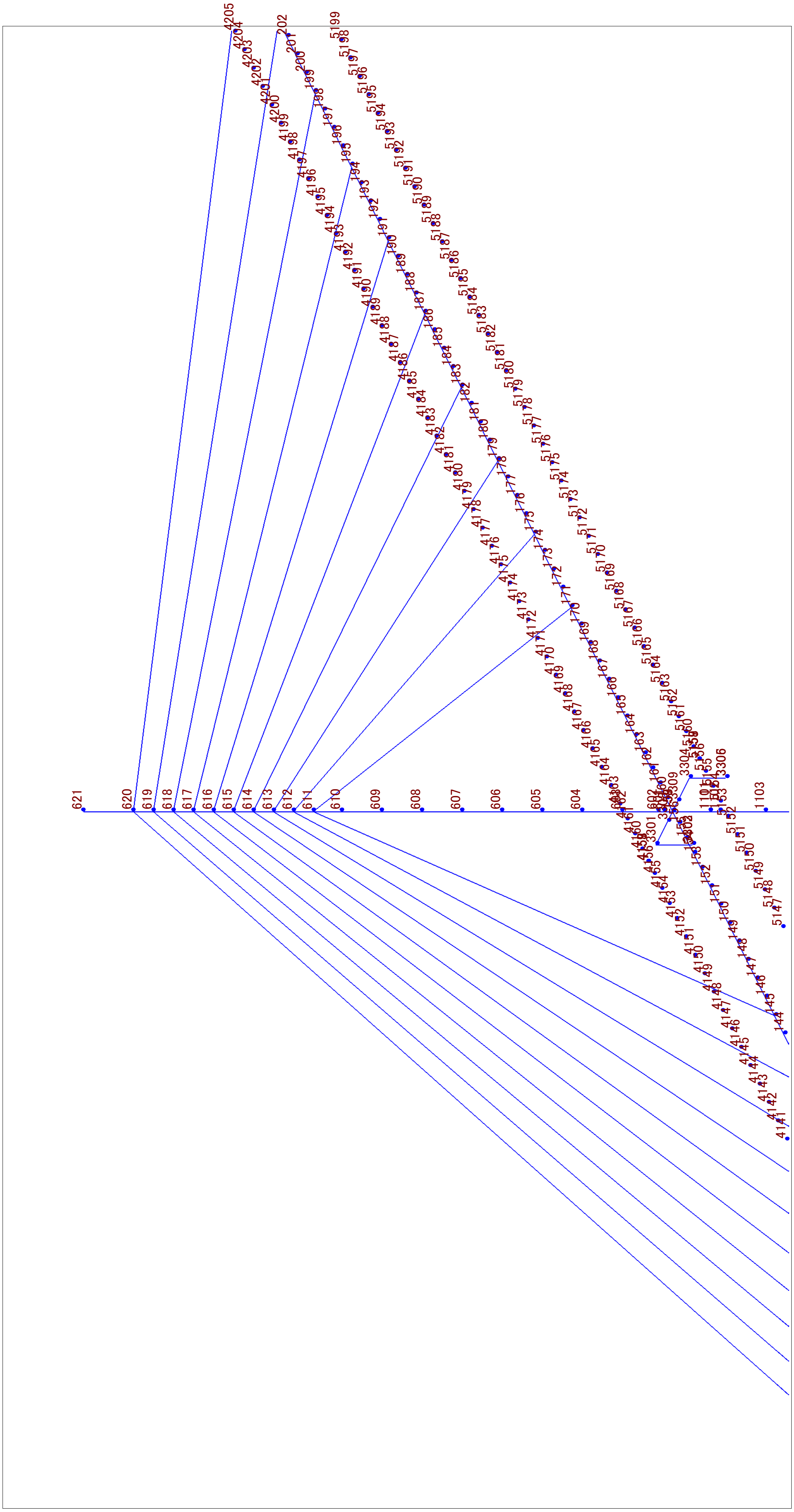
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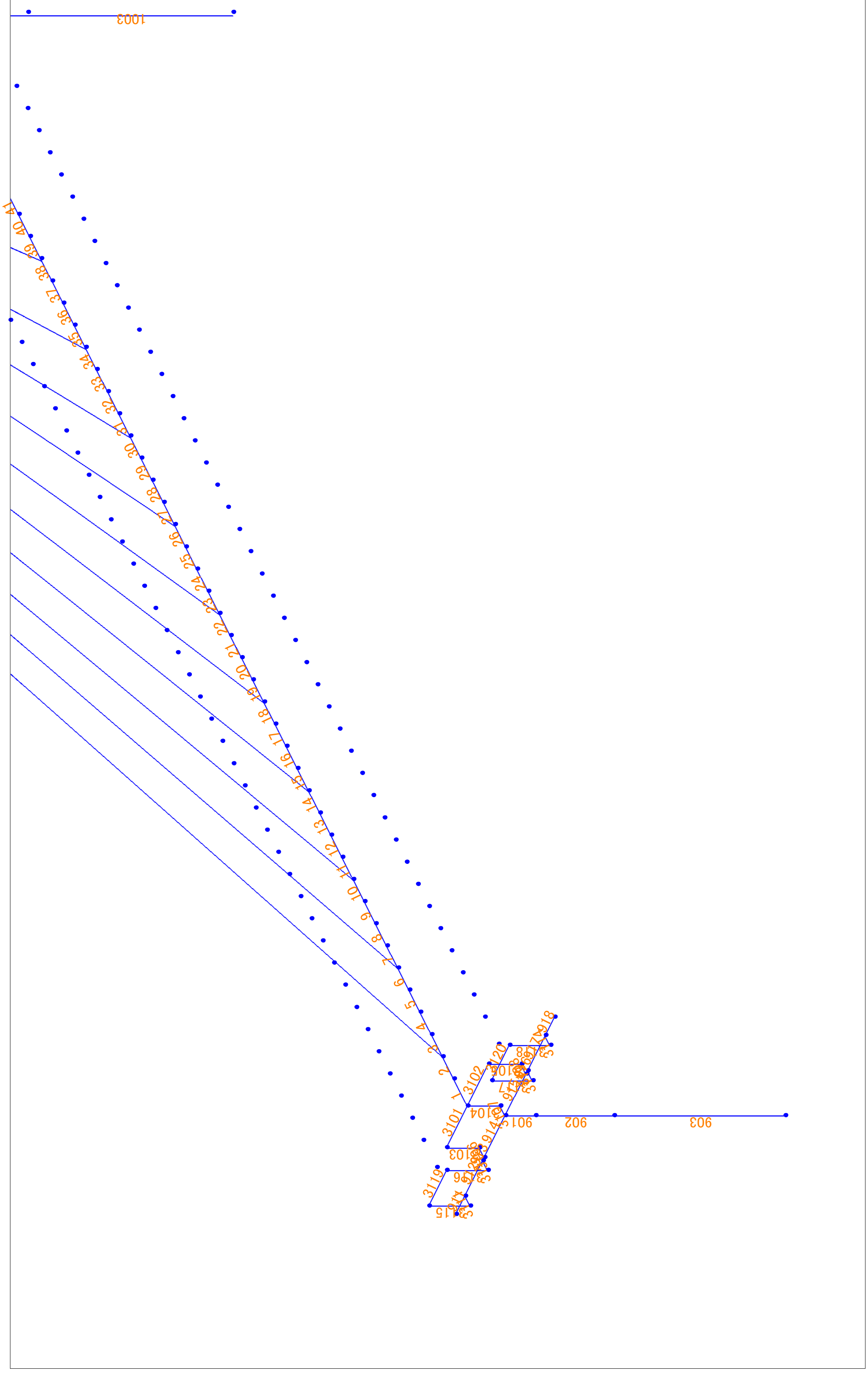
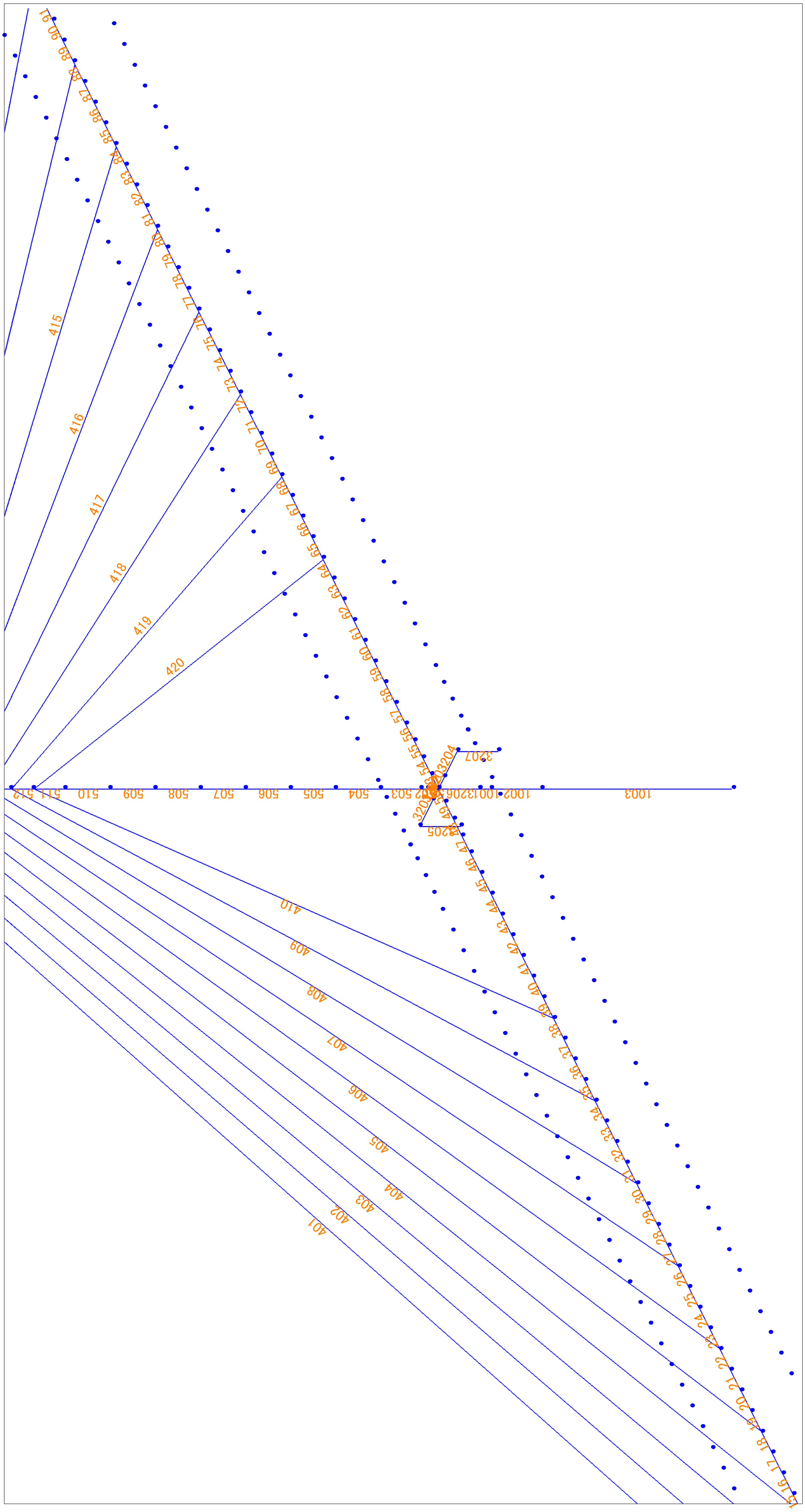
(6)Element Number

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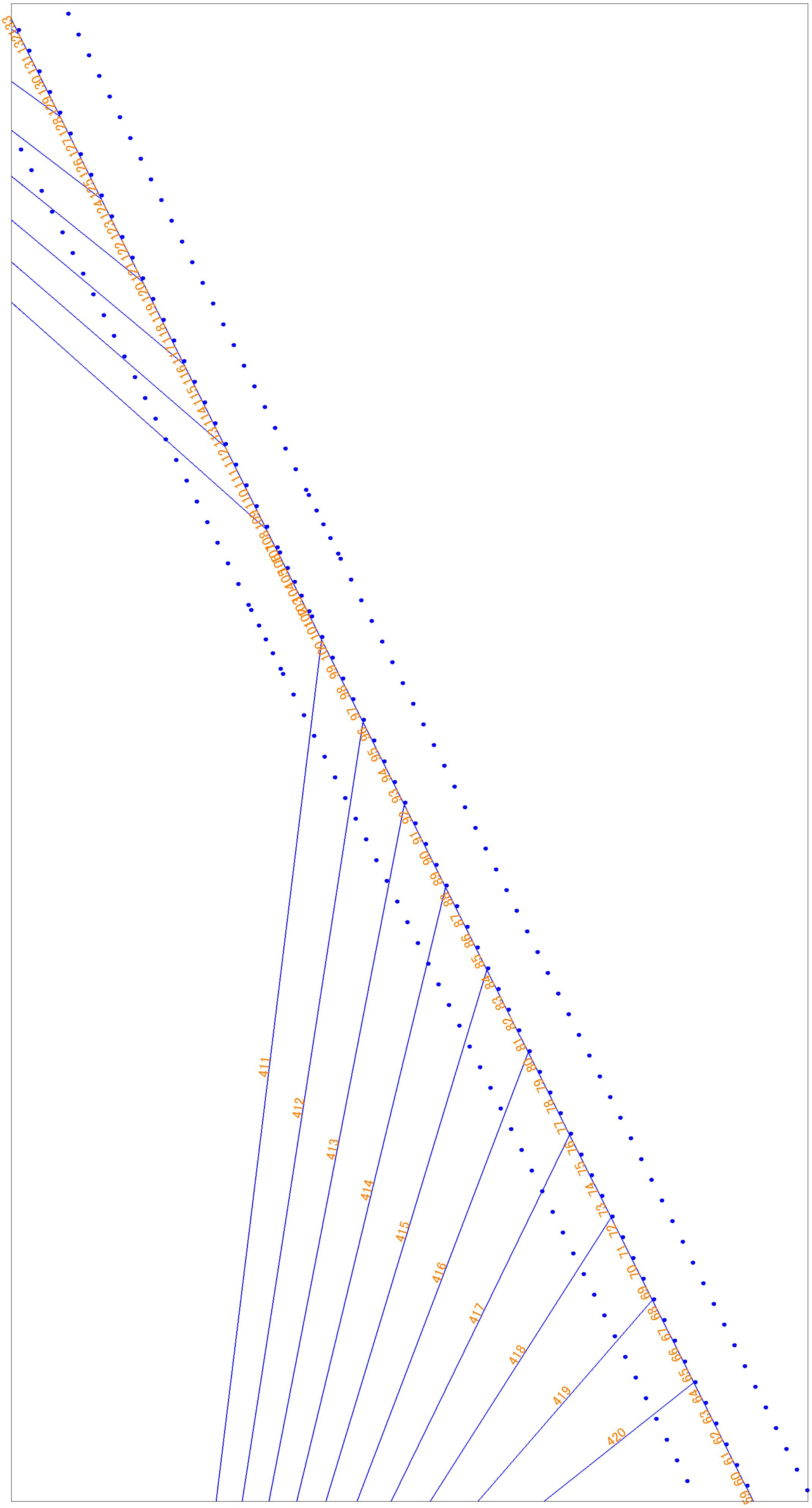
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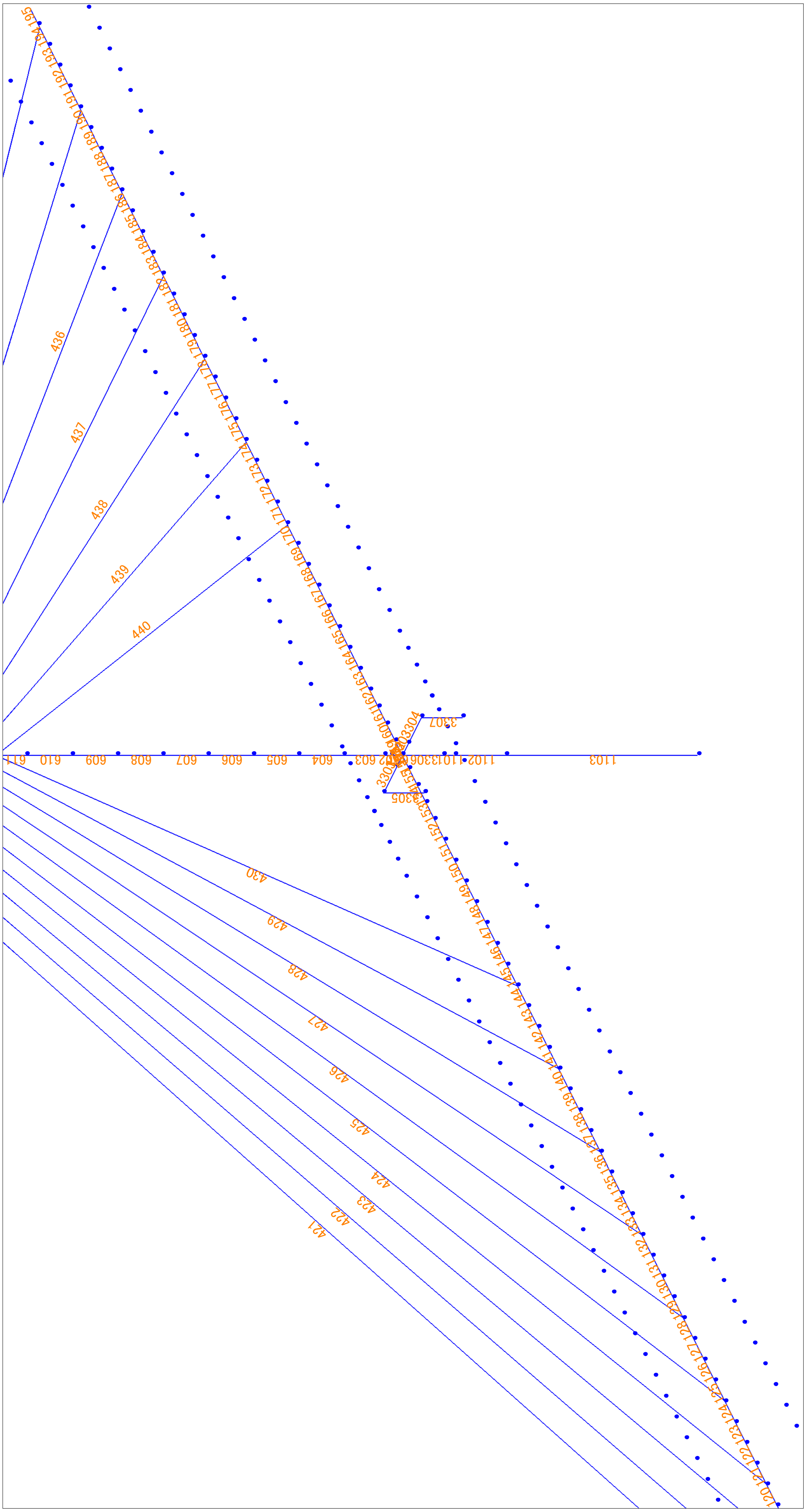

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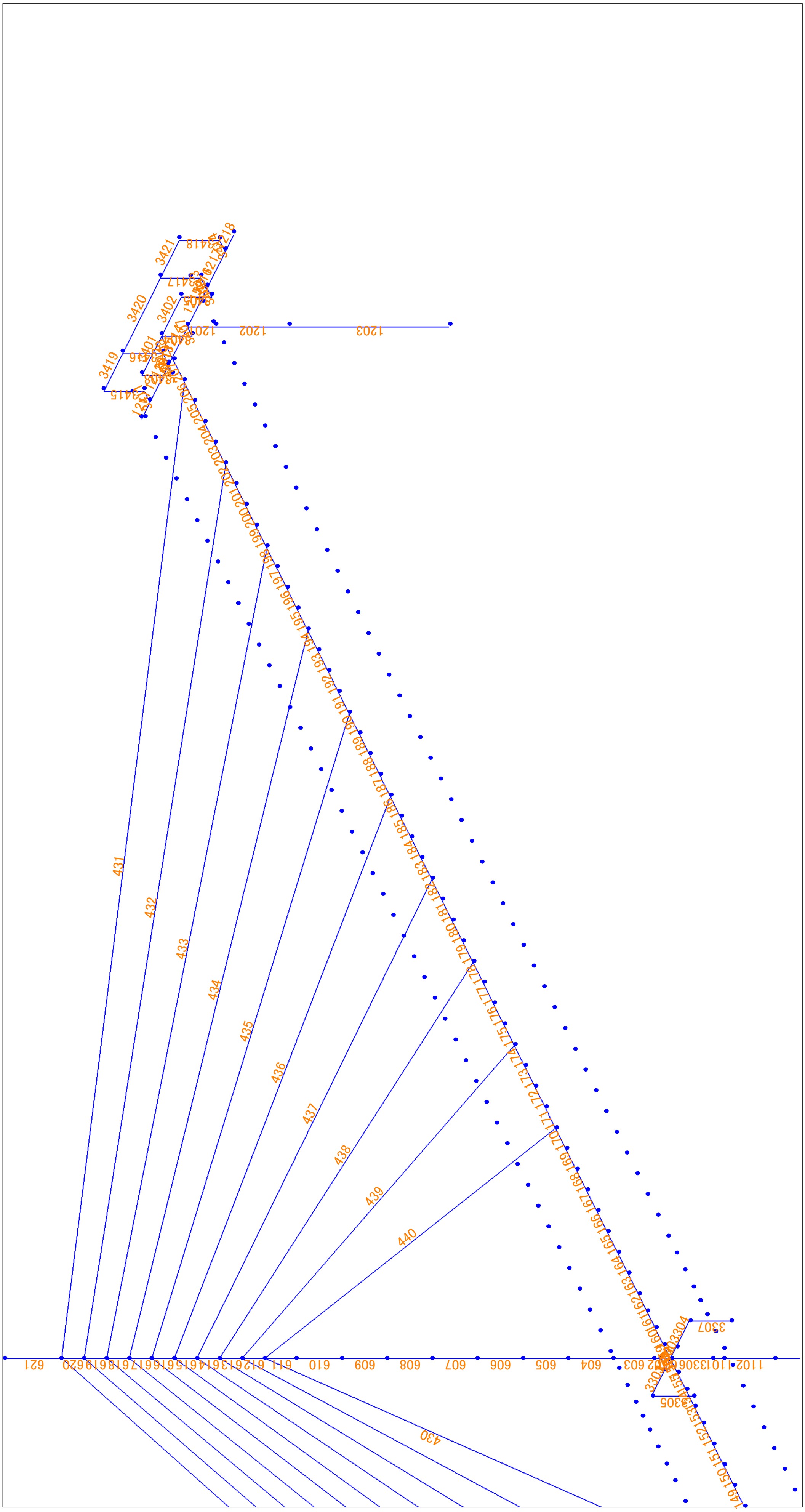

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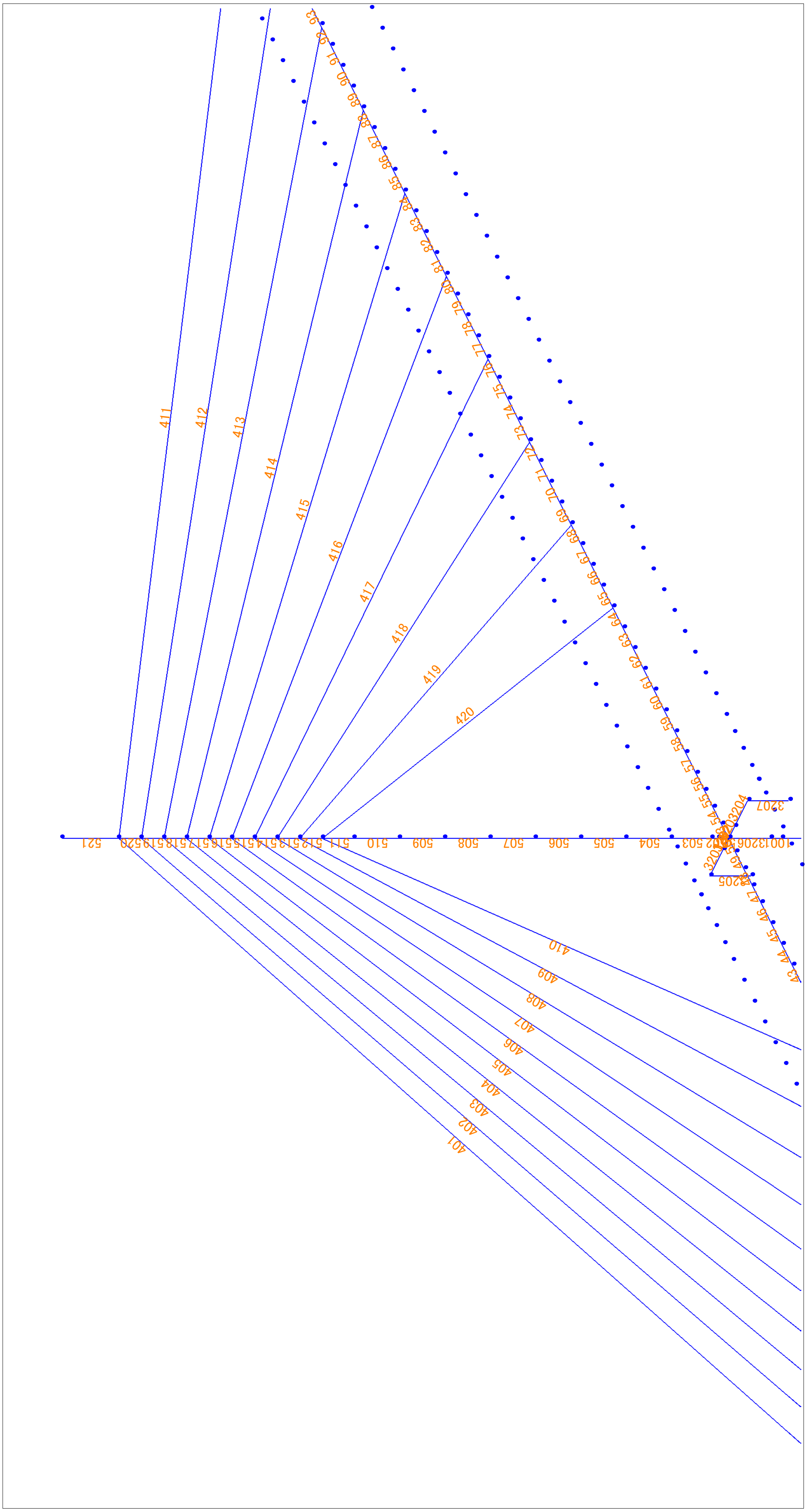
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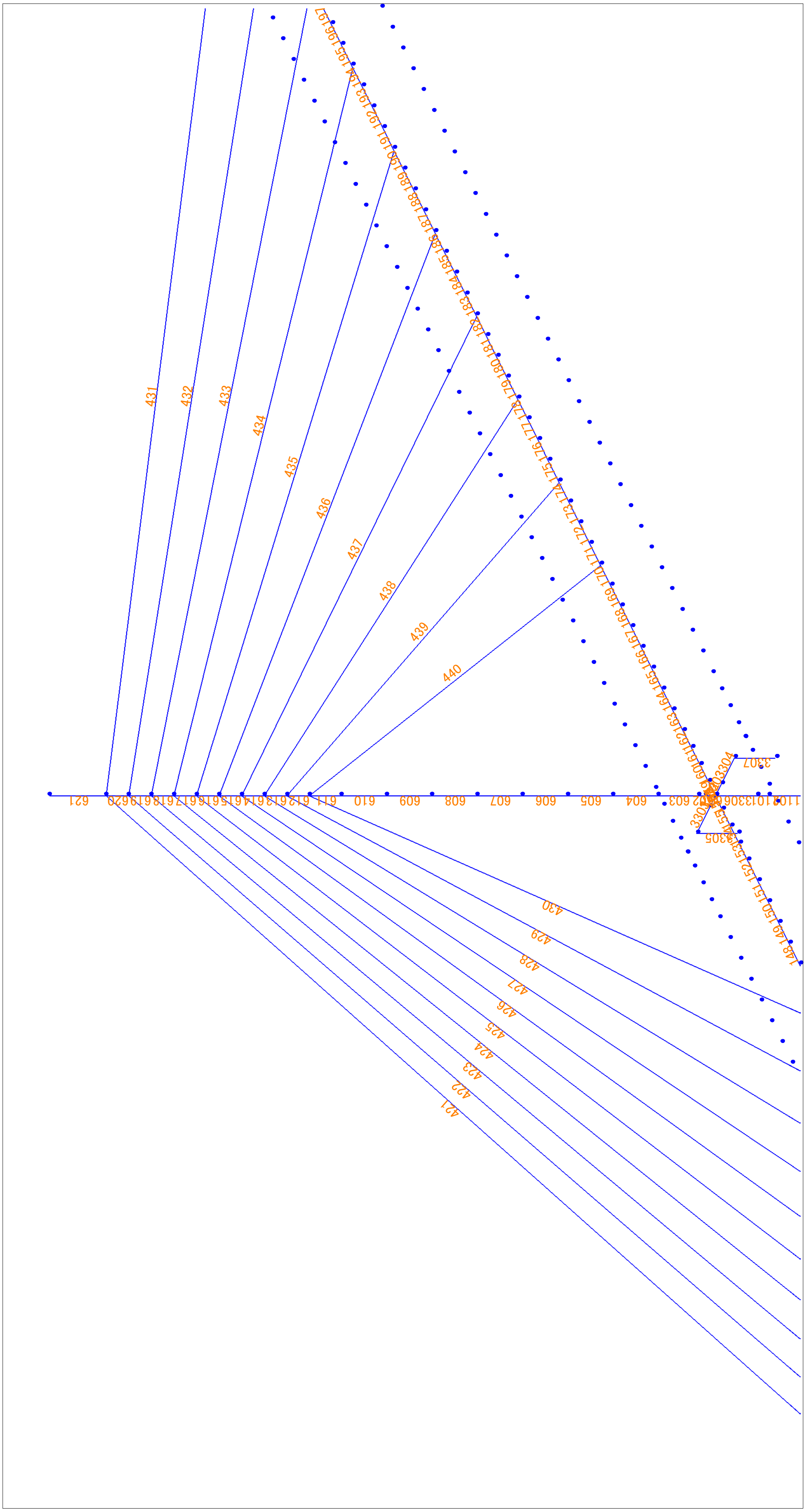
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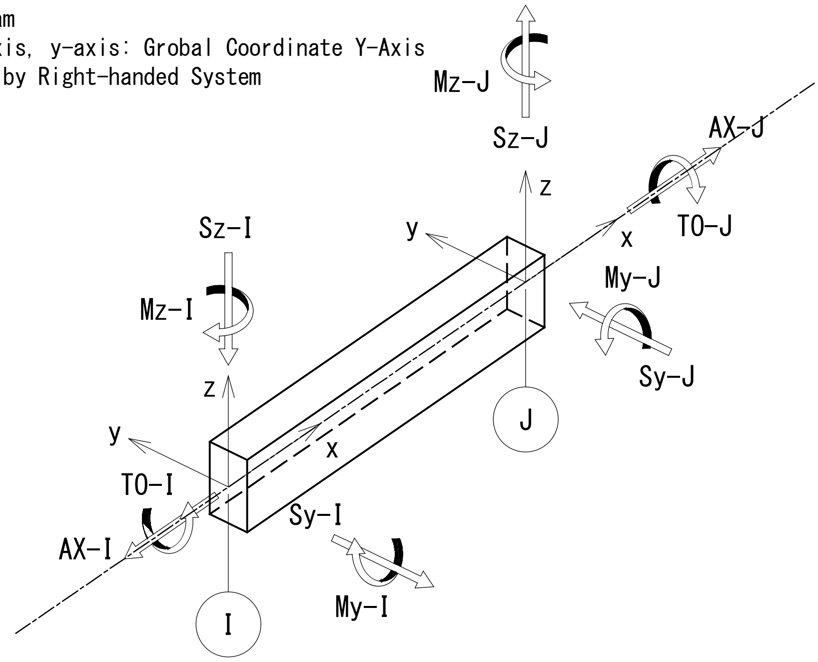
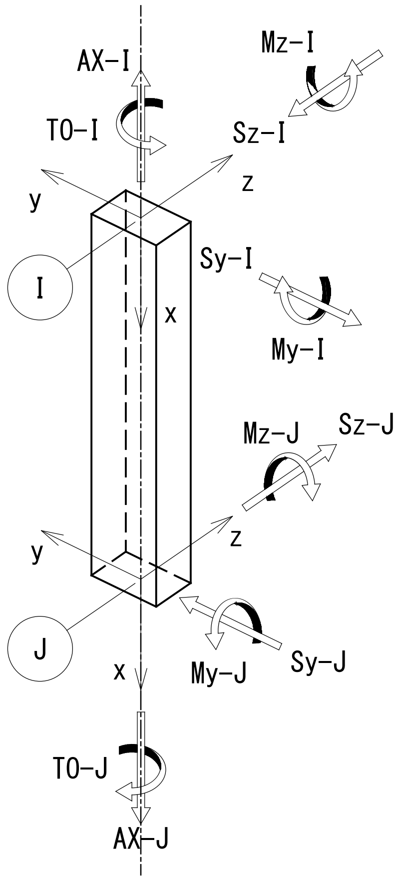
3. Member Coordinates

・Direction of Stress Resultants

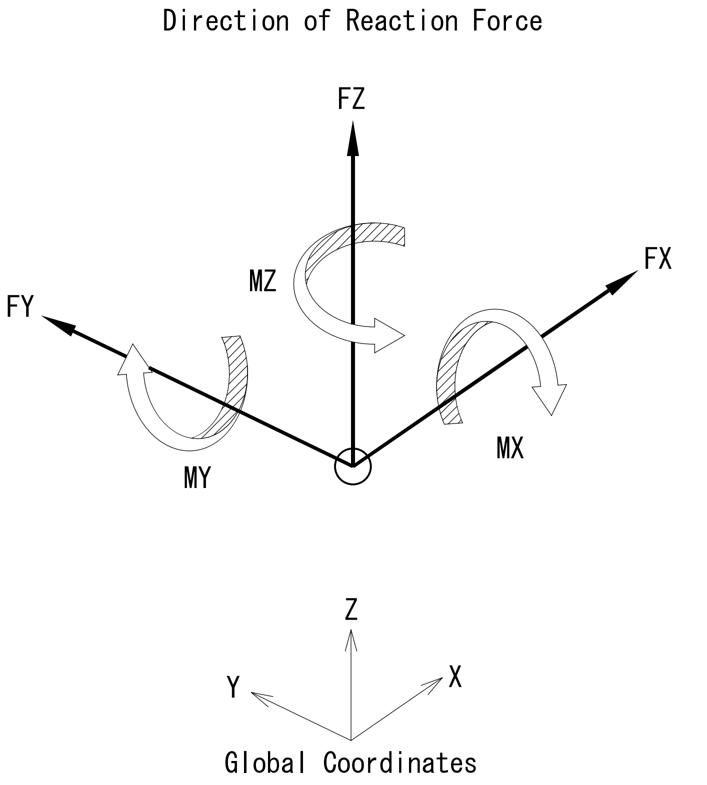
a. Girder・Cross Beam
x-axis: Member Axis, y-axis: Grobal Coordinate Y-Axis
z-axis: Selected by Right-handed System



b. Tower・Pier
x-axis: Member Axis, y-axis: Global Coordinate Y-Axis, Z-axia:Selected by Right-handed System



・Direction of Reaction Force at Pier Base



4. Analysis Conditions

(1) Node Coordinates

Girder

Name	Node No.	Girder Center (CL)		
		X	Y	Z
S1(P10)	1	1.0000	0.0000	16.8172
D1	2	3.7500	0.0000	16.8248
R1	3	6.0000	0.0000	16.8310
D2	4	8.2500	0.0000	16.8371
R2	5	10.5000	0.0000	16.8431
D3	6	12.7500	0.0000	16.8491
R3	7	15.0000	0.0000	16.8550
D4	8	17.2500	0.0000	16.8608
R4	9	19.5000	0.0000	16.8666
D5	10	21.7500	0.0000	16.8723
R5	11	24.0000	0.0000	16.8780
D6	12	26.2500	0.0000	16.8836
R6	13	28.5000	0.0000	16.8891
D7	14	30.7500	0.0000	16.8946
R7	15	33.0000	0.0000	16.9000
D8	16	35.2500	0.0000	16.9053
R8	17	37.5000	0.0000	16.9106
D9	18	39.7500	0.0000	16.9158
R9	19	42.0000	0.0000	16.9210
D10	20	44.2500	0.0000	16.9261
R10	21	46.5000	0.0000	16.9311
D11	22	48.7500	0.0000	16.9360
R11	23	51.0000	0.0000	16.9409
D12	24	53.2500	0.0000	16.9458
R12	25	55.5000	0.0000	16.9505
D13	26	57.7500	0.0000	16.9553
R13	27	60.0000	0.0000	16.9599
D14	28	62.2500	0.0000	16.9645
R14	29	64.5000	0.0000	16.9690
D15	30	66.7500	0.0000	16.9735
R15	31	69.0000	0.0000	16.9778
D16	32	71.2500	0.0000	16.9822
R16	33	73.5000	0.0000	16.9864
D17	34	75.7500	0.0000	16.9906
R17	35	78.0000	0.0000	16.9948
D18	36	80.2500	0.0000	16.9988
R18	37	82.5000	0.0000	17.0029
D19	38	84.7500	0.0000	17.0068
R19	39	87.0000	0.0000	17.0107
D20	40	89.2500	0.0000	17.0145
R20	41	91.5000	0.0000	17.0183
D21	42	93.7500	0.0000	17.0220
R21	43	96.0000	0.0000	17.0256
D22	44	98.2500	0.0000	17.0292
R22	45	100.5000	0.0000	17.0327
D23	46	102.7500	0.0000	17.0361
R23	47	105.0000	0.0000	17.0395
D24	48	106.8333	0.0000	17.0422
R24	49	108.6667	0.0000	17.0449
P11L	50	110.5000	0.0000	17.0475
P11L'	51	111.9900	0.0000	17.0496
P11	52	112.0000	0.0000	17.0496
P11R'	53	112.0100	0.0000	17.0496
P11R	54	113.5000	0.0000	17.0517
R25	55	115.3333	0.0000	17.0542
D25	56	117.1667	0.0000	17.0567

Name	Node No.	Girder Center (CL)		
		X	Y	Z
R26	57	119.0000	0.0000	17.0591
D26	58	121.2500	0.0000	17.0620
R27	59	123.5000	0.0000	17.0649
D27	60	125.7500	0.0000	17.0677
R28	61	128.0000	0.0000	17.0704
D28	62	130.2500	0.0000	17.0731
R29	63	132.5000	0.0000	17.0757
D29	64	134.7500	0.0000	17.0782
R30	65	137.0000	0.0000	17.0807
D30	66	139.2500	0.0000	17.0831
R31	67	141.5000	0.0000	17.0855
D31	68	143.7500	0.0000	17.0877
R32	69	146.0000	0.0000	17.0900
D32	70	148.2500	0.0000	17.0921
R33	71	150.5000	0.0000	17.0942
D33	72	152.7500	0.0000	17.0963
R34	73	155.0000	0.0000	17.0982
D34	74	157.2500	0.0000	17.1002
R35	75	159.5000	0.0000	17.1020
D35	76	161.7500	0.0000	17.1038
R36	77	164.0000	0.0000	17.1055
D36	78	166.2500	0.0000	17.1072
R37	79	168.5000	0.0000	17.1087
D37	80	170.7500	0.0000	17.1103
R38	81	173.0000	0.0000	17.1117
D38	82	175.2500	0.0000	17.1131
R39	83	177.5000	0.0000	17.1145
D39	84	179.7500	0.0000	17.1158
R40	85	182.0000	0.0000	17.1170
D40	86	184.2500	0.0000	17.1181
R41	87	186.5000	0.0000	17.1192
D41	88	188.7500	0.0000	17.1202
R42	89	191.0000	0.0000	17.1212
D42	90	193.2500	0.0000	17.1221
R43	91	195.5000	0.0000	17.1229
D43	92	197.7500	0.0000	17.1237
R44	93	200.0000	0.0000	17.1244
D44	94	202.2500	0.0000	17.1250
R45	95	204.5000	0.0000	17.1256
D45	96	206.7500	0.0000	17.1261
R46	97	209.0000	0.0000	17.1266
D46	98	211.2500	0.0000	17.1270
R47	99	213.5000	0.0000	17.1273
D47	100	215.7500	0.0000	17.1276
R48	101	218.0000	0.0000	17.1278
D48	102	220.2500	0.0000	17.1279
J26	103	220.8100	0.0000	17.1279
R49	104	222.5000	0.0000	17.1280
D49	105	224.0000	0.0000	17.1280
R50	106	225.5000	0.0000	17.1280
J27	107	227.1900	0.0000	17.1279
D50	108	227.7500	0.0000	17.1279
R51	109	230.0000	0.0000	17.1278
D51	110	232.2500	0.0000	17.1276
R52	111	234.5000	0.0000	17.1273
D52	112	236.7500	0.0000	17.1270
R53	113	239.0000	0.0000	17.1266
D53	114	241.2500	0.0000	17.1261
R54	115	243.5000	0.0000	17.1256
D54	116	245.7500	0.0000	17.1250
R55	117	248.0000	0.0000	17.1244

Name	Node No.	Girder Center (CL)		
		X	Y	Z
D55	118	250.2500	0.0000	17.1237
R56	119	252.5000	0.0000	17.1229
D56	120	254.7500	0.0000	17.1221
R57	121	257.0000	0.0000	17.1212
D57	122	259.2500	0.0000	17.1202
R58	123	261.5000	0.0000	17.1192
D58	124	263.7500	0.0000	17.1181
R59	125	266.0000	0.0000	17.1170
D59	126	268.2500	0.0000	17.1158
R60	127	270.5000	0.0000	17.1145
D60	128	272.7500	0.0000	17.1131
R61	129	275.0000	0.0000	17.1117
D61	130	277.2500	0.0000	17.1103
R62	131	279.5000	0.0000	17.1087
D62	132	281.7500	0.0000	17.1072
R63	133	284.0000	0.0000	17.1055
D63	134	286.2500	0.0000	17.1038
R64	135	288.5000	0.0000	17.1020
D64	136	290.7500	0.0000	17.1002
R65	137	293.0000	0.0000	17.0982
D65	138	295.2500	0.0000	17.0963
R66	139	297.5000	0.0000	17.0942
D66	140	299.7500	0.0000	17.0921
R67	141	302.0000	0.0000	17.0900
D67	142	304.2500	0.0000	17.0877
R68	143	306.5000	0.0000	17.0855
D68	144	308.7500	0.0000	17.0831
R69	145	311.0000	0.0000	17.0807
D69	146	313.2500	0.0000	17.0782
R70	147	315.5000	0.0000	17.0757
D70	148	317.7500	0.0000	17.0731
R71	149	320.0000	0.0000	17.0704
D71	150	322.2500	0.0000	17.0677
R72	151	324.5000	0.0000	17.0649
D72	152	326.7500	0.0000	17.0620
R73	153	329.0000	0.0000	17.0591
D73	154	330.8333	0.0000	17.0567
R74	155	332.6667	0.0000	17.0542
P12L	156	334.5000	0.0000	17.0517
P12L'	157	335.9900	0.0000	17.0496
P12	158	336.0000	0.0000	17.0496
P12R'	159	336.0100	0.0000	17.0496
P12R	160	337.5000	0.0000	17.0475
R75	161	339.3333	0.0000	17.0449
D74	162	341.1667	0.0000	17.0422
R76	163	343.0000	0.0000	17.0395
D75	164	345.2500	0.0000	17.0361
R77	165	347.5000	0.0000	17.0327
D76	166	349.7500	0.0000	17.0292
R78	167	352.0000	0.0000	17.0256
D77	168	354.2500	0.0000	17.0220
R79	169	356.5000	0.0000	17.0183
D78	170	358.7500	0.0000	17.0145
R80	171	361.0000	0.0000	17.0107
D79	172	363.2500	0.0000	17.0068
R81	173	365.5000	0.0000	17.0029
D80	174	367.7500	0.0000	16.9988
R82	175	370.0000	0.0000	16.9948
D81	176	372.2500	0.0000	16.9906
R83	177	374.5000	0.0000	16.9864
D82	178	376.7500	0.0000	16.9822

Name	Node No.	Girder Center (CL)		
		X	Y	Z
R84	179	379.0000	0.0000	16.9778
D83	180	381.2500	0.0000	16.9735
R85	181	383.5000	0.0000	16.9690
D84	182	385.7500	0.0000	16.9645
R86	183	388.0000	0.0000	16.9599
D85	184	390.2500	0.0000	16.9553
R87	185	392.5000	0.0000	16.9505
D86	186	394.7500	0.0000	16.9458
R88	187	397.0000	0.0000	16.9409
D87	188	399.2500	0.0000	16.9360
R89	189	401.5000	0.0000	16.9311
D88	190	403.7500	0.0000	16.9261
R90	191	406.0000	0.0000	16.9210
D89	192	408.2500	0.0000	16.9158
R91	193	410.5000	0.0000	16.9106
D90	194	412.7500	0.0000	16.9053
R92	195	415.0000	0.0000	16.9000
D91	196	417.2500	0.0000	16.8946
R93	197	419.5000	0.0000	16.8891
D92	198	421.7500	0.0000	16.8836
R94	199	424.0000	0.0000	16.8780
D93	200	426.2500	0.0000	16.8723
R95	201	428.5000	0.0000	16.8666
D94	202	430.7500	0.0000	16.8608
R96	203	433.0000	0.0000	16.8550
D95	204	435.2500	0.0000	16.8491
R97	205	437.5000	0.0000	16.8431
D96	206	439.7500	0.0000	16.8371
R98	207	442.0000	0.0000	16.8310
D97	208	444.2500	0.0000	16.8248
S2(P13)	209	447.0000	0.0000	16.8172

Name	Node No.	Web Left Side(WLU)			Node No.	Web Right Side(WRU)		
		X	Y	Z		X	Y	Z
S1(P10)	4001	1.0000	6.2500	16.8172	5001	1.0000	-6.2500	16.8172
D1	4002	3.7500	6.2500	16.8248	5002	3.7500	-6.2500	16.8248
R1	4003	6.0000	6.2500	16.8310	5003	6.0000	-6.2500	16.8310
D2	4004	8.2500	6.2500	16.8371	5004	8.2500	-6.2500	16.8371
R2	4005	10.5000	6.2500	16.8431	5005	10.5000	-6.2500	16.8431
D3	4006	12.7500	6.2500	16.8491	5006	12.7500	-6.2500	16.8491
R3	4007	15.0000	6.2500	16.8550	5007	15.0000	-6.2500	16.8550
D4	4008	17.2500	6.2500	16.8608	5008	17.2500	-6.2500	16.8608
R4	4009	19.5000	6.2500	16.8666	5009	19.5000	-6.2500	16.8666
D5	4010	21.7500	6.2500	16.8723	5010	21.7500	-6.2500	16.8723
R5	4011	24.0000	6.2500	16.8780	5011	24.0000	-6.2500	16.8780
D6	4012	26.2500	6.2500	16.8836	5012	26.2500	-6.2500	16.8836
R6	4013	28.5000	6.2500	16.8891	5013	28.5000	-6.2500	16.8891
D7	4014	30.7500	6.2500	16.8946	5014	30.7500	-6.2500	16.8946
R7	4015	33.0000	6.2500	16.9000	5015	33.0000	-6.2500	16.9000
D8	4016	35.2500	6.2500	16.9053	5016	35.2500	-6.2500	16.9053
R8	4017	37.5000	6.2500	16.9106	5017	37.5000	-6.2500	16.9106
D9	4018	39.7500	6.2500	16.9158	5018	39.7500	-6.2500	16.9158
R9	4019	42.0000	6.2500	16.9210	5019	42.0000	-6.2500	16.9210
D10	4020	44.2500	6.2500	16.9261	5020	44.2500	-6.2500	16.9261
R10	4021	46.5000	6.2500	16.9311	5021	46.5000	-6.2500	16.9311
D11	4022	48.7500	6.2500	16.9360	5022	48.7500	-6.2500	16.9360
R11	4023	51.0000	6.2500	16.9409	5023	51.0000	-6.2500	16.9409
D12	4024	53.2500	6.2500	16.9458	5024	53.2500	-6.2500	16.9458
R12	4025	55.5000	6.2500	16.9505	5025	55.5000	-6.2500	16.9505
D13	4026	57.7500	6.2500	16.9553	5026	57.7500	-6.2500	16.9553
R13	4027	60.0000	6.2500	16.9599	5027	60.0000	-6.2500	16.9599
D14	4028	62.2500	6.2500	16.9645	5028	62.2500	-6.2500	16.9645
R14	4029	64.5000	6.2500	16.9690	5029	64.5000	-6.2500	16.9690
D15	4030	66.7500	6.2500	16.9735	5030	66.7500	-6.2500	16.9735
R15	4031	69.0000	6.2500	16.9778	5031	69.0000	-6.2500	16.9778
D16	4032	71.2500	6.2500	16.9822	5032	71.2500	-6.2500	16.9822
R16	4033	73.5000	6.2500	16.9864	5033	73.5000	-6.2500	16.9864
D17	4034	75.7500	6.2500	16.9906	5034	75.7500	-6.2500	16.9906
R17	4035	78.0000	6.2500	16.9948	5035	78.0000	-6.2500	16.9948
D18	4036	80.2500	6.2500	16.9988	5036	80.2500	-6.2500	16.9988
R18	4037	82.5000	6.2500	17.0029	5037	82.5000	-6.2500	17.0029
D19	4038	84.7500	6.2500	17.0068	5038	84.7500	-6.2500	17.0068
R19	4039	87.0000	6.2500	17.0107	5039	87.0000	-6.2500	17.0107
D20	4040	89.2500	6.2500	17.0145	5040	89.2500	-6.2500	17.0145
R20	4041	91.5000	6.2500	17.0183	5041	91.5000	-6.2500	17.0183
D21	4042	93.7500	6.2500	17.0220	5042	93.7500	-6.2500	17.0220
R21	4043	96.0000	6.2500	17.0256	5043	96.0000	-6.2500	17.0256
D22	4044	98.2500	6.2500	17.0292	5044	98.2500	-6.2500	17.0292
R22	4045	100.5000	6.2500	17.0327	5045	100.5000	-6.2500	17.0327
D23	4046	102.7500	6.2500	17.0361	5046	102.7500	-6.2500	17.0361
R23	4047	105.0000	6.2500	17.0395	5047	105.0000	-6.2500	17.0395
D24	4048	106.8333	6.2500	17.0422	5048	106.8333	-6.2500	17.0422
R24	4049	108.6667	6.2500	17.0449	5049	108.6667	-6.2500	17.0449
P11L	4050	110.5000	6.2500	17.0475	5050	110.5000	-6.2500	17.0475
P11L’	4051	111.9900	6.2500	17.0496	5051	111.9900	-6.2500	17.0496
P11	4052	112.0000	6.2500	17.0496	5052	112.0000	-6.2500	17.0496
P11R’	4053	112.0100	6.2500	17.0496	5053	112.0100	-6.2500	17.0496
P11R	4054	113.5000	6.2500	17.0517	5054	113.5000	-6.2500	17.0517
R25	4055	115.3333	6.2500	17.0542	5055	115.3333	-6.2500	17.0542
D25	4056	117.1667	6.2500	17.0567	5056	117.1667	-6.2500	17.0567
R26	4057	119.0000	6.2500	17.0591	5057	119.0000	-6.2500	17.0591
D26	4058	121.2500	6.2500	17.0620	5058	121.2500	-6.2500	17.0620
R27	4059	123.5000	6.2500	17.0649	5059	123.5000	-6.2500	17.0649
D27	4060	125.7500	6.2500	17.0677	5060	125.7500	-6.2500	17.0677
R28	4061	128.0000	6.2500	17.0704	5061	128.0000	-6.2500	17.0704

Name	Node No.	Web Left Side(WLU)			Node No.	Web Right Side(WRU)		
		X	Y	Z		X	Y	Z
D28	4062	130.2500	6.2500	17.0731	5062	130.2500	-6.2500	17.0731
R29	4063	132.5000	6.2500	17.0757	5063	132.5000	-6.2500	17.0757
D29	4064	134.7500	6.2500	17.0782	5064	134.7500	-6.2500	17.0782
R30	4065	137.0000	6.2500	17.0807	5065	137.0000	-6.2500	17.0807
D30	4066	139.2500	6.2500	17.0831	5066	139.2500	-6.2500	17.0831
R31	4067	141.5000	6.2500	17.0855	5067	141.5000	-6.2500	17.0855
D31	4068	143.7500	6.2500	17.0877	5068	143.7500	-6.2500	17.0877
R32	4069	146.0000	6.2500	17.0900	5069	146.0000	-6.2500	17.0900
D32	4070	148.2500	6.2500	17.0921	5070	148.2500	-6.2500	17.0921
R33	4071	150.5000	6.2500	17.0942	5071	150.5000	-6.2500	17.0942
D33	4072	152.7500	6.2500	17.0963	5072	152.7500	-6.2500	17.0963
R34	4073	155.0000	6.2500	17.0982	5073	155.0000	-6.2500	17.0982
D34	4074	157.2500	6.2500	17.1002	5074	157.2500	-6.2500	17.1002
R35	4075	159.5000	6.2500	17.1020	5075	159.5000	-6.2500	17.1020
D35	4076	161.7500	6.2500	17.1038	5076	161.7500	-6.2500	17.1038
R36	4077	164.0000	6.2500	17.1055	5077	164.0000	-6.2500	17.1055
D36	4078	166.2500	6.2500	17.1072	5078	166.2500	-6.2500	17.1072
R37	4079	168.5000	6.2500	17.1087	5079	168.5000	-6.2500	17.1087
D37	4080	170.7500	6.2500	17.1103	5080	170.7500	-6.2500	17.1103
R38	4081	173.0000	6.2500	17.1117	5081	173.0000	-6.2500	17.1117
D38	4082	175.2500	6.2500	17.1131	5082	175.2500	-6.2500	17.1131
R39	4083	177.5000	6.2500	17.1145	5083	177.5000	-6.2500	17.1145
D39	4084	179.7500	6.2500	17.1158	5084	179.7500	-6.2500	17.1158
R40	4085	182.0000	6.2500	17.1170	5085	182.0000	-6.2500	17.1170
D40	4086	184.2500	6.2500	17.1181	5086	184.2500	-6.2500	17.1181
R41	4087	186.5000	6.2500	17.1192	5087	186.5000	-6.2500	17.1192
D41	4088	188.7500	6.2500	17.1202	5088	188.7500	-6.2500	17.1202
R42	4089	191.0000	6.2500	17.1212	5089	191.0000	-6.2500	17.1212
D42	4090	193.2500	6.2500	17.1221	5090	193.2500	-6.2500	17.1221
R43	4091	195.5000	6.2500	17.1229	5091	195.5000	-6.2500	17.1229
D43	4092	197.7500	6.2500	17.1237	5092	197.7500	-6.2500	17.1237
R44	4093	200.0000	6.2500	17.1244	5093	200.0000	-6.2500	17.1244
D44	4094	202.2500	6.2500	17.1250	5094	202.2500	-6.2500	17.1250
R45	4095	204.5000	6.2500	17.1256	5095	204.5000	-6.2500	17.1256
D45	4096	206.7500	6.2500	17.1261	5096	206.7500	-6.2500	17.1261
R46	4097	209.0000	6.2500	17.1266	5097	209.0000	-6.2500	17.1266
D46	4098	211.2500	6.2500	17.1270	5098	211.2500	-6.2500	17.1270
R47	4099	213.5000	6.2500	17.1273	5099	213.5000	-6.2500	17.1273
D47	4100	215.7500	6.2500	17.1276	5100	215.7500	-6.2500	17.1276
R48	4101	218.0000	6.2500	17.1278	5101	218.0000	-6.2500	17.1278
D48	4102	220.2500	6.2500	17.1279	5102	220.2500	-6.2500	17.1279
J26	4103	220.8100	6.2500	17.1279	5103	220.8100	-6.2500	17.1279
R49	4104	222.5000	6.2500	17.1280	5104	222.5000	-6.2500	17.1280
D49	4105	224.0000	6.2500	17.1280	5105	224.0000	-6.2500	17.1280
R50	4106	225.5000	6.2500	17.1280	5106	225.5000	-6.2500	17.1280
J27	4107	227.1900	6.2500	17.1279	5107	227.1900	-6.2500	17.1279
D50	4108	227.7500	6.2500	17.1279	5108	227.7500	-6.2500	17.1279
R51	4109	230.0000	6.2500	17.1278	5109	230.0000	-6.2500	17.1278
D51	4110	232.2500	6.2500	17.1276	5110	232.2500	-6.2500	17.1276
R52	4111	234.5000	6.2500	17.1273	5111	234.5000	-6.2500	17.1273
D52	4112	236.7500	6.2500	17.1270	5112	236.7500	-6.2500	17.1270
R53	4113	239.0000	6.2500	17.1266	5113	239.0000	-6.2500	17.1266
D53	4114	241.2500	6.2500	17.1261	5114	241.2500	-6.2500	17.1261
R54	4115	243.5000	6.2500	17.1256	5115	243.5000	-6.2500	17.1256
D54	4116	245.7500	6.2500	17.1250	5116	245.7500	-6.2500	17.1250
R55	4117	248.0000	6.2500	17.1244	5117	248.0000	-6.2500	17.1244
D55	4118	250.2500	6.2500	17.1237	5118	250.2500	-6.2500	17.1237
R56	4119	252.5000	6.2500	17.1229	5119	252.5000	-6.2500	17.1229
D56	4120	254.7500	6.2500	17.1221	5120	254.7500	-6.2500	17.1221
R57	4121	257.0000	6.2500	17.1212	5121	257.0000	-6.2500	17.1212
D57	4122	259.2500	6.2500	17.1202	5122	259.2500	-6.2500	17.1202

Name	Node No.	Web Left Side(WLU)			Node No.	Web Right Side(WRU)		
		X	Y	Z		X	Y	Z
R58	4123	261.5000	6.2500	17.1192	5123	261.5000	-6.2500	17.1192
D58	4124	263.7500	6.2500	17.1181	5124	263.7500	-6.2500	17.1181
R59	4125	266.0000	6.2500	17.1170	5125	266.0000	-6.2500	17.1170
D59	4126	268.2500	6.2500	17.1158	5126	268.2500	-6.2500	17.1158
R60	4127	270.5000	6.2500	17.1145	5127	270.5000	-6.2500	17.1145
D60	4128	272.7500	6.2500	17.1131	5128	272.7500	-6.2500	17.1131
R61	4129	275.0000	6.2500	17.1117	5129	275.0000	-6.2500	17.1117
D61	4130	277.2500	6.2500	17.1103	5130	277.2500	-6.2500	17.1103
R62	4131	279.5000	6.2500	17.1087	5131	279.5000	-6.2500	17.1087
D62	4132	281.7500	6.2500	17.1072	5132	281.7500	-6.2500	17.1072
R63	4133	284.0000	6.2500	17.1055	5133	284.0000	-6.2500	17.1055
D63	4134	286.2500	6.2500	17.1038	5134	286.2500	-6.2500	17.1038
R64	4135	288.5000	6.2500	17.1020	5135	288.5000	-6.2500	17.1020
D64	4136	290.7500	6.2500	17.1002	5136	290.7500	-6.2500	17.1002
R65	4137	293.0000	6.2500	17.0982	5137	293.0000	-6.2500	17.0982
D65	4138	295.2500	6.2500	17.0963	5138	295.2500	-6.2500	17.0963
R66	4139	297.5000	6.2500	17.0942	5139	297.5000	-6.2500	17.0942
D66	4140	299.7500	6.2500	17.0921	5140	299.7500	-6.2500	17.0921
R67	4141	302.0000	6.2500	17.0900	5141	302.0000	-6.2500	17.0900
D67	4142	304.2500	6.2500	17.0877	5142	304.2500	-6.2500	17.0877
R68	4143	306.5000	6.2500	17.0855	5143	306.5000	-6.2500	17.0855
D68	4144	308.7500	6.2500	17.0831	5144	308.7500	-6.2500	17.0831
R69	4145	311.0000	6.2500	17.0807	5145	311.0000	-6.2500	17.0807
D69	4146	313.2500	6.2500	17.0782	5146	313.2500	-6.2500	17.0782
R70	4147	315.5000	6.2500	17.0757	5147	315.5000	-6.2500	17.0757
D70	4148	317.7500	6.2500	17.0731	5148	317.7500	-6.2500	17.0731
R71	4149	320.0000	6.2500	17.0704	5149	320.0000	-6.2500	17.0704
D71	4150	322.2500	6.2500	17.0677	5150	322.2500	-6.2500	17.0677
R72	4151	324.5000	6.2500	17.0649	5151	324.5000	-6.2500	17.0649
D72	4152	326.7500	6.2500	17.0620	5152	326.7500	-6.2500	17.0620
R73	4153	329.0000	6.2500	17.0591	5153	329.0000	-6.2500	17.0591
D73	4154	330.8333	6.2500	17.0567	5154	330.8333	-6.2500	17.0567
R74	4155	332.6667	6.2500	17.0542	5155	332.6667	-6.2500	17.0542
P12L	4156	334.5000	6.2500	17.0517	5156	334.5000	-6.2500	17.0517
P12L'	4157	335.9900	6.2500	17.0496	5157	335.9900	-6.2500	17.0496
P12	4158	336.0000	6.2500	17.0496	5158	336.0000	-6.2500	17.0496
P12R'	4159	336.0100	6.2500	17.0496	5159	336.0100	-6.2500	17.0496
P12R	4160	337.5000	6.2500	17.0475	5160	337.5000	-6.2500	17.0475
R75	4161	339.3333	6.2500	17.0449	5161	339.3333	-6.2500	17.0449
D74	4162	341.1667	6.2500	17.0422	5162	341.1667	-6.2500	17.0422
R76	4163	343.0000	6.2500	17.0395	5163	343.0000	-6.2500	17.0395
D75	4164	345.2500	6.2500	17.0361	5164	345.2500	-6.2500	17.0361
R77	4165	347.5000	6.2500	17.0327	5165	347.5000	-6.2500	17.0327
D76	4166	349.7500	6.2500	17.0292	5166	349.7500	-6.2500	17.0292
R78	4167	352.0000	6.2500	17.0256	5167	352.0000	-6.2500	17.0256
D77	4168	354.2500	6.2500	17.0220	5168	354.2500	-6.2500	17.0220
R79	4169	356.5000	6.2500	17.0183	5169	356.5000	-6.2500	17.0183
D78	4170	358.7500	6.2500	17.0145	5170	358.7500	-6.2500	17.0145
R80	4171	361.0000	6.2500	17.0107	5171	361.0000	-6.2500	17.0107
D79	4172	363.2500	6.2500	17.0068	5172	363.2500	-6.2500	17.0068
R81	4173	365.5000	6.2500	17.0029	5173	365.5000	-6.2500	17.0029
D80	4174	367.7500	6.2500	16.9988	5174	367.7500	-6.2500	16.9988
R82	4175	370.0000	6.2500	16.9948	5175	370.0000	-6.2500	16.9948
D81	4176	372.2500	6.2500	16.9906	5176	372.2500	-6.2500	16.9906
R83	4177	374.5000	6.2500	16.9864	5177	374.5000	-6.2500	16.9864
D82	4178	376.7500	6.2500	16.9822	5178	376.7500	-6.2500	16.9822
R84	4179	379.0000	6.2500	16.9778	5179	379.0000	-6.2500	16.9778
D83	4180	381.2500	6.2500	16.9735	5180	381.2500	-6.2500	16.9735
R85	4181	383.5000	6.2500	16.9690	5181	383.5000	-6.2500	16.9690
D84	4182	385.7500	6.2500	16.9645	5182	385.7500	-6.2500	16.9645
R86	4183	388.0000	6.2500	16.9599	5183	388.0000	-6.2500	16.9599

Name	Node No.	Web Left Side(WLU)			Node No.	Web Right Side(WRU)		
		X	Y	Z		X	Y	Z
D85	4184	390.2500	6.2500	16.9553	5184	390.2500	-6.2500	16.9553
R87	4185	392.5000	6.2500	16.9505	5185	392.5000	-6.2500	16.9505
D86	4186	394.7500	6.2500	16.9458	5186	394.7500	-6.2500	16.9458
R88	4187	397.0000	6.2500	16.9409	5187	397.0000	-6.2500	16.9409
D87	4188	399.2500	6.2500	16.9360	5188	399.2500	-6.2500	16.9360
R89	4189	401.5000	6.2500	16.9311	5189	401.5000	-6.2500	16.9311
D88	4190	403.7500	6.2500	16.9261	5190	403.7500	-6.2500	16.9261
R90	4191	406.0000	6.2500	16.9210	5191	406.0000	-6.2500	16.9210
D89	4192	408.2500	6.2500	16.9158	5192	408.2500	-6.2500	16.9158
R91	4193	410.5000	6.2500	16.9106	5193	410.5000	-6.2500	16.9106
D90	4194	412.7500	6.2500	16.9053	5194	412.7500	-6.2500	16.9053
R92	4195	415.0000	6.2500	16.9000	5195	415.0000	-6.2500	16.9000
D91	4196	417.2500	6.2500	16.8946	5196	417.2500	-6.2500	16.8946
R93	4197	419.5000	6.2500	16.8891	5197	419.5000	-6.2500	16.8891
D92	4198	421.7500	6.2500	16.8836	5198	421.7500	-6.2500	16.8836
R94	4199	424.0000	6.2500	16.8780	5199	424.0000	-6.2500	16.8780
D93	4200	426.2500	6.2500	16.8723	5200	426.2500	-6.2500	16.8723
R95	4201	428.5000	6.2500	16.8666	5201	428.5000	-6.2500	16.8666
D94	4202	430.7500	6.2500	16.8608	5202	430.7500	-6.2500	16.8608
R96	4203	433.0000	6.2500	16.8550	5203	433.0000	-6.2500	16.8550
D95	4204	435.2500	6.2500	16.8491	5204	435.2500	-6.2500	16.8491
R97	4205	437.5000	6.2500	16.8431	5205	437.5000	-6.2500	16.8431
D96	4206	439.7500	6.2500	16.8371	5206	439.7500	-6.2500	16.8371
R98	4207	442.0000	6.2500	16.8310	5207	442.0000	-6.2500	16.8310
D97	4208	444.2500	6.2500	16.8248	5208	444.2500	-6.2500	16.8248
S2(P13)	4209	447.0000	6.2500	16.8172	5209	447.0000	-6.2500	16.8172

Name	Node No.	X	Y	Z
P11 Tower	501	112.0000	0.0000	18.0296
	502	112.0000	0.0000	18.6296
	503	112.0000	0.0000	22.2296
	504	112.0000	0.0000	26.2296
	505	112.0000	0.0000	30.2296
	506	112.0000	0.0000	34.2296
	507	112.0000	0.0000	38.2296
	508	112.0000	0.0000	42.2296
	509	112.0000	0.0000	46.2296
	510	112.0000	0.0000	50.2296
	511	112.0000	0.0000	53.0296
	512	112.0000	0.0000	55.0296
	513	112.0000	0.0000	57.0296
	514	112.0000	0.0000	59.0296
	515	112.0000	0.0000	61.0296
	516	112.0000	0.0000	63.0296
	517	112.0000	0.0000	65.0296
	518	112.0000	0.0000	67.0296
	519	112.0000	0.0000	69.0296
	520	112.0000	0.0000	71.0296
	521	112.0000	0.0000	76.0296
P12 Tower	601	336.0000	0.0000	18.0296
	602	336.0000	0.0000	18.6296
	603	336.0000	0.0000	22.2296
	604	336.0000	0.0000	26.2296
	605	336.0000	0.0000	30.2296
	606	336.0000	0.0000	34.2296
	607	336.0000	0.0000	38.2296
	608	336.0000	0.0000	42.2296
	609	336.0000	0.0000	46.2296
	610	336.0000	0.0000	50.2296
	611	336.0000	0.0000	53.0296
	612	336.0000	0.0000	55.0296
	613	336.0000	0.0000	57.0296
	614	336.0000	0.0000	59.0296
	615	336.0000	0.0000	61.0296
	616	336.0000	0.0000	63.0296
	617	336.0000	0.0000	65.0296
	618	336.0000	0.0000	67.0296
	619	336.0000	0.0000	69.0296
	620	336.0000	0.0000	71.0296
	621	336.0000	0.0000	76.0296

Name	Node No.	X	Y	Z
P10 Pier	901	0.0000	0.0000	14.1000
	902	0.0000	0.0000	11.6000
	903	0.0000	0.0000	5.1000
	904	0.0000	0.0000	-9.1000
	911	0.0000	10.0000	14.1000
	912	0.0000	8.1500	14.1000
	913	0.0000	4.5500	14.1000
	914	0.0000	4.2500	14.1000
	915	0.0000	-4.2500	14.1000
	916	0.0000	-4.5500	14.1000
	917	0.0000	-8.1500	14.1000
	918	0.0000	-10.0000	14.1000
P11 Pier	1001	112.0000	0.0000	13.4000
	1002	112.0000	0.0000	12.4000
	1003	112.0000	0.0000	7.9000
	1004	112.0000	0.0000	-9.1000
	1011	112.0000	0.0000	13.4001
P12 Pier	1101	336.0000	0.0000	13.4000
	1102	336.0000	0.0000	12.4000
	1103	336.0000	0.0000	7.9000
	1104	336.0000	0.0000	-9.1000
	1111	336.0000	0.0000	13.4001
P13 Pier	1201	448.0000	0.0000	14.1000
	1202	448.0000	0.0000	11.6000
	1203	448.0000	0.0000	5.1000
	1204	448.0000	0.0000	-9.1000
	1211	448.0000	10.0000	14.1000
	1212	448.0000	8.1780	14.1000
	1213	448.0000	4.2500	14.1000
	1214	448.0000	4.1000	14.1000
	1215	448.0000	-4.1000	14.1000
	1216	448.0000	-4.2500	14.1000
	1217	448.0000	-8.1780	14.1000
	1218	448.0000	-10.0000	14.1000

Name	Node No.	Pier		
		X	Y	Z
Support	3101	1.0000	4.2500	16.8172
	3102	1.0000	4.2500	14.1001
	3103	1.0000	4.2500	14.1000
	3104	1.0000	-4.2500	16.8172
	3105	1.0000	-4.2500	14.1001
	3106	1.0000	-4.2500	14.1000
	3107	1.0000	0.0000	14.1001
	3108	1.0000	0.0000	14.1000
	3111	-1.0000	8.1500	17.5000
	3112	-1.0000	8.1500	14.1000
	3113	-1.0000	4.5500	17.5000
	3114	-1.0000	4.5500	14.1000
	3115	-1.0000	-4.5500	17.5000
	3116	-1.0000	-4.5500	14.1000
	3117	-1.0000	-8.1500	17.5000
	3118	-1.0000	-8.1500	14.1000
	3201	112.0000	4.0850	17.0496
	3202	112.0000	4.0850	13.4001
	3203	112.0000	4.0850	13.4000
	3204	112.0000	-4.0850	17.0496
	3205	112.0000	-4.0850	13.4001
	3206	112.0000	-4.0850	13.4000
	3208	112.0000	1.2500	17.0496
	3209	112.0000	-1.2500	17.0496
	3301	336.0000	4.0850	17.0496
	3302	336.0000	4.0850	13.4001
	3303	336.0000	4.0850	13.4000
	3304	336.0000	-4.0850	17.0496
	3305	336.0000	-4.0850	13.4001
	3306	336.0000	-4.0850	13.4000
	3308	336.0000	1.2500	17.0496
	3309	336.0000	-1.2500	17.0496
	3401	447.0000	4.2500	16.8172
	3402	447.0000	4.2500	14.1001
	3403	447.0000	4.2500	14.1000
	3404	447.0000	-4.2500	16.8172
	3405	447.0000	-4.2500	14.1001
	3406	447.0000	-4.2500	14.1000
	3407	447.0000	0.0000	14.1001
	3408	447.0000	0.0000	14.1000
	3411	449.2000	8.1780	17.7000
	3412	449.2000	8.1780	14.1000
	3413	449.2000	4.1000	17.7000
	3414	449.2000	4.1000	14.1000
	3415	449.2000	-4.1000	17.7000
	3416	449.2000	-4.1000	14.1000
	3417	449.2000	-8.1780	17.7000
	3418	449.2000	-8.1780	14.1000

(2) Member Rigidity

・Girder Rigidity

	Element	Node No.		A	Ix	Iz	Iy
Girder	1	1	2	0.933870	1.891085	29.096652	1.030202
	2	2	3	0.933870	1.891085	29.096652	1.030202
	3	3	4	0.933870	1.891085	29.096652	1.030202
	4	4	5	0.933870	1.891085	29.096652	1.030202
	5	5	6	0.933870	1.891085	29.096652	1.030202
	6	6	7	0.933870	1.891085	29.096652	1.030202
	7	7	8	0.933870	1.891085	29.096652	1.030202
	8	8	9	0.933870	1.891085	29.096652	1.030202
	9	9	10	0.933870	1.891085	29.096652	1.030202
	10	10	11	0.933870	1.891085	29.096652	1.030202
	11	11	12	0.933870	1.891085	29.096652	1.030202
	12	12	13	0.933870	1.891085	29.096652	1.030202
	13	13	14	0.933870	1.891085	29.096652	1.030202
	14	14	15	0.933870	1.891085	29.096652	1.030202
	15	15	16	0.933870	1.891085	29.096652	1.030202
	16	16	17	0.933870	1.891085	29.096652	1.030202
	17	17	18	0.933870	1.891085	29.096652	1.030202
	18	18	19	0.933870	1.891085	29.096652	1.030202
	19	19	20	0.933870	1.891085	29.096652	1.030202
	20	20	21	0.933870	1.891085	29.096652	1.030202
	21	21	22	0.933870	1.891085	29.096652	1.030202
	22	22	23	0.933870	1.891085	29.096652	1.030202
	23	23	24	0.933870	1.891085	29.096652	1.030202
	24	24	25	0.933870	1.891085	29.096652	1.030202
	25	25	26	0.930264	1.868521	29.068737	1.017316
	26	26	27	0.904650	1.718179	28.865650	0.931837
	27	27	28	0.904650	1.718179	28.865650	0.931837
	28	28	29	0.904650	1.718179	28.865650	0.931837
	29	29	30	0.904650	1.718179	28.865650	0.931837
	30	30	31	0.904650	1.718179	28.865650	0.931837
	31	31	32	0.904650	1.718179	28.865650	0.931837
	32	32	33	0.904650	1.718179	28.865650	0.931837
	33	33	34	0.904650	1.718179	28.865650	0.931837
	34	34	35	0.904650	1.718179	28.865650	0.931837
	35	35	36	0.904650	1.718179	28.865650	0.931837
	36	36	37	0.904650	1.718179	28.865650	0.931837
	37	37	38	0.904650	1.718179	28.865650	0.931837
	38	38	39	0.904650	1.718179	28.865650	0.931837
	39	39	40	0.904650	1.718179	28.865650	0.931837
	40	40	41	0.904650	1.718179	28.865650	0.931837
	41	41	42	0.904650	1.718179	28.865650	0.931837
	42	42	43	0.904650	1.718179	28.865650	0.931837
	43	43	44	0.904650	1.718179	28.865650	0.931837
	44	44	45	0.904650	1.718179	28.865650	0.931837
	45	45	46	1.000588	1.978928	29.853355	1.016358
	46	46	47	1.015270	2.020746	29.993304	1.029086
	47	47	48	1.015270	2.020746	29.993304	1.029086
	48	48	49	1.015270	2.020746	29.993304	1.029086
	49	49	50	1.015270	2.020746	29.993304	1.029086
	50	50	51	10	100	100	100
	51	51	52	10	100	100	100
	52	52	53	10	100	100	100
	53	53	54	10	100	100	100
	54	54	55	1.015270	2.020746	29.993304	1.029086
	55	55	56	1.015270	2.020746	29.993304	1.029086
	56	56	57	1.015270	2.020746	29.993304	1.029086
	57	57	58	1.015270	2.020746	29.993304	1.029086
	58	58	59	1.000588	1.978928	29.853355	1.016535
	59	59	60	0.904650	1.718179	28.865650	0.933080
	60	60	61	0.904650	1.718179	28.865650	0.933080

	Element	Node No.		A	Ix	Iz	Iy
Girder	61	61	62	0.904650	1.718179	28.865650	0.933080
	62	62	63	0.904650	1.718179	28.865650	0.933080
	63	63	64	0.904650	1.718179	28.865650	0.933080
	64	64	65	0.904650	1.718179	28.865650	0.933080
	65	65	66	0.904650	1.718179	28.865650	0.933080
	66	66	67	0.904650	1.718179	28.865650	0.933080
	67	67	68	0.904650	1.718179	28.865650	0.933080
	68	68	69	0.904650	1.718179	28.865650	0.933080
	69	69	70	0.904650	1.718179	28.865650	0.933080
	70	70	71	0.904650	1.718179	28.865650	0.933080
	71	71	72	0.904650	1.718179	28.865650	0.933080
	72	72	73	0.904650	1.718179	28.865650	0.933080
	73	73	74	0.904650	1.718179	28.865650	0.933080
	74	74	75	0.904650	1.718179	28.865650	0.933080
	75	75	76	0.904650	1.718179	28.865650	0.933080
	76	76	77	0.904650	1.718179	28.865650	0.933080
	77	77	78	0.904650	1.718179	28.865650	0.933080
	78	78	79	0.904650	1.718179	28.865650	0.933080
	79	79	80	0.904650	1.718179	28.865650	0.933080
	80	80	81	0.904650	1.718179	28.865650	0.933080
	81	81	82	0.904650	1.718179	28.865650	0.933080
	82	82	83	0.904650	1.718179	28.865650	0.933080
	83	83	84	0.904650	1.718179	28.865650	0.933080
	84	84	85	0.904650	1.718179	28.865650	0.933080
	85	85	86	0.904650	1.718179	28.865650	0.933080
	86	86	87	0.904650	1.718179	28.865650	0.933080
	87	87	88	0.904650	1.718179	28.865650	0.933080
	88	88	89	0.904650	1.718179	28.865650	0.933080
	89	89	90	0.904650	1.718179	28.865650	0.933080
	90	90	91	0.904650	1.718179	28.865650	0.933080
	91	91	92	0.904650	1.718179	28.865650	0.933080
	92	92	93	0.904650	1.718179	28.865650	0.933080
	93	93	94	0.904650	1.718179	28.865650	0.933080
	94	94	95	0.904650	1.718179	28.865650	0.933080
	95	95	96	0.904650	1.718179	28.865650	0.933080
	96	96	97	0.904650	1.718179	28.865650	0.933080
	97	97	98	0.904650	1.718179	28.865650	0.933080
	98	98	99	0.904650	1.718179	28.865650	0.933080
	99	99	100	0.904650	1.718179	28.865650	0.933080
	100	100	101	0.904650	1.718179	28.865650	0.933080
	101	101	102	0.904650	1.718179	28.865650	0.933080
	102	102	103	0.904650	1.718179	28.865650	0.933080
	103	103	104	0.904650	1.718179	28.865650	0.933080
	104	104	105	0.904650	1.718179	28.865650	0.933080
	105	105	106	0.904650	1.718179	28.865650	0.933080
	106	106	107	0.904650	1.718179	28.865650	0.933080
	107	107	108	0.904650	1.718179	28.865650	0.933080
	108	108	109	0.904650	1.718179	28.865650	0.933080
	109	109	110	0.904650	1.718179	28.865650	0.933080
	110	110	111	0.904650	1.718179	28.865650	0.933080
	111	111	112	0.904650	1.718179	28.865650	0.933080
	112	112	113	0.904650	1.718179	28.865650	0.933080
	113	113	114	0.904650	1.718179	28.865650	0.933080
	114	114	115	0.904650	1.718179	28.865650	0.933080
	115	115	116	0.904650	1.718179	28.865650	0.933080
	116	116	117	0.904650	1.718179	28.865650	0.933080
	117	117	118	0.904650	1.718179	28.865650	0.933080
	118	118	119	0.904650	1.718179	28.865650	0.933080
	119	119	120	0.904650	1.718179	28.865650	0.933080
	120	120	121	0.904650	1.718179	28.865650	0.933080
	121	121	122	0.904650	1.718179	28.865650	0.933080
	122	122	123	0.904650	1.718179	28.865650	0.933080

	Element	Node No.		A	Ix	Iz	Iy
Girder	123	123	124	0.904650	1.718179	28.865650	0.933080
	124	124	125	0.904650	1.718179	28.865650	0.933080
	125	125	126	0.904650	1.718179	28.865650	0.933080
	126	126	127	0.904650	1.718179	28.865650	0.933080
	127	127	128	0.904650	1.718179	28.865650	0.933080
	128	128	129	0.904650	1.718179	28.865650	0.933080
	129	129	130	0.904650	1.718179	28.865650	0.933080
	130	130	131	0.904650	1.718179	28.865650	0.933080
	131	131	132	0.904650	1.718179	28.865650	0.933080
	132	132	133	0.904650	1.718179	28.865650	0.933080
	133	133	134	0.904650	1.718179	28.865650	0.933080
	134	134	135	0.904650	1.718179	28.865650	0.933080
	135	135	136	0.904650	1.718179	28.865650	0.933080
	136	136	137	0.904650	1.718179	28.865650	0.933080
	137	137	138	0.904650	1.718179	28.865650	0.933080
	138	138	139	0.904650	1.718179	28.865650	0.933080
	139	139	140	0.904650	1.718179	28.865650	0.933080
	140	140	141	0.904650	1.718179	28.865650	0.933080
	141	141	142	0.904650	1.718179	28.865650	0.933080
	142	142	143	0.904650	1.718179	28.865650	0.933080
	143	143	144	0.904650	1.718179	28.865650	0.933080
	144	144	145	0.904650	1.718179	28.865650	0.933080
	145	145	146	0.904650	1.718179	28.865650	0.933080
	146	146	147	0.904650	1.718179	28.865650	0.933080
	147	147	148	0.904650	1.718179	28.865650	0.933080
	148	148	149	0.904650	1.718179	28.865650	0.933080
	149	149	150	0.904650	1.718179	28.865650	0.933080
	150	150	151	0.904650	1.718179	28.865650	0.933080
	151	151	152	1.000588	1.978928	29.853355	1.016535
	152	152	153	1.015270	2.020746	29.993304	1.029086
	153	153	154	1.015270	2.020746	29.993304	1.029086
	154	154	155	1.015270	2.020746	29.993304	1.029086
	155	155	156	1.015270	2.020746	29.993304	1.029086
	156	156	157	10	100	100	100
	157	157	158	10	100	100	100
	158	158	159	10	100	100	100
	159	159	160	10	100	100	100
	160	160	161	1.015270	2.020746	29.993304	1.029086
	161	161	162	1.015270	2.020746	29.993304	1.029086
	162	162	163	1.015270	2.020746	29.993304	1.029086
	163	163	164	1.015270	2.020746	29.993304	1.029086
	164	164	165	1.000588	1.978928	29.853355	1.016358
	165	165	166	0.904650	1.718179	28.865650	0.931837
	166	166	167	0.904650	1.718179	28.865650	0.931837
	167	167	168	0.904650	1.718179	28.865650	0.931837
	168	168	169	0.904650	1.718179	28.865650	0.931837
	169	169	170	0.904650	1.718179	28.865650	0.931837
	170	170	171	0.904650	1.718179	28.865650	0.931837
	171	171	172	0.904650	1.718179	28.865650	0.931837
	172	172	173	0.904650	1.718179	28.865650	0.931837
	173	173	174	0.904650	1.718179	28.865650	0.931837
	174	174	175	0.904650	1.718179	28.865650	0.931837
	175	175	176	0.904650	1.718179	28.865650	0.931837
	176	176	177	0.904650	1.718179	28.865650	0.931837
	177	177	178	0.904650	1.718179	28.865650	0.931837
	178	178	179	0.904650	1.718179	28.865650	0.931837
	179	179	180	0.904650	1.718179	28.865650	0.931837
	180	180	181	0.904650	1.718179	28.865650	0.931837
	181	181	182	0.904650	1.718179	28.865650	0.931837
	182	182	183	0.904650	1.718179	28.865650	0.931837
	183	183	184	0.904650	1.718179	28.865650	0.931837
	184	184	185	0.930264	1.868521	29.068737	1.017316

	Element	Node No.		A	Ix	Iz	Iy
Girder	185	185	186	0.933870	1.891085	29.096652	1.030202
	186	186	187	0.933870	1.891085	29.096652	1.030202
	187	187	188	0.933870	1.891085	29.096652	1.030202
	188	188	189	0.933870	1.891085	29.096652	1.030202
	189	189	190	0.933870	1.891085	29.096652	1.030202
	190	190	191	0.933870	1.891085	29.096652	1.030202
	191	191	192	0.933870	1.891085	29.096652	1.030202
	192	192	193	0.933870	1.891085	29.096652	1.030202
	193	193	194	0.933870	1.891085	29.096652	1.030202
	194	194	195	0.933870	1.891085	29.096652	1.030202
	195	195	196	0.933870	1.891085	29.096652	1.030202
	196	196	197	0.933870	1.891085	29.096652	1.030202
	197	197	198	0.933870	1.891085	29.096652	1.030202
	198	198	199	0.933870	1.891085	29.096652	1.030202
	199	199	200	0.933870	1.891085	29.096652	1.030202
	200	200	201	0.933870	1.891085	29.096652	1.030202
	201	201	202	0.933870	1.891085	29.096652	1.030202
	202	202	203	0.933870	1.891085	29.096652	1.030202
	203	203	204	0.933870	1.891085	29.096652	1.030202
	204	204	205	0.933870	1.891085	29.096652	1.030202
	205	205	206	0.933870	1.891085	29.096652	1.030202
	206	206	207	0.933870	1.891085	29.096652	1.030202
	207	207	208	0.933870	1.891085	29.096652	1.030202
	208	208	209	0.933870	1.891085	29.096652	1.030202

・Rigidity of Tower

	Element	Node No.		A	Ix	Iz	Iy
P11 Tower	501	501	52	10	100	100	100
	502	502	501	0.468600	0.688738	0.482573	0.609102
	503	503	502	0.468600	0.688738	0.482573	0.609102
	504	504	503	0.468600	0.688738	0.482573	0.609102
	505	505	504	0.468600	0.688738	0.482573	0.609102
	506	506	505	0.468600	0.688738	0.482573	0.609102
	507	507	506	0.468600	0.688738	0.482573	0.609102
	508	508	507	0.526340	0.782780	0.537639	0.688228
	509	509	508	0.526340	0.782780	0.537639	0.688228
	510	510	509	0.526340	0.782780	0.537639	0.688228
	511	511	510	0.526340	0.782780	0.537639	0.688228
	512	512	511	0.526340	0.782780	0.537639	0.688228
	513	513	512	0.526340	0.782780	0.537639	0.688228
	514	514	513	0.526340	0.782780	0.537639	0.688228
	515	515	514	0.526340	0.782780	0.537639	0.688228
	516	516	515	0.526340	0.782780	0.537639	0.688228
	517	517	516	0.526340	0.782780	0.537639	0.688228
	518	518	517	0.526340	0.782780	0.537639	0.688228
	519	519	518	0.526340	0.782780	0.537639	0.688228
	520	520	519	0.526340	0.782780	0.537639	0.688228
	521	521	520	0.526340	0.782780	0.537639	0.688228
P12 Tower	601	601	158	10	100	100	100
	602	602	601	0.468600	0.688738	0.482573	0.609102
	603	603	602	0.468600	0.688738	0.482573	0.609102
	604	604	603	0.468600	0.688738	0.482573	0.609102
	605	605	604	0.468600	0.688738	0.482573	0.609102
	606	606	605	0.468600	0.688738	0.482573	0.609102
	607	607	606	0.468600	0.688738	0.482573	0.609102
	608	608	607	0.526340	0.782780	0.537639	0.688228
	609	609	608	0.526340	0.782780	0.537639	0.688228
	610	610	609	0.526340	0.782780	0.537639	0.688228
	611	611	610	0.526340	0.782780	0.537639	0.688228
	612	612	611	0.526340	0.782780	0.537639	0.688228
	613	613	612	0.526340	0.782780	0.537639	0.688228
	614	614	613	0.526340	0.782780	0.537639	0.688228
	615	615	614	0.526340	0.782780	0.537639	0.688228
	616	616	615	0.526340	0.782780	0.537639	0.688228
	617	617	616	0.526340	0.782780	0.537639	0.688228
	618	618	617	0.526340	0.782780	0.537639	0.688228
	619	619	618	0.526340	0.782780	0.537639	0.688228
	620	620	619	0.526340	0.782780	0.537639	0.688228
	621	621	620	0.526340	0.782780	0.537639	0.688228

・Ridigity of Cable

	Element	Node No.		A	Ix	Iz	Iy
K1	401	3	520	0.010255	0.000000	0.000000	0.000000
K2	402	7	519	0.010255	0.000000	0.000000	0.000000
K3	403	11	518	0.010255	0.000000	0.000000	0.000000
K4	404	15	517	0.010255	0.000000	0.000000	0.000000
K5	405	19	516	0.010255	0.000000	0.000000	0.000000
K6	406	23	515	0.005420	0.000000	0.000000	0.000000
K7	407	27	514	0.005420	0.000000	0.000000	0.000000
K8	408	31	513	0.005420	0.000000	0.000000	0.000000
K9	409	35	512	0.005420	0.000000	0.000000	0.000000
K10	410	39	511	0.005420	0.000000	0.000000	0.000000
K11	411	101	520	0.010255	0.000000	0.000000	0.000000
K12	412	97	519	0.010255	0.000000	0.000000	0.000000
K13	413	93	518	0.010255	0.000000	0.000000	0.000000
K14	414	89	517	0.010255	0.000000	0.000000	0.000000
K15	415	85	516	0.010255	0.000000	0.000000	0.000000
K16	416	81	515	0.005420	0.000000	0.000000	0.000000
K17	417	77	514	0.005420	0.000000	0.000000	0.000000
K18	418	73	513	0.005420	0.000000	0.000000	0.000000
K19	419	69	512	0.005420	0.000000	0.000000	0.000000
K20	420	65	511	0.005420	0.000000	0.000000	0.000000
K21	421	109	620	0.010255	0.000000	0.000000	0.000000
K22	422	113	619	0.010255	0.000000	0.000000	0.000000
K23	423	117	618	0.010255	0.000000	0.000000	0.000000
K24	424	121	617	0.010255	0.000000	0.000000	0.000000
K25	425	125	616	0.010255	0.000000	0.000000	0.000000
K26	426	129	615	0.005420	0.000000	0.000000	0.000000
K27	427	133	614	0.005420	0.000000	0.000000	0.000000
K28	428	137	613	0.005420	0.000000	0.000000	0.000000
K29	429	141	612	0.005420	0.000000	0.000000	0.000000
K30	430	145	611	0.005420	0.000000	0.000000	0.000000
K31	431	207	620	0.010255	0.000000	0.000000	0.000000
K32	432	203	619	0.010255	0.000000	0.000000	0.000000
K33	433	199	618	0.010255	0.000000	0.000000	0.000000
K34	434	195	617	0.010255	0.000000	0.000000	0.000000
K35	435	191	616	0.010255	0.000000	0.000000	0.000000
K36	436	187	615	0.005420	0.000000	0.000000	0.000000
K37	437	183	614	0.005420	0.000000	0.000000	0.000000
K38	438	179	613	0.005420	0.000000	0.000000	0.000000
K39	439	175	612	0.005420	0.000000	0.000000	0.000000
K40	440	171	611	0.005420	0.000000	0.000000	0.000000

・Virtual Member (Support)

	Element	Node No.		A	Ix	Iz	Iy
P10	3101	3101	1	10	100	100	100
	3102	1	3104	10	100	100	100
	3103	3101	3102	10	100	100	100
	3104	1	3107	10	100	100	100
	3105	3104	3105	10	100	100	100
	3106	914	3103	10000	10000	10000	10000
	3107	901	3108	10000	10000	10000	10000
	3108	915	3106	10000	10000	10000	10000
	3111	3112	912	10000	10000	10000	10000
	3112	3114	913	10000	10000	10000	10000
	3113	3116	916	10000	10000	10000	10000
	3114	3118	917	10000	10000	10000	10000
	3115	3112	3111	10000	10000	10000	10000
	3116	3114	3113	10000	10000	10000	10000
	3117	3116	3115	10000	10000	10000	10000
	3118	3118	3117	10000	10000	10000	10000
	3119	3111	3113	10000	10000	10000	10000
	3120	3115	3117	10000	10000	10000	10000
P11	3201	3201	3208	0.415358	0.455871	100	0.371025
	3202	3208	52	10	100	100	100
	3203	52	3209	10	100	100	100
	3204	3209	3204	0.415358	0.455871	100	0.371025
	3205	3201	3202	10	100	100	100
	3206	52	1011	10	100	100	100
	3207	3204	3205	10	100	100	100
	3208	3203	1001	10000	10000	10000	10000
	3209	1001	3206	10000	10000	10000	10000
P12	3301	3301	3308	0.415358	0.455871	100	0.371025
	3302	3308	158	10	100	100	100
	3303	158	3309	10	100	100	100
	3304	3309	3304	0.415358	0.455871	100	0.371025
	3305	3301	3302	10	100	100	100
	3306	158	1111	10	100	100	100
	3307	3304	3305	10	100	100	100
	3308	3303	1101	10000	10000	10000	10000
	3309	1101	3306	10000	10000	10000	10000
P13	3401	3401	209	10	100	100	100
	3402	209	3404	10	100	100	100
	3403	3401	3402	10	100	100	100
	3404	209	3407	10	100	100	100
	3405	3404	3405	10	100	100	100
	3406	3403	1213	10000	10000	10000	10000
	3407	3408	1201	10000	10000	10000	10000
	3408	3406	1216	10000	10000	10000	10000
	3411	1212	3412	10000	10000	10000	10000
	3412	1214	3414	10000	10000	10000	10000
	3413	1215	3416	10000	10000	10000	10000
	3414	1217	3418	10000	10000	10000	10000
	3415	3412	3411	10	100	100	100
	3416	3414	3413	10	100	100	100
	3417	3416	3415	10	100	100	100
	3418	3418	3417	10	100	100	100
	3419	3411	3413	10	100	100	100
	3420	3413	3415	10	100	100	100
	3421	3415	3417	10	100	100	100

・Pier

	Element	Node No.		A	Ix	Iz	Iy
P10	901	901	902	10000	10000	10000	10000
	902	902	903	94.7859	1119.6495	1324.6418	392.5369
	903	903	904	77.9286	811.7399	752.3293	313.5187
	911	911	912	10000	10000	10000	10000
	912	912	913	10000	10000	10000	10000
	913	913	914	10000	10000	10000	10000
	914	914	901	10000	10000	10000	10000
	915	901	915	10000	10000	10000	10000
	916	915	916	10000	10000	10000	10000
	917	916	917	10000	10000	10000	10000
	918	917	918	10000	10000	10000	10000
P11	1001	1001	1002	10000	10000	10000	10000
	1002	1002	1003	83.0040	903.5506	901.9877	337.3095
	1003	1003	1004	77.9286	811.7399	752.3293	313.5187
P12	1101	1101	1102	10000	10000	10000	10000
	1102	1102	1103	83.0040	903.5506	901.9877	337.3095
	1103	1103	1104	77.9286	811.7399	752.3293	313.5187
P13	1201	1201	1202	10000	10000	10000	10000
	1202	1202	1203	94.78587	1120	1325	393
	1203	1203	1204	77.9286	812	752	314
	1211	1211	1212	10000	10000	10000	10000
	1212	1212	1213	10000	10000	10000	10000
	1213	1213	1214	10000	10000	10000	10000
	1214	1214	1201	10000	10000	10000	10000
	1215	1201	1215	10000	10000	10000	10000
	1216	1215	1216	10000	10000	10000	10000
	1217	1216	1217	10000	10000	10000	10000
	1218	1217	1218	10000	10000	10000	10000

(3)General Spring Support(Spring support element)

・ Normal

Pier No.	Node No.	SDx (kN/m)	SDy (kN/m)	SDz (kN/m)	SRx (kN·m/rad)	SRy (kN·m/rad)	SRz (kN·m/rad)	C1 (kN/rad)	C2 (kN/rad)
P10	904	2.444000E+06	2.491800E+06	1.000000E+12	8.492100E+08	6.946800E+08	1.000000E+12	-2.803900E+07	2.903700E+07
P11	1004	3.318900E+06	3.539900E+06	1.000000E+12	1.275400E+09	8.765900E+08	1.000000E+12	-3.456400E+07	3.917600E+07
P12	1104	2.491600E+06	2.705600E+06	1.000000E+12	1.251000E+09	8.615300E+08	1.000000E+12	-3.203500E+07	3.651800E+07
P13	1204	2.272800E+06	2.320000E+06	1.000000E+12	8.514800E+08	6.948500E+08	1.000000E+12	-2.723200E+07	2.813500E+07

・ Seismic

Pier No.	Node No.	SDx (kN/m)	SDy (kN/m)	SDz (kN/m)	SRx (kN·m/rad)	SRy (kN·m/rad)	SRz (kN·m/rad)	C1 (kN/rad)	C2 (kN/rad)
P10	904	9.541000E+06	9.679500E+06	1.000000E+12	1.542000E+09	1.247400E+09	1.000000E+12	-7.521600E+07	7.663100E+07
P11	1004	1.364000E+07	1.437900E+07	1.000000E+12	2.470300E+09	1.664900E+09	1.000000E+12	-9.883800E+07	1.086200E+08
P12	1104	9.772600E+06	1.045500E+07	1.000000E+12	2.280200E+09	1.566900E+09	1.000000E+12	-8.698800E+07	9.662300E+07
P13	1204	8.761100E+06	8.895200E+06	1.000000E+12	1.508200E+09	1.223000E+09	1.000000E+12	-7.163100E+07	7.303000E+07

SDx： X-axis spring constant (Longi.)
SDy： Y-axis spring constant (Trans.)
SDz： Z-axis spring constant (Vertical)

SRx： X-axis rotation spring constant
SRy： Y-axis rotation spring constant
SRz： Z-axis rotation spring constant

C1： Coupled Spring 1
C2： Coupled Spring 1

(4)General Link(Link Element)

・ Normal

Pier No.	NodeNo.		SDx (kN/m)	SDy (kN/m)	SDz (kN/m)	SRx (kN･m/rad)	SRy (kN･m/rad)	SRz (kN･m/rad)
P10	3107	3108	0.000000E+00	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
	3102	3103	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
	3105	3106	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
P11	1011	1001	1.000000E+12	1.000000E+12	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00
	3202	3203	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
	3205	3206	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
P12	1111	1101	1.000000E+12	1.000000E+12	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00
	3302	3303	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
	3305	3306	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
P13	3407	3408	0.000000E+00	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
	3402	3403	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
	3405	3406	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00

・ 下部工安定照査用支承断面力計算時(1支承線上の反力計算時)

Pier No.	NodeNo.		Dx (kN/m)	Dy (kN/m)	Dz (kN/m)	Rx (kN･m/rad)	Ry (kN･m/rad)	Rz (kN･m/rad)
P10	3107	3108	1.000000E+12	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	1.000000E+12
P11	1011	1001	1.000000E+12	1.000000E+12	1.000000E+12	0.000000E+00	0.000000E+00	1.000000E+12
P12	1111	1101	1.000000E+12	1.000000E+12	1.000000E+12	0.000000E+00	0.000000E+00	1.000000E+12
P13	3407	3408	1.000000E+12	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	1.000000E+12

Dx: x-axis spring constant (Vertical)
Dy: y-axis spring constant(Trans.)
Dz: z-axis spring constant(Longi.)

Rx: x-axis rotation spring constant
Ry: y-axis rotation spring constant
Rz: z-axis rotation spring constant

(5)Poing Spring Supports(Node spring support elemtns)

・Only before Closing

NodeNo.	SDx	SDy	SDz	SRx	SRy	SRz
	(kN/m)	(kN/m)	(kN/m)	(kN・m/rad)	(kN・m/rad)	(kN・m/rad)
105	1.000000E+12	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00

SDx: X-axis spring constant (Longi.)
SDy: Y-axis spring constant (Trans.)
SDz: Z-axis spring constant (Vertical)

SRx: X-axis rotation spring constant
SRy: Y-axis rotation spring constant
SRz: Z-axis rotation spring constant

(6)Young's Modulus

1)Girder, Tower, Pier

Girder: 2.000E+08 kN/m2
Tower: 2.000E+08 kN/m2
Pier: 2.800E+07 kN/m2

2)Cable

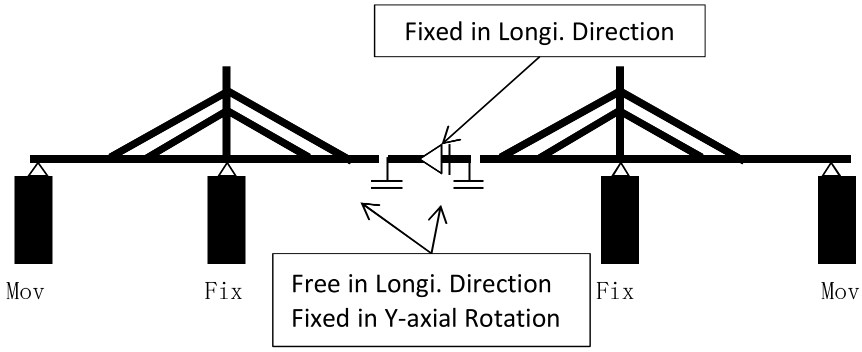
	Elem. No.	Modulus of elasticity of cable with sag							
		Cable Type	A (mm2)	Dead Load Tension TD	σ (N/mm2)	γ' (N/m)	γ (N/mm3)	Horiz. length l(m)	E EFF(kN/m2)
P11 Tower Side Span (Bottom ← Top)	401	70	10,255	4,370	426	885	8.63E-05	106	1.868E+08
	402	70	10,255	4,084	398	885	8.63E-05	97	1.867E+08
	403	70	10,255	3,866	377	885	8.63E-05	88	1.868E+08
	404	70	10,255	3,819	372	885	8.63E-05	79	1.873E+08
	405	70	10,255	4,066	396	885	8.63E-05	70	1.883E+08
	406	37	5,420	2,434	449	468	8.63E-05	61	1.891E+08
	407	37	5,420	2,689	496	468	8.63E-05	52	1.895E+08
	408	37	5,420	2,813	519	468	8.63E-05	43	1.897E+08
	409	37	5,420	2,857	527	468	8.63E-05	34	1.898E+08
	410	37	5,420	2,805	518	468	8.63E-05	25	1.899E+08
P11 Tower Main Span (Bottom ← Top)	411	70	10,255	4,358	425	885	8.63E-05	106	1.868E+08
	412	70	10,255	4,072	397	885	8.63E-05	97	1.867E+08
	413	70	10,255	3,853	376	885	8.63E-05	88	1.868E+08
	414	70	10,255	3,818	372	885	8.63E-05	79	1.873E+08
	415	70	10,255	4,055	395	885	8.63E-05	70	1.882E+08
	416	37	5,420	2,432	449	468	8.63E-05	61	1.891E+08
	417	37	5,420	2,682	495	468	8.63E-05	52	1.895E+08
	418	37	5,420	2,816	520	468	8.63E-05	43	1.897E+08
	419	37	5,420	2,859	527	468	8.63E-05	34	1.898E+08
	420	37	5,420	2,810	518	468	8.63E-05	25	1.899E+08
P12 Tower Main Span (Bottom ← Top)	421	70	10,255	4,358	425	885	8.63E-05	106	1.868E+08
	422	70	10,255	4,072	397	885	8.63E-05	97	1.867E+08
	423	70	10,255	3,853	376	885	8.63E-05	88	1.868E+08
	424	70	10,255	3,818	372	885	8.63E-05	79	1.873E+08
	425	70	10,255	4,055	395	885	8.63E-05	70	1.882E+08
	426	37	5,420	2,432	449	468	8.63E-05	61	1.891E+08
	427	37	5,420	2,682	495	468	8.63E-05	52	1.895E+08
	428	37	5,420	2,816	520	468	8.63E-05	43	1.897E+08
	429	37	5,420	2,859	527	468	8.63E-05	34	1.898E+08
	430	37	5,420	2,810	518	468	8.63E-05	25	1.899E+08
P12 Tower Side Span (Bottom ← Top)	431	70	10,255	4,370	426	885	8.63E-05	106	1.868E+08
	432	70	10,255	4,084	398	885	8.63E-05	97	1.867E+08
	433	70	10,255	3,866	377	885	8.63E-05	88	1.868E+08
	434	70	10,255	3,818	372	885	8.63E-05	79	1.873E+08
	435	70	10,255	4,066	396	885	8.63E-05	70	1.883E+08
	436	37	5,420	2,434	449	468	8.63E-05	61	1.891E+08
	437	37	5,420	2,689	496	468	8.63E-05	52	1.895E+08
	438	37	5,420	2,813	519	468	8.63E-05	43	1.897E+08
	439	37	5,420	2,857	527	468	8.63E-05	34	1.898E+08
	440	37	5,420	2,805	518	468	8.63E-05	25	1.899E+08

5. Load Strength

5.1 Superstructure Loads

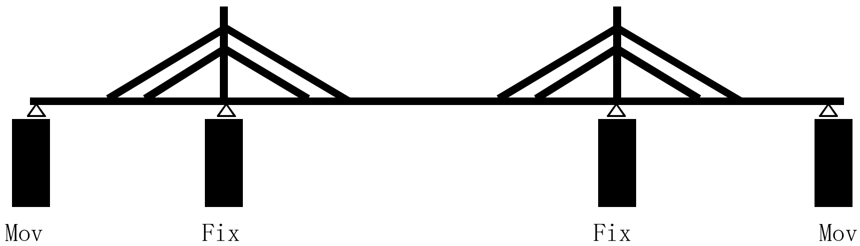
・ Considering the bridge construction steps, design loads were separated and loaded into two analysis models, i.e., before girder closing and after girder closing.

＜Before Closing Model＞



載荷荷重： Girder Weight
Tower Weight
Cable Weight
Pier Weight
Fairing
Attached Equipments
Rail for Inspection Car
Rocking Bearing
Pre-stressing

＜After Closing Model＞



Load Condition： All loads (exclude included loads in Before Closing Model)

(1) Dead Load

1) Before Closing

・ Girder Weight

Generel Part (Node No.：1～3, 39～65, 101～109, 145～171, 207～209)
105.00 kN/m

Cable Anchorage Part (Node No.：3～39, 65～101, 109～145, 171～207)
3.6t × 10 point × 9.80665 / 81.000 = 4.36 kN/m
105.00 + 4.36 = 109.36 kN/m
Weight for Cable Anchorage Part → 110.00 kN/m

・ Tower Weight

Generel Part (Node No.：501～511, 520～521, 601～611, 620～621)
43.00 kN/m

Cable Anchorage Part (Node No.：511～520, 611～620)
5.2t × 10 point × 9.80665 / 18.000 = 28.33 kN/m
43.00 + 28.33 = 71.33 kN/m
Weight for Cable Anchorage Part → 75.00 kN/m

・ Fairing 5.00 × 2 = 10.00 kN/m

・ Attached Equipments 6.00 × 1 = 6.00 kN/m

・ Rail for Inspection Car 1.50 × 2 = 3.00 kN/m

・ Rocking Bearing 100.00 kN

・ Cable Weight(see "(8)Cable load details")

(kN)

Girder Side			Tower Side				
	Node No.	Load		Node No.	Lower No.	Higher No.	Total
P11 Side Span	3	56	P11 Tower	520	56	56	112
	7	52		519	52	52	104
	11	48		518	48	48	96
	15	45		517	44	44	88
	19	41		516	40	40	80
	23	19		515	19	19	38
	27	17		514	17	17	34
	31	16		513	15	15	30
	35	14		512	14	14	28
	39	12		511	12	12	24
P11 Main Span	101	56	P12 Tower	620	56	56	112
	97	52		619	52	52	104
	93	48		618	48	48	96
	89	45		617	44	44	88
	85	41		616	40	40	80
	81	19		615	19	19	38
	77	17		614	17	17	34
	73	16		613	15	15	30
	69	14		612	14	14	28
	65	12		611	12	12	24
P12 Main Span	109	56					
	113	52					
	117	48					
	121	45					
	125	41					
	129	19					
	133	17					
	137	16					
	141	14					
	145	12					
P12 Side Span	207	56					
	203	52					
	199	48					
	195	45					
	191	41					
	187	19					
	183	17					
	179	16					
	175	14					
	171	12					

2) After Closing

- Pavement 0.080 × 9.000 × 22.5 × 2 = 32.40 kN/m

- Curb (0.330 + 0.342)/ 2 × 0.600 × 24.5 × 2 = 9.88 kN/m

- Median

Filling Concrete	0.080	×	2.500	×	23.0	×	1	=	4.60	kN/m
Curb (	0.330	+	0.318	)/	2	×	0.600			
				×	24.5	×	2	=	9.53	kN/m
							Σ	=	14.13	kN/m

- Railing 0.60 × 4 = 2.40 kN/m

- Additional Load 0.700 × 22.900 × 1 = 16.03 kN/m

- Girder End (on P10, P13 support)

Pavement	32.40	×	0.800	=	25.92	kN
Curb	9.88	×	0.800	=	7.90	kN
Median	14.13	×	0.800	=	11.30	kN
Railing	2.40	×	0.800	=	1.92	kN
Fairing	10.00	×	0.800	=	8.00	kN
Additional	16.03	×	0.800	=	12.82	kN
Attached Equipments	6.00	×	0.800	=	4.80	kN
			Σ	=	72.660	kN
				→	80.00	kN

(2) Cable Pre-stressing

Cable Pre-stress shall be decided by followings conditions
- The bending moment distribution along the main girder is smoothened.
- The tower must not be subjected to bending moment during the completed stage.
- During the final girder closing, the girders do not require any force (closing force, enforcement) → M≒0 at joint

(kN)

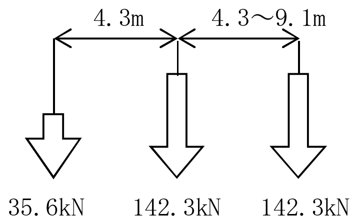
	Elem. No.	Load		Elem. No.	Load	
P11 Side Span	401	720	P12 Main Span	421	1420	Upper
	402	330		422	650	
	403	0		423	20	
	404	-170		424	-360	
	405	-50		425	-400	↓
	406	210		426	-20	
	407	470		427	220	
	408	700		428	470	
	409	1010		429	810	
	410	1450		430	1300	Lower
P11 Main Span	411	1420	P12 Side Span	431	720	Upper
	412	650		432	330	
	413	20		433	0	
	414	-360		434	-170	
	415	-400		435	-50	↓
	416	-20		436	210	
	417	220		437	470	
	418	470		438	700	
	419	810		439	1010	
	420	1300		440	1450	Lower

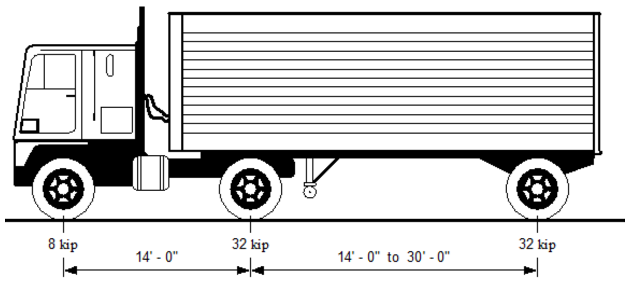
(3) Love Load

1) Live Load Strength

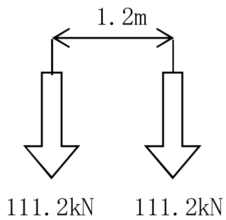
a . Design Load : AASHTO LRFD Bridge Design Specifications

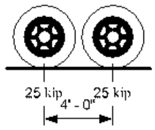
・ ①Truck Load



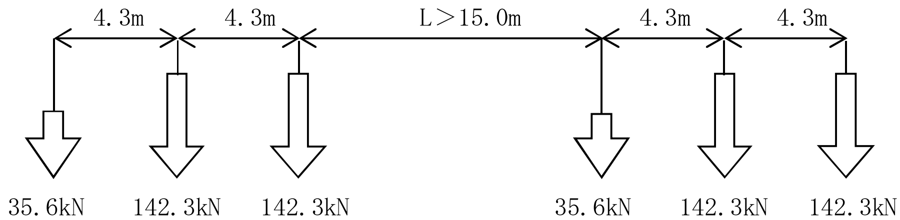


・ ②Tandem Load

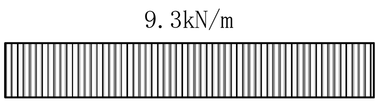




・ ③Truck Load (Negative bending section)



・ ④Lane Load



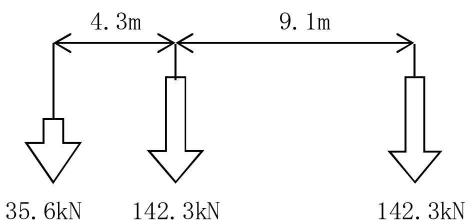
・ Load Combinations

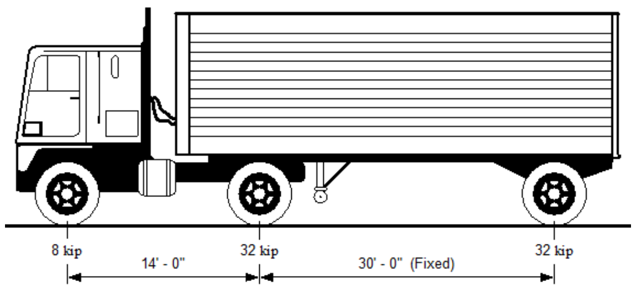
①+④

②+④

(③+④) ・0.9

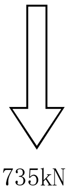
・ ⑤Fatigue Evaluation



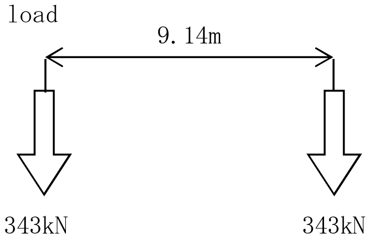


b．Desing Load：Special Load (only for main structure desing)

・①1 point load



・②2 points load



2) Impact Factor(follow JSHB)

・Girder
Impact Factor(Normal)　i=20/(50+L)
Impact Factor(Fatigue)　i=10/(50+L)

	Span L(m)	Normal	Fatigue
		Impact Factor i	Impact Factor i
1st Span	111.000	0.124	0.062
P11 intermediate support※	167.500	0.092	0.046
2nd Span	224.000	0.073	0.036
P12 intermediate support※	167.500	0.092	0.046
3rd Span	111.000	0.124	0.062

※Span Length for Intermediate Support
L=(1st Span L + 2nd Span L) / 2

・Tower　Normal:　0.150　Fatigue:　0.075

・Cable　Normal:　0.200　Fatigue:　0.100

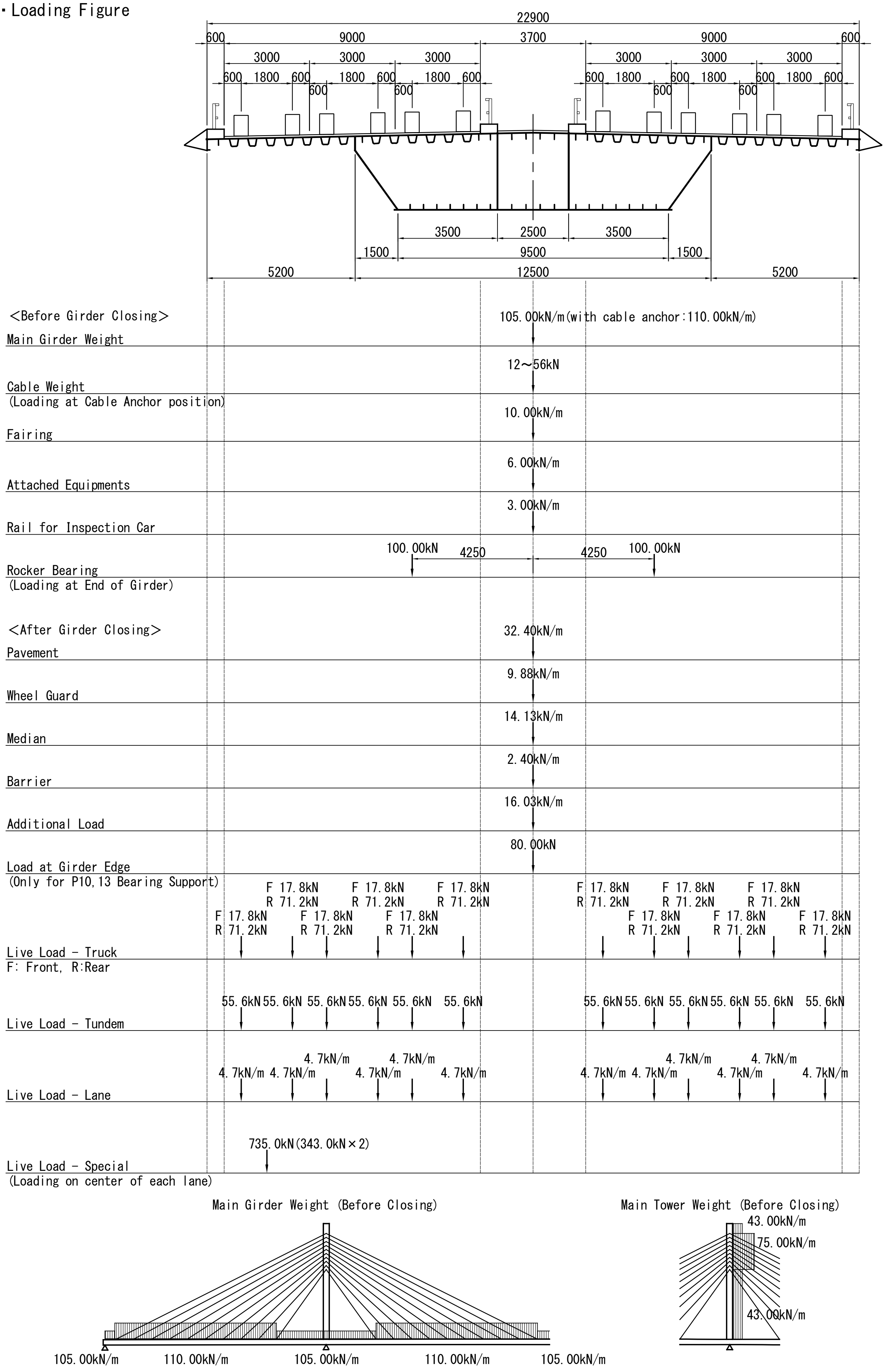
3) Multiple Presence of Live Load

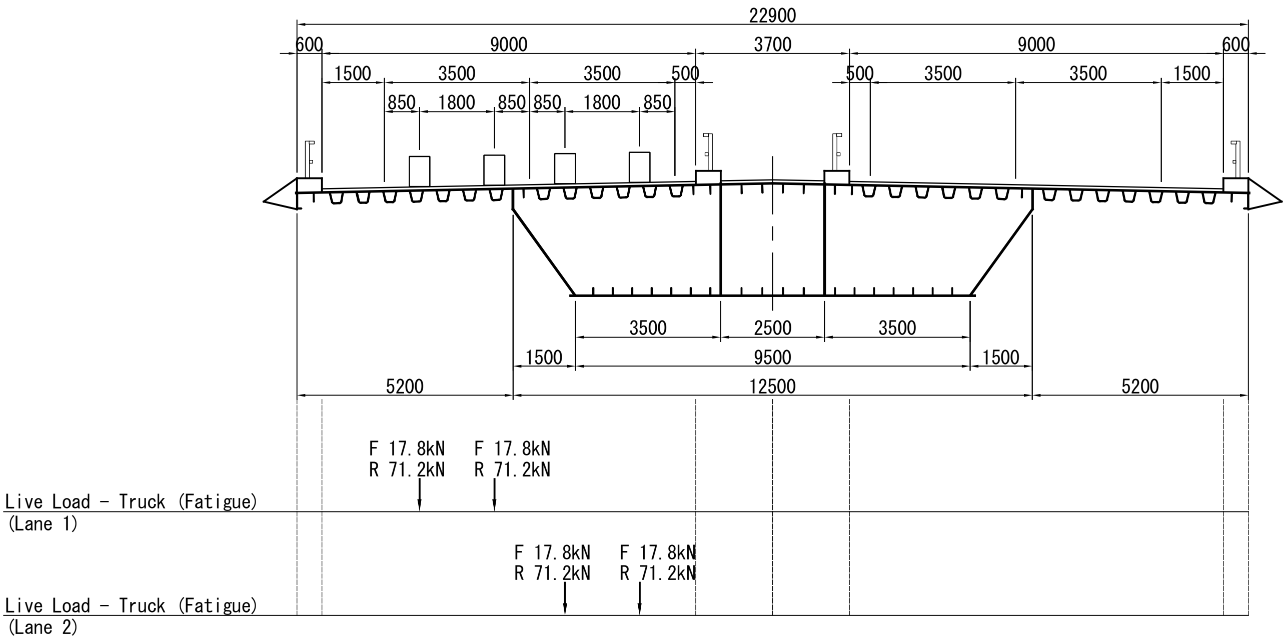
・Normal

Lane	Factor
1	1.20
2	1.00
3	0.85
＞3	0.65

・For Fatigue and Special Load：1.00

・Loading Figure




22900
600
9000
3700
9000
600
1500
3500
3500
500
500
3500
3500
1500
850
1800
850
850
1800
850
3500
2500
3500
1500
9500
1500
5200
12500
5200
F 17.8kN
R 71.2kN
F 17.8kN
R 71.2kN
Live Load - Truck (Fatigue)
(Lane 1)
F 17.8kN
R 71.2kN
F 17.8kN
R 71.2kN
Live Load - Truck (Fatigue)
(Lane 2)

(4) Temperature Load

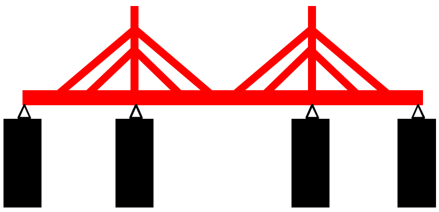
1) Temperature Load

①+	Temperature :	<u>+15℃</u>	Load Point : Girder, Tower, Cable
①-	Temperature :	<u>-15℃</u>	Load Point : Girder, Tower, Cable
②	Bending Moment due to the temperature difference +15℃		Load Point : Girder
③	Temperature :	<u>+15℃</u>	Load Point : Tower
④	Temperature :	<u>+15℃</u>	Load Point : Cable

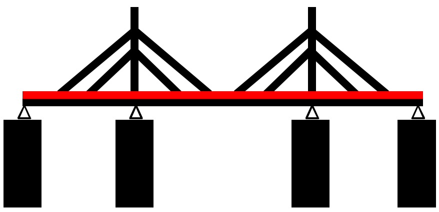
2) Combination Case

- The most severe stress resultants at each member shall be selected from the following cases

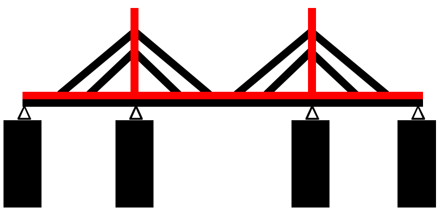
T1+(T1-) : ①+ or ①-



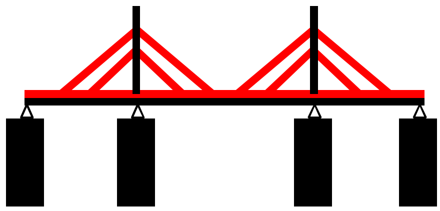
T2 : ②



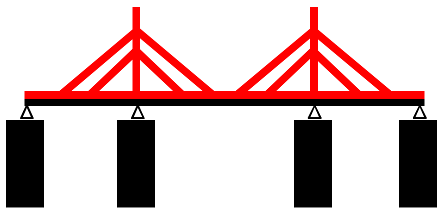
T3 : ②+③



T4 : ②+④



T5 : ②+③+④



3)Bending Moment due to Temperature Difference of Girder

Items	Symbol	Unit	Section①	Section②	Section③	Section④
Upper FLG Width	bfu	(mm)	22944	22944	22944	22944
Upper FLG Thickness	tfu	(mm)	16	16	16	16
Lower FLG Thickness	tl	(mm)	14	11	15	11
Outer WEB Thickness (per sheet)	two	(mm)	14	14	17	14
Inner WEB Thickness (per sheet)	twi	(mm)	14	14	17	14
Girder Height	h	(mm)	2700	2700	2700	2700
U-rib Section	Urib	(cm2)	1401. 40	1401. 40	1401. 40	1401. 40
Plate Rib Section	Rib	(cm2)	640. 00	640. 00	640. 00	640. 00
Rib Area Total	ΣArib	(cm2)	2041. 40	2041. 40	2041. 40	2041. 40
Rib Converted Upper Flange Thickness	tr=ΣArib/bfu	(mm)	9	9	9	9
Converted thickness of Upper Flange	tu=tfu+tr	(mm)	25	25	25	25
Steel Deck Cross Section Area(include Longi. Rib)	Au	(cm2)	5712. 44	5712. 44	5712. 44	5712. 44
Neutral Axis～Lower FLG Bottom Surface	d'	(cm)	181. 0	186. 5	172. 8	186. 5
Upper FLG Bottom Surface～Neutral Axis	d=h-tfu-d'	(cm)	87. 4	81. 9	95. 6	81. 9
Young's Modulus	E	(N/mm2)	200000	200000	200000	200000
Linear Expansion Coefficient	α	—	0. 000012	0. 000012	0. 000012	0. 000012
Tempareture Difference	t	(℃)	15	15	15	15
Effected Height of WEB Tempareture Difference	βh	(mm)	300	300	300	300
Web Cross Section Area of 300mm Height	βAw=βh・(2・two+2・twi)	(cm2)	168. 00	168. 00	204. 00	168. 00
Axial Force at Steel Deck	Pu=E・α・t・Au	(kN)	20565	20565	20565	20565
Axial Force at WEB	Pw=E・α・t・βAW/2	(kN)	302	302	367	302
Axial Force Total	P=Pu+Pw	(kN)	20867	20867	20932	20867
Bending Moment Mp caused by Axial Force P	Mp=Pu(d+tu/2)+Pw(d-βh/3)	(kN・m)	18465	17317	20231	17317
Eccentricity	H=Mp/P	(m)	0. 885	0. 830	0. 967	0. 830

(5) Superstructure Wind Load

- Reference Wind Speed U10 30 m/s

- Reference Height Z

Girder(Average height of girder at main span)
Planned Height

	Z	=	18.080 →	18.1 m

Tower(65% height of the tower)

Height・65%	58.000	×	0.65	=	37.700	
Road surface height				+	18.030	
			Z	=	55.730 →	55.8 m

Cable(Average height of girder at main span and that of tower height)

Tower Height	18.030	+	58.000	=	76.030 m	
(18.080 +	76.030)/		2	=	47.055 →	47.1 m

- Design Reference Wind Speed
  Ud = μ1・U10
  μ1=(Z/10)^(1/8)

Structure	Ref. Height Z(m)	μ1	U10(m/s)	Ud(m/s)
Girder	18.1	1.077	30	32.3
Tower	55.8	1.240	30	37.2
Cable	47.1	1.214	30	36.4

- Total Height of Bridge D

Railing	0.400 m	
Curb	0.250 m	
Pavement	0.080 m	
Girder Height	2.700 m	
Bot. Flange Thickness(assumption)	0.020 m	
D =	3.450 →	3.500 m

- Wind Load Loading Height for Girder

Total Height D/2	1.750 m	
Girder Height	-2.700 m	
Upper Surface of Slab - Analysis Frame	0.900 m	
Bot. Flange Thickness(assumption)	-0.020 m	
h =	-0.070 →	0.000 m

- Total Width B B = 22.900 m

- Drag Coefficient CD

B/D = 6.54

Drag coefficient for girder shall be calculated by following equations.
1≦B/D≦8 : 2.1-0.1(B/D)
B/D>8 : 1.3

Structure	CD
	Trans. Direction
Girder	1.45
Tower	1.80
Cable	0.70

- Projected Area A

Structure	A (m2)
	Trans. Direction
Girder	1561.0
Tower	173.0
Cable	719.2

・ Correction Factor μ

Object	Girder	Tower
Direction	Trans. Direction	Trans. Direction
Girder $\mu 2$	1.90	1.65
Tower $\mu 3$	1.90	1.65
Cable $\mu 2$	1.90	1.65

・ Wind Load(per unit area kN/m2)

Girder・Cable　　　　PD = 1/2・ρ・Ud^2・μ2・CD
Tower　　　　　　　　PD = 1/2・ρ・Ud^2・μ3・CD
ρ : Air Density (1.23kg/m3)

Object	Girder	Tower
Direction	Trans. Direction	Trans. Direction
Girder	1.77	1.54
Tower	2.91	2.53
Cable	1.08	0.94

・ Wind Load(per unit length kN/m)

Girder・Cable　　　　PD = 1/2・ρ・Ud^2・μ2・CD・h
Tower　　　　　　　　PD = 1/2・ρ・Ud^2・μ3・CD・h
ρ : Air Density (1.23kg/m3)

Object		Girder	Tower
Direction		Trans. Direction	Trans. Direction
Girder	h	3.500	3.500
	PD	6.2	5.4
Tower	h	3.000	3.000
	PD	8.7	7.6

<Reference>Calculation of Reference Wind Speed U10:30m/s

Relation of 3 sec instantaneous wind and U10:
Umax = U10 + kσ = U10 (1 + k(σ/U10)) = G・U10
Umax : 3 sec instantaneous wind speed(m/s)
U10 : Reference wind speed (Height: 10m, 10 min average wind speed) (m/s)
σ : Standard deviation of wind speed variation
σ/U10 : Intensity of turbulance
k : Peak factor (usual value: k = 3)
G : Gust factor, G = Umax／U10

Intensity of turbulance at Roughness Category II, 10m height (σ/U10) : 0.17
Therefore, G＝1 + k (σ/U10) ＝ 1 + 3 x 0.17 = 1.51
∴ U10＝44.7(m/s)／G＝44.7／1.51＝29.6(m/s) ⇒30.0(m/s)

2)Wind Load for Cable in Transverse Direction(see "(8)Cable LoadDetails")

・ For Girder Design

Girder Side		
	Node No.	Load
P11 Side Span	3	16
	7	15
	11	14
	15	12
	19	11
	23	7
	27	6
	31	6
	35	5
	39	4
P11 Main Span	101	16
	97	15
	93	14
	89	12
	85	11
	81	7
	77	6
	73	6
	69	5
	65	4
P12 Main Span	109	16
	113	15
	117	14
	121	12
	125	11
	129	7
	133	6
	137	6
	141	5
	145	4
P12 Side Span	207	16
	203	15
	199	14
	195	12
	191	11
	187	7
	183	6
	179	6
	175	5
	171	4

Tower Side				
	Node No.	Side Span	Main Span	Total
P11 Side Span	520	16	16	32
	519	15	15	30
	518	14	14	28
	517	12	12	24
	516	11	11	22
	515	7	7	14
	514	6	6	12
	513	6	6	12
	512	5	5	10
	511	4	4	8
P12 Side Span	620	16	16	32
	619	15	15	30
	618	14	14	28
	617	12	12	24
	616	11	11	22
	615	7	7	14
	614	6	6	12
	613	6	6	12
	612	5	5	10
	611	4	4	8

・ For Tower Design

Girder Side	Node No.	Load
P11 Side Span	3	14
	7	13
	11	12
	15	11
	19	10
	23	6
	27	6
	31	5
	35	4
	39	4
P11 Main Span	101	14
	97	13
	93	12
	89	11
	85	10
	81	6
	77	6
	73	5
	69	4
	65	4
P12 Main Span	109	14
	113	13
	117	12
	121	11
	125	10
	129	6
	133	6
	137	5
	141	4
	145	4
P12 Side Span	207	14
	203	13
	199	12
	195	11
	191	10
	187	6
	183	6
	179	5
	175	4
	171	4

Tower Side	Node No.	Side Span	Main Span	Total
P11 Side Span	520	14	14	28
	519	13	13	26
	518	12	12	24
	517	11	11	22
	516	10	10	20
	515	6	6	12
	514	6	6	12
	513	5	5	10
	512	4	4	8
	511	4	4	8
P12 Side Span	620	14	14	28
	619	13	13	26
	618	12	12	24
	617	11	11	22
	616	10	10	20
	615	6	6	12
	614	6	6	12
	613	5	5	10
	612	4	4	8
	611	4	4	8

3)Wind Load for Live Load

・ Load Strength

Ud = 32.3 m/s(Girder)

pd = 1/2・ρ・Ud^2・Cd・G

= 1/2 × 1.23 × 32.3^2 × 1.6 × 1.9 / 1000

= 1.951 kN/m2

w = 1.951kN/m2 / 2 × 1.00m2/m

= 0.976 kN/m → 1.0 kN/m

・ Wind Load Loading Height

Loading Position～Surface	1.500 m
Pavement	0.080 m
Slab Surface～Analysis Frame	0.900 m
h =	2.480 → 2.500 m

(6) Seismic Load

Design Horizontal Seismic Coefficient (Longi.・Trans.)

kh = 0.30

1) Girder

・General Part

Pavement	32.40	×	0.30		=	9.72 kN/m
Curb	9.88	×	0.30		=	2.96 kN/m
Median	14.13	×	0.30		=	4.24 kN/m
Railing	2.40	×	0.30		=	0.72 kN/m
Fairing	10.00	×	0.30		=	3.00 kN/m
Additional Load	16.03	×	0.30		=	4.81 kN/m
Attached Equipments	6.00	×	0.30		=	1.80 kN/m
Rail for Inspection Car	3.00	×	0.30		=	0.90 kN/m
Girder Weight	105.00	×	0.30		=	31.50 kN/m
				Σ	=	59.65 kN/m
					→	60 kN/m

・Cable Anchorage Part

Pavement	32.40	×	0.30		=	9.72 kN/m
Curb	9.88	×	0.30		=	2.96 kN/m
Median	14.13	×	0.30		=	4.24 kN/m
Railing	2.40	×	0.30		=	0.72 kN/m
Fairing	10.00	×	0.30		=	3.00 kN/m
Additional Load	16.03	×	0.30		=	4.81 kN/m
Attached Equipments	6.00	×	0.30		=	1.80 kN/m
Rail for Inspection Car	3.00	×	0.30		=	0.90 kN/m
Girder Weight	110.00	×	0.30		=	33.00 kN/m
				Σ	=	61.15 kN/m
					→	62 kN/m

2) Tower Weight	General Part	43.00	×	0.30	=	12.90 kN/m
					→	13 kN/m
	Cable Anchorage Part	75.00	×	0.30	=	22.50 kN/m
					→	23 kN/m

3) Girder End	72.66	×	0.30	=	21.80 kN
				→	22 kN/m
4) Rocking Bearing	100.00	×	0.30	=	30.00 kN
				→	30 kN/m

5) Cable

(kN)

Girder Side				
	Node No.	Dead Load	kh	Seismic Load
P11 Side Span	3	56	0.30	17
	7	52	0.30	16
	11	48	0.30	14
	15	45	0.30	14
	19	41	0.30	12
	23	19	0.30	6
	27	17	0.30	5
	31	16	0.30	5
	35	14	0.30	4
	39	12	0.30	4
P11 Main Span	101	56	0.30	17
	97	52	0.30	16
	93	48	0.30	14
	89	45	0.30	14
	85	41	0.30	12
	81	19	0.30	6
	77	17	0.30	5
	73	16	0.30	5
	69	14	0.30	4
	65	12	0.30	4
P12 Main Span	109	56	0.30	17
	113	52	0.30	16
	117	48	0.30	14
	121	45	0.30	14
	125	41	0.30	12
	129	19	0.30	6
	133	17	0.30	5
	137	16	0.30	5
	141	14	0.30	4
	145	12	0.30	4
P12 Side Span	207	56	0.30	17
	203	52	0.30	16
	199	48	0.30	14
	195	45	0.30	14
	191	41	0.30	12
	187	19	0.30	6
	183	17	0.30	5
	179	16	0.30	5
	175	14	0.30	4
	171	12	0.30	4

(kN)

Tower Side				
	Node No.	Dead Load	kh	Total
P11 Tower	520	112	0.30	34
	519	104	0.30	31
	518	96	0.30	29
	517	88	0.30	26
	516	80	0.30	24
	515	38	0.30	11
	514	34	0.30	10
	513	30	0.30	9
	512	28	0.30	8
	511	24	0.30	7
P12 Tower	620	112	0.30	34
	619	104	0.30	31
	618	96	0.30	29
	617	88	0.30	26
	616	80	0.30	24
	615	38	0.30	11
	614	34	0.30	10
	613	30	0.30	9
	612	28	0.30	8
	611	24	0.30	7

(7) Adjacent Load

P10 Pier	Dead Load	Left Girder	3050kN→	3300 kN(per bearing)
		Right Girder	3250kN→	3300 kN(per bearing)
	Love Load	Left Girder	1128kN→	1300 kN(per bearing)
		Right Girder	1208kN→	1300 kN(per bearing)
	Wind Load(Trans.)	Left Girder	100kN→	100 kN(per bearing)
		Right Girder	100kN→	100 kN(per bearing)
	Seismic Load(Longi.)	Left Girder	975kN→	1000 kN(per bearing)
		Right Girder	975kN→	1000 kN(per bearing)
	Seismic Load(Trans.)	Left Girder	675kN→	700 kN(per bearing)
		Right Girder	675kN→	700 kN(per bearing)
P13 Pier	Dead Load	G1・G4	2127kN→	2200 kN(per bearing)
		G2・G3	2125kN→	2200 kN(per bearing)
	Love Load	G1・G4	3034kN→	3100 kN(per bearing)
		G2・G3	3040kN→	3100 kN(per bearing)
	Wind Load(Trans.)	G1・G4	134kN→	200 kN(per bearing)
		G2・G3	134kN→	200 kN(per bearing)
	Seismic Load(Longi.)	G1・G4	220kN→	300 kN(per bearing)
		G2・G3	220kN→	300 kN(per bearing)
	Seismic Load(Trans.)	G1・G4	638kN→	700 kN(per bearing)
		G2・G3	638kN→	700 kN(per bearing)

(8)Cable Load Details

				Node No.		Type	Unit Weight (kN/m)	Cable Length L1(m)	Y-Z Plane Projected Length L2(m)	Cable Weight (kN)	Nodal Force at Anchorage Part				
				Girder	Tower						①Cable Weight (kN)	②Tower Anchorage (kN)	③Girder Anchorage (kN)	Tower Side①+② (kN)	Girder Side ①+③ (kN)
P11	Sipe Span	Upper	401	3	520	70	0.885	119.052	54.199	105.4	52.7	3.0	3.6	56	56
			402	7	519	70	0.885	110.142	52.175	97.5	48.8	3.0	3.6	52	52
			403	11	518	70	0.885	101.288	50.152	89.6	44.8	3.0	3.6	48	48
			404	15	517	70	0.885	92.507	48.130	81.9	41.0	3.0	3.6	44	45
		↓	405	19	516	70	0.885	83.821	46.109	74.2	37.1	3.0	3.6	40	41
			406	23	515	37	0.468	75.265	44.089	35.2	17.6	1.6	1.7	19	19
			407	27	514	37	0.468	66.887	42.070	31.3	15.7	1.6	1.7	17	17
			408	31	513	37	0.468	58.763	40.052	27.5	13.8	1.6	1.7	15	16
			409	35	512	37	0.468	51.016	38.035	23.9	12.0	1.6	1.7	14	14
		Lower	410	39	511	37	0.468	43.845	36.019	20.5	10.3	1.6	1.7	12	12
	Main Span	Upper	411	101	520	70	0.885	118.918	53.902	105.2	52.6	3.0	3.6	56	56
			412	97	519	70	0.885	110.013	51.903	97.4	48.7	3.0	3.6	52	52
			413	93	518	70	0.885	101.166	49.905	89.5	44.8	3.0	3.6	48	48
			414	89	517	70	0.885	92.392	47.908	81.8	40.9	3.0	3.6	44	45
		↓	415	85	516	70	0.885	83.714	45.913	74.1	37.1	3.0	3.6	40	41
			416	81	515	37	0.468	75.165	43.918	35.2	17.6	1.6	1.7	19	19
			417	77	514	37	0.468	66.795	41.924	31.3	15.7	1.6	1.7	17	17
			418	73	513	37	0.468	58.681	39.931	27.5	13.8	1.6	1.7	15	16
			419	69	512	37	0.468	50.945	37.940	23.8	11.9	1.6	1.7	14	14
		Lower	420	65	511	37	0.468	43.787	35.949	20.5	10.3	1.6	1.7	12	12
P12	Main Span	Upper	421	109	620	70	0.885	118.918	53.902	105.2	52.6	3.0	3.6	56	56
			422	113	619	70	0.885	110.013	51.903	97.4	48.7	3.0	3.6	52	52
			423	117	618	70	0.885	101.166	49.905	89.5	44.8	3.0	3.6	48	48
			424	121	617	70	0.885	92.392	47.908	81.8	40.9	3.0	3.6	44	45
		↓	425	125	616	70	0.885	83.714	45.913	74.1	37.1	3.0	3.6	40	41
			426	129	615	37	0.468	75.165	43.918	35.2	17.6	1.6	1.7	19	19
			427	133	614	37	0.468	66.795	41.924	31.3	15.7	1.6	1.7	17	17
			428	137	613	37	0.468	58.681	39.931	27.5	13.8	1.6	1.7	15	16
			429	141	612	37	0.468	50.945	37.940	23.8	11.9	1.6	1.7	14	14
		Lower	430	145	611	37	0.468	43.787	35.949	20.5	10.3	1.6	1.7	12	12
	Side Span	Upper	431	207	620	70	0.885	119.052	54.199	105.4	52.7	3.0	3.6	56	56
			432	203	619	70	0.885	110.142	52.175	97.5	48.8	3.0	3.6	52	52
			433	199	618	70	0.885	101.288	50.152	89.6	44.8	3.0	3.6	48	48
			434	195	617	70	0.885	92.507	48.130	81.9	41.0	3.0	3.6	44	45
		↓	435	191	616	70	0.885	83.821	46.109	74.2	37.1	3.0	3.6	40	41
			436	187	615	37	0.468	75.265	44.089	35.2	17.6	1.6	1.7	19	19
			437	183	614	37	0.468	66.887	42.070	31.3	15.7	1.6	1.7	17	17
			438	179	613	37	0.468	58.763	40.052	27.5	13.8	1.6	1.7	15	16
			439	175	612	37	0.468	51.016	38.035	23.9	12.0	1.6	1.7	14	14
		Lower	440	171	611	37	0.468	43.845	36.019	20.5	10.3	1.6	1.7	12	12

(8)Cable Load Details

				Node No.		Type	Trans. Direction Cable Projected Area		Trans. Direction Wind Load for Girder Design		Trans. Direction Wind Load for Tower Design	
				Girder	Tower		Protect Pipe Outer Dia. D(m)	Total Cross Section Area D×L1(m2)	per unit area w(kN/m2)	Desing Load w×D×L1(kN)	per unit area w(kN/m2)	Design Load w×D×L1(kN)
P11	Sipe Span	Upper ↓ Lower	401	3	520	70	0.250	29.8	1.08	16	0.94	14
			402	7	519	70	0.250	27.5	1.08	15	0.94	13
			403	11	518	70	0.250	25.3	1.08	14	0.94	12
			404	15	517	70	0.250	23.1	1.08	12	0.94	11
			405	19	516	70	0.250	21.0	1.08	11	0.94	10
			406	23	515	37	0.180	13.5	1.08	7	0.94	6
			407	27	514	37	0.180	12.0	1.08	6	0.94	6
			408	31	513	37	0.180	10.6	1.08	6	0.94	5
			409	35	512	37	0.180	9.2	1.08	5	0.94	4
			410	39	511	37	0.180	7.9	1.08	4	0.94	4
	Main Span	Upper ↓ Lower	411	101	520	70	0.250	29.7	1.08	16	0.94	14
			412	97	519	70	0.250	27.5	1.08	15	0.94	13
			413	93	518	70	0.250	25.3	1.08	14	0.94	12
			414	89	517	70	0.250	23.1	1.08	12	0.94	11
			415	85	516	70	0.250	20.9	1.08	11	0.94	10
			416	81	515	37	0.180	13.5	1.08	7	0.94	6
			417	77	514	37	0.180	12.0	1.08	6	0.94	6
			418	73	513	37	0.180	10.6	1.08	6	0.94	5
			419	69	512	37	0.180	9.2	1.08	5	0.94	4
			420	65	511	37	0.180	7.9	1.08	4	0.94	4
P12	Main Span	Upper ↓ Lower	421	109	620	70	0.250	29.7	1.08	16	0.94	14
			422	113	619	70	0.250	27.5	1.08	15	0.94	13
			423	117	618	70	0.250	25.3	1.08	14	0.94	12
			424	121	617	70	0.250	23.1	1.08	12	0.94	11
			425	125	616	70	0.250	20.9	1.08	11	0.94	10
			426	129	615	37	0.180	13.5	1.08	7	0.94	6
			427	133	614	37	0.180	12.0	1.08	6	0.94	6
			428	137	613	37	0.180	10.6	1.08	6	0.94	5
			429	141	612	37	0.180	9.2	1.08	5	0.94	4
			430	145	611	37	0.180	7.9	1.08	4	0.94	4
	Side Span	Upper ↓ Lower	431	207	620	70	0.250	29.8	1.08	16	0.94	14
			432	203	619	70	0.250	27.5	1.08	15	0.94	13
			433	199	618	70	0.250	25.3	1.08	14	0.94	12
			434	195	617	70	0.250	23.1	1.08	12	0.94	11
			435	191	616	70	0.250	21.0	1.08	11	0.94	10
			436	187	615	37	0.180	13.5	1.08	7	0.94	6
			437	183	614	37	0.180	12.0	1.08	6	0.94	6
			438	179	613	37	0.180	10.6	1.08	6	0.94	5
			439	175	612	37	0.180	9.2	1.08	5	0.94	4
			440	171	611	37	0.180	7.9	1.08	4	0.94	4

5.2 Substructure Load

(1) Dead Load

P10,P13(Top)

7.500× 20.000× 24.500 = 3675 kN/m

P10,P13(Oval Part Top)

(7.500× 12.500+ π× 7.500^2 / 4)× 24.500= 3379 kN/m

P10,P13(Oval Part Bottom)

(7.500× 4.500+ π× 7.500^2 / 4)× 24.500= 1909 kN/m

P11,P12(Top)

7.500× 14.500× 24.500 = 2664 kN/m

P11,P12(Oval Part Top)

(7.500× 7.000+ π× 7.500^2 / 4)× 24.500= 2369 kN/m

P11,P12(Oval Part Bottom)

(7.500× 4.500+ π× 7.500^2 / 4)× 24.500= 1909 kN/m

(2) Wind Load

・Following load strengths are value under without live load

Oval : $p=1/2\cdot\rho\cdot Ud^2\cdot Cd\cdot G=1/2\times1.23\times30^2\times0.8\times1.9/1000=0.841$kN/m2 → 0.85kN/m2

Design Reference Wind Speed : Ud=30m/s

Air Density : ρ=1.23kg/m3

Drag Coefficient : Cd=0.8

Gust Response Factor : G=1.9

1) P10・P13 Pier

Loading Direction	Loading Point	Section	Width (mm)	Unit Load (kN/m2)	Distributed Load (kN/m)
Trans.	Oval Part	Oval	7500	0.85	6.4

2) P11・P12 Pier

Loading Direction	Loading Point	Section	Width (mm)	Unit Load (kN/m2)	Distributed Load (kN/m)
Trans.	Oval Part	Oval	7500	0.85	6.4

(3) Seismic Load

P10,P13(Top) 3675× 0.30= 1103 kN/m

P10,P13(Oval Part Top) 3379× 0.30= 1014 kN/m

P10,P13(Oval Part Bottom) 1909× 0.30= 573 kN/m

P11,P12(Top) 2664× 0.30= 799 kN/m

P11,P12(Oval Part Top) 2369× 0.30= 711 kN/m

P11,P12(Oval Part Bottom) 1909× 0.30= 573 kN/m

5.3 Load Combination

(1)Design Force for Superstructure

・The names in ( ) in the load combinations of wind and wind + temperature show load cases for main tower design.

・The stress resultants are equivalent values: the section force over the increase coefficient.

Case	Name	Increase Coefficient	Dead Load	PS	Live Load	Temperature	Wind Load		Seismic Load			
							Trans.		Longi.		Trans.	
							WTR↑	WTR↓	ELG→	ELG←	ETR↑	ETR↓
Dead Load	D[Db+Da+PS]:Dead Load+PS	1.00	○	○								
Normal	D+L	1.00	○	○	PICK UP							
Temperature	D+L+T	1.15	○	○	PICK UP	PICK UP						
Wind	D+WgTR↑ (D+WtTR↑)	1.25	○	○			○					
	D+WgTR↓ (D+WtTR↓)	1.25	○	○				○				
	D+L+WgTR↑ (D+L+WtTR↑)	1.25	○	○	PICK UP		○x0.5					
	D+L+WgTR↓ (D+L+WtTR↓)	1.25	○	○	PICK UP			○x0.5				
Wind + Temperature	D+WgTR↑+T (D+WtTR↑+T)	1.35	○	○		PICK UP	○					
	D+WgTR↓+T (D+WtTR↓+T)	1.35	○	○		PICK UP		○				
	D+L+WgTR↑+T (D+L+WtTR↑+T)	1.35	○	○	PICK UP	PICK UP	○x0.5					
	D+L+WgTR↓+T (D+L+WtTR↓+T)	1.35	○	○	PICK UP	PICK UP		○x0.5				
Seismic Performance Level 1	D+ELG→	1.50	○	○					○			
	D+ELG←	1.50	○	○						○		
	D+ETR↑	1.50	○	○							○	
	D+ETR↓	1.50	○	○								○

(2)For Bearing Support

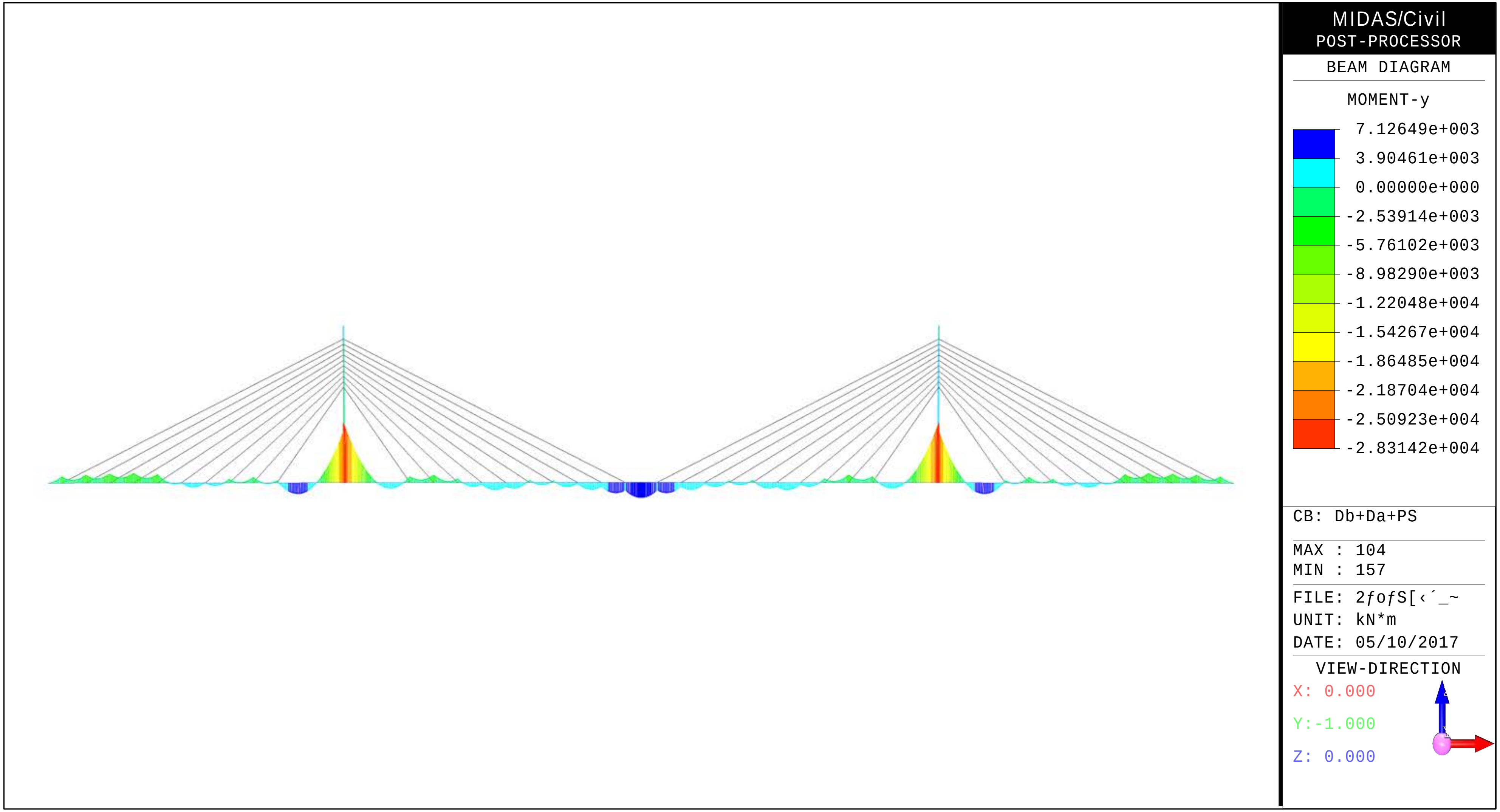
・The names in ( ) in the load combinations of wind and wind + temperature show load cases for main tower design.

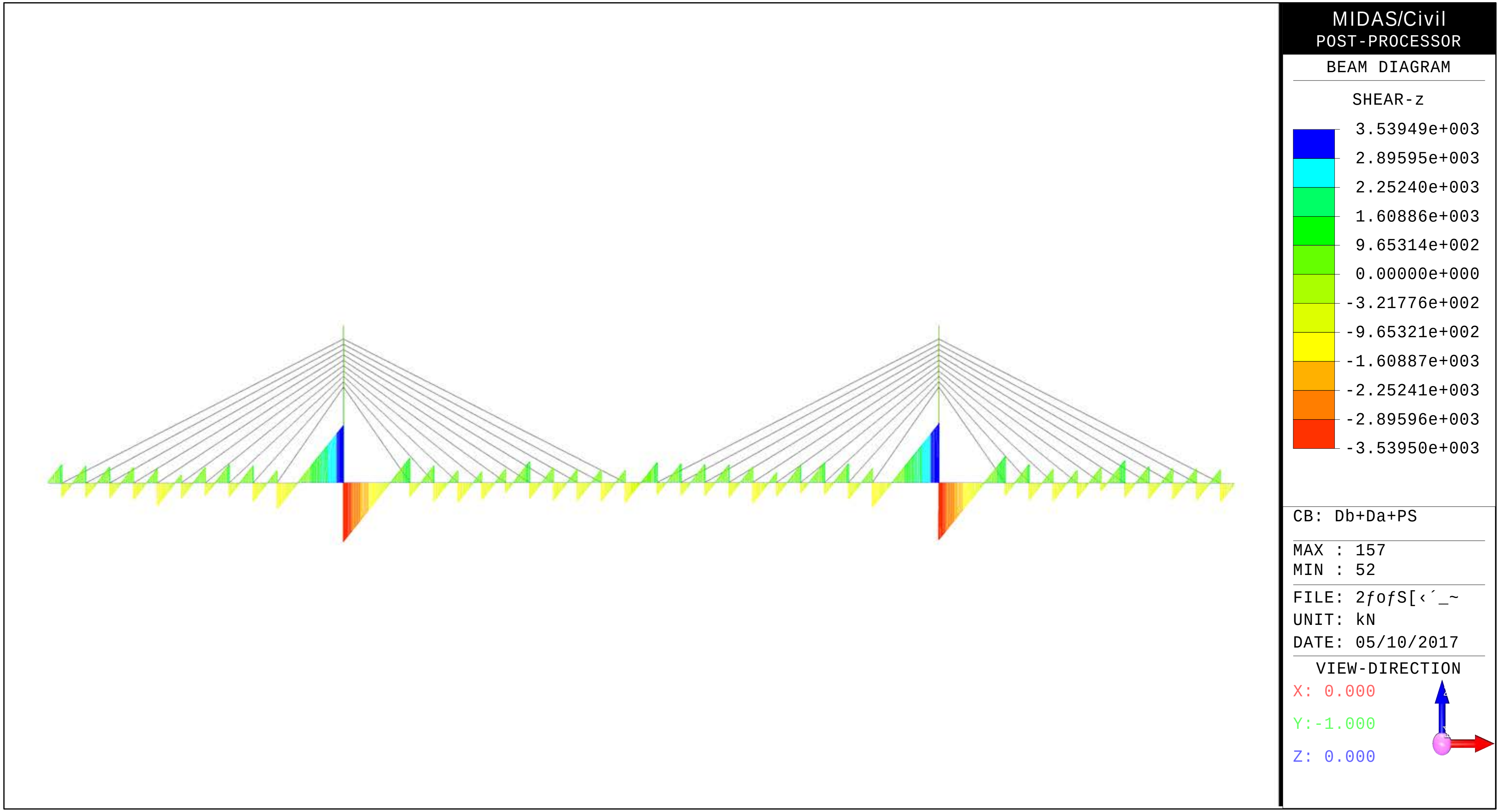
・The stress resultants are raw value.

・The stress resultants at seismic performance level 2 are calculated for the bearing support design. Meanwhile, the bearing support was not designed based on the stress resultants for safety investigation of substructure.

Case	Name	Dead Load	PS	Live Load	Temperature	Wind Load		Seismic Load			
						Trans.		Longi.		Trans.	
						WTR↑	WTR↓	ELG→	ELG←	ETR↑	ETR↓
Dead Load	D[Db+Da+PS]:Dead Load+PS	○	○								
Normal	D+L	○	○	PICK UP							
Temperature	D+L+T	○	○	PICK UP	PICK UP						
Wind	D+WgTR↑ (D+WtTR↑)	○	○			○					
	D+WgTR↓ (D+WtTR↓)	○	○				○				
	D+L+WgTR↑ (D+L+WtTR↑)	○	○	PICK UP		○x0.5					
	D+L+WgTR↓ (D+L+WtTR↓)	○	○	PICK UP			○x0.5				
Wind + Temperature	D+WgTR↑+T (D+WtTR↑+T)	○	○		PICK UP	○					
	D+WgTR↓+T (D+WtTR↓+T)	○	○		PICK UP		○				
	D+L+WgTR↑+T (D+L+WtTR↑+T)	○	○	PICK UP	PICK UP	○x0.5					
	D+L+WgTR↓+T (D+L+WtTR↓+T)	○	○	PICK UP	PICK UP		○x0.5				
Seismic Performance Level 1	D+ELG→	○	○					○			
	D+ELG←	○	○						○		
	D+ETR↑	○	○							○	
	D+ETR↓	○	○								○
Seismic Performance Level 2	D+SELG→	○	○					○x1.5			
	D+SELG←	○	○						○x1.5		
	D+SETR↑	○	○							○x1.5	
	D+SETR↓	○	○								○x1.5

(1)Completion

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POST-PROCESSOR
BEAM DIAGRAM
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1.60886e+003
9.65314e+002
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-3.21776e+002
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-2.25241e+003
-2.89596e+003
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CB: Db+Da+PS
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DATE: 05/10/2017
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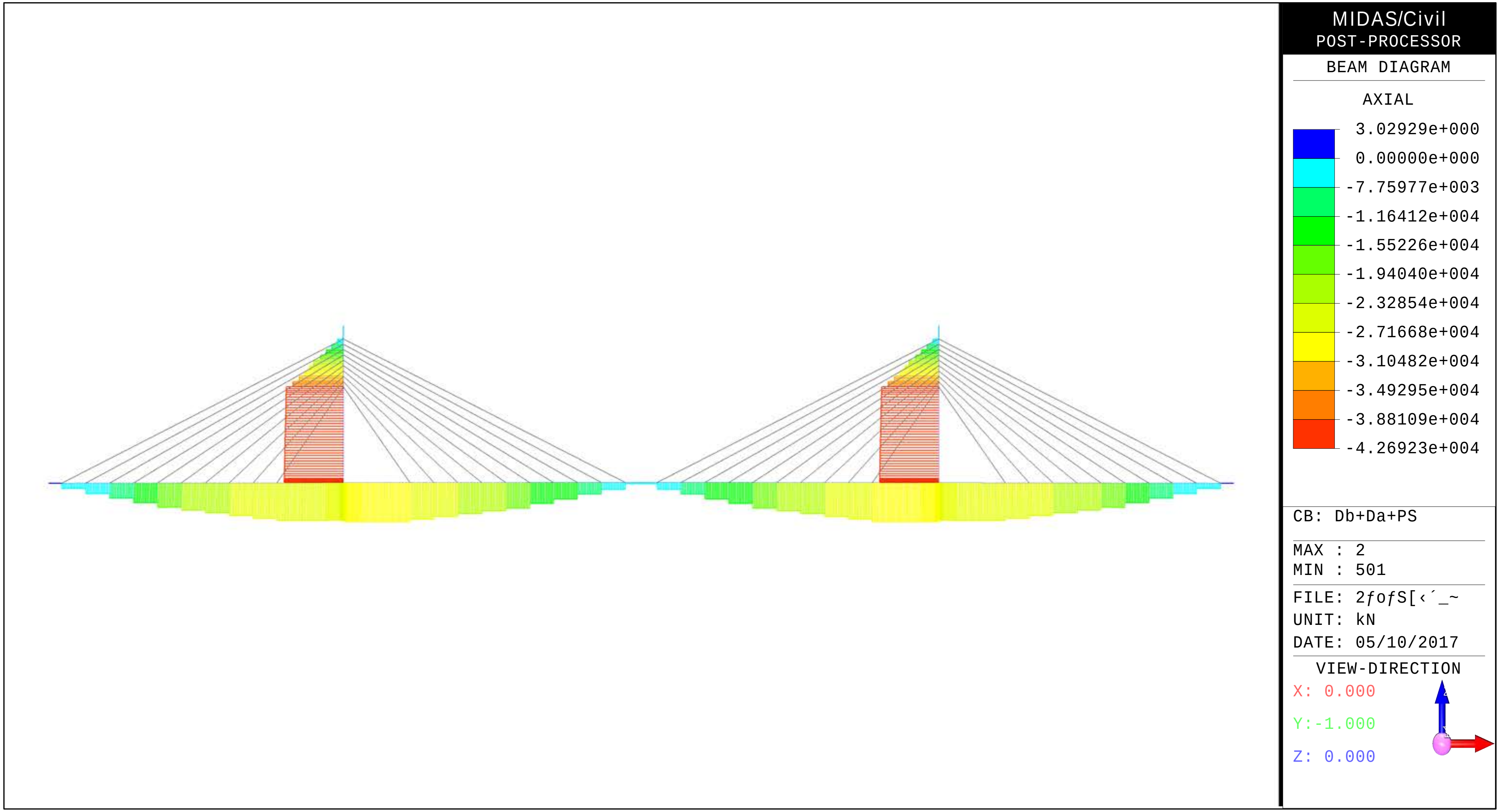
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(2) Normal

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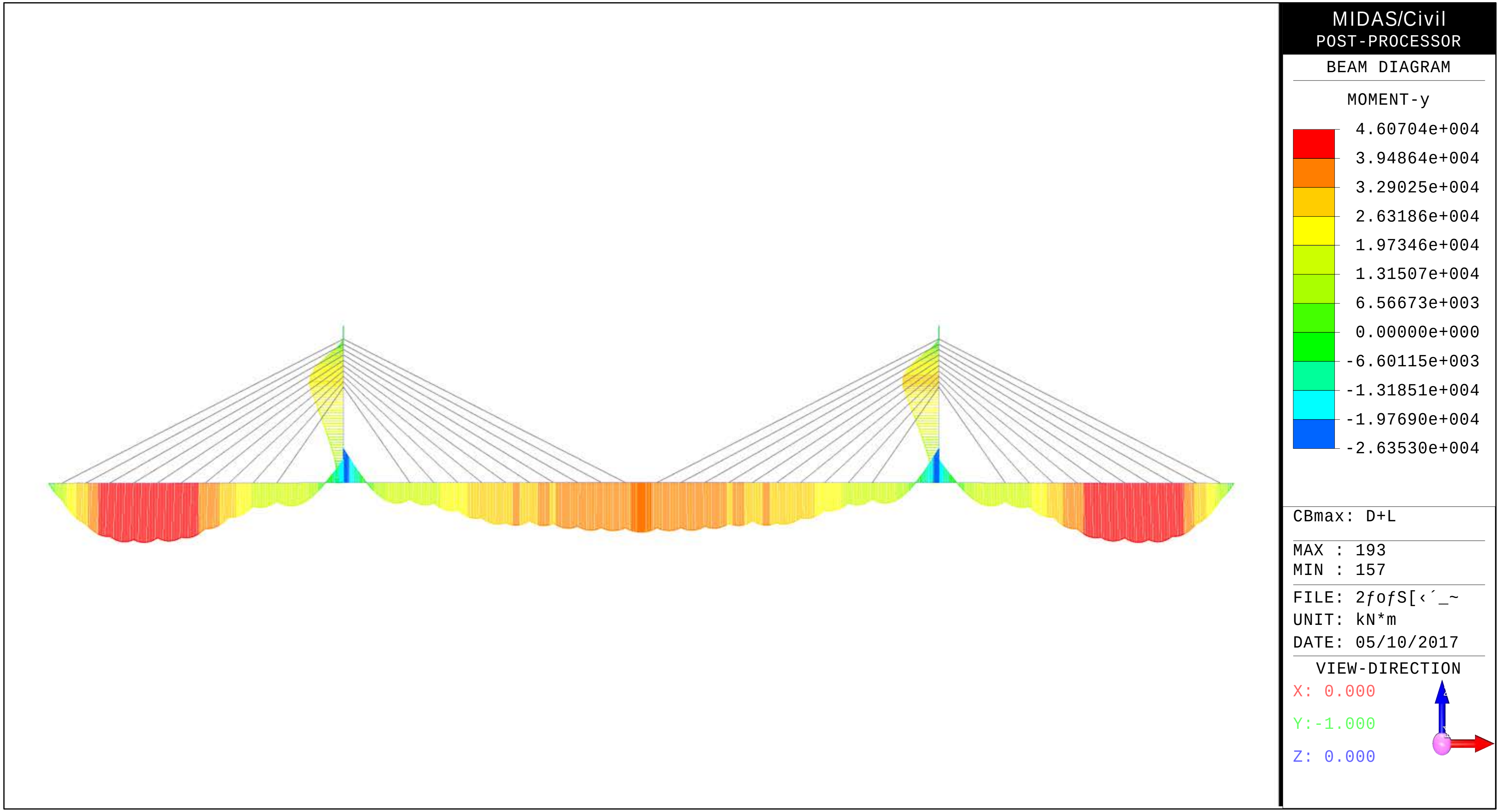

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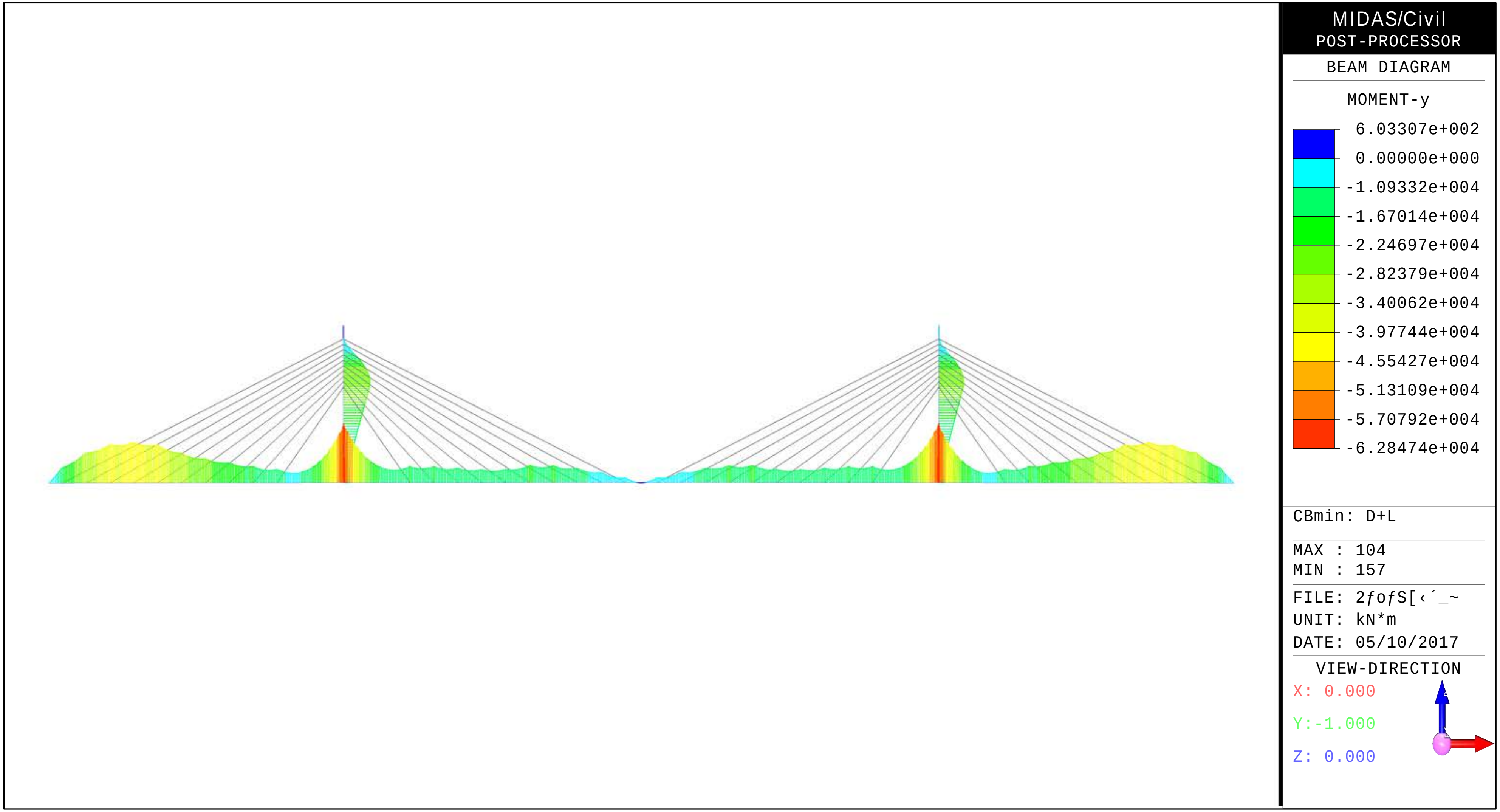
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BEAM DIAGRAM
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-1.67014e+004
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-2.82379e+004
-3.40062e+004
-3.97744e+004
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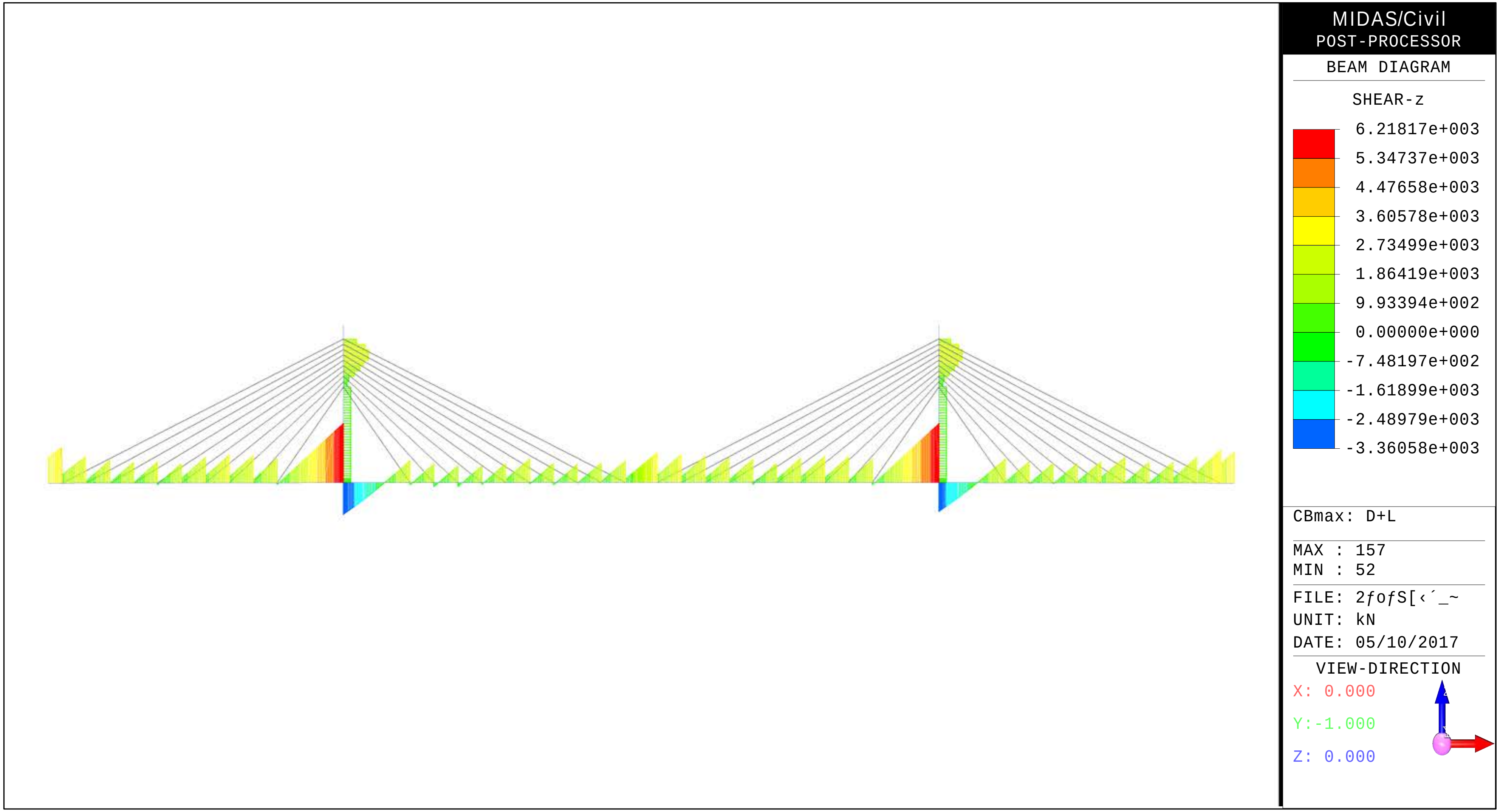
3) Szmax


MIDAS/Civil
POST-PROCESSOR
BEAM DIAGRAM
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-1.61899e+003
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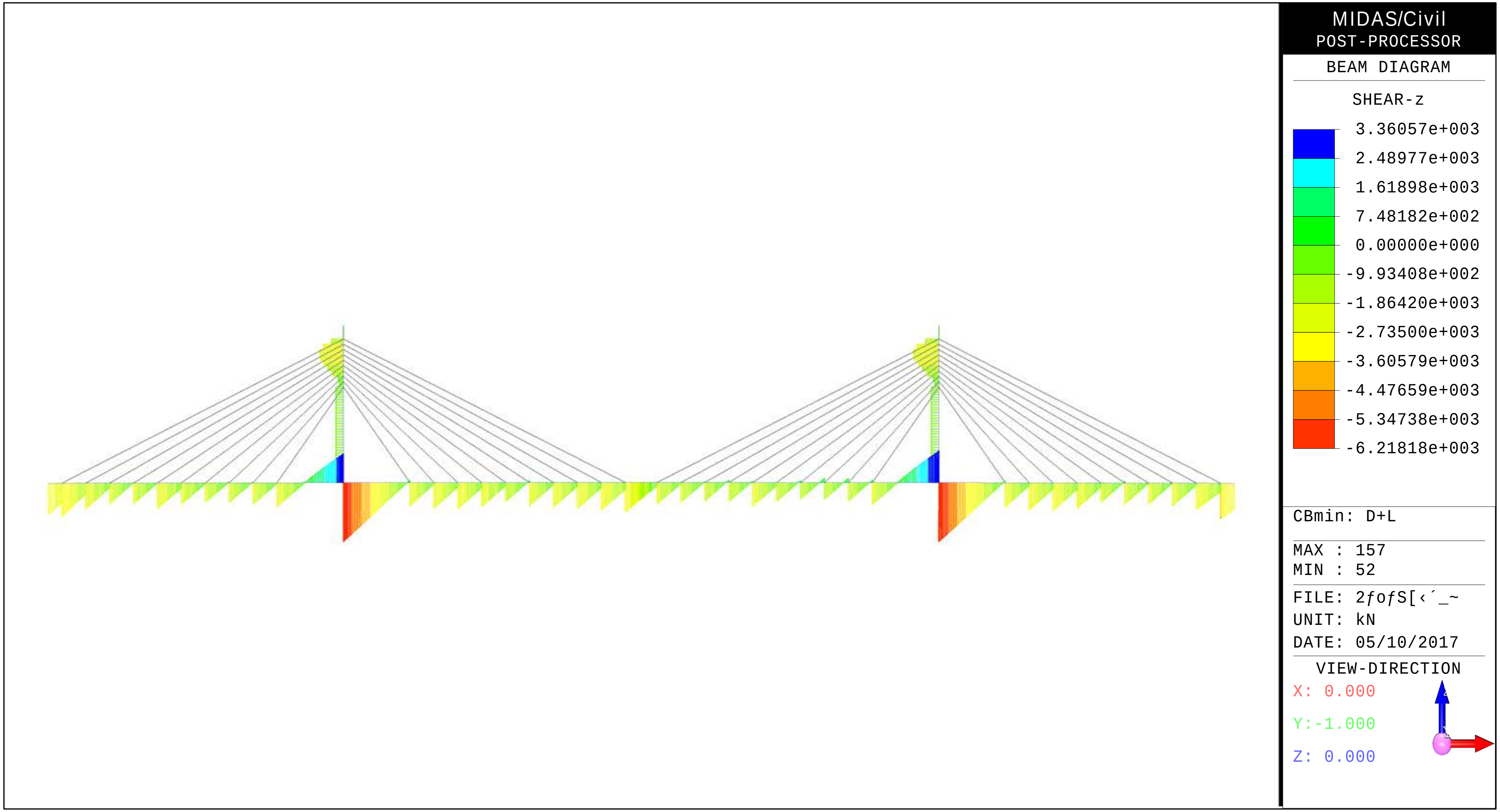
Z: 0.000

4) Szmin



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-4.47659e+003
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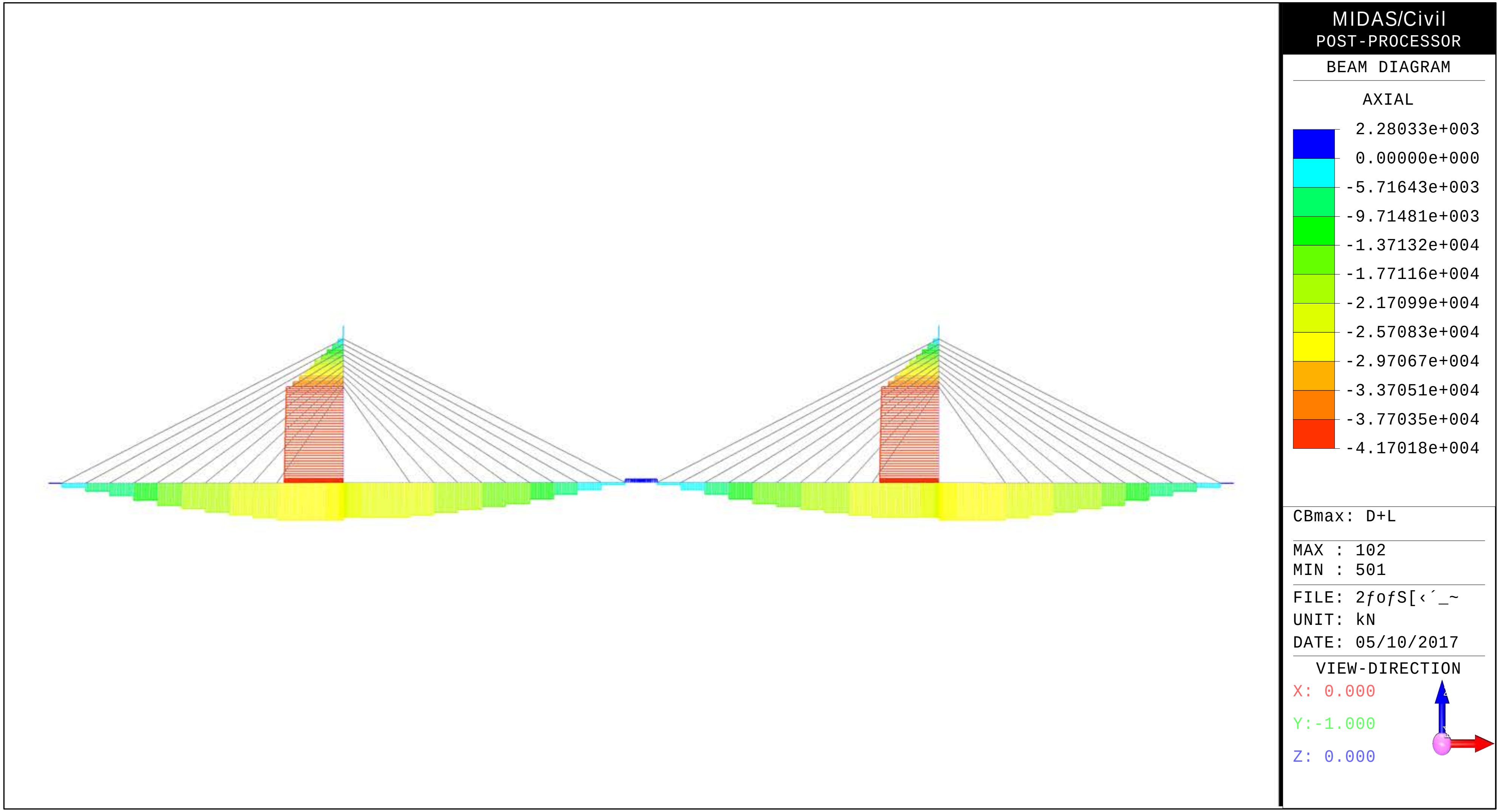

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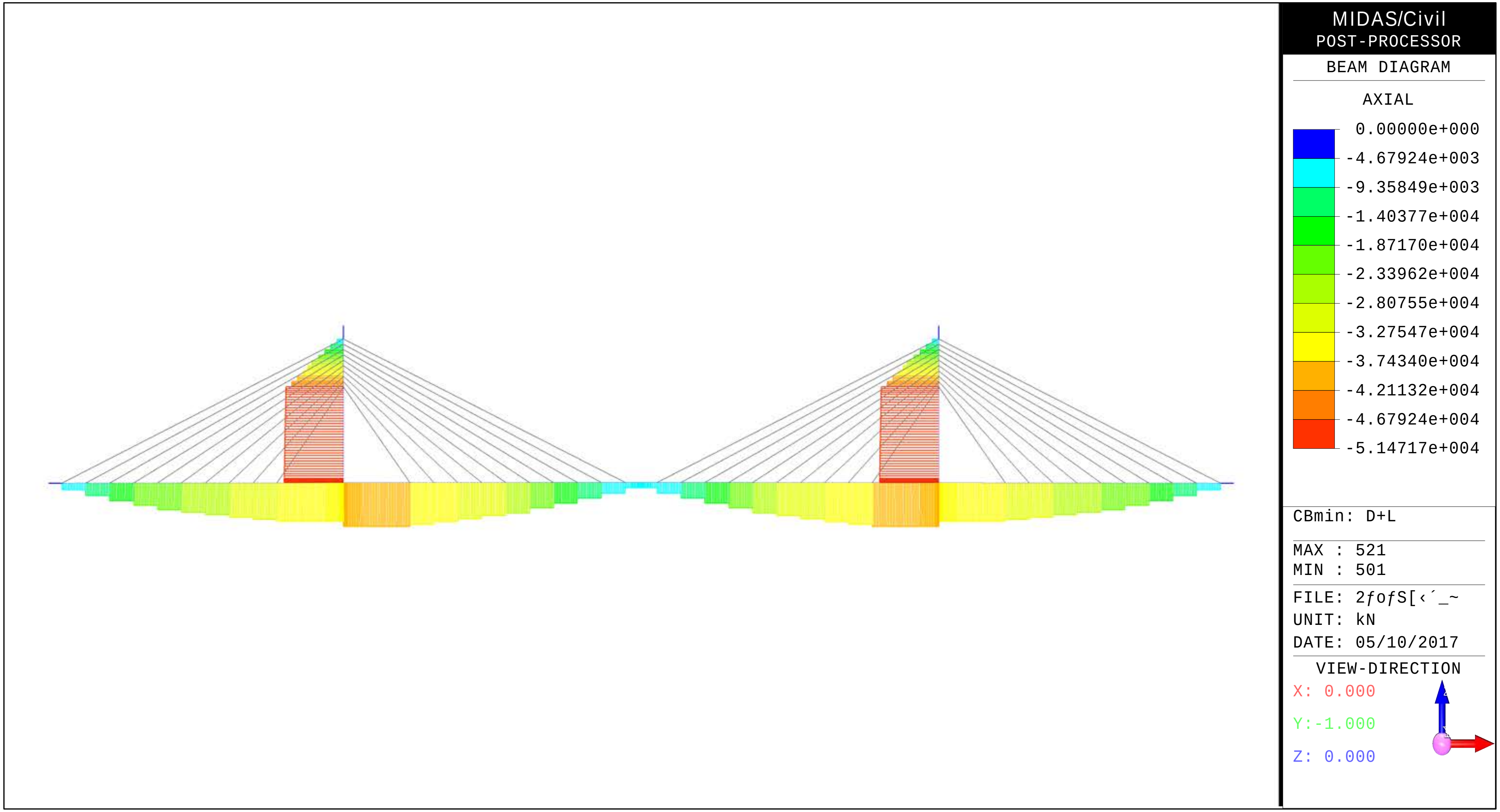

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POST-PROCESSOR
BEAM DIAGRAM
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-1.87170e+004
-2.33962e+004
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-3.74340e+004
-4.21132e+004
-4.67924e+004
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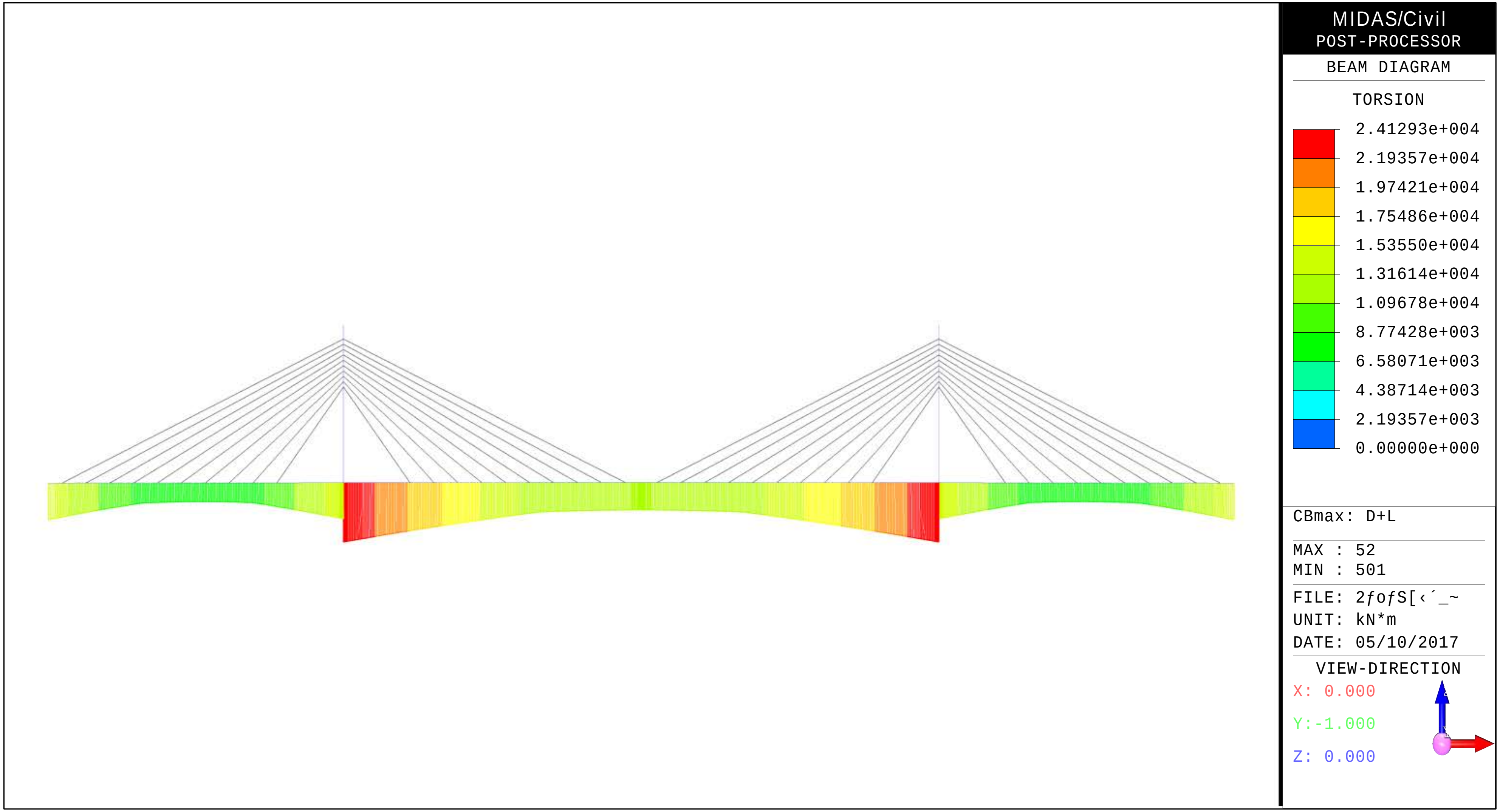
7) Mxmax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POST-PROCESSOR
BEAM DIAGRAM
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1.31614e+004
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6.58071e+003
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2.19357e+003
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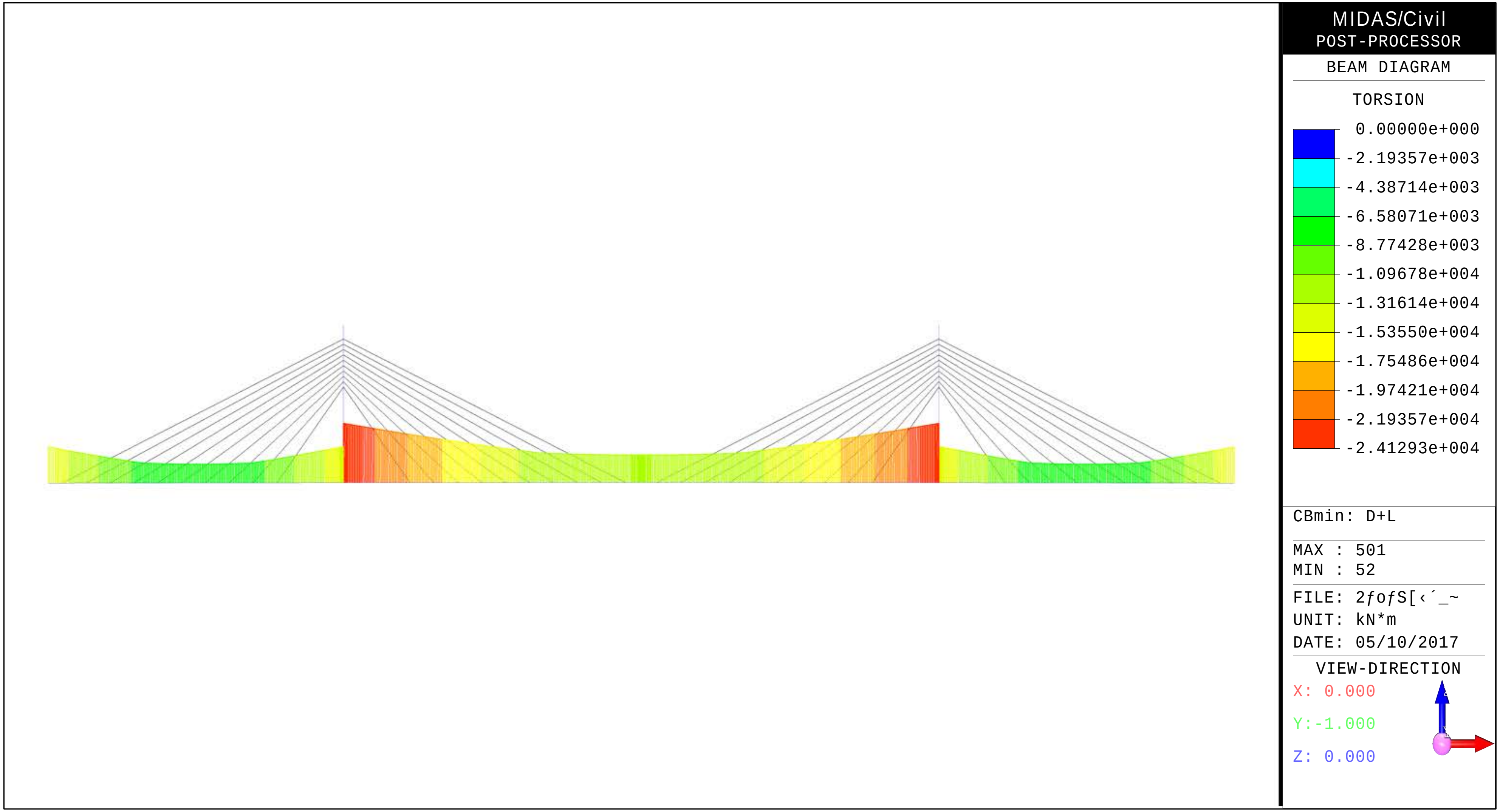
8) Mxmin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BEAM DIAGRAM
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-4.38714e+003
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-1.53550e+004
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CBmin: D+L
MAX : 501
MIN : 52
FILE: 2ƒoƒS[‹´_~
UNIT: kN*m
DATE: 05/10/2017
VIEW-DIRECTION
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Y:-1.000
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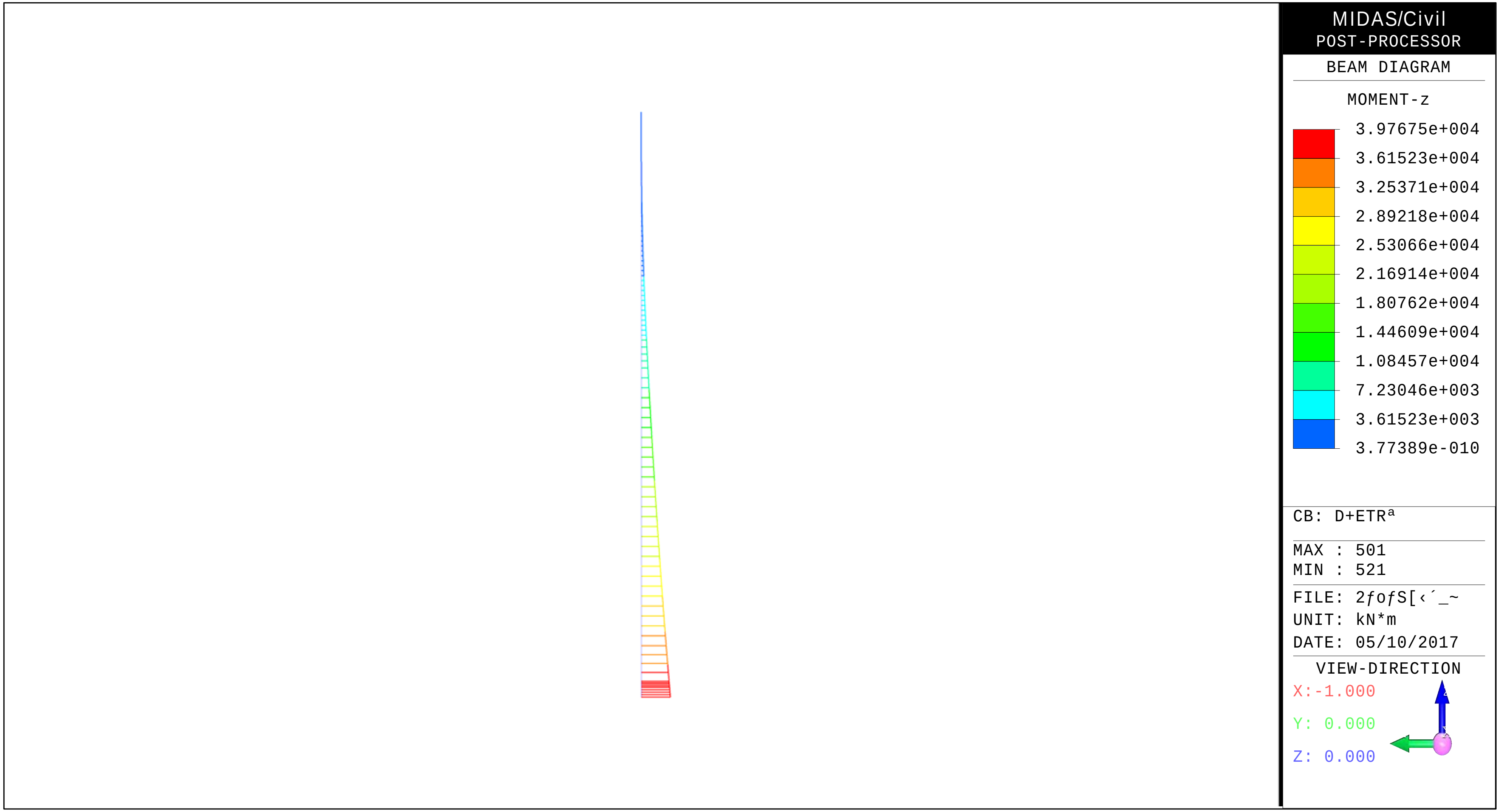
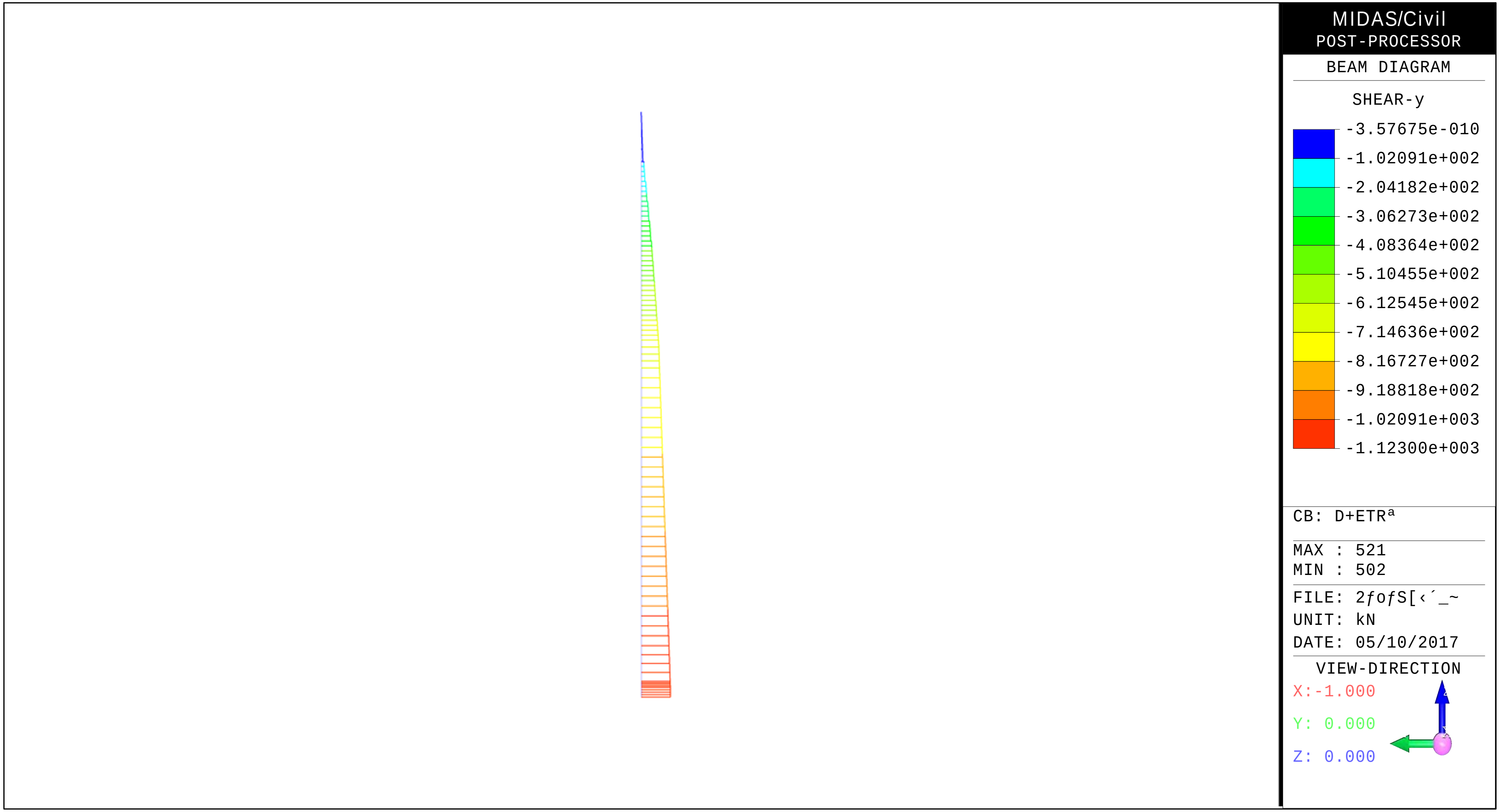
(3) Trans. Direction Seismic_Tower_Out-plane Direction

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BEAM DIAGRAM
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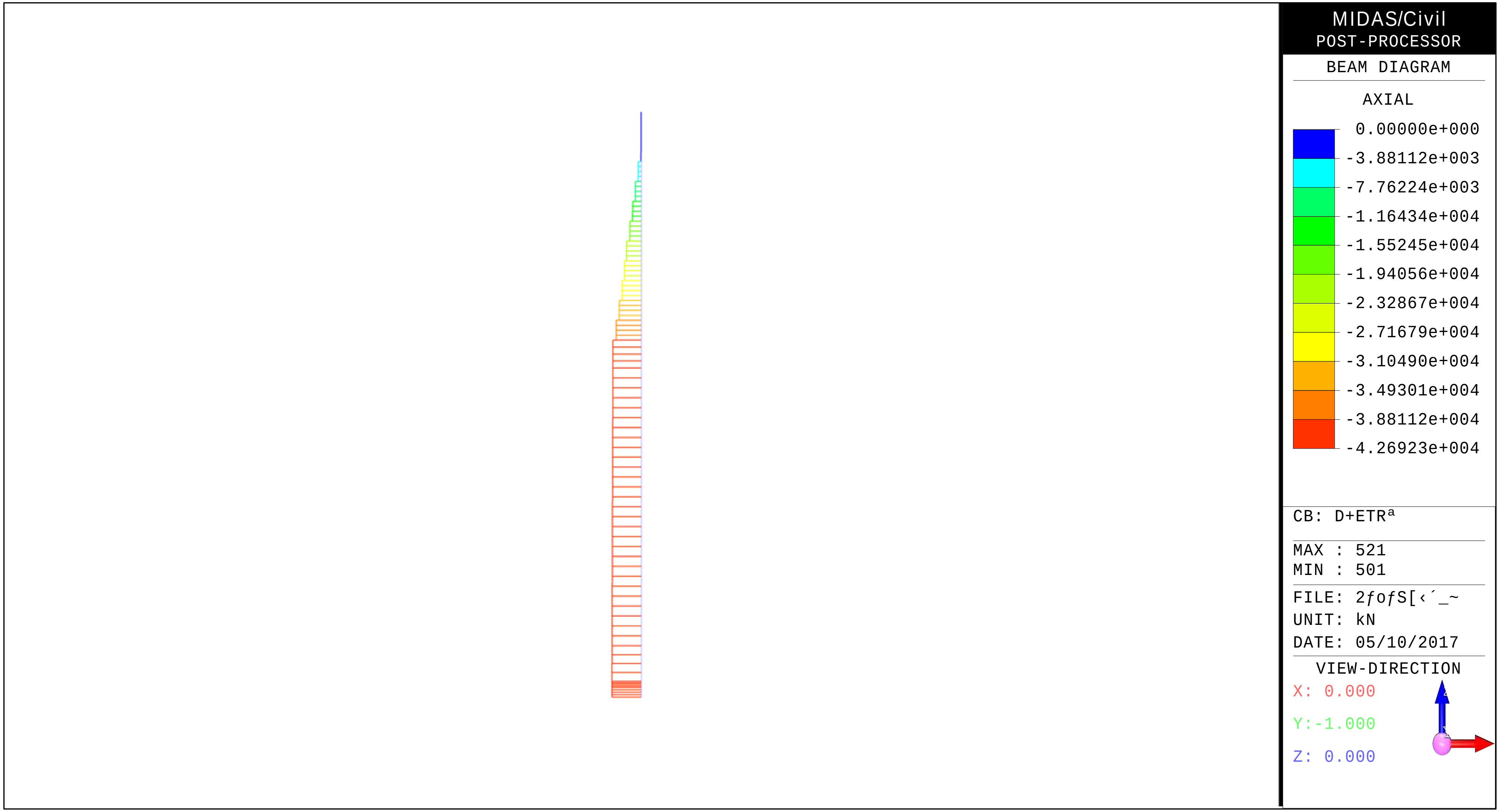
MIDAS/Civil
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BEAM DIAGRAM
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CB: D+ETRª
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MIN : 501
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UNIT: kN
DATE: 05/10/2017
VIEW-DIRECTION
X: 0.000
Y:-1.000
Z: 0.000

7. Study on Cable Pre-stressing

・Following conditions shall be considered for cable pre-stressing

① The bending moment distribution along the main girder is smoothened.

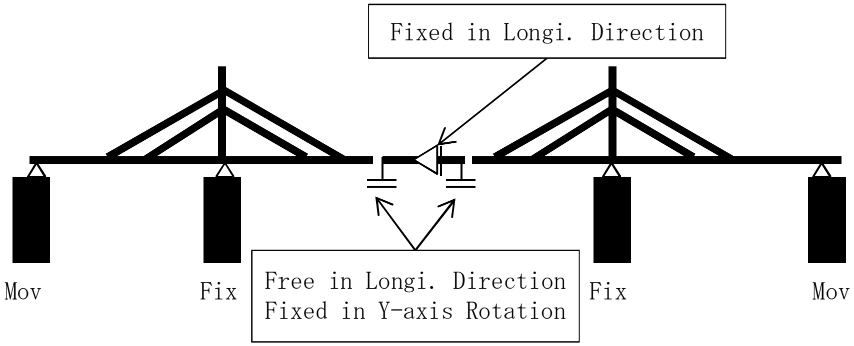
② The tower must not be subjected to bending moment during the completed stage.

③ During the final girder closing, the girders do not require any force (closing force, enforcement) → M≒0 at joint

・For the purpose of the study, the assumed loading on the structure during the closing state mentioned in item 3 above shall include the loads temporarily created by construction equipment such as cranes(assumed as 1800kN).

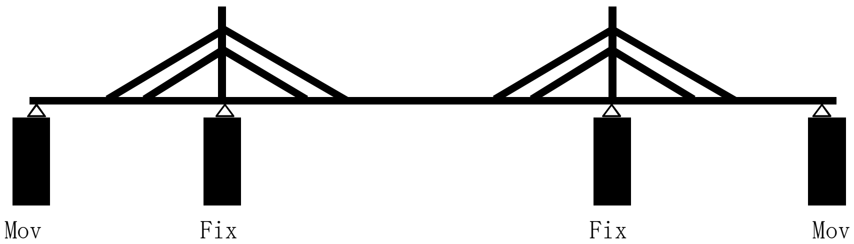
・Bending Moment Diagrams are shown in the next page.

<Before Closing Model>



Load : Girder Weight, Tower Weight, Cable Weight, Pier Weight, Fairing, Attachments, rail for Inspection Car, Rocking Bearing, Pre-stress

<After Closing Model>

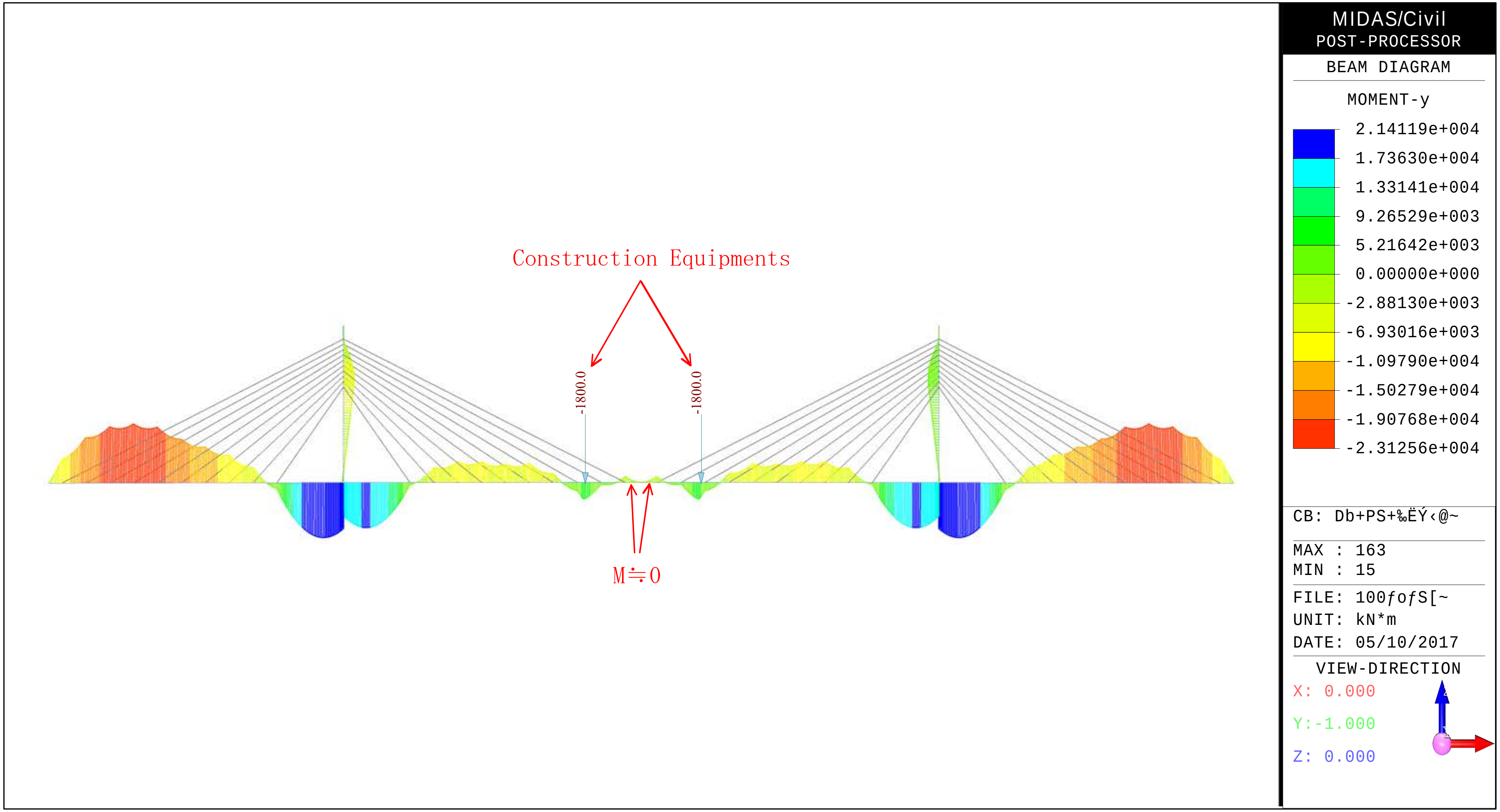


Load: All loads (exclude included loads in Before Closing Model)

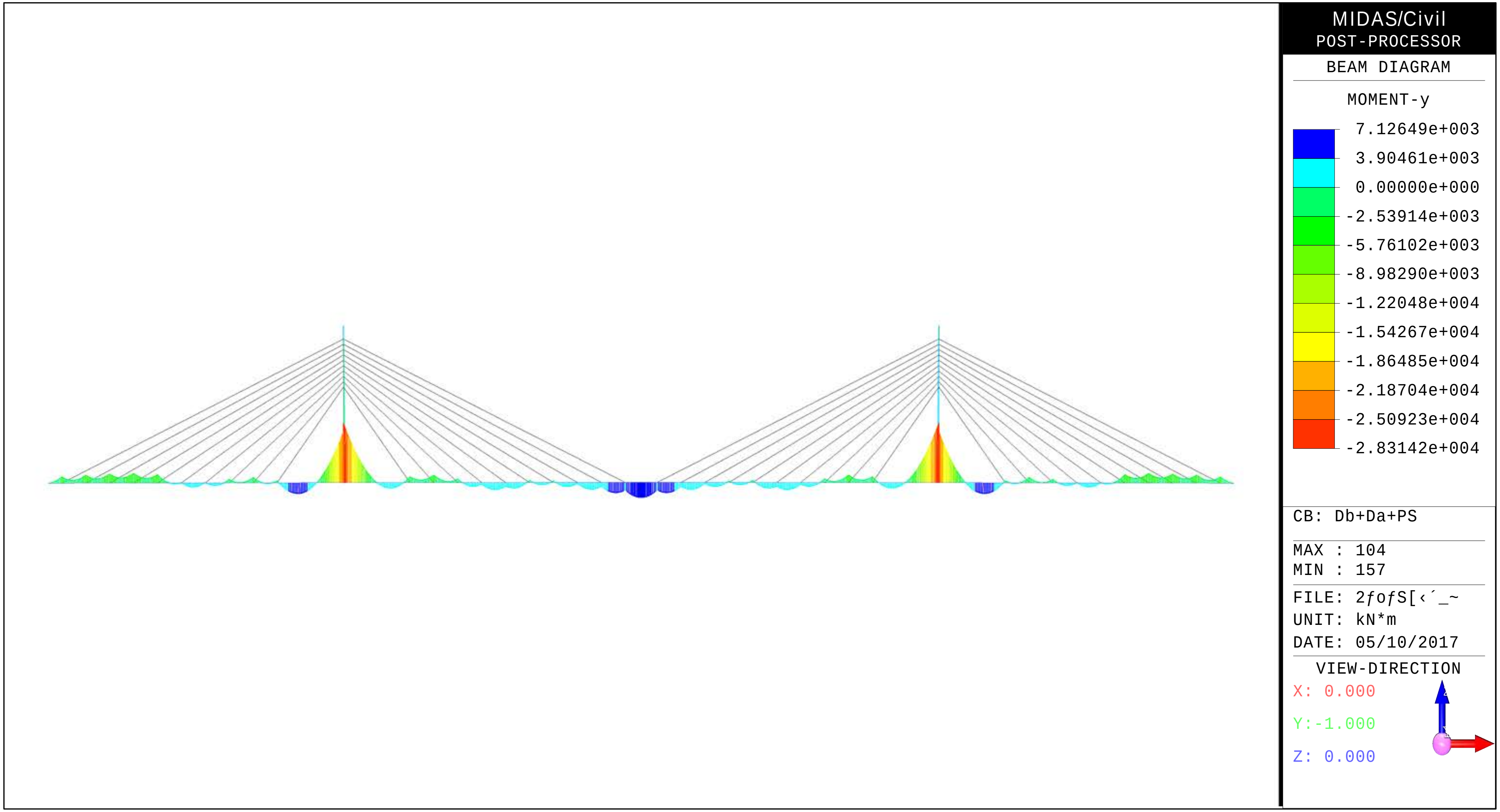
・Cable Pre-stressing Force

		Elem. No.	PS(kN)			Elem. No.	PS(kN)
Side Span P10	Top	401	720	Main Span P12	Top	421	1420
		402	330			422	650
		403	0			423	20
		404	-170			424	-360
		405	-50			425	-400
		406	210			426	-20
		407	470			427	220
		408	700			428	470
		409	1010			429	810
	Bot.	410	1450		Bot.	430	1300
Main Span P11	Top	411	1420	Side Span P13	Top	431	720
		412	650			432	330
		413	20			433	0
		414	-360			434	-170
		415	-400			435	-50
		416	-20			436	210
		417	220			437	470
		418	470			438	700
		419	810			439	1010
	Bot.	420	1300		Bot.	440	1450

・Closing(Before Closing Dead Load + Ps + Construction Equipment)



· Completion(Before Closing Dead Load + After Closing Dead Load +PS)



Cable Stayed Bridge

3) Dynamic Structure Analysis

- Contents -

§1.Basic Conditions

1.1 Outline

(1) Software

T-DAPⅢ Ver3.08 Level_04 （ARK Information System, INC.）

The purpose of the analysis is to observe the behavior of the main section, i.e., the cable-stayed bridge, during an earthquake.

(2) Outline of Structure

① Structure Type

・Superstructure three-span continuous cable-stayed bridge

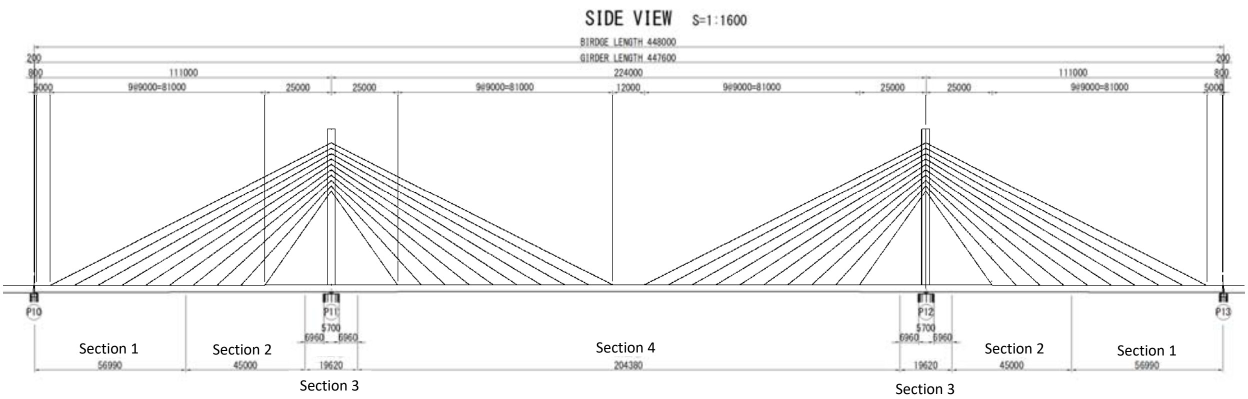
・Substructure Reinforced concrete single column type pier

・Foundation P10 Pier: Steel pipe sheet pile foundation
P11 Pier: Steel pipe sheet pile foundation
P12 Pier: Steel pipe sheet pile foundation
P13 Pier: Steel pipe sheet pile foundation

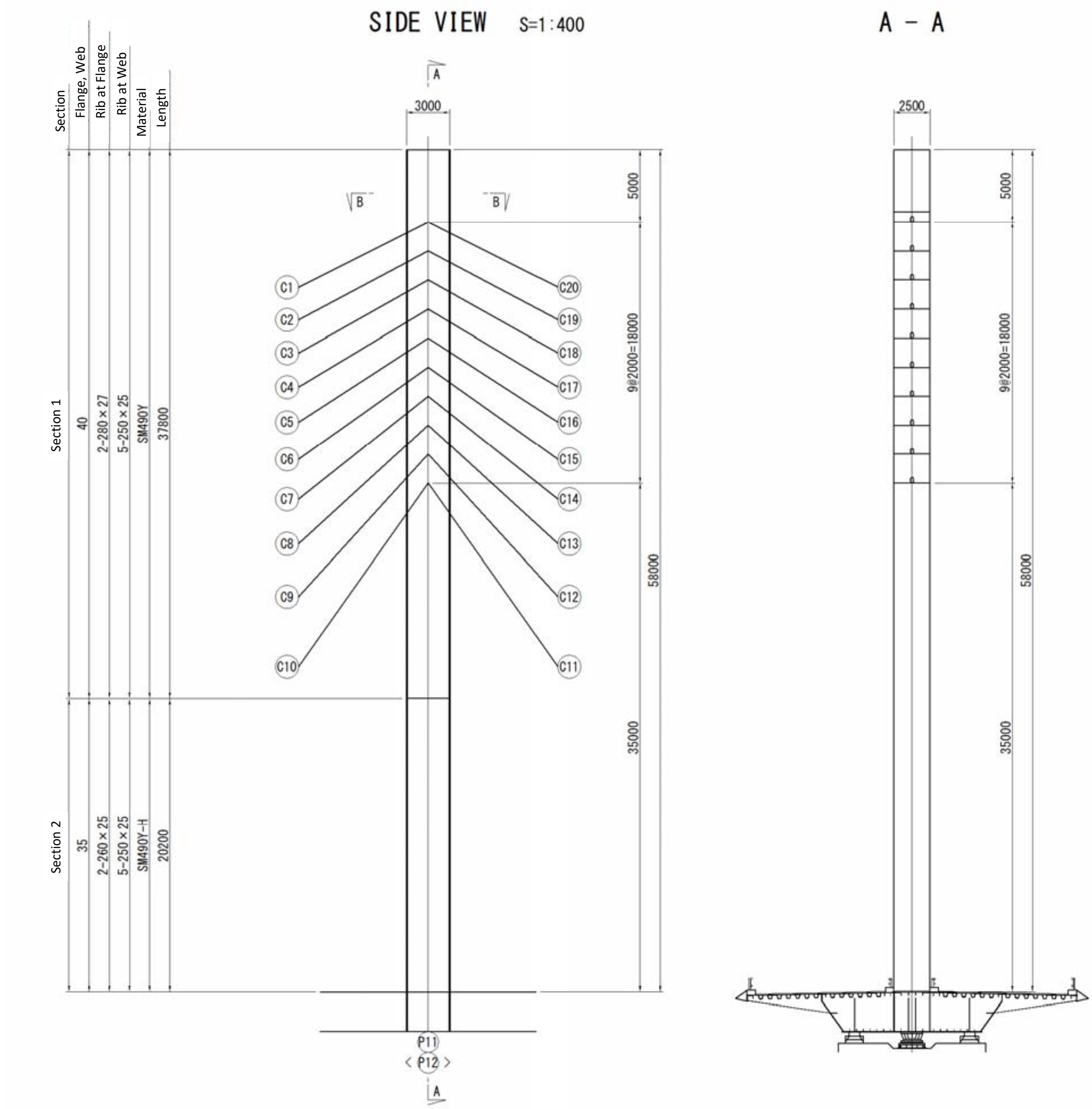
②Bearing P10 Pier: Movable (Fixed on transverse direction) Rocking Bearing
P11 Pier: Fixed (Fixed on transverse direction)
P12 Pier: Fixed (Fixed on transverse direction)
P13 Pier: Movable (Fixed on transverse direction) Rocking Bearing

③Structure Plan

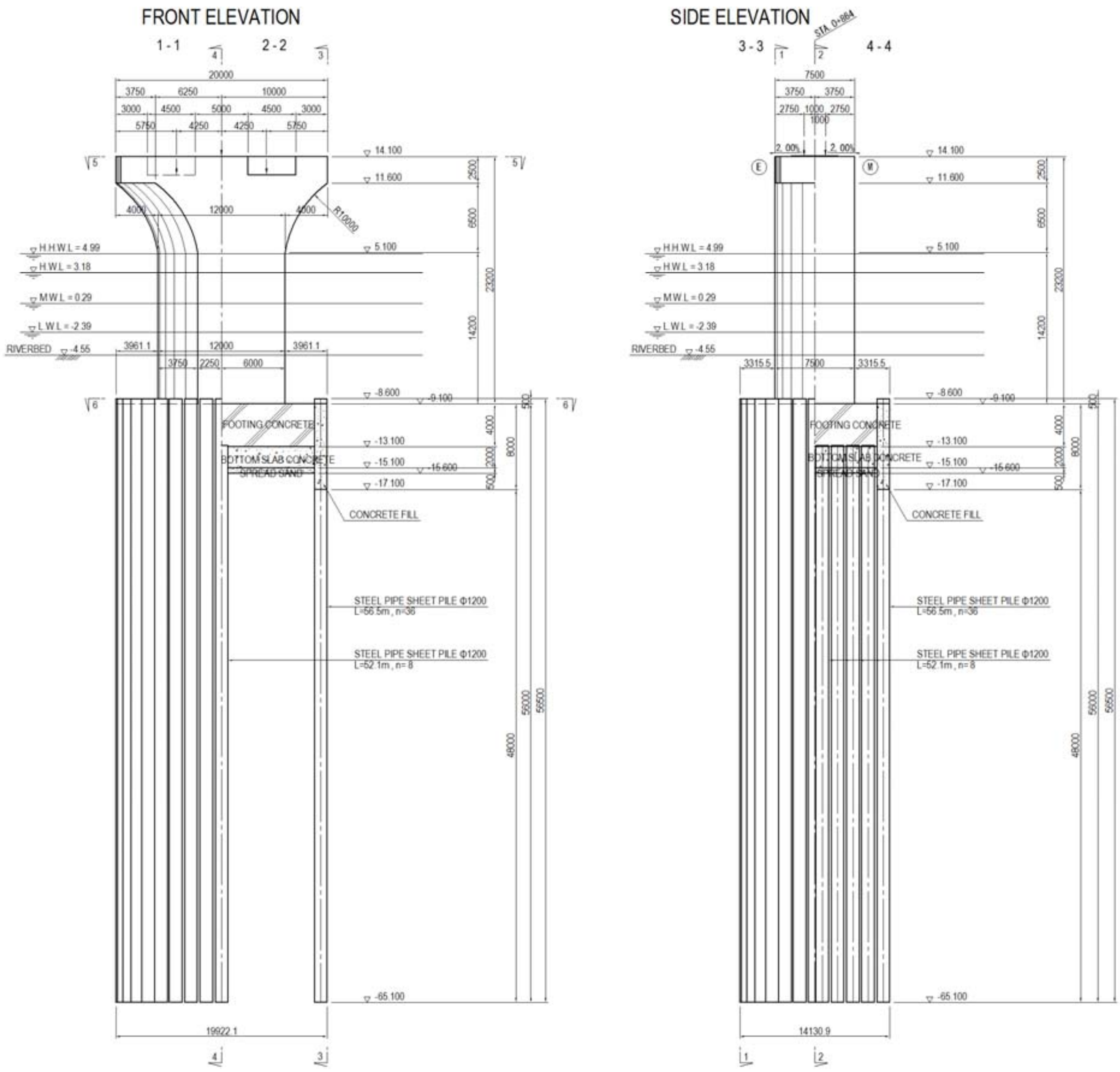
Superstructure



Tower

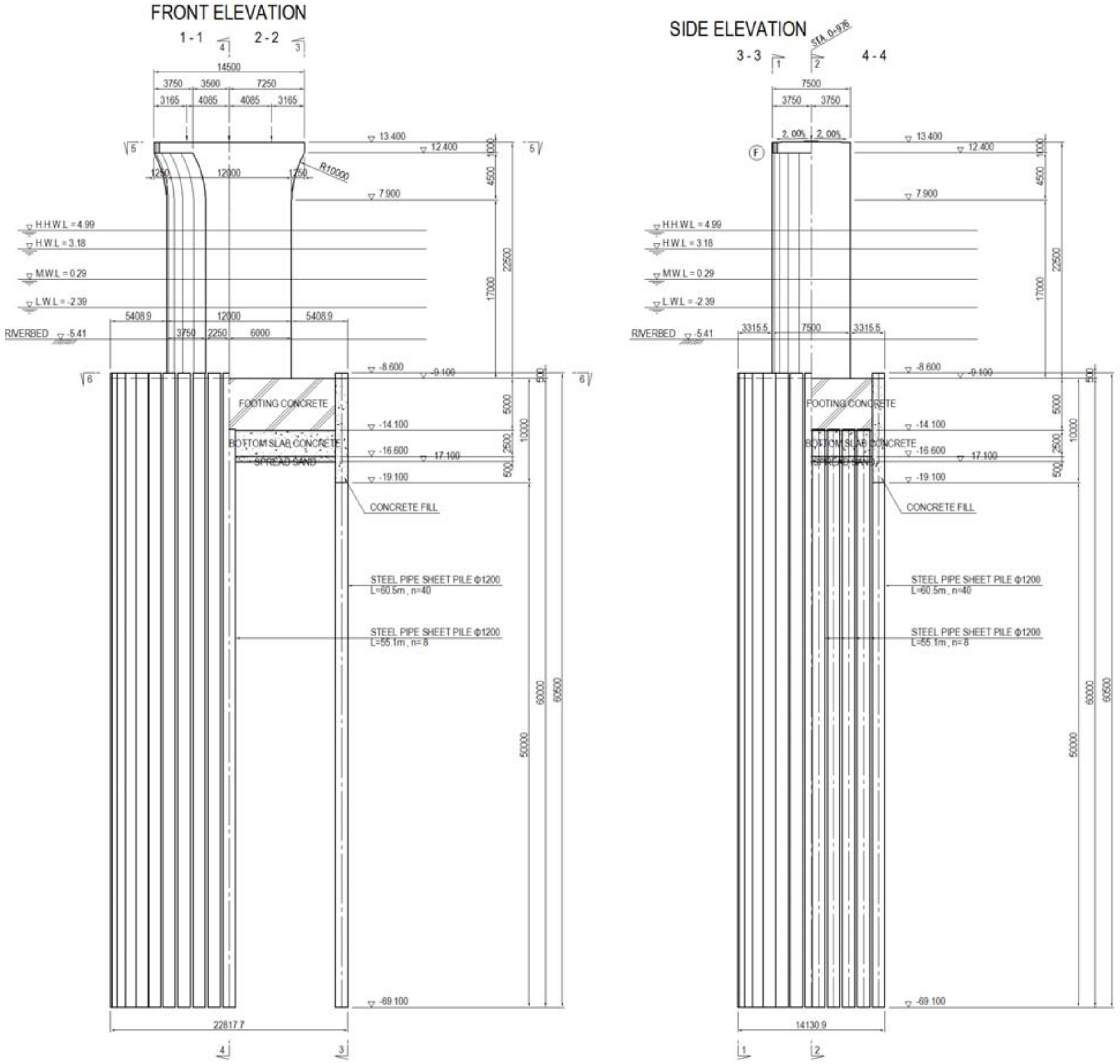

SIDE VIEW S=1:400
A - A
Section
Flange, Web
Rib at Flange
Rib at Web
Material
Length
Section 1
40
2-280×27
5-250×25
SM490Y
37800
Section 2
35
2-260×25
5-250×25
SM490Y-H
20200
3000
2500
5000
9@2000=18000
58000
35000
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
P11
P12
A
B

P10 (P13)



The figure above shows P10 pier. P13 pier has the same column dimension except for the embedded footing length, which was changed from 56.5 m to 49.5 m.

P11 (P12)



The figure above shows P11 pier. P12 pier has the same column dimension except for the embedded footing length, which was changed from 60.5 m to 52.0 m.

1.2 Basic Policy of Models

(1) Analysis Model

The one mass point spring SR model shall be used.

(2) Excitation Method

Acceleration for the excitation of the foundation is inputted.

(3) Response Calculation

1) Integral time : 0.02 seconds

2) Integration method : Newmark β Method (β = 0.25)

(4) Gravity

The section force and the cable pre-stress induced by gravity are set as the initial stage section force and included in the first step of the time response analysis.

(5) Internal Damping - Radiational Damping

Rayleigh's damping shall be applied. For the configuration of Rayleigh's damping, the coefficients for the vibrational modes shall be specified as stated in the Specification of Highway Bridges V and shall be determined by the following equation:

$$h_i = \frac{\sum_{j=1}^{n} h_j \{\phi_{ij}\}^T [K_j] \{\phi_{ij}\}}{\{\phi_i\}^T [K] \{\phi_i\}} \quad \cdots\cdots\cdots \text{ JSHB V A-7.3.1}$$

Where,

$\{\phi_{ij}\}$; Mode Vector of element j at ith mode

h_j ; Dumping coefficient of element j

$[K_j]$; Stiffness matrix of element j

$\{\phi_i\}$; Mode Vector of whole structure j at ith mode

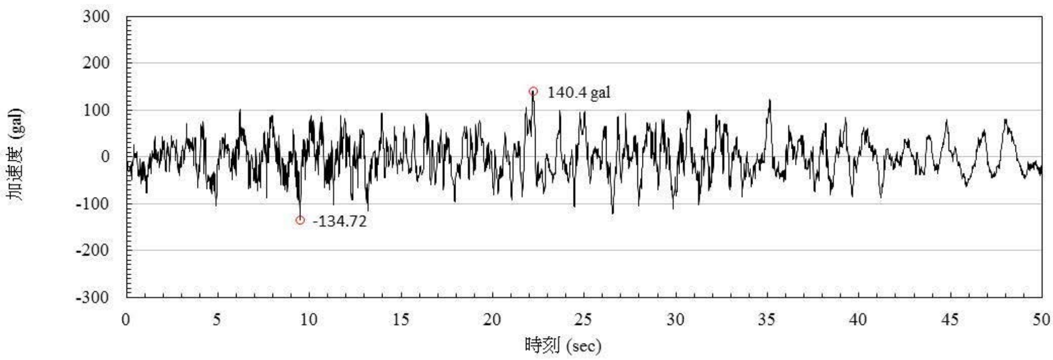
$[K]$; Stiffness matrix of whole structure

1.3 Design Seismic Wave

The design seismic wave used for the dynamic analysis shall use the waveform of the Specification of Highway Bridges Level 1 Seismic Motion (Type III Ground) corresponding to kh = 0.3 of the seismic coefficient method.

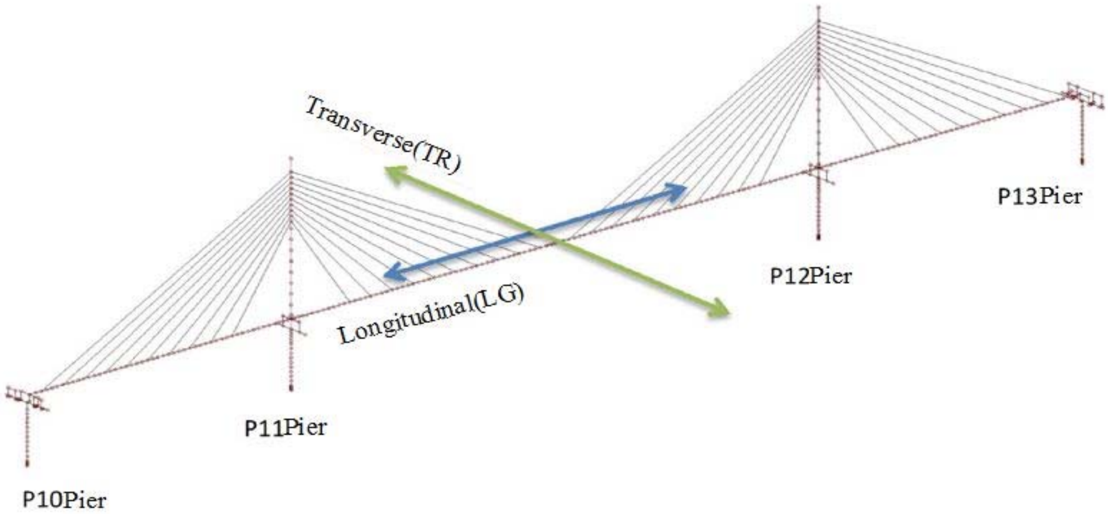
【Design Seismic Wave】

Type I	Miyagi-earthquake, 1978	LG	25 sec
Type III	Hyuuganada-earthquake, 1968	LG	30 sec
Type III	Japanese Sea Middle area-earthquake, 1983	TR	50 sec



1.4 Analysis Direction

The analysis of the bridge shall be performed in two directions, namely: the direction connecting the P10 and P13 pier, which is the Longitudinal Direction (LG), and the direction perpendicular to it, which is the Transverse Direction (TR), considering the bridge is straight.



1.5 Evaluation Method for the Dynamic Analysis Results

(1) Evaluation of Superstructure

The main girder and main column are verified to not undergo plasticization due to the seismic response section force. Furthermore, the response at the joint gap at the girder end and bearing support is verified to be below the allowable value.

(2) Evaluation of Cable

The tension in the cable due the seismic response is verified to be below the allowable value. Furthermore, it is verified that no compression acts on the cable.

(3) Evaluation of Pier

1) For Flexual Capacity

The bending stress on the reinforced concrete member generated by the bending moment due to the seismic response is verified to be below the allowable bending stress.

2) For Shear Capacity

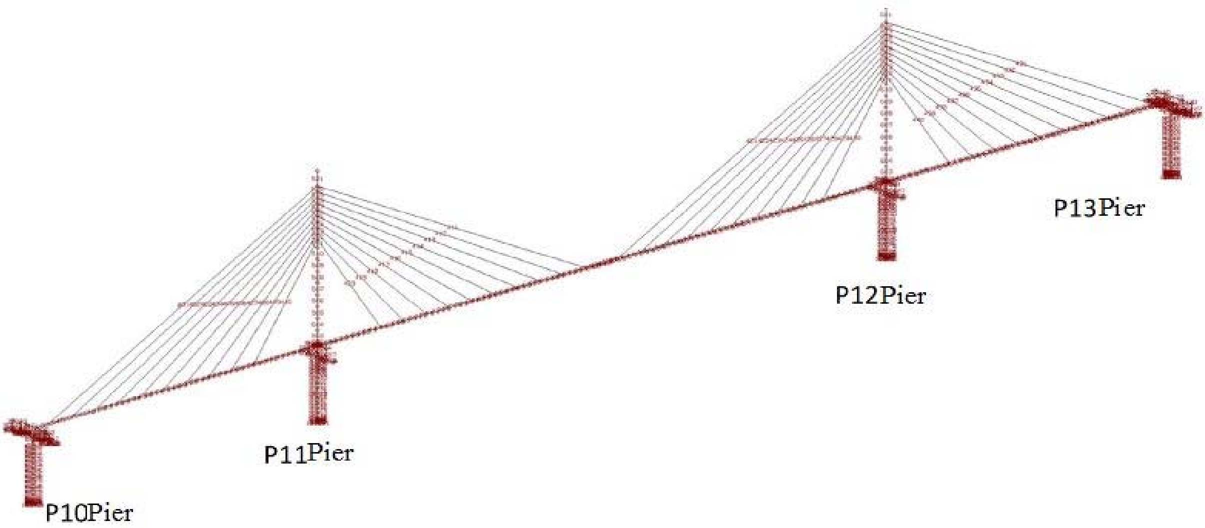
The shearing stress on the concrete generated by the shear stress due to the seismic response is verified to be below the allowable shearing stress.

§2. Analysis Model

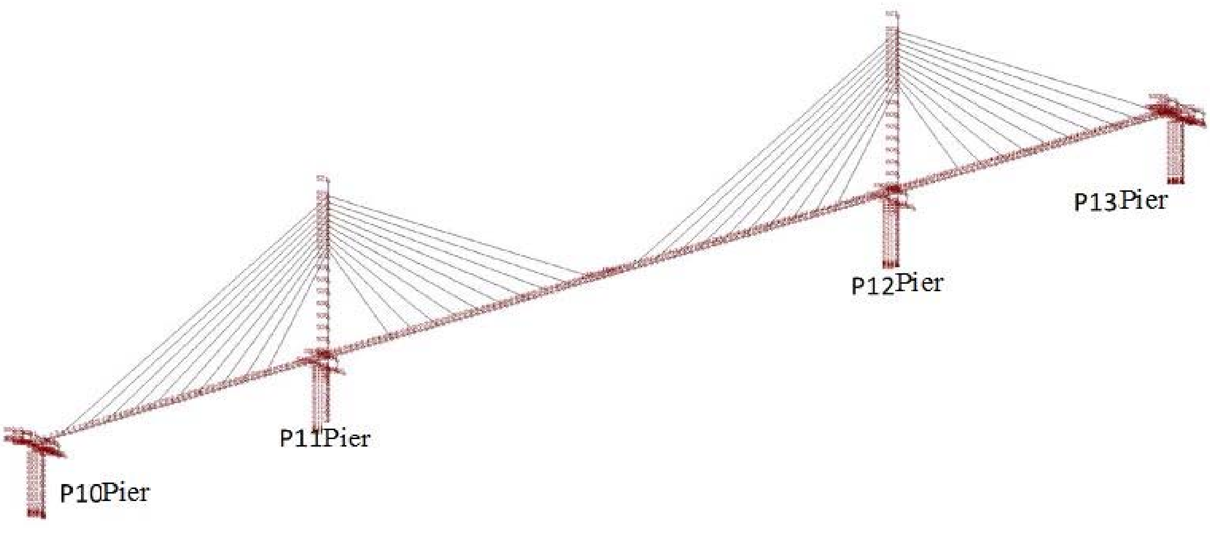
2.1 Analysis Model

The analysis model is a 3D model (6 degrees of freedom) of the entire bridge system.

Node No.



Element No.



2.2 Models of Members

(1) Superstructure　　　　Linear Beam Element

The superstructure shall be modelled as a linear beam member. An axis and a mass point shall be established at the centroid position of the superstructure, regardless of the analysis direction.

(2) Bearing Support

	Longi.	Trans.
P10Pier	Movable	Fixed
P11Pier	Fixed	Fixed
P12Pier	Fixed	Fixed
P13Pier	Movable	Fixed

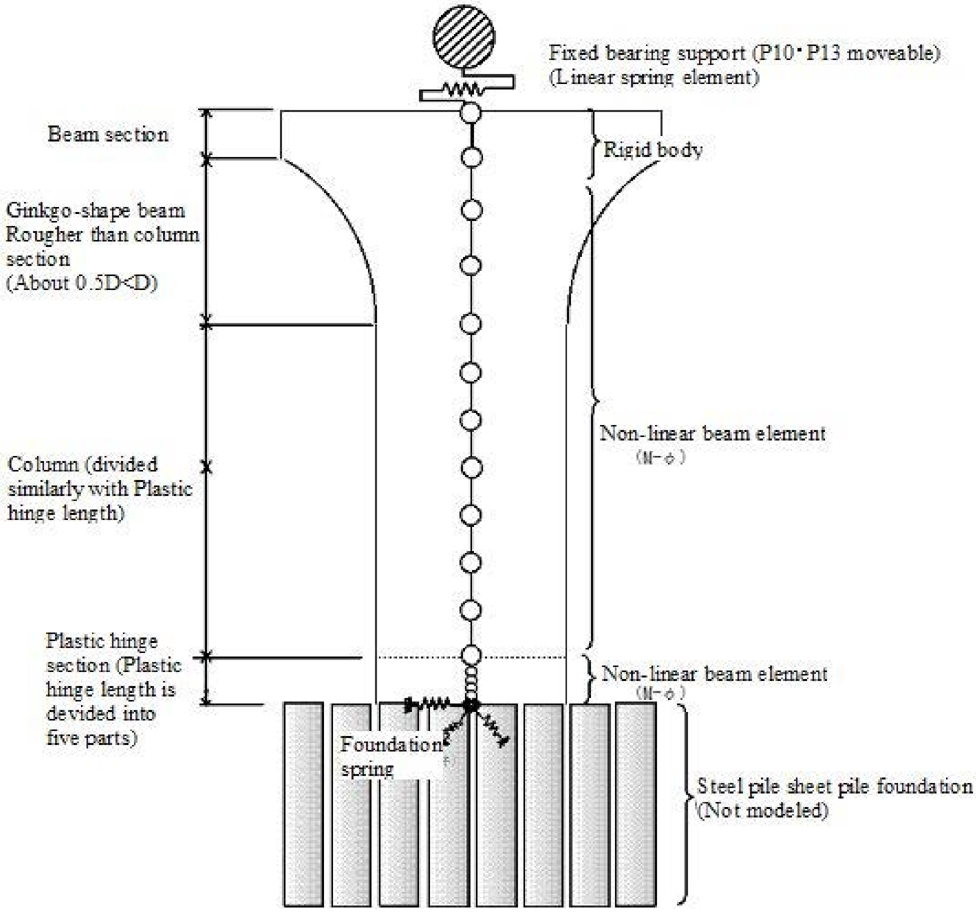
Support	Longi.	Trans.	Vertical	Longi. Rotation	Trans. Rotation	Vertical Rotation
Movable Support	Free	Restricted	Restricted	Restricted	Free	Free
Fixed Support	Restricted	Restricted	Restricted	Restricted	Free	Free

(3) RC Pier

Plastic hinge member : The plastic hinge section shall be considered as a non-linear beam element and the length shall be divided into five equal parts.
M-ϕ ; Peak orient Bi-linear (Takeda)
(Rigidity reduction index α =-0.5)

Generel : Non-linear beam element
M-ϕ ; Peak orient Bi-linear (Takeda)
(Rigidity reduction index α =-0.5)

Model of Pier and Foundation



(4) Foundation

The effect of the ground/foundation shall be replaced by a linear concentrated spring. The concentrated spring shall consider rotation and horizontal couple.

2.3 Damping

(1) Hysteresis Damping
Hysteresis damping is considered automatically in the dynamic analysis.

(2) b) Damping Coefficient of Structural Elements

Structural Member			Dumping Coef	Remarks
Superstructure	Steel		2%	Steel Structure Linear Member is 2%
	Cable		1%	Cable is 1%
Substructure	RC Pier	Linear	5%	Linear Member is 5%
		Non-linear	1%	Non-linear Member is 5%
Foundation	Ground Type Ⅲ		20%	Steel Pipe Sheet Pile Foundation
Bearing support	Fixed Bearing Support		0%	Fixed Bearing Support is 0%
	Movable Bearing Support		0%	Movable Bearing Support is 0%

3) Internal Damping and Radiational Damping
Internal damping and radiational damping shall apply Rayleigh's damping and the damping coefficient for each member shall be obtained from the Specifications of Highway Bridges, Graph 7.3.1.

2.4 Point Mass

Point mass shall be decided as follows:

(1) Superstructure
In order to consider high vibration mode, the point mass shall be set at same position with Node for static analysis.

(2) Pier
The point mass shall be set at node point which is divided by plastic-hinge length. Beam will be divided roughly rather than column.

2.5 Node Coordinates

Node Coordinates (Superstructure)			
Girder			
Node No.	X	Y	Z
1	1.0000	0.0000	16.8172
2	3.7500	0.0000	16.8248
3	6.0000	0.0000	16.8310
4	8.2500	0.0000	16.8371
5	10.5000	0.0000	16.8431
6	12.7500	0.0000	16.8491
7	15.0000	0.0000	16.8550
8	17.2500	0.0000	16.8608
9	19.5000	0.0000	16.8666
10	21.7500	0.0000	16.8723
11	24.0000	0.0000	16.8780
12	26.2500	0.0000	16.8836
13	28.5000	0.0000	16.8891
14	30.7500	0.0000	16.8946
15	33.0000	0.0000	16.9000
16	35.2500	0.0000	16.9053
17	37.5000	0.0000	16.9106
18	39.7500	0.0000	16.9158
19	42.0000	0.0000	16.9210
20	44.2500	0.0000	16.9261
21	46.5000	0.0000	16.9311
22	48.7500	0.0000	16.9360
23	51.0000	0.0000	16.9409
24	53.2500	0.0000	16.9458
25	55.5000	0.0000	16.9505
26	57.7500	0.0000	16.9553
27	60.0000	0.0000	16.9599
28	62.2500	0.0000	16.9645
29	64.5000	0.0000	16.9690
30	66.7500	0.0000	16.9735
31	69.0000	0.0000	16.9778
32	71.2500	0.0000	16.9822
33	73.5000	0.0000	16.9864
34	75.7500	0.0000	16.9906
35	78.0000	0.0000	16.9948
36	80.2500	0.0000	16.9988
37	82.5000	0.0000	17.0029
38	84.7500	0.0000	17.0068
39	87.0000	0.0000	17.0107
40	89.2500	0.0000	17.0145
41	91.5000	0.0000	17.0183
42	93.7500	0.0000	17.0220
43	96.0000	0.0000	17.0256
44	98.2500	0.0000	17.0292
45	100.5000	0.0000	17.0327
46	102.7500	0.0000	17.0361
47	105.0000	0.0000	17.0395
48	106.8333	0.0000	17.0422
49	108.6667	0.0000	17.0449
50	110.5000	0.0000	17.0475
51	111.9000	0.0000	17.0496
52	112.0000	0.0000	17.0496
53	112.1000	0.0000	17.0496
54	113.5000	0.0000	17.0517
55	115.3333	0.0000	17.0542
56	117.1667	0.0000	17.0567
57	119.0000	0.0000	17.0591
58	121.2500	0.0000	17.0620
59	123.5000	0.0000	17.0649
60	125.7500	0.0000	17.0677
61	128.0000	0.0000	17.0704
62	130.2500	0.0000	17.0731
63	132.5000	0.0000	17.0757
64	134.7500	0.0000	17.0782
65	137.0000	0.0000	17.0807
66	139.2500	0.0000	17.0831

Node No.	X	Y	Z
67	141.5000	0.0000	17.0855
68	143.7500	0.0000	17.0877
69	146.0000	0.0000	17.0900
70	148.2500	0.0000	17.0921
71	150.5000	0.0000	17.0942
72	152.7500	0.0000	17.0963
73	155.0000	0.0000	17.0982
74	157.2500	0.0000	17.1002
75	159.5000	0.0000	17.1020
76	161.7500	0.0000	17.1038
77	164.0000	0.0000	17.1055
78	166.2500	0.0000	17.1072
79	168.5000	0.0000	17.1087
80	170.7500	0.0000	17.1103
81	173.0000	0.0000	17.1117
82	175.2500	0.0000	17.1131
83	177.5000	0.0000	17.1145
84	179.7500	0.0000	17.1158
85	182.0000	0.0000	17.1170
86	184.2500	0.0000	17.1181
87	186.5000	0.0000	17.1192
88	188.7500	0.0000	17.1202
89	191.0000	0.0000	17.1212
90	193.2500	0.0000	17.1221
91	195.5000	0.0000	17.1229
92	197.7500	0.0000	17.1237
93	200.0000	0.0000	17.1244
94	202.2500	0.0000	17.1250
95	204.5000	0.0000	17.1256
96	206.7500	0.0000	17.1261
97	209.0000	0.0000	17.1266
98	211.2500	0.0000	17.1270
99	213.5000	0.0000	17.1273
100	215.7500	0.0000	17.1276
101	218.0000	0.0000	17.1278
102	220.2500	0.0000	17.1279
103	220.8100	0.0000	17.1279
104	222.5000	0.0000	17.1280
105	224.0000	0.0000	17.1280
106	225.5000	0.0000	17.1280
107	227.1900	0.0000	17.1279
108	227.7500	0.0000	17.1279
109	230.0000	0.0000	17.1278
110	232.2500	0.0000	17.1276
111	234.5000	0.0000	17.1273
112	236.7500	0.0000	17.1270
113	239.0000	0.0000	17.1266
114	241.2500	0.0000	17.1261
115	243.5000	0.0000	17.1256
116	245.7500	0.0000	17.1250
117	248.0000	0.0000	17.1244
118	250.2500	0.0000	17.1237
119	252.5000	0.0000	17.1229
120	254.7500	0.0000	17.1221
121	257.0000	0.0000	17.1212
122	259.2500	0.0000	17.1202
123	261.5000	0.0000	17.1192
124	263.7500	0.0000	17.1181
125	266.0000	0.0000	17.1170
126	268.2500	0.0000	17.1158
127	270.5000	0.0000	17.1145
128	272.7500	0.0000	17.1131
129	275.0000	0.0000	17.1117
130	277.2500	0.0000	17.1103
131	279.5000	0.0000	17.1087
132	281.7500	0.0000	17.1072

Node No.	X	Y	Z
133	284.0000	0.0000	17.1055
134	286.2500	0.0000	17.1038
135	288.5000	0.0000	17.1020
136	290.7500	0.0000	17.1002
137	293.0000	0.0000	17.0982
138	295.2500	0.0000	17.0963
139	297.5000	0.0000	17.0942
140	299.7500	0.0000	17.0921
141	302.0000	0.0000	17.0900
142	304.2500	0.0000	17.0877
143	306.5000	0.0000	17.0855
144	308.7500	0.0000	17.0831
145	311.0000	0.0000	17.0807
146	313.2500	0.0000	17.0782
147	315.5000	0.0000	17.0757
148	317.7500	0.0000	17.0731
149	320.0000	0.0000	17.0704
150	322.2500	0.0000	17.0677
151	324.5000	0.0000	17.0649
152	326.7500	0.0000	17.0620
153	329.0000	0.0000	17.0591
154	330.8333	0.0000	17.0567
155	332.6667	0.0000	17.0542
156	334.5000	0.0000	17.0517
157	335.9000	0.0000	17.0496
158	336.0000	0.0000	17.0496
159	336.1000	0.0000	17.0496
160	337.5000	0.0000	17.0475
161	339.3333	0.0000	17.0449
162	341.1667	0.0000	17.0422
163	343.0000	0.0000	17.0395
164	345.2500	0.0000	17.0361
165	347.5000	0.0000	17.0327
166	349.7500	0.0000	17.0292
167	352.0000	0.0000	17.0256
168	354.2500	0.0000	17.0220
169	356.5000	0.0000	17.0183
170	358.7500	0.0000	17.0145
171	361.0000	0.0000	17.0107
172	363.2500	0.0000	17.0068
173	365.5000	0.0000	17.0029
174	367.7500	0.0000	16.9988
175	370.0000	0.0000	16.9948
176	372.2500	0.0000	16.9906
177	374.5000	0.0000	16.9864
178	376.7500	0.0000	16.9822
179	379.0000	0.0000	16.9778
180	381.2500	0.0000	16.9735
181	383.5000	0.0000	16.9690
182	385.7500	0.0000	16.9645
183	388.0000	0.0000	16.9599
184	390.2500	0.0000	16.9553
185	392.5000	0.0000	16.9505
186	394.7500	0.0000	16.9458
187	397.0000	0.0000	16.9409
188	399.2500	0.0000	16.9360
189	401.5000	0.0000	16.9311
190	403.7500	0.0000	16.9261
191	406.0000	0.0000	16.9210
192	408.2500	0.0000	16.9158
193	410.5000	0.0000	16.9106
194	412.7500	0.0000	16.9053
195	415.0000	0.0000	16.9000
196	417.2500	0.0000	16.8946
197	419.5000	0.0000	16.8891
198	421.7500	0.0000	16.8836

Node No.	X	Y	Z
199	424.0000	0.0000	16.8780
200	426.2500	0.0000	16.8723
201	428.5000	0.0000	16.8666
202	430.7500	0.0000	16.8608
203	433.0000	0.0000	16.8550
204	435.2500	0.0000	16.8491
205	437.5000	0.0000	16.8431
206	439.7500	0.0000	16.8371
207	442.0000	0.0000	16.8310
208	444.2500	0.0000	16.8248
209	447.0000	0.0000	16.8172
10103	220.8100	0.0000	17.1279
10107	227.1900	0.0000	17.1279

Tower			
Node No.	X	Y	Z
501	112.0000	0.0000	18.0296
502	112.0000	0.0000	18.6296
503	112.0000	0.0000	22.2296
504	112.0000	0.0000	26.2296
505	112.0000	0.0000	30.2296
506	112.0000	0.0000	34.2296
507	112.0000	0.0000	38.2296
508	112.0000	0.0000	42.2296
509	112.0000	0.0000	46.2296
510	112.0000	0.0000	50.2296
511	112.0000	0.0000	53.0296
512	112.0000	0.0000	55.0296
513	112.0000	0.0000	57.0296
514	112.0000	0.0000	59.0296
515	112.0000	0.0000	61.0296
516	112.0000	0.0000	63.0296
517	112.0000	0.0000	65.0296
518	112.0000	0.0000	67.0296
519	112.0000	0.0000	69.0296
520	112.0000	0.0000	71.0296
521	112.0000	0.0000	76.0296
601	336.0000	0.0000	18.0296
602	336.0000	0.0000	18.6296
603	336.0000	0.0000	22.2296
604	336.0000	0.0000	26.2296
605	336.0000	0.0000	30.2296
606	336.0000	0.0000	34.2296
607	336.0000	0.0000	38.2296
608	336.0000	0.0000	42.2296
609	336.0000	0.0000	46.2296
610	336.0000	0.0000	50.2296
611	336.0000	0.0000	53.0296
612	336.0000	0.0000	55.0296
613	336.0000	0.0000	57.0296
614	336.0000	0.0000	59.0296
615	336.0000	0.0000	61.0296
616	336.0000	0.0000	63.0296
617	336.0000	0.0000	65.0296
618	336.0000	0.0000	67.0296
619	336.0000	0.0000	69.0296
620	336.0000	0.0000	71.0296
621	336.0000	0.0000	76.0296

Cross Beam			
Node No.	X	Y	Z
3101	1.0000	4.2500	16.8172
3104	1.0000	-4.2500	16.8172
3201	112.0000	4.0850	17.0496
3208	112.0000	1.2500	17.0496
3209	112.0000	-1.2500	17.0496
3204	112.0000	-4.0850	17.0496
3301	336.0000	4.0850	17.0496
3308	336.0000	1.2500	17.0496
3309	336.0000	-1.2500	17.0496
3304	336.0000	-4.0850	17.0496
3401	447.0000	4.2500	16.8172
3404	447.0000	-4.2500	16.8172

End Link (Rocking Bearing)			
Node No.	X	Y	Z
3111	1.0000	4.2500	16.8172
3114	1.0000	-4.2500	16.8172
3411	447.0000	4.2500	16.8172
3414	447.0000	-4.2500	16.8172
3121	1.0000	4.2500	13.8172
3124	1.0000	-4.2500	13.8172
3421	447.0000	4.2500	13.8172
3424	447.0000	-4.2500	13.8172

Bearing Support Virtual Member			
Node No.	X	Y	Z
20011	1.0000	4.2500	13.8172
20012	0.0000	4.2500	13.8172
20001	1.0000	0.0000	14.1000
20002	1.0000	0.0000	14.1000
20021	1.0000	-4.2500	13.8172
20022	0.0000	-4.2500	13.8172
20031	112.0000	4.0850	13.4000
20041	112.0000	0.0000	13.4000
20051	112.0000	-4.0850	13.4000
20061	336.0000	4.0850	13.4000
20071	336.0000	0.0000	13.4000
20081	336.0000	-4.0850	13.4000
20091	447.0000	4.2500	13.8172
20092	448.0000	4.2500	13.8172
20209	447.0000	0.0000	14.1000
20210	447.0000	0.0000	14.1000
20101	447.0000	-4.2500	13.8172
20102	448.0000	-4.2500	13.8172

Adjacent Bridge (BP side PC Girder)			
Node No.	X	Y	Z
30010	-1.0000	8.1500	17.5000
30011	-1.0000	8.1500	14.5000
30012	-1.0000	8.1500	14.5000
30013	-1.0000	8.1500	14.1000
30020	-1.0000	4.5500	17.5000
30021	-1.0000	4.5500	14.5000
30022	-1.0000	4.5500	14.5000
30023	-1.0000	4.5500	14.1000
30030	-1.0000	-4.5500	17.5000
30031	-1.0000	-4.5500	14.5000
30032	-1.0000	-4.5500	14.5000
30033	-1.0000	-4.5500	14.1000
30040	-1.0000	-8.1500	17.5000
30041	-1.0000	-8.1500	14.5000
30042	-1.0000	-8.1500	14.5000
30043	-1.0000	-8.1500	14.1000

Adjacent Bridge (EP side steel Girder)			
Node No.	X	Y	Z
30050	449.2000	8.1780	17.7000
30051	449.2000	8.1780	14.3000
30052	449.2000	8.1780	14.3000
30053	449.2000	8.1780	14.1000
30060	449.2000	4.1000	17.7000
30061	449.2000	4.1000	14.3000
30062	449.2000	4.1000	14.3000
30063	449.2000	4.1000	14.1000
30070	449.2000	-4.1000	17.7000
30071	449.2000	-4.1000	14.3000
30072	449.2000	-4.1000	14.3000
30073	449.2000	-4.1000	14.1000
30080	449.2000	-8.1780	17.7000
30081	449.2000	-8.1780	14.3000
30082	449.2000	-8.1780	14.3000
30083	449.2000	-8.1780	14.1000

P10 Pier			
Node No.	X	Y	Z
6001	0.0000	10.0000	14.1000
6002	0.0000	8.1500	14.1000
6003	0.0000	4.5500	14.1000
6004	0.0000	4.2500	14.1000
6005	0.0000	0.0000	14.1000
6006	0.0000	-4.2500	14.1000
6007	0.0000	-4.5500	14.1000
6008	0.0000	-8.1500	14.1000
6009	0.0000	-10.0000	14.1000
6010	0.0000	0.0000	11.6000
6011	0.0000	0.0000	9.9750
6012	0.0000	0.0000	8.3500
6013	0.0000	0.0000	6.7250
6014	0.0000	0.0000	5.1000
6015	0.0000	0.0000	3.3250
6016	0.0000	0.0000	1.5500
6017	0.0000	0.0000	-0.2250
6018	0.0000	0.0000	-2.0000
6019	0.0000	0.0000	-3.7750
6020	0.0000	0.0000	-5.5500
6021	0.0000	0.0000	-7.3250
6022	0.0000	0.0000	-7.6800
6023	0.0000	0.0000	-8.0350
6024	0.0000	0.0000	-8.3900
6025	0.0000	0.0000	-8.7450
6026	0.0000	0.0000	-9.1000

P11 Pier			
Node No.	X	Y	Z
6101	112.0000	7.2500	13.4000
6102	112.0000	4.0850	13.4000
6103	112.0000	0.0000	13.4000
6104	112.0000	-4.0850	13.4000
6105	112.0000	-7.2500	13.4000
6106	112.0000	0.0000	12.4000
6107	112.0000	0.0000	11.2750
6108	112.0000	0.0000	10.1500
6109	112.0000	0.0000	9.0250
6110	112.0000	0.0000	7.9000
6111	112.0000	0.0000	6.2000
6112	112.0000	0.0000	4.5000
6113	112.0000	0.0000	2.8000
6114	112.0000	0.0000	1.1000
6115	112.0000	0.0000	-0.6000
6116	112.0000	0.0000	-2.3000
6117	112.0000	0.0000	-4.0000
6118	112.0000	0.0000	-5.7000
6119	112.0000	0.0000	-7.4000
6120	112.0000	0.0000	-7.7400
6121	112.0000	0.0000	-8.0800
6122	112.0000	0.0000	-8.4200
6123	112.0000	0.0000	-8.7600
6124	112.0000	0.0000	-9.1000

P12 Pier			
Node No.	X	Y	Z
6201	336.0000	7.2500	13.4000
6202	336.0000	4.0850	13.4000
6203	336.0000	0.0000	13.4000
6204	336.0000	-4.0850	13.4000
6205	336.0000	-7.2500	13.4000
6206	336.0000	0.0000	12.4000
6207	336.0000	0.0000	11.2750
6208	336.0000	0.0000	10.1500
6209	336.0000	0.0000	9.0250
6210	336.0000	0.0000	7.9000
6211	336.0000	0.0000	6.2000
6212	336.0000	0.0000	4.5000
6213	336.0000	0.0000	2.8000
6214	336.0000	0.0000	1.1000
6215	336.0000	0.0000	-0.6000
6216	336.0000	0.0000	-2.3000
6217	336.0000	0.0000	-4.0000
6218	336.0000	0.0000	-5.7000
6219	336.0000	0.0000	-7.4000
6220	336.0000	0.0000	-7.7400
6221	336.0000	0.0000	-8.0800
6222	336.0000	0.0000	-8.4200
6223	336.0000	0.0000	-8.7600
6224	336.0000	0.0000	-9.1000

P13 Pier			
Node No.	X	Y	Z
6301	448.0000	10.0000	14.1000
6302	448.0000	8.1780	14.1000
6303	448.0000	4.2500	14.1000
6304	448.0000	4.1000	14.1000
6305	448.0000	0.0000	14.1000
6306	448.0000	-4.1000	14.1000
6307	448.0000	-4.2500	14.1000
6308	448.0000	-8.1780	14.1000
6309	448.0000	-10.0000	14.1000
6310	448.0000	0.0000	11.6000
6311	448.0000	0.0000	9.9750
6312	448.0000	0.0000	8.3500
6313	448.0000	0.0000	6.7250
6314	448.0000	0.0000	5.1000
6315	448.0000	0.0000	3.3250
6316	448.0000	0.0000	1.5500
6317	448.0000	0.0000	-0.2250
6318	448.0000	0.0000	-2.0000
6319	448.0000	0.0000	-3.7750
6320	448.0000	0.0000	-5.5500
6321	448.0000	0.0000	-7.3250
6322	448.0000	0.0000	-7.6800
6323	448.0000	0.0000	-8.0350
6324	448.0000	0.0000	-8.3900
6325	448.0000	0.0000	-8.7450
6326	448.0000	0.0000	-9.1000

2.6 Nodal Mass

Nodal Mass ※Distribution Load shall be considered by beam elemnt

Girder

Node No.	X	Y	Z	RX	RY	RZ	
1	80.000	80.000	80.000	0	0	0	
2	0	0	0	0	0	0	
3	39.600	39.600	39.600	0	0	0	
4	0	0	0	0	0	0	
5	0	0	0	0	0	0	
6	0	0	0	0	0	0	
7	39.600	39.600	39.600	0	0	0	
8	0	0	0	0	0	0	
9	0	0	0	0	0	0	
10	0	0	0	0	0	0	
11	39.600	39.600	39.600	0	0	0	
12	0	0	0	0	0	0	
13	0	0	0	0	0	0	
14	0	0	0	0	0	0	
15	39.600	39.600	39.600	0	0	0	
16	0	0	0	0	0	0	
17	0	0	0	0	0	0	
18	0	0	0	0	0	0	
19	39.600	39.600	39.600	0	0	0	
20	0	0	0	0	0	0	
21	0	0	0	0	0	0	
22	0	0	0	0	0	0	
23	37.700	37.700	37.700	0	0	0	
24	0	0	0	0	0	0	
25	0	0	0	0	0	0	
26	0	0	0	0	0	0	
27	37.700	37.700	37.700	0	0	0	
28	0	0	0	0	0	0	
29	0	0	0	0	0	0	
30	0	0	0	0	0	0	
31	37.700	37.700	37.700	0	0	0	
32	0	0	0	0	0	0	
33	0	0	0	0	0	0	
34	0	0	0	0	0	0	
35	37.700	37.700	37.700	0	0	0	
36	0	0	0	0	0	0	
37	0	0	0	0	0	0	
38	0	0	0	0	0	0	
39	37.700	37.700	37.700	0	0	0	
40	0	0	0	0	0	0	
41	0	0	0	0	0	0	
42	0	0	0	0	0	0	
43	0	0	0	0	0	0	
44	0	0	0	0	0	0	
45	0	0	0	0	0	0	
46	0	0	0	0	0	0	
47	0	0	0	0	0	0	
48	0	0	0	0	0	0	
49	0	0	0	0	0	0	
50	0	0	0	0	0	0	
51	0	0	0	0	0	0	
52	0	0	0	0	0	0	
53	0	0	0	0	0	0	
54	0	0	0	0	0	0	
55	0	0	0	0	0	0	
56	0	0	0	0	0	0	
57	0	0	0	0	0	0	
58	0	0	0	0	0	0	
59	0	0	0	0	0	0	
60	0	0	0	0	0	0	
61	0	0	0	0	0	0	
62	0	0	0	0	0	0	
63	0	0	0	0	0	0	
64	0	0	0	0	0	0	
65	37.700	37.700	37.700	0	0	0	
66	0	0	0	0	0	0	
67	0	0	0	0	0	0	

Node No.	X	Y	Z	RX	RY	RZ
68	0	0	0	0	0	0
69	37.700	37.700	37.700	0	0	0
70	0	0	0	0	0	0
71	0	0	0	0	0	0
72	0	0	0	0	0	0
73	37.700	37.700	37.700	0	0	0
74	0	0	0	0	0	0
75	0	0	0	0	0	0
76	0	0	0	0	0	0
77	37.700	37.700	37.700	0	0	0
78	0	0	0	0	0	0
79	0	0	0	0	0	0
80	0	0	0	0	0	0
81	37.700	37.700	37.700	0	0	0
82	0	0	0	0	0	0
83	0	0	0	0	0	0
84	0	0	0	0	0	0
85	39.600	39.600	39.600	0	0	0
86	0	0	0	0	0	0
87	0	0	0	0	0	0
88	0	0	0	0	0	0
89	39.600	39.600	39.600	0	0	0
90	0	0	0	0	0	0
91	0	0	0	0	0	0
92	0	0	0	0	0	0
93	39.600	39.600	39.600	0	0	0
94	0	0	0	0	0	0
95	0	0	0	0	0	0
96	0	0	0	0	0	0
97	39.600	39.600	39.600	0	0	0
98	0	0	0	0	0	0
99	0	0	0	0	0	0
100	0	0	0	0	0	0
101	39.600	39.600	39.600	0	0	0
102	0	0	0	0	0	0
103	0	0	0	0	0	0
104	0	0	0	0	0	0
105	0	0	0	0	0	0
106	0	0	0	0	0	0
107	0	0	0	0	0	0
108	0	0	0	0	0	0
109	39.600	39.600	39.600	0	0	0
110	0	0	0	0	0	0
111	0	0	0	0	0	0
112	0	0	0	0	0	0
113	39.600	39.600	39.600	0	0	0
114	0	0	0	0	0	0
115	0	0	0	0	0	0
116	0	0	0	0	0	0
117	39.600	39.600	39.600	0	0	0
118	0	0	0	0	0	0
119	0	0	0	0	0	0
120	0	0	0	0	0	0
121	39.600	39.600	39.600	0	0	0
122	0	0	0	0	0	0
123	0	0	0	0	0	0
124	0	0	0	0	0	0
125	39.600	39.600	39.600	0	0	0
126	0	0	0	0	0	0
127	0	0	0	0	0	0
128	0	0	0	0	0	0
129	37.700	37.700	37.700	0	0	0
130	0	0	0	0	0	0
131	0	0	0	0	0	0
132	0	0	0	0	0	0
133	37.700	37.700	37.700	0	0	0
134	0	0	0	0	0	0

Node No.	X	Y	Z	RX	RY	RZ
135	0	0	0	0	0	0
136	0	0	0	0	0	0
137	37.700	37.700	37.700	0	0	0
138	0	0	0	0	0	0
139	0	0	0	0	0	0
140	0	0	0	0	0	0
141	37.700	37.700	37.700	0	0	0
142	0	0	0	0	0	0
143	0	0	0	0	0	0
144	0	0	0	0	0	0
145	37.700	37.700	37.700	0	0	0
146	0	0	0	0	0	0
147	0	0	0	0	0	0
148	0	0	0	0	0	0
149	0	0	0	0	0	0
150	0	0	0	0	0	0
151	0	0	0	0	0	0
152	0	0	0	0	0	0
153	0	0	0	0	0	0
154	0	0	0	0	0	0
155	0	0	0	0	0	0
156	0	0	0	0	0	0
157	0	0	0	0	0	0
158	0	0	0	0	0	0
159	0	0	0	0	0	0
160	0	0	0	0	0	0
161	0	0	0	0	0	0
162	0	0	0	0	0	0
163	0	0	0	0	0	0
164	0	0	0	0	0	0
165	0	0	0	0	0	0
166	0	0	0	0	0	0
167	0	0	0	0	0	0
168	0	0	0	0	0	0
169	0	0	0	0	0	0
170	0	0	0	0	0	0
171	37.700	37.700	37.700	0	0	0
172	0	0	0	0	0	0
173	0	0	0	0	0	0
174	0	0	0	0	0	0
175	37.700	37.700	37.700	0	0	0
176	0	0	0	0	0	0
177	0	0	0	0	0	0
178	0	0	0	0	0	0
179	37.700	37.700	37.700	0	0	0
180	0	0	0	0	0	0
181	0	0	0	0	0	0
182	0	0	0	0	0	0
183	37.700	37.700	37.700	0	0	0
184	0	0	0	0	0	0
185	0	0	0	0	0	0
186	0	0	0	0	0	0
187	37.700	37.700	37.700	0	0	0
188	0	0	0	0	0	0
189	0	0	0	0	0	0
190	0	0	0	0	0	0
191	39.600	39.600	39.600	0	0	0
192	0	0	0	0	0	0
193	0	0	0	0	0	0
194	0	0	0	0	0	0
195	39.600	39.600	39.600	0	0	0
196	0	0	0	0	0	0
197	0	0	0	0	0	0
198	0	0	0	0	0	0
199	39.600	39.600	39.600	0	0	0
200	0	0	0	0	0	0
201	0	0	0	0	0	0

Node No.	X	Y	Z	RX	RY	RZ	
202	0	0	0	0	0	0	
203	39.600	39.600	39.600	0	0	0	
204	0	0	0	0	0	0	
205	0	0	0	0	0	0	
206	0	0	0	0	0	0	
207	39.600	39.600	39.600	0	0	0	
208	0	0	0	0	0	0	
209	80.000	80.000	80.000	0	0	0	

Tower							
Node No.	X	Y	Z	RX	RY	RZ	
501	0	0	0	0	0	0	
502	0	0	0	0	0	0	
503	0	0	0	0	0	0	
504	0	0	0	0	0	0	
505	0	0	0	0	0	0	
506	0	0	0	0	0	0	
507	0	0	0	0	0	0	
508	0	0	0	0	0	0	
509	0	0	0	0	0	0	
510	0	0	0	0	0	0	
511	0	0	0	0	0	0	
512	55.200	55.200	55.200	0	0	0	
513	55.200	55.200	55.200	0	0	0	
514	55.200	55.200	55.200	0	0	0	
515	55.200	55.200	55.200	0	0	0	
516	55.200	55.200	55.200	0	0	0	
517	58.000	58.000	58.000	0	0	0	
518	58.000	58.000	58.000	0	0	0	
519	58.000	58.000	58.000	0	0	0	
520	58.000	58.000	58.000	0	0	0	
521	58.000	58.000	58.000	0	0	0	
601	0	0	0	0	0	0	
602	0	0	0	0	0	0	
603	0	0	0	0	0	0	
604	0	0	0	0	0	0	
605	0	0	0	0	0	0	
606	0	0	0	0	0	0	
607	0	0	0	0	0	0	
608	0	0	0	0	0	0	
609	0	0	0	0	0	0	
610	0	0	0	0	0	0	
611	0	0	0	0	0	0	
612	55.200	55.200	55.200	0	0	0	
613	55.200	55.200	55.200	0	0	0	
614	55.200	55.200	55.200	0	0	0	
615	55.200	55.200	55.200	0	0	0	
616	55.200	55.200	55.200	0	0	0	
617	58.000	58.000	58.000	0	0	0	
618	58.000	58.000	58.000	0	0	0	
619	58.000	58.000	58.000	0	0	0	
620	58.000	58.000	58.000	0	0	0	
621	58.000	58.000	58.000	0	0	0	

Cross Beam							
Node No.	X	Y	Z	RX	RY	RZ	
3101	100.000	100.000	100.000	0	0	0	
3104	100.000	100.000	100.000	0	0	0	
3201	0	0	0	0	0	0	
3204	0	0	0	0	0	0	
3301	0	0	0	0	0	0	
3304	0	0	0	0	0	0	
3401	100.000	100.000	100.000	0	0	0	
3404	100.000	100.000	100.000	0	0	0	

End Link (Rocking Bearing)							
Node No.	X	Y	Z	RX	RY	RZ	
3111	0	0	0	0	0	0	
3114	0	0	0	0	0	0	
3411	0	0	0	0	0	0	
3414	0	0	0	0	0	0	
3121	0	0	0	0	0	0	
3124	0	0	0	0	0	0	
3421	0	0	0	0	0	0	
3424	0	0	0	0	0	0	

Bearing Support Virtual Member							
Node No.	X	Y	Z	RX	RY	RZ	
20011	0	0	0	0	0	0	
20012	0	0	0	0	0	0	
20021	0	0	0	0	0	0	
20022	0	0	0	0	0	0	
20031	0	0	0	0	0	0	
20041	0	0	0	0	0	0	
20051	0	0	0	0	0	0	
20061	0	0	0	0	0	0	
20071	0	0	0	0	0	0	
20081	0	0	0	0	0	0	
20091	0	0	0	0	0	0	
20092	0	0	0	0	0	0	
20101	0	0	0	0	0	0	
20102	0	0	0	0	0	0	

Adjacent Bridge (BP side PC Girder)							
Node No.	X	Y	Z	RX	RY	RZ	
30010	3000	2200	3050	0	0	0	
30011	0	0	0	0	0	0	
30012	0	0	0	0	0	0	
30013	0	0	0	0	0	0	
30020	3000	2200	3050	0	0	0	
30021	0	0	0	0	0	0	
30022	0	0	0	0	0	0	
30023	0	0	0	0	0	0	
30030	3100	2400	3250	0	0	0	
30031	0	0	0	0	0	0	
30032	0	0	0	0	0	0	
30033	0	0	0	0	0	0	
30040	3100	2400	3250	0	0	0	
30041	0	0	0	0	0	0	
30042	0	0	0	0	0	0	
30043	0	0	0	0	0	0	

Adjacent Bridge (EP side steel Girder)							
Node No.	X	Y	Z	RX	RY	RZ	
30050	750	2200	2150	0	0	0	
30051	0	0	0	0	0	0	
30052	0	0	0	0	0	0	
30053	0	0	0	0	0	0	
30060	750	2200	2150	0	0	0	
30061	0	0	0	0	0	0	
30062	0	0	0	0	0	0	
30063	0	0	0	0	0	0	
30070	750	2200	2150	0	0	0	
30071	0	0	0	0	0	0	
30072	0	0	0	0	0	0	
30073	0	0	0	0	0	0	
30080	750	2200	2150	0	0	0	
30081	0	0	0	0	0	0	
30082	0	0	0	0	0	0	
30083	0	0	0	0	0	0	

P10 Pier						
Node No.	X	Y	Z	RX	RY	RZ
6001	0	0	0	0	0	0
6002	0	0	0	0	0	0
6003	0	0	0	0	0	0
6004	100	100	100	0	0	0
6005	4224.065	4224.065	4224.065	0	0	0
6006	100	100	100	0	0	0
6007	0	0	0	0	0	0
6008	0	0	0	0	0	0
6009	0	0	0	0	0	0
6010	6827.822	6827.822	6827.822	0	0	0
6011	4639.975	4639.975	4639.975	0	0	0
6012	3789.702	3789.702	3789.702	0	0	0
6013	3176.818	3176.818	3176.818	0	0	0
6014	3245.728	3245.728	3245.728	0	0	0
6015	3388.922	3388.922	3388.922	0	0	0
6016	3400.842	3394.386	3388.922	0	0	0
6017	3834.926	3593.342	3388.922	0	0	0
6018	4300.549	3806.755	3388.922	0	0	0
6019	4507.974	3901.826	3388.922	0	0	0
6020	4653.380	3968.470	3388.922	0	0	0
6021	2845.399	2405.544	2033.353	0	0	0
6022	958.816	806.592	677.784	0	0	0
6023	962.879	808.454	677.784	0	0	0
6024	966.830	810.265	677.784	0	0	0
6025	970.676	812.027	677.784	0	0	0
6026	486.595	406.590	338.892	0	0	0

P11 Pier						
Node No.	X	Y	Z	RX	RY	RZ
6101	0	0	0	0	0	0
6102	160	160	160	0	0	0
6103	1604.313	1604.313	1604.313	0	0	0
6104	160	160	160	0	0	0
6105	0	0	0	0	0	0
6106	2485.597	2485.597	2485.597	0	0	0
6107	2478.289	2478.289	2478.289	0	0	0
6108	2292.239	2292.239	2292.239	0	0	0
6109	2162.218	2162.218	2162.218	0	0	0
6110	2696.818	2696.818	2696.818	0	0	0
6111	3245.728	3245.728	3245.728	0	0	0
6112	3245.728	3245.728	3245.728	0	0	0
6113	3245.728	3245.728	3245.728	0	0	0
6114	3283.527	3263.053	3245.728	0	0	0
6115	3781.097	3491.108	3245.728	0	0	0
6116	4162.419	3665.882	3245.728	0	0	0
6117	4337.932	3746.326	3245.728	0	0	0
6118	4467.418	3805.674	3245.728	0	0	0
6119	2728.685	2305.512	1947.437	0	0	0
6120	918.970	772.816	649.146	0	0	0
6121	922.681	774.517	649.146	0	0	0
6122	926.295	776.173	649.146	0	0	0
6123	929.816	777.787	649.146	0	0	0
6124	466.060	389.422	324.573	0	0	0

P12 Pier							
Node No.	X	Y	Z	RX	RY	RZ	
6201	0	0	0	0	0	0	
6202	160	160	160	0	0	0	
6203	1604.3134	1604.3134	1604.313	0	0	0	
6204	160	160	160	0	0	0	
6205	0	0	0	0	0	0	
6206	2485.597	2485.597	2485.597	0	0	0	
6207	2478.289	2478.289	2478.289	0	0	0	
6208	2292.239	2292.239	2292.239	0	0	0	
6209	2162.218	2162.218	2162.218	0	0	0	
6210	2696.818	2696.818	2696.818	0	0	0	
6211	3245.728	3245.728	3245.728	0	0	0	
6212	3245.728	3245.728	3245.728	0	0	0	
6213	3245.728	3245.728	3245.728	0	0	0	
6214	3283.527	3263.053	3245.728	0	0	0	
6215	3781.097	3491.108	3245.728	0	0	0	
6216	4162.419	3665.882	3245.728	0	0	0	
6217	4337.932	3746.326	3245.728	0	0	0	
6218	4467.418	3805.674	3245.728	0	0	0	
6219	2728.685	2305.512	1947.437	0	0	0	
6220	918.970	772.816	649.146	0	0	0	
6221	922.681	774.517	649.146	0	0	0	
6222	926.295	776.173	649.146	0	0	0	
6223	929.816	777.787	649.146	0	0	0	
6224	466.060	389.422	324.573	0	0	0	

P13 Pier							
Node No.	X	Y	Z	RX	RY	RZ	
6301	0	0	0	0	0	0	
6302	0	0	0	0	0	0	
6303	100	100	100	0	0	0	
6304	0	0	0	0	0	0	
6305	4224.0648	4224.0648	4224.065	0	0	0	
6306	0	0	0	0	0	0	
6307	100	100	100	0	0	0	
6308	0	0	0	0	0	0	
6309	0	0	0	0	0	0	
6310	6827.822	6827.822	6827.822	0	0	0	
6311	4639.9748	4639.9748	4639.975	0	0	0	
6312	3789.7018	3789.7018	3789.702	0	0	0	
6313	3176.8182	3176.8182	3176.818	0	0	0	
6314	3245.7281	3245.7281	3245.728	0	0	0	
6315	3388.922	3388.922	3388.922	0	0	0	
6316	3400.8425	3394.3856	3388.922	0	0	0	
6317	3834.9256	3593.3421	3388.922	0	0	0	
6318	4300.5491	3806.7547	3388.922	0	0	0	
6319	4507.9744	3901.8255	3388.922	0	0	0	
6320	4653.3804	3968.4705	3388.922	0	0	0	
6321	2845.3986	2405.5439	2033.353	0	0	0	
6322	958.81568	806.59153	677.784	0	0	0	
6323	962.87924	808.45402	677.784	0	0	0	
6324	966.83009	810.26484	677.784	0	0	0	
6325	970.67573	812.02744	677.784	0	0	0	
6326	486.59478	406.58981	338.892	0	0	0	

2.7 3-dimensional Beam Element

3-dimentional beam element

Girder

Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)	Unit Weight
1	1	1	2	0.93387	1.891085	1.030202	29.096652	200.00
2	2	2	3	0.93387	1.891085	1.030202	29.096652	200.00
3	3	3	4	0.93387	1.891085	1.030202	29.096652	200.00
4	4	4	5	0.93387	1.891085	1.030202	29.096652	200.00
5	5	5	6	0.93387	1.891085	1.030202	29.096652	200.00
6	6	6	7	0.93387	1.891085	1.030202	29.096652	200.00
7	7	7	8	0.93387	1.891085	1.030202	29.096652	200.00
8	8	8	9	0.93387	1.891085	1.030202	29.096652	200.00
9	9	9	10	0.93387	1.891085	1.030202	29.096652	200.00
10	10	10	11	0.93387	1.891085	1.030202	29.096652	200.00
11	11	11	12	0.93387	1.891085	1.030202	29.096652	200.00
12	12	12	13	0.93387	1.891085	1.030202	29.096652	200.00
13	13	13	14	0.93387	1.891085	1.030202	29.096652	200.00
14	14	14	15	0.93387	1.891085	1.030202	29.096652	200.00
15	15	15	16	0.93387	1.891085	1.030202	29.096652	200.00
16	16	16	17	0.93387	1.891085	1.030202	29.096652	200.00
17	17	17	18	0.93387	1.891085	1.030202	29.096652	200.00
18	18	18	19	0.93387	1.891085	1.030202	29.096652	200.00
19	19	19	20	0.93387	1.891085	1.030202	29.096652	200.00
20	20	20	21	0.93387	1.891085	1.030202	29.096652	200.00
21	21	21	22	0.93387	1.891085	1.030202	29.096652	200.00
22	22	22	23	0.93387	1.891085	1.030202	29.096652	200.00
23	23	23	24	0.93387	1.891085	1.030202	29.096652	200.00
24	24	24	25	0.93387	1.891085	1.030202	29.096652	200.00
25	25	25	26	0.93026	1.868521	1.017316	29.068737	200.00
26	26	26	27	0.90465	1.718179	0.931837	28.865650	200.00
27	27	27	28	0.90465	1.718179	0.931837	28.865650	200.00
28	28	28	29	0.90465	1.718179	0.931837	28.865650	200.00
29	29	29	30	0.90465	1.718179	0.931837	28.865650	200.00
30	30	30	31	0.90465	1.718179	0.931837	28.865650	200.00
31	31	31	32	0.90465	1.718179	0.931837	28.865650	200.00
32	32	32	33	0.90465	1.718179	0.931837	28.865650	200.00
33	33	33	34	0.90465	1.718179	0.931837	28.865650	200.00
34	34	34	35	0.90465	1.718179	0.931837	28.865650	200.00
35	35	35	36	0.90465	1.718179	0.931837	28.865650	200.00
36	36	36	37	0.90465	1.718179	0.931837	28.865650	200.00
37	37	37	38	0.90465	1.718179	0.931837	28.865650	200.00
38	38	38	39	0.90465	1.718179	0.931837	28.865650	200.00
39	39	39	40	0.90465	1.718179	0.931837	28.865650	200.00
40	40	40	41	0.90465	1.718179	0.931837	28.865650	200.00
41	41	41	42	0.90465	1.718179	0.931837	28.865650	200.00
42	42	42	43	0.90465	1.718179	0.931837	28.865650	200.00
43	43	43	44	0.90465	1.718179	0.931837	28.865650	200.00
44	44	44	45	0.90465	1.718179	0.931837	28.865650	200.00
45	45	45	46	1.00059	1.978928	1.016358	29.853355	200.00
46	46	46	47	1.01527	2.020746	1.029086	29.993304	200.00
47	47	47	48	1.01527	2.020746	1.029086	29.993304	200.00
48	48	48	49	1.01527	2.020746	1.029086	29.993304	200.00
49	49	49	50	1.01527	2.020746	1.029086	29.993304	200.00
50	50	50	51	10	100	100	100	200.00
51	51	51	52	10	100	100	100	200.00
52	52	52	53	10	100	100	100	200.00
53	53	53	54	10	100	100	100	200.00
54	54	54	55	1.01527	2.020746	1.029086	29.993304	200.00
55	55	55	56	1.01527	2.020746	1.029086	29.993304	200.00
56	56	56	57	1.01527	2.020746	1.029086	29.993304	200.00
57	57	57	58	1.01527	2.020746	1.029086	29.993304	200.00
58	58	58	59	1.00059	1.978928	1.016535	29.853355	200.00
59	59	59	60	0.90465	1.718179	0.933080	28.865650	200.00
60	60	60	61	0.90465	1.718179	0.933080	28.865650	200.00
61	61	61	62	0.90465	1.718179	0.933080	28.865650	200.00
62	62	62	63	0.90465	1.718179	0.933080	28.865650	200.00
63	63	63	64	0.90465	1.718179	0.933080	28.865650	200.00
64	64	64	65	0.90465	1.718179	0.933080	28.865650	200.00
65	65	65	66	0.90465	1.718179	0.933080	28.865650	200.00
66	66	66	67	0.90465	1.718179	0.933080	28.865650	200.00
67	67	67	68	0.90465	1.718179	0.933080	28.865650	200.00

Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)	Unit Weight
68	68	68	69	0.90465	1.718179	0.933080	28.865650	200.00
69	69	69	70	0.90465	1.718179	0.933080	28.865650	200.00
70	70	70	71	0.90465	1.718179	0.933080	28.865650	200.00
71	71	71	72	0.90465	1.718179	0.933080	28.865650	200.00
72	72	72	73	0.90465	1.718179	0.933080	28.865650	200.00
73	73	73	74	0.90465	1.718179	0.933080	28.865650	200.00
74	74	74	75	0.90465	1.718179	0.933080	28.865650	200.00
75	75	75	76	0.90465	1.718179	0.933080	28.865650	200.00
76	76	76	77	0.90465	1.718179	0.933080	28.865650	200.00
77	77	77	78	0.90465	1.718179	0.933080	28.865650	200.00
78	78	78	79	0.90465	1.718179	0.933080	28.865650	200.00
79	79	79	80	0.90465	1.718179	0.933080	28.865650	200.00
80	80	80	81	0.90465	1.718179	0.933080	28.865650	200.00
81	81	81	82	0.90465	1.718179	0.933080	28.865650	200.00
82	82	82	83	0.90465	1.718179	0.933080	28.865650	200.00
83	83	83	84	0.90465	1.718179	0.933080	28.865650	200.00
84	84	84	85	0.90465	1.718179	0.933080	28.865650	200.00
85	85	85	86	0.90465	1.718179	0.933080	28.865650	200.00
86	86	86	87	0.90465	1.718179	0.933080	28.865650	200.00
87	87	87	88	0.90465	1.718179	0.933080	28.865650	200.00
88	88	88	89	0.90465	1.718179	0.933080	28.865650	200.00
89	89	89	90	0.90465	1.718179	0.933080	28.865650	200.00
90	90	90	91	0.90465	1.718179	0.933080	28.865650	200.00
91	91	91	92	0.90465	1.718179	0.933080	28.865650	200.00
92	92	92	93	0.90465	1.718179	0.933080	28.865650	200.00
93	93	93	94	0.90465	1.718179	0.933080	28.865650	200.00
94	94	94	95	0.90465	1.718179	0.933080	28.865650	200.00
95	95	95	96	0.90465	1.718179	0.933080	28.865650	200.00
96	96	96	97	0.90465	1.718179	0.933080	28.865650	200.00
97	97	97	98	0.90465	1.718179	0.933080	28.865650	200.00
98	98	98	99	0.90465	1.718179	0.933080	28.865650	200.00
99	99	99	100	0.90465	1.718179	0.933080	28.865650	200.00
100	100	100	101	0.90465	1.718179	0.933080	28.865650	200.00
101	101	101	102	0.90465	1.718179	0.933080	28.865650	200.00
102	102	102	10103	0.90465	1.718179	0.933080	28.865650	200.00
103	103	103	104	0.90465	1.718179	0.933080	28.865650	200.00
104	104	104	105	0.90465	1.718179	0.933080	28.865650	200.00
105	105	105	106	0.90465	1.718179	0.933080	28.865650	200.00
106	106	106	107	0.90465	1.718179	0.933080	28.865650	200.00
107	107	10107	108	0.90465	1.718179	0.933080	28.865650	200.00
108	108	108	109	0.90465	1.718179	0.933080	28.865650	200.00
109	109	109	110	0.90465	1.718179	0.933080	28.865650	200.00
110	110	110	111	0.90465	1.718179	0.933080	28.865650	200.00
111	111	111	112	0.90465	1.718179	0.933080	28.865650	200.00
112	112	112	113	0.90465	1.718179	0.933080	28.865650	200.00
113	113	113	114	0.90465	1.718179	0.933080	28.865650	200.00
114	114	114	115	0.90465	1.718179	0.933080	28.865650	200.00
115	115	115	116	0.90465	1.718179	0.933080	28.865650	200.00
116	116	116	117	0.90465	1.718179	0.933080	28.865650	200.00
117	117	117	118	0.90465	1.718179	0.933080	28.865650	200.00
118	118	118	119	0.90465	1.718179	0.933080	28.865650	200.00
119	119	119	120	0.90465	1.718179	0.933080	28.865650	200.00
120	120	120	121	0.90465	1.718179	0.933080	28.865650	200.00
121	121	121	122	0.90465	1.718179	0.933080	28.865650	200.00
122	122	122	123	0.90465	1.718179	0.933080	28.865650	200.00
123	123	123	124	0.90465	1.718179	0.933080	28.865650	200.00
124	124	124	125	0.90465	1.718179	0.933080	28.865650	200.00
125	125	125	126	0.90465	1.718179	0.933080	28.865650	200.00
126	126	126	127	0.90465	1.718179	0.933080	28.865650	200.00
127	127	127	128	0.90465	1.718179	0.933080	28.865650	200.00
128	128	128	129	0.90465	1.718179	0.933080	28.865650	200.00
129	129	129	130	0.90465	1.718179	0.933080	28.865650	200.00
130	130	130	131	0.90465	1.718179	0.933080	28.865650	200.00
131	131	131	132	0.90465	1.718179	0.933080	28.865650	200.00
132	132	132	133	0.90465	1.718179	0.933080	28.865650	200.00
133	133	133	134	0.90465	1.718179	0.933080	28.865650	200.00
134	134	134	135	0.90465	1.718179	0.933080	28.865650	200.00

Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)	Unit Weight
135	135	135	136	0.90465	1.718179	0.933080	28.865650	200.00
136	136	136	137	0.90465	1.718179	0.933080	28.865650	200.00
137	137	137	138	0.90465	1.718179	0.933080	28.865650	200.00
138	138	138	139	0.90465	1.718179	0.933080	28.865650	200.00
139	139	139	140	0.90465	1.718179	0.933080	28.865650	200.00
140	140	140	141	0.90465	1.718179	0.933080	28.865650	200.00
141	141	141	142	0.90465	1.718179	0.933080	28.865650	200.00
142	142	142	143	0.90465	1.718179	0.933080	28.865650	200.00
143	143	143	144	0.90465	1.718179	0.933080	28.865650	200.00
144	144	144	145	0.90465	1.718179	0.933080	28.865650	200.00
145	145	145	146	0.90465	1.718179	0.933080	28.865650	200.00
146	146	146	147	0.90465	1.718179	0.933080	28.865650	200.00
147	147	147	148	0.90465	1.718179	0.933080	28.865650	200.00
148	148	148	149	0.90465	1.718179	0.933080	28.865650	200.00
149	149	149	150	0.90465	1.718179	0.933080	28.865650	200.00
150	150	150	151	0.90465	1.718179	0.933080	28.865650	200.00
151	151	151	152	1.00059	1.978928	1.016535	29.853355	200.00
152	152	152	153	1.01527	2.020746	1.029086	29.993304	200.00
153	153	153	154	1.01527	2.020746	1.029086	29.993304	200.00
154	154	154	155	1.01527	2.020746	1.029086	29.993304	200.00
155	155	155	156	1.01527	2.020746	1.029086	29.993304	200.00
156	156	156	157	10	100	100	100	200.00
157	157	157	158	10	100	100	100	200.00
158	158	158	159	10	100	100	100	200.00
159	159	159	160	10	100	100	100	200.00
160	160	160	161	1.01527	2.020746	1.029086	29.993304	200.00
161	161	161	162	1.01527	2.020746	1.029086	29.993304	200.00
162	162	162	163	1.01527	2.020746	1.029086	29.993304	200.00
163	163	163	164	1.01527	2.020746	1.029086	29.993304	200.00
164	164	164	165	1.00059	1.978928	1.016358	29.853355	200.00
165	165	165	166	0.90465	1.718179	0.931837	28.865650	200.00
166	166	166	167	0.90465	1.718179	0.931837	28.865650	200.00
167	167	167	168	0.90465	1.718179	0.931837	28.865650	200.00
168	168	168	169	0.90465	1.718179	0.931837	28.865650	200.00
169	169	169	170	0.90465	1.718179	0.931837	28.865650	200.00
170	170	170	171	0.90465	1.718179	0.931837	28.865650	200.00
171	171	171	172	0.90465	1.718179	0.931837	28.865650	200.00
172	172	172	173	0.90465	1.718179	0.931837	28.865650	200.00
173	173	173	174	0.90465	1.718179	0.931837	28.865650	200.00
174	174	174	175	0.90465	1.718179	0.931837	28.865650	200.00
175	175	175	176	0.90465	1.718179	0.931837	28.865650	200.00
176	176	176	177	0.90465	1.718179	0.931837	28.865650	200.00
177	177	177	178	0.90465	1.718179	0.931837	28.865650	200.00
178	178	178	179	0.90465	1.718179	0.931837	28.865650	200.00
179	179	179	180	0.90465	1.718179	0.931837	28.865650	200.00
180	180	180	181	0.90465	1.718179	0.931837	28.865650	200.00
181	181	181	182	0.90465	1.718179	0.931837	28.865650	200.00
182	182	182	183	0.90465	1.718179	0.931837	28.865650	200.00
183	183	183	184	0.90465	1.718179	0.931837	28.865650	200.00
184	184	184	185	0.93026	1.868521	1.017316	29.068737	200.00
185	185	185	186	0.93387	1.891085	1.030202	29.096652	200.00
186	186	186	187	0.93387	1.891085	1.030202	29.096652	200.00
187	187	187	188	0.93387	1.891085	1.030202	29.096652	200.00
188	188	188	189	0.93387	1.891085	1.030202	29.096652	200.00
189	189	189	190	0.93387	1.891085	1.030202	29.096652	200.00
190	190	190	191	0.93387	1.891085	1.030202	29.096652	200.00
191	191	191	192	0.93387	1.891085	1.030202	29.096652	200.00
192	192	192	193	0.93387	1.891085	1.030202	29.096652	200.00
193	193	193	194	0.93387	1.891085	1.030202	29.096652	200.00
194	194	194	195	0.93387	1.891085	1.030202	29.096652	200.00
195	195	195	196	0.93387	1.891085	1.030202	29.096652	200.00
196	196	196	197	0.93387	1.891085	1.030202	29.096652	200.00
197	197	197	198	0.93387	1.891085	1.030202	29.096652	200.00
198	198	198	199	0.93387	1.891085	1.030202	29.096652	200.00
199	199	199	200	0.93387	1.891085	1.030202	29.096652	200.00
200	200	200	201	0.93387	1.891085	1.030202	29.096652	200.00
201	201	201	202	0.93387	1.891085	1.030202	29.096652	200.00

Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)	Unit Weight
202	202	202	203	0.93387	1.891085	1.030202	29.096652	200.00
203	203	203	204	0.93387	1.891085	1.030202	29.096652	200.00
204	204	204	205	0.93387	1.891085	1.030202	29.096652	200.00
205	205	205	206	0.93387	1.891085	1.030202	29.096652	200.00
206	206	206	207	0.93387	1.891085	1.030202	29.096652	200.00
207	207	207	208	0.93387	1.891085	1.030202	29.096652	200.00
208	208	208	209	0.93387	1.891085	1.030202	29.096652	200.00

Tower (P12)								
Elem. No.	Character No.	I-Node	J-Node	$A(m^2)$	$J(m^4)$	$Iy(m^4)$	$Iz(m^4)$	Unit Weight
501	501	501	52	10	100	100	100	43.00
502	502	502	501	0.46860	0.688738	0.609102	0.482573	43.00
503	503	503	502	0.46860	0.688738	0.609102	0.482573	43.00
504	504	504	503	0.46860	0.688738	0.609102	0.482573	43.00
505	505	505	504	0.46860	0.688738	0.609102	0.482573	43.00
506	506	506	505	0.46860	0.688738	0.609102	0.482573	43.00
507	507	507	506	0.46860	0.688738	0.609102	0.482573	43.00
508	508	508	507	0.52634	0.782780	0.688228	0.537639	43.00
509	509	509	508	0.52634	0.782780	0.688228	0.537639	43.00
510	510	510	509	0.52634	0.782780	0.688228	0.537639	43.00
511	511	511	510	0.52634	0.782780	0.688228	0.537639	43.00
512	512	512	511	0.52634	0.782780	0.688228	0.537639	43.00
513	513	513	512	0.52634	0.782780	0.688228	0.537639	43.00
514	514	514	513	0.52634	0.782780	0.688228	0.537639	43.00
515	515	515	514	0.52634	0.782780	0.688228	0.537639	43.00
516	516	516	515	0.52634	0.782780	0.688228	0.537639	43.00
517	517	517	516	0.52634	0.782780	0.688228	0.537639	43.00
518	518	518	517	0.52634	0.782780	0.688228	0.537639	43.00
519	519	519	518	0.52634	0.782780	0.688228	0.537639	43.00
520	520	520	519	0.52634	0.782780	0.688228	0.537639	43.00
521	521	521	520	0.52634	0.782780	0.688228	0.537639	43.00

Tower (P13)								
Elem. No.	Character No.	I-Node	J-Node	$A(m^2)$	$J(m^4)$	$Iy(m^4)$	$Iz(m^4)$	Unit Weight
601	601	601	158	10	100	100	100	43.00
602	602	602	601	0.46860	0.688738	0.609102	0.482573	43.00
603	603	603	602	0.46860	0.688738	0.609102	0.482573	43.00
604	604	604	603	0.46860	0.688738	0.609102	0.482573	43.00
605	605	605	604	0.46860	0.688738	0.609102	0.482573	43.00
606	606	606	605	0.46860	0.688738	0.609102	0.482573	43.00
607	607	607	606	0.46860	0.688738	0.609102	0.482573	43.00
608	608	608	607	0.52634	0.782780	0.688228	0.537639	43.00
609	609	609	608	0.52634	0.782780	0.688228	0.537639	43.00
610	610	610	609	0.52634	0.782780	0.688228	0.537639	43.00
611	611	611	610	0.52634	0.782780	0.688228	0.537639	43.00
612	612	612	611	0.52634	0.782780	0.688228	0.537639	43.00
613	613	613	612	0.52634	0.782780	0.688228	0.537639	43.00
614	614	614	613	0.52634	0.782780	0.688228	0.537639	43.00
615	615	615	614	0.52634	0.782780	0.688228	0.537639	43.00
616	616	616	615	0.52634	0.782780	0.688228	0.537639	43.00
617	617	617	616	0.52634	0.782780	0.688228	0.537639	43.00
618	618	618	617	0.52634	0.782780	0.688228	0.537639	43.00
619	619	619	618	0.52634	0.782780	0.688228	0.537639	43.00
620	620	620	619	0.52634	0.782780	0.688228	0.537639	43.00
621	621	621	620	0.52634	0.782780	0.688228	0.537639	43.00

Cross Beam							
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)
3101	3101	3101	1	10	100	100	100
3102	3102	1	3104	10	100	100	100
3201	3201	3201	3208	0.41536	0.4558707	0.3710245	100
3202	3202	3208	52	10	100	100	100
3203	3203	52	3209	10	100	100	100
3204	3204	3209	3204	0.41536	0.4558707	0.3710245	100
3301	3301	3301	3308	0.41536	0.4558707	0.3710245	100
3302	3302	3308	158	10	100	100	100
3303	3303	158	3309	10	100	100	100
3304	3304	3309	3304	0.41536	0.4558707	0.3710245	100
3401	3401	3401	209	10	100	100	100
3402	3402	209	3404	10	100	100	100

End Link (Rocking Bearing)							
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)
4101	4101	3111	3121	10	100	100	100
4102	4102	3114	3124	10	100	100	100
4401	4401	3411	3421	10	100	100	100
4402	4402	3414	3424	10	100	100	100

Bearing Support Virtual Member							
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)
20017	20017	20012	20011	1000	1000	1000	1000
20018	20018	6004	20012	1000	1000	1000	1000
20001	20001	1	20001	1000	1000	1000	1000
20002	20002	6005	20002	1000	1000	1000	1000
20027	20027	20022	20021	1000	1000	1000	1000
20028	20028	6006	20022	1000	1000	1000	1000
20037	20037	3201	20031	1000	1000	1000	1000
20047	20047	52	20041	1000	1000	1000	1000
20057	20057	3204	20051	1000	1000	1000	1000
20067	20067	3301	20061	1000	1000	1000	1000
20077	20077	158	20071	1000	1000	1000	1000
20087	20087	3304	20081	1000	1000	1000	1000
20097	20097	20091	20092	1000	1000	1000	1000
20098	20098	6303	20092	1000	1000	1000	1000
20209	20209	209	20209	1000	1000	1000	1000
20210	20210	20210	6305	1000	1000	1000	1000
20107	20107	20101	20102	1000	1000	1000	1000
20108	20108	6307	20102	1000	1000	1000	1000

Adjacent Bridge (BP side PC Girder)							
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)
30017	30017	30010	30011	1000	1000	1000	1000
30018	30018	30012	30013	1000	1000	1000	1000
30019	30019	30013	6002	1000	1000	1000	1000
30027	30027	30020	30021	1000	1000	1000	1000
30028	30028	30022	30023	1000	1000	1000	1000
30029	30029	30023	6003	1000	1000	1000	1000
30030	30030	30010	30020	1000	1000	1000	1000
30047	30047	30030	30031	1000	1000	1000	1000
30048	30048	30032	30033	1000	1000	1000	1000
30049	30049	30033	6007	1000	1000	1000	1000
30057	30057	30040	30041	1000	1000	1000	1000
30058	30058	30042	30043	1000	1000	1000	1000
30059	30059	30043	6008	1000	1000	1000	1000
30060	30060	30030	30040	1000	1000	1000	1000

Adjacent Bridge (EP side Steel Girder)							
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)
30077	30077	30050	30051	1000	1000	1000	1000
30078	30078	30052	30053	1000	1000	1000	1000
30079	30079	6302	30053	1000	1000	1000	1000
30087	30087	30060	30061	1000	1000	1000	1000
30088	30088	30062	30063	1000	1000	1000	1000
30089	30089	6304	30063	1000	1000	1000	1000
30097	30097	30070	30071	1000	1000	1000	1000
30098	30098	30072	30073	1000	1000	1000	1000
30099	30099	6306	30073	1000	1000	1000	1000
30107	30107	30080	30081	1000	1000	1000	1000
30108	30108	30082	30083	1000	1000	1000	1000
30109	30109	6308	30083	1000	1000	1000	1000
30110	30110	30050	30060	1000	1000	1000	1000
30120	30120	30060	30070	1000	1000	1000	1000
30130	30130	30070	30080	1000	1000	1000	1000

P10Pier							
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)
6001	6001	6001	6002	10000	100000	100000	100000
6002	6002	6002	6003	10000	100000	100000	100000
6003	6003	6003	6004	10000	100000	100000	100000
6004	6004	6004	6005	10000	100000	100000	100000
6005	6005	6005	6006	10000	100000	100000	100000
6006	6006	6006	6007	10000	100000	100000	100000
6007	6007	6007	6008	10000	100000	100000	100000
6008	6008	6008	6009	10000	100000	100000	100000
6009	6009	6005	6010	10000	100000	100000	100000
6010	6010	6010	6011	61.6015	824.0039	0	532.4442
6011	6011	6011	6012	51.1584	629.5222	0	439.1164
6012	6012	6012	6013	44.3711	504.2004	0	373.3741
6013	6013	6013	6014	40.2097	428.3323	0	346.0253
6014	6014	6014	6015	38.9643	405.8699	0	325.7113
6015	6015	6015	6016	38.9643	405.8699	0	330.8350
6016	6016	6016	6017	38.9643	405.8699	0	323.5160
6017	6017	6017	6018	38.9643	405.8699	0	328.4500
6018	6018	6018	6019	38.9643	405.8699	0	321.4776
6019	6019	6019	6020	38.9643	405.8699	0	326.2353
6020	6020	6020	6021	38.9643	405.8699	0	330.9932
6021	6021	6021	6022	38.9643	405.8699	0	322.3360
6022	6022	6022	6023	38.9643	405.8699	0	323.2547
6023	6023	6023	6024	38.9643	405.8699	0	324.1734
6024	6024	6024	6025	38.9643	405.8699	0	325.0921
6025	6025	6025	6026	38.9643	405.8699	0	326.0110
16010	16010	6010	6011	61.6015	824.0039	0	2718.0735
16011	16011	6011	6012	51.1584	629.5222	0	1692.1925
16012	16012	6012	6013	44.3711	504.2004	0	1093.5574
16013	16013	6013	6014	40.2097	428.3323	0	868.2775
16014	16014	6014	6015	38.9643	405.8699	0	772.9609
16015	16015	6015	6016	38.9643	405.8699	0	785.1205
16016	16016	6016	6017	38.9643	405.8699	0	750.3813
16017	16017	6017	6018	38.9643	405.8699	0	761.8256
16018	16018	6018	6019	38.9643	405.8699	0	773.2700
16019	16019	6019	6020	38.9643	405.8699	0	784.7143
16020	16020	6020	6021	38.9643	405.8699	0	751.9276
16021	16021	6021	6022	38.9643	405.8699	0	758.4127
16022	16022	6022	6023	38.9643	405.8699	0	760.5744
16023	16023	6023	6024	38.9643	405.8699	0	762.7363
16024	16024	6024	6025	38.9643	405.8699	0	764.8980
16025	16025	6025	6026	38.9643	405.8699	0	767.0597

P11Pier							
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)
6101	6101	6101	6102	10000	100000	100000	100000
6102	6102	6102	6103	10000	100000	100000	100000
6103	6103	6103	6104	10000	100000	100000	100000
6104	6104	6104	6105	10000	100000	100000	100000
6105	6105	6103	6106	10000	100000	100000	100000
6106	6106	6106	6107	46.1697	537.2673	0	404.2512
6107	6107	6107	6108	42.7731	474.9452	0	382.2767
6108	6108	6108	6109	40.4948	433.4934	0	355.4438
6109	6109	6109	6110	39.2323	410.6914	0	349.6026
6110	6110	6110	6111	38.9643	405.8699	0	338.7618
6111	6111	6111	6112	38.9643	405.8699	0	343.2820
6112	6112	6112	6113	38.9643	405.8699	0	347.8021
6113	6113	6113	6114	38.9643	405.8699	0	340.5781
6114	6114	6114	6115	38.9643	405.8699	0	344.9476
6115	6115	6115	6116	38.9643	405.8699	0	338.0487
6116	6116	6116	6117	38.9643	405.8699	0	342.2773
6117	6117	6117	6118	38.9643	405.8699	0	346.5058
6118	6118	6118	6119	38.9643	405.8699	0	339.7739
6119	6119	6119	6120	38.9643	405.8699	0	342.2317
6120	6120	6120	6121	38.9643	405.8699	0	343.0509
6121	6121	6121	6122	38.9643	405.8699	0	343.8702
6122	6122	6122	6123	38.9643	405.8699	0	344.6895
6123	6123	6123	6124	38.9643	405.8699	0	345.5087
16106	16106	6106	6108	46.1697	537.2673	0	1287.2593
16107	16107	6107	6109	42.7731	474.9452	0	995.6070
16108	16108	6108	6110	40.4948	433.4934	0	862.0550
16109	16109	6109	6111	39.2323	410.6914	0	779.7530
16110	16110	6110	6112	38.9643	405.8699	0	777.0117
16111	16111	6111	6113	38.9643	405.8699	0	787.3794
16112	16112	6112	6114	38.9643	405.8699	0	797.7470
16113	16113	6113	6115	38.9643	405.8699	0	765.5825
16114	16114	6114	6116	38.9643	405.8699	0	775.4045
16115	16115	6115	6117	38.9643	405.8699	0	785.2265
16116	16116	6116	6118	38.9643	405.8699	0	795.0487
16117	16117	6117	6119	38.9643	405.8699	0	764.6271
16118	16118	6118	6120	38.9643	405.8699	0	773.9580
16119	16119	6119	6121	38.9643	405.8699	0	779.5566
16120	16120	6120	6122	38.9643	405.8699	0	781.4229
16121	16121	6121	6123	38.9643	405.8699	0	783.2891
16122	16122	6122	6124	38.9643	405.8699	0	785.1552
16123	16123	6123	6108	38.9643	405.8699	0	787.0214

P12Pier							
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)
6201	6201	6201	6202	10000	100000	100000	100000
6202	6202	6202	6203	10000	100000	100000	100000
6203	6203	6203	6204	10000	100000	100000	100000
6204	6204	6204	6205	10000	100000	100000	100000
6205	6205	6203	6206	10000	100000	100000	100000
6206	6206	6206	6207	46.1697	537.2673	0	404.2507
6207	6207	6207	6208	42.7731	474.9452	0	382.2762
6208	6208	6208	6209	40.4948	433.4934	0	355.4434
6209	6209	6209	6210	39.2323	410.6914	0	349.6020
6210	6210	6210	6211	38.9643	405.8699	0	338.7615
6211	6211	6211	6212	38.9643	405.8699	0	343.2815
6212	6212	6212	6213	38.9643	405.8699	0	347.8017
6213	6213	6213	6214	38.9643	405.8699	0	340.5777
6214	6214	6214	6215	38.9643	405.8699	0	344.9471
6215	6215	6215	6216	38.9643	405.8699	0	338.0484
6216	6216	6216	6217	38.9643	405.8699	0	342.2768
6217	6217	6217	6218	38.9643	405.8699	0	346.5054
6218	6218	6218	6219	38.9643	405.8699	0	339.7734
6219	6219	6219	6220	38.9643	405.8699	0	342.2313
6220	6220	6220	6221	38.9643	405.8699	0	343.0506
6221	6221	6221	6222	38.9643	405.8699	0	343.8699
6222	6222	6222	6223	38.9643	405.8699	0	344.6891
6223	6223	6223	6224	38.9643	405.8699	0	345.5084
16206	16206	6206	6208	46.1697	537.2673	0	1287.2578
16207	16207	6207	6209	42.7731	474.9452	0	995.6057
16208	16208	6208	6210	40.4948	433.4934	0	862.0540
16209	16209	6209	6211	39.2323	410.6914	0	779.7520
16210	16210	6210	6212	38.9643	405.8699	0	777.0107
16211	16211	6211	6213	38.9643	405.8699	0	787.3784
16212	16212	6212	6214	38.9643	405.8699	0	797.7462
16213	16213	6213	6215	38.9643	405.8699	0	765.5816
16214	16214	6214	6216	38.9643	405.8699	0	775.4036
16215	16215	6215	6217	38.9643	405.8699	0	785.2258
16216	16216	6216	6218	38.9643	405.8699	0	795.0477
16217	16217	6217	6219	38.9643	405.8699	0	764.6263
16218	16218	6218	6220	38.9643	405.8699	0	773.9573
16219	16219	6219	6221	38.9643	405.8699	0	779.5559
16220	16220	6220	6222	38.9643	405.8699	0	781.4220
16221	16221	6221	6223	38.9643	405.8699	0	783.2882
16222	16222	6222	6224	38.9643	405.8699	0	785.1545
16223	16223	6223	6208	38.9643	405.8699	0	787.0205

P13Pier							
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	J(m^4)	Iy(m^4)	Iz(m^4)
6301	6301	6301	6302	10000	100000	100000	100000
6302	6302	6302	6303	10000	100000	100000	100000
6303	6303	6303	6304	10000	100000	100000	100000
6304	6304	6304	6305	10000	100000	100000	100000
6305	6305	6305	6306	10000	100000	100000	100000
6306	6306	6306	6307	10000	100000	100000	100000
6307	6307	6307	6308	10000	100000	100000	100000
6308	6308	6308	6309	10000	100000	100000	100000
6309	6309	6305	6310	10000	100000	100000	100000
6310	6310	6310	6311	61.6015	824.0039	0	534.7626
6311	6311	6311	6312	51.1584	629.5222	0	450.4280
6312	6312	6312	6313	44.3711	504.2004	0	381.5844
6313	6313	6313	6314	40.2097	428.3323	0	339.0534
6314	6314	6314	6315	38.9643	405.8699	0	331.8213
6315	6315	6315	6316	38.9643	405.8699	0	324.1827
6316	6316	6316	6317	38.9643	405.8699	0	329.3066
6317	6317	6317	6318	38.9643	405.8699	0	322.0440
6318	6318	6318	6319	38.9643	405.8699	0	326.9782
6319	6319	6319	6320	38.9643	405.8699	0	331.9122
6320	6320	6320	6321	38.9643	405.8699	0	324.8159
6321	6321	6321	6322	38.9643	405.8699	0	327.6707
6322	6322	6322	6323	38.9643	405.8699	0	328.6223
6323	6323	6323	6324	38.9643	405.8699	0	329.5739
6324	6324	6324	6325	38.9643	405.8699	0	330.5254
6325	6325	6325	6326	38.9643	405.8699	0	331.4770
16310	16310	6310	6311	61.6015	824.0039	0	2991.6315
16311	16311	6311	6312	51.1584	629.5222	0	1692.5189
16312	16312	6312	6313	44.3711	504.2004	0	1155.4305
16313	16313	6313	6314	40.2097	428.3323	0	850.7833
16314	16314	6314	6315	38.9643	405.8699	0	757.1739
16315	16315	6315	6316	38.9643	405.8699	0	769.3335
16316	16316	6316	6317	38.9643	405.8699	0	781.4931
16317	16317	6317	6318	38.9643	405.8699	0	746.9672
16318	16318	6318	6319	38.9643	405.8699	0	758.4116
16319	16319	6319	6320	38.9643	405.8699	0	769.8559
16320	16320	6320	6321	38.9643	405.8699	0	781.3004
16321	16321	6321	6322	38.9643	405.8699	0	744.3800
16322	16322	6322	6323	38.9643	405.8699	0	746.5417
16323	16323	6323	6324	38.9643	405.8699	0	748.7034
16324	16324	6324	6325	38.9643	405.8699	0	750.8651
16325	16325	6325	6326	38.9643	405.8699	0	753.0268

2.8 Non-linear characteristics of Pier

P10 Pier (Longi. Member)

Member No.	Axial Force (kN)	+ Side						− Side					
		Mc (kN·m)	My0 (kN·m)	Mls2 (kN·m)	φc (1/m)	φy0 (1/m)	φls2 (1/m)	Mc (kN·m)	My0 (kN·m)	Mls2 (kN·m)	φc (1/m)	φy0 (1/m)	φls2 (1/m)
6001	0	---	---	---	---	---	---	---	---	---	---	---	---
6002	0	---	---	---	---	---	---	---	---	---	---	---	---
6003	0	---	---	---	---	---	---	---	---	---	---	---	---
6004	0	---	---	---	---	---	---	---	---	---	---	---	---
6005	0	---	---	---	---	---	---	---	---	---	---	---	---
6006	0	---	---	---	---	---	---	---	---	---	---	---	---
6007	0	---	---	---	---	---	---	---	---	---	---	---	---
6008	0	---	---	---	---	---	---	---	---	---	---	---	---
6009	-17799.0	---	---	---	---	---	---	---	---	---	---	---	---
6010	-23993.2	349831.3	353023.8	418565.6	0.000023	0.000280	0.005060	-349831.3	-353023.8	-418565.6	-0.000023	-0.000280	-0.005060
6011	-27933.6	295908.6	360661.8	430631.8	0.000024	0.000287	0.005098	-295908.6	-360661.8	-430631.8	-0.000024	-0.000287	-0.005098
6012	-31874.0	262197.0	368354.8	442606.4	0.000024	0.000294	0.005134	-262197.0	-368354.8	-442606.4	-0.000024	-0.000294	-0.005134
6013	-35814.4	243065.8	376551.1	454387.8	0.000025	0.000300	0.005169	-243065.8	-376551.1	-454387.8	-0.000025	-0.000300	-0.005169
6014	-39479.0	239094.4	363328.3	433745.1	0.000026	0.000301	0.005172	-239094.4	-363328.3	-433745.1	-0.000026	-0.000301	-0.005172
6015	-42867.9	242837.2	372871.1	444839.9	0.000026	0.000303	0.005181	-242837.2	-372871.1	-444839.9	-0.000026	-0.000303	-0.005181
6016	-46256.9	246580.1	382362.7	455901.4	0.000027	0.000304	0.005191	-246580.1	-382362.7	-455901.4	-0.000027	-0.000304	-0.005191
6017	-49645.8	250322.9	391804.3	466931.2	0.000027	0.000306	0.005201	-250322.9	-391804.3	-466931.2	-0.000027	-0.000306	-0.005201
6018	-53034.7	254065.8	401196.7	477928.0	0.000027	0.000307	0.005210	-254065.8	-401196.7	-477928.0	-0.000027	-0.000307	-0.005210
6019	-56423.6	257808.6	410541.0	488883.5	0.000028	0.000309	0.005219	-257808.6	-410541.0	-488883.5	-0.000028	-0.000309	-0.005219
6020	-59812.5	261551.5	419838.1	499804.0	0.000028	0.000310	0.005229	-261551.5	-419838.1	-499804.0	-0.000028	-0.000310	-0.005229
6021	-61845.9	263797.2	425394.0	506340.8	0.000029	0.000311	0.005234	-263797.2	-425394.0	-506340.8	-0.000029	-0.000311	-0.005234
6022	-62523.7	264545.8	427242.3	508517.1	0.000029	0.000312	0.005236	-264545.8	-427242.3	-508517.1	-0.000029	-0.000312	-0.005236
6023	-63201.5	265294.4	429088.8	510692.1	0.000029	0.000312	0.005238	-265294.4	-429088.8	-510692.1	-0.000029	-0.000312	-0.005238
6024	-63879.2	266042.9	430933.4	512865.8	0.000029	0.000312	0.005240	-266042.9	-430933.4	-512865.8	-0.000029	-0.000312	-0.005240
6025	-64557.0	266791.5	432776.2	515038.3	0.000029	0.000312	0.005242	-266791.5	-432776.2	-515038.3	-0.000029	-0.000312	-0.005242

P11 Pier (Longi. Member)

Member No.	Axial Force (kN)	+ Side						− Side					
		Mc (kN·m)	My0 (kN·m)	Mls2 (kN·m)	φc (1/m)	φy0 (1/m)	φls2 (1/m)	Mc (kN·m)	My0 (kN·m)	Mls2 (kN·m)	φc (1/m)	φy0 (1/m)	φls2 (1/m)
6101	0	---	---	---	---	---	---	---	---	---	---	---	---
6102	0	---	---	---	---	---	---	---	---	---	---	---	---
6103	0	---	---	---	---	---	---	---	---	---	---	---	---
6104	0	---	---	---	---	---	---	---	---	---	---	---	---
6105	-51527.4	---	---	---	---	---	---	---	---	---	---	---	---
6106	-53875.2	305613.9	588849.5	707589.3	0.000027	0.000307	0.005728	-305613.9	-588849.5	-707589.3	-0.000027	-0.000307	-0.005728
6107	-56202.2	289001.2	591429.8	713672.6	0.000027	0.000311	0.005758	-289001.2	-591429.8	-713672.6	-0.000027	-0.000311	-0.005758
6108	-58529.2	278667.9	594835.2	719883.6	0.000028	0.000315	0.005784	-278667.9	-594835.2	-719883.6	-0.000028	-0.000315	-0.005784
6109	-60856.2	274088.4	599305.8	726539.7	0.000028	0.000317	0.005803	-274088.4	-599305.8	-726539.7	-0.000028	-0.000317	-0.005803
6110	-63642.6	275074.6	596107.2	706175.6	0.000029	0.000321	0.005687	-275074.6	-596107.2	-706175.6	-0.000029	-0.000321	-0.005687
6111	-66888.3	278745.0	604731.4	716474.4	0.000029	0.000322	0.005697	-278745.0	-604731.4	-716474.4	-0.000029	-0.000322	-0.005697
6112	-70134.0	282415.3	613320.8	726742.9	0.000029	0.000324	0.005706	-282415.3	-613320.8	-726742.9	-0.000029	-0.000324	-0.005706
6113	-73379.8	286085.6	621876.0	736980.6	0.000030	0.000325	0.005715	-286085.6	-621876.0	-736980.6	-0.000030	-0.000325	-0.005715
6114	-76625.5	289756.0	630397.2	747187.3	0.000030	0.000326	0.005724	-289756.0	-630397.2	-747187.3	-0.000030	-0.000326	-0.005724
6115	-79871.2	293426.3	638884.9	757362.5	0.000031	0.000327	0.005734	-293426.3	-638884.9	-757362.5	-0.000031	-0.000327	-0.005734
6116	-83116.9	297096.7	647339.6	767505.9	0.000031	0.000329	0.005743	-297096.7	-647339.6	-767505.9	-0.000031	-0.000329	-0.005743
6117	-86362.7	300767.0	655761.7	777614.0	0.000031	0.000330	0.005752	-300767.0	-655761.7	-777614.0	-0.000031	-0.000330	-0.005752
6118	-89608.4	304437.4	664151.5	787683.9	0.000032	0.000331	0.005761	-304437.4	-664151.5	-787683.9	-0.000032	-0.000331	-0.005761
6119	-91555.8	306639.6	669170.1	793704.4	0.000032	0.000332	0.005767	-306639.6	-669170.1	-793704.4	-0.000032	-0.000332	-0.005767
6120	-92205.0	307373.6	670840.4	795707.3	0.000032	0.000332	0.005769	-307373.6	-670840.4	-795707.3	-0.000032	-0.000332	-0.005769
6121	-92854.1	308107.7	672509.5	797708.8	0.000032	0.000332	0.005771	-308107.7	-672509.5	-797708.8	-0.000032	-0.000332	-0.005771
6122	-93503.3	308841.8	674177.3	799708.9	0.000032	0.000333	0.005773	-308841.8	-674177.3	-799708.9	-0.000032	-0.000333	-0.005773
6123	-94152.4	309575.8	675843.8	801707.7	0.000032	0.000333	0.005775	-309575.8	-675843.8	-801707.7	-0.000032	-0.000333	-0.005775

P12 Pier (Longi. Member)

Member No.	Axial Force (kN)	+ Side						− Side					
		Mc (kN·m)	My0 (kN·m)	Mls2 (kN·m)	φc (1/m)	φy0 (1/m)	φls2 (1/m)	Mc (kN·m)	My0 (kN·m)	Mls2 (kN·m)	φc (1/m)	φy0 (1/m)	φls2 (1/m)
6201	0	---	---	---	---	---	---	---	---	---	---	---	---
6202	0	---	---	---	---	---	---	---	---	---	---	---	---
6203	0	---	---	---	---	---	---	---	---	---	---	---	---
6204	0	---	---	---	---	---	---	---	---	---	---	---	---
6205	-51527.1	---	---	---	---	---	---	---	---	---	---	---	---
6206	-53874.9	305613.5	588848.6	707588.3	0.000027	0.000307	0.005728	-305613.5	-588848.6	-707588.3	-0.000027	-0.000307	-0.005728
6207	-56201.9	289000.8	591429	713671.6	0.000027	0.000311	0.005758	-289000.8	-591429	-713671.6	-0.000027	-0.000311	-0.005758
6208	-58528.9	278667.6	594834.4	719882.6	0.000028	0.000315	0.005784	-278667.6	-594834.4	-719882.6	-0.000028	-0.000315	-0.005784
6209	-60855.9	274088	599305	726538.7	0.000028	0.000317	0.005803	-274088	-599305	-726538.7	-0.000028	-0.000317	-0.005803
6210	-63642.3	275074.3	596106.4	706174.6	0.000029	0.000321	0.005687	-275074.3	-596106.4	-706174.6	-0.000029	-0.000321	-0.005687
6211	-66888.0	278744.6	604730.6	716473.5	0.000029	0.000322	0.005697	-278744.6	-604730.6	-716473.5	-0.000029	-0.000322	-0.005697
6212	-70133.7	282415.0	613320.1	726741.9	0.000029	0.000324	0.005706	-282415.0	-613320.1	-726741.9	-0.000029	-0.000324	-0.005706
6213	-73379.5	286085.3	621875.2	736979.7	0.000030	0.000325	0.005715	-286085.3	-621875.2	-736979.7	-0.000030	-0.000325	-0.005715
6214	-76625.2	289755.6	630396.4	747186.3	0.000030	0.000326	0.005724	-289755.6	-630396.4	-747186.3	-0.000030	-0.000326	-0.005724
6215	-79870.9	293426.0	638884.1	757361.6	0.000031	0.000327	0.005734	-293426.0	-638884.1	-757361.6	-0.000031	-0.000327	-0.005734
6216	-83116.6	297096.3	647338.9	767505.0	0.000031	0.000329	0.005743	-297096.3	-647338.9	-767505.0	-0.000031	-0.000329	-0.005743
6217	-86362.4	300766.7	655760.9	777613.0	0.000031	0.000330	0.005752	-300766.7	-655760.9	-777613.0	-0.000031	-0.000330	-0.005752
6218	-89608.1	304437.0	664150.8	787682.9	0.000032	0.000331	0.005761	-304437.0	-664150.8	-787682.9	-0.000032	-0.000331	-0.005761
6219	-91555.5	306639.2	669169.3	793703.5	0.000032	0.000332	0.005767	-306639.2	-669169.3	-793703.5	-0.000032	-0.000332	-0.005767
6220	-92204.7	307373.3	670839.6	795706.4	0.000032	0.000332	0.005769	-307373.3	-670839.6	-795706.4	-0.000032	-0.000332	-0.005769
6221	-92853.8	308107.4	672508.7	797707.9	0.000032	0.000332	0.005771	-308107.4	-672508.7	-797707.9	-0.000032	-0.000332	-0.005771
6222	-93503.0	308841.4	674176.5	799708.0	0.000032	0.000333	0.005773	-308841.4	-674176.5	-799708.0	-0.000032	-0.000333	-0.005773
6223	-94152.1	309575.5	675843.0	801706.7	0.000032	0.000333	0.005775	-309575.5	-675843.0	-801706.7	-0.000032	-0.000333	-0.005775

P13 Pier (Longi. Member)

Member No.	Axial Force (kN)	+ Side						− Side					
		Mc (kN·m)	My0 (kN·m)	Mls2 (kN·m)	φc (1/m)	φy0 (1/m)	φls2 (1/m)	Mc (kN·m)	My0 (kN·m)	Mls2 (kN·m)	φc (1/m)	φy0 (1/m)	φls2 (1/m)
6301	0	---	---	---	---	---	---	---	---	---	---	---	---
6302	0	---	---	---	---	---	---	---	---	---	---	---	---
6303	0	---	---	---	---	---	---	---	---	---	---	---	---
6304	0	---	---	---	---	---	---	---	---	---	---	---	---
6305	0	---	---	---	---	---	---	---	---	---	---	---	---
6306	0	---	---	---	---	---	---	---	---	---	---	---	---
6307	0	---	---	---	---	---	---	---	---	---	---	---	---
6308	0	---	---	---	---	---	---	---	---	---	---	---	---
6309	-13399.1	---	---	---	---	---	---	---	---	---	---	---	---
6310	-19593.3	336054.3	339495.9	403509.3	0.000022	0.000279	0.005053	-336054.3	-339495.9	-403509.3	-0.000022	-0.000279	-0.005053
6311	-23533.7	290892.1	347522.1	415794.7	0.000023	0.000286	0.005088	-290892.1	-347522.1	-415794.7	-0.000023	-0.000286	-0.005088
6312	-27474.1	257252.9	355563.7	427916.7	0.000024	0.000292	0.005124	-257252.9	-355563.7	-427916.7	-0.000024	-0.000292	-0.005124
6313	-31414.5	238177.8	364044.6	439927.1	0.000025	0.000298	0.005157	-238177.8	-364044.6	-439927.1	-0.000025	-0.000298	-0.005157
6314	-35079.1	234234.9	350860.7	419291.3	0.000025	0.000299	0.005159	-234234.9	-350860.7	-419291.3	-0.000025	-0.000299	-0.005159
6315	-38468.0	237977.8	360471.5	430428.7	0.000026	0.000301	0.005169	-237977.8	-360471.5	-430428.7	-0.000026	-0.000301	-0.005169
6316	-41857.0	241720.6	370029.7	441533.9	0.000026	0.000302	0.005179	-241720.6	-370029.7	-441533.9	-0.000026	-0.000302	-0.005179
6317	-45245.9	245463.5	379536.5	452604.9	0.000027	0.000304	0.005188	-245463.5	-379536.5	-452604.9	-0.000027	-0.000304	-0.005188
6318	-48634.8	249206.4	388992.9	463644.1	0.000027	0.000305	0.005198	-249206.4	-388992.9	-463644.1	-0.000027	-0.000305	-0.005198
6319	-52023.7	252949.2	398399.9	474651.5	0.000027	0.000307	0.005207	-252949.2	-398399.9	-474651.5	-0.000027	-0.000307	-0.005207
6320	-55412.6	256692.1	407758.4	485619.5	0.000028	0.000308	0.005217	-256692.1	-407758.4	-485619.5	-0.000028	-0.000308	-0.005217
6321	-57446.0	258937.8	413350.7	492181.4	0.000028	0.000309	0.005222	-258937.8	-413350.7	-492181.4	-0.000028	-0.000309	-0.005222
6322	-58123.8	259686.4	415211.1	494366.2	0.000028	0.000310	0.005224	-259686.4	-415211.1	-494366.2	-0.000028	-0.000310	-0.005224
6323	-58801.6	260434.9	417069.5	496549.6	0.000028	0.000310	0.005226	-260434.9	-417069.5	-496549.6	-0.000028	-0.000310	-0.005226
6324	-59479.3	261183.5	418926.1	498731.8	0.000028	0.000310	0.005228	-261183.5	-418926.1	-498731.8	-0.000028	-0.000310	-0.005228
6325	-60157.1	261932.1	420780.8	500912.6	0.000028	0.000311	0.005230	-261932.1	-420780.8	-500912.6	-0.000028	-0.000311	-0.005230

P10 Pier (Trans. Member)

Member No.	Axial Force (kN)	＋ Side						─ Side					
		Mc (kN·m)	My0 (kN·m)	MIs2 (kN·m)	φc (1/m)	φy0 (1/m)	φIs2 (1/m)	Mc (kN·m)	My0 (kN·m)	MIs2 (kN·m)	φc (1/m)	φy0 (1/m)	φIs2 (1/m)
16001	0	---	---	---	---	---	---	---	---	---	---	---	---
16002	0	---	---	---	---	---	---	---	---	---	---	---	---
16003	0	---	---	---	---	---	---	---	---	---	---	---	---
16004	0	---	---	---	---	---	---	---	---	---	---	---	---
16005	0	---	---	---	---	---	---	---	---	---	---	---	---
16006	0	---	---	---	---	---	---	---	---	---	---	---	---
16007	0	---	---	---	---	---	---	---	---	---	---	---	---
16008	0	---	---	---	---	---	---	---	---	---	---	---	---
16009	-17799.0	---	---	---	---	---	---	---	---	---	---	---	---
16010	-23993.2	529874.5	594950.8	963040.2	0.000007	0.000116	0.000735	-527783.9	-592801.7	-960564.4	-0.000007	-0.000116	-0.000735
16011	-27933.6	486783.1	537368.8	824809.6	0.000010	0.000141	0.000881	-484730.2	-535252.3	-822329.9	-0.000010	-0.000141	-0.000881
16012	-31874.0	429279.2	506098.5	744942.9	0.000014	0.000163	0.001011	-429243.2	-504008.0	-742459.0	-0.000014	-0.000163	-0.001011
16013	-35814.4	366037.0	493265.8	705802.8	0.000015	0.000181	0.001112	-366000.3	-491194.7	-703314.6	-0.000015	-0.000181	-0.001112
16014	-39479.0	350621.9	463092.1	651675.1	0.000016	0.000187	0.000963	-350621.9	-463092.1	-651675.1	-0.000016	-0.000187	-0.000963
16015	-42867.9	356110.6	477543.6	668154.8	0.000016	0.000188	0.000966	-356110.6	-477543.6	-668154.8	-0.000016	-0.000188	-0.000966
16016	-46256.9	361599.4	491926.2	684586.1	0.000017	0.000189	0.000968	-361599.4	-491926.2	-684586.1	-0.000017	-0.000189	-0.000968
16017	-49645.8	367088.1	506241.1	700969.4	0.000017	0.000190	0.000970	-367088.1	-506241.1	-700969.4	-0.000017	-0.000190	-0.000970
16018	-53034.7	372576.9	520489.5	717305.1	0.000017	0.000190	0.000972	-372576.9	-520489.5	-717305.1	-0.000017	-0.000190	-0.000972
16019	-56423.6	378065.6	534672.5	733593.5	0.000017	0.000191	0.000974	-378065.6	-534672.5	-733593.5	-0.000017	-0.000191	-0.000974
16020	-59812.5	383554.4	548791.2	749834.9	0.000018	0.000192	0.000976	-383554.4	-548791.2	-749834.9	-0.000018	-0.000192	-0.000976
16021	-61845.9	386847.6	557232.0	759557.3	0.000018	0.000193	0.000977	-386847.6	-557232.0	-759557.3	-0.000018	-0.000193	-0.000977
16022	-62523.7	387945.4	560040.5	762794.4	0.000018	0.000193	0.000977	-387945.4	-560040.5	-762794.4	-0.000018	-0.000193	-0.000977
16023	-63201.5	389043.1	562846.6	766029.6	0.000018	0.000193	0.000978	-389043.1	-562846.6	-766029.6	-0.000018	-0.000193	-0.000978
16024	-63879.2	390140.8	565650.2	769262.9	0.000018	0.000193	0.000978	-390140.8	-565650.2	-769262.9	-0.000018	-0.000193	-0.000978
16025	-64557.0	391238.6	568451.3	772494.4	0.000018	0.000193	0.000978	-391238.6	-568451.3	-772494.4	-0.000018	-0.000193	-0.000978

P11 Pier (Trans. Member)

Member No.	Axial Force (kN)	＋ Side						─ Side					
		Mc (kN·m)	My0 (kN·m)	MIs2 (kN·m)	φc (1/m)	φy0 (1/m)	φIs2 (1/m)	Mc (kN·m)	My0 (kN·m)	MIs2 (kN·m)	φc (1/m)	φy0 (1/m)	φIs2 (1/m)
16101	0	---	---	---	---	---	---	---	---	---	---	---	---
16102	0	---	---	---	---	---	---	---	---	---	---	---	---
16103	0	---	---	---	---	---	---	---	---	---	---	---	---
16104	0	---	---	---	---	---	---	---	---	---	---	---	---
16105	-51527.4	---	---	---	---	---	---	---	---	---	---	---	---
16106	-53875.2	504734.1	750857.2	1205149.8	0.000014	0.000164	0.000967	-504477.2	-737699.1	-1189485.5	-0.000014	-0.000164	-0.000966
16107	-56202.2	446162.7	722115.5	1138237.8	0.000016	0.000178	0.001042	-445901.2	-709075.5	-1123727.6	-0.000016	-0.000177	-0.00104
16108	-58529.2	410471.2	706285.9	1098303.2	0.000017	0.000188	0.001099	-410205.2	-693334	-1084701.6	-0.000017	-0.000188	-0.001097
16109	-60856.2	393130.5	701624.3	1080767	0.000018	0.000195	0.001134	-392860.5	-688730.1	-1067623.4	-0.000018	-0.000195	-0.001132
16110	-63642.6	391613.9	678674.9	1038568.6	0.000018	0.000198	0.001111	-391613.9	-678674.9	-1038568.6	-0.000018	-0.000198	-0.001111
16111	-66888.3	396839.2	691346.7	1053329.9	0.000018	0.000198	0.001113	-396839.2	-691346.7	-1053329.9	-0.000018	-0.000198	-0.001113
16112	-70134.0	402064.5	703974.3	1068049.6	0.000018	0.000199	0.001115	-402064.5	-703974.3	-1068049.6	-0.000018	-0.000199	-0.001115
16113	-73379.8	407289.9	716558.0	1082727.6	0.000019	0.000200	0.001117	-407289.9	-716558.0	-1082727.6	-0.000019	-0.000200	-0.001117
16114	-76625.5	412515.2	729098.4	1097364.1	0.000019	0.000201	0.001119	-412515.2	-729098.4	-1097364.1	-0.000019	-0.000201	-0.001119
16115	-79871.2	417740.5	741595.7	1111958.8	0.000019	0.000201	0.001121	-417740.5	-741595.7	-1111958.8	-0.000019	-0.000201	-0.001121
16116	-83116.9	422965.9	754050.5	1126496.2	0.000019	0.000202	0.001123	-422965.9	-754050.5	-1126496.2	-0.000019	-0.000202	-0.001123
16117	-86362.7	428191.2	766463.1	1140991.5	0.000020	0.000203	0.001124	-428191.2	-766463.1	-1140991.5	-0.000020	-0.000203	-0.001124
16118	-89608.4	433416.5	778833.8	1155444.6	0.000020	0.000203	0.001126	-433416.5	-778833.8	-1155444.6	-0.000020	-0.000203	-0.001126
16119	-91555.8	436551.7	786236.4	1164096.1	0.000020	0.000204	0.001127	-436551.7	-786236.4	-1164096.1	-0.000020	-0.000204	-0.001127
16120	-92205.0	437596.8	788700.6	1166976.5	0.000020	0.000204	0.001128	-437596.8	-788700.6	-1166976.5	-0.000020	-0.000204	-0.001128
16121	-92854.1	438641.9	791163.2	1169855.3	0.000020	0.000204	0.001128	-438641.9	-791163.2	-1169855.3	-0.000020	-0.000204	-0.001128
16122	-93503.3	439686.9	793624.1	1172732.4	0.000020	0.000204	0.001128	-439686.9	-793624.1	-1172732.4	-0.000020	-0.000204	-0.001128
16123	-94152.4	440732.0	796083.4	1175607.7	0.000020	0.000204	0.001129	-440732.0	-796083.4	-1175607.7	-0.000020	-0.000204	-0.001129

P12 Pier (Trans. Member)

Member No.	Axial Force (kN)	+ Side						— Side					
		Mc (kN·m)	My0 (kN·m)	MIs2 (kN·m)	φc (1/m)	φy0 (1/m)	φIs2 (1/m)	Mc (kN·m)	My0 (kN·m)	MIs2 (kN·m)	φc (1/m)	φy0 (1/m)	φIs2 (1/m)
16201	0	---	---	---	---	---	---	---	---	---	---	---	---
16202	0	---	---	---	---	---	---	---	---	---	---	---	---
16203	0	---	---	---	---	---	---	---	---	---	---	---	---
16204	0	---	---	---	---	---	---	---	---	---	---	---	---
16205	-51527.1	---	---	---	---	---	---	---	---	---	---	---	---
16206	-53874.9	504733.5	750855.8	1205148.2	0.000014	0.000164	0.000967	-504476.6	-737697.7	-1189483.9	-0.000014	-0.000164	-0.000966
16207	-56201.9	446162.1	722114.2	1138236.3	0.000016	0.000178	0.001042	-445900.6	-709074.2	-1123726.1	-0.000016	-0.000177	-0.00104
16208	-58528.9	410470.7	706284.7	1098301.7	0.000017	0.000188	0.001099	-410204.7	-693332.8	-1084700.2	-0.000017	-0.000188	-0.001097
16209	-60855.9	393130	701623.2	1080765.6	0.000018	0.000195	0.001134	-392860	-688728.9	-1067622	-0.000018	-0.000195	-0.001132
16210	-63642.3	391613.4	678673.8	1038567.3	0.000018	0.000198	0.001111	-391613.4	-678673.8	-1038567.3	-0.000018	-0.000198	-0.001111
16211	-66888.0	396838.7	691345.6	1053328.5	0.000018	0.000198	0.001113	-396838.7	-691345.6	-1053328.5	-0.000018	-0.000198	-0.001113
16212	-70133.7	402064.1	703973.1	1068048.2	0.000018	0.000199	0.001115	-402064.1	-703973.1	-1068048.2	-0.000018	-0.000199	-0.001115
16213	-73379.5	407289.4	716556.9	1082726.3	0.000019	0.000200	0.001117	-407289.4	-716556.9	-1082726.3	-0.000019	-0.000200	-0.001117
16214	-76625.2	412514.7	729097.2	1097362.7	0.000019	0.000201	0.001119	-412514.7	-729097.2	-1097362.7	-0.000019	-0.000201	-0.001119
16215	-79870.9	417740.1	741594.6	1111957.4	0.000019	0.000201	0.001121	-417740.1	-741594.6	-1111957.4	-0.000019	-0.000201	-0.001121
16216	-83116.6	422965.4	754049.4	1126494.9	0.000019	0.000202	0.001123	-422965.4	-754049.4	-1126494.9	-0.000019	-0.000202	-0.001123
16217	-86362.4	428190.7	766461.9	1140990.2	0.000020	0.000203	0.001124	-428190.7	-766461.9	-1140990.2	-0.000020	-0.000203	-0.001124
16218	-89608.1	433416.1	778832.7	1155443.2	0.000020	0.000203	0.001126	-433416.1	-778832.7	-1155443.2	-0.000020	-0.000203	-0.001126
16219	-91555.5	436551.3	786235.2	1164094.7	0.000020	0.000204	0.001127	-436551.3	-786235.2	-1164094.7	-0.000020	-0.000204	-0.001127
16220	-92204.7	437596.3	788699.5	1166975.2	0.000020	0.000204	0.001128	-437596.3	-788699.5	-1166975.2	-0.000020	-0.000204	-0.001128
16221	-92853.8	438641.4	791162.0	1169854.0	0.000020	0.000204	0.001128	-438641.4	-791162.0	-1169854.0	-0.000020	-0.000204	-0.001128
16222	-93503.0	439686.5	793623.0	1172731.0	0.000020	0.000204	0.001128	-439686.5	-793623.0	-1172731.0	-0.000020	-0.000204	-0.001128
16223	-94152.1	440731.5	796082.3	1175606.4	0.000020	0.000204	0.001129	-440731.5	-796082.3	-1175606.4	-0.000020	-0.000204	-0.001129

P13 Pier (Trans. Member)

Member No.	Axial Force (kN)	+ Side						— Side					
		Mc (kN·m)	My0 (kN·m)	MIs2 (kN·m)	φc (1/m)	φy0 (1/m)	φIs2 (1/m)	Mc (kN·m)	My0 (kN·m)	MIs2 (kN·m)	φc (1/m)	φy0 (1/m)	φIs2 (1/m)
16301	0	---	---	---	---	---	---	---	---	---	---	---	---
16302	0	---	---	---	---	---	---	---	---	---	---	---	---
16303	0	---	---	---	---	---	---	---	---	---	---	---	---
16304	0	---	---	---	---	---	---	---	---	---	---	---	---
16305	0	---	---	---	---	---	---	---	---	---	---	---	---
16306	0	---	---	---	---	---	---	---	---	---	---	---	---
16307	0	---	---	---	---	---	---	---	---	---	---	---	---
16308	0	---	---	---	---	---	---	---	---	---	---	---	---
16309	-13399.1	---	---	---	---	---	---	---	---	---	---	---	---
16310	-19593.3	500147.3	564553.1	929197.8	0.000006	0.000115	0.000733	-498050.6	-562398.9	-926723.8	-0.000006	-0.000115	-0.000733
16311	-23533.7	462366.4	512376.9	796744.2	0.000010	0.000140	0.000879	-460306.5	-510254.5	-794266.7	-0.000010	-0.000140	-0.000879
16312	-27474.1	421184.4	484565.7	720495.2	0.000013	0.000162	0.001009	-421149.2	-482468.9	-718013.7	-0.000013	-0.000162	-0.001009
16313	-31414.5	358676.1	473842.6	683543.3	0.000015	0.000180	0.001109	-358640.0	-471764.8	-681057.8	-0.000015	-0.000180	-0.001109
16314	-35079.1	343495.8	444224.7	630189.6	0.000016	0.000186	0.000961	-343495.8	-444224.7	-630189.6	-0.000016	-0.000186	-0.000961
16315	-38468.0	348984.5	458767.4	646745.6	0.000016	0.000187	0.000963	-348984.5	-458767.4	-646745.6	-0.000016	-0.000187	-0.000963
16316	-41857.0	354473.2	473239.7	663243.8	0.000016	0.000188	0.000965	-354473.2	-473239.7	-663243.8	-0.000016	-0.000188	-0.000965
16317	-45245.9	359962.0	487642.7	679689.4	0.000017	0.000188	0.000967	-359962.0	-487642.7	-679689.4	-0.000017	-0.000188	-0.000967
16318	-48634.8	365450.7	501977.7	696086.9	0.000017	0.000189	0.000969	-365450.7	-501977.7	-696086.9	-0.000017	-0.000189	-0.000969
16319	-52023.7	370939.5	516245.8	712436.8	0.000017	0.000190	0.000971	-370939.5	-516245.8	-712436.8	-0.000017	-0.000190	-0.000971
16320	-55412.6	376428.2	530448.3	728739.3	0.000017	0.000191	0.000973	-376428.2	-530448.3	-728739.3	-0.000017	-0.000191	-0.000973
16321	-57446.0	379721.5	538938.6	738498.2	0.000018	0.000192	0.000974	-379721.5	-538938.6	-738498.2	-0.000018	-0.000192	-0.000974
16322	-58123.8	380819.2	541763.6	741747.4	0.000018	0.000192	0.000975	-380819.2	-541763.6	-741747.4	-0.000018	-0.000192	-0.000975
16323	-58801.6	381917.0	544586.0	744994.7	0.000018	0.000192	0.000975	-381917.0	-544586.0	-744994.7	-0.000018	-0.000192	-0.000975
16324	-59479.3	383014.7	547405.9	748240.2	0.000018	0.000192	0.000975	-383014.7	-547405.9	-748240.2	-0.000018	-0.000192	-0.000975
16325	-60157.1	384112.5	550223.3	751483.8	0.000018	0.000192	0.000976	-384112.5	-550223.3	-751483.8	-0.000018	-0.000192	-0.000976

2.9 Cable Element

Cable Element								
Elem. No.	Character No.	I-Node	J-Node	A(m^2)	Young's Modulus E(kN/m2)	Unit Weight (kN/m)	PS (kN)	Initial Deformation (m)
401	401	3	520	0.010255	186803000	0.885	720.0	0.0447
402	402	7	519	0.010255	186721000	0.885	330.0	0.0190
403	403	11	518	0.010255	186817000	0.885	0.0	0.0000
404	404	15	517	0.010255	187331000	0.885	-170.0	-0.0082
405	405	19	516	0.010255	188255000	0.885	-50.0	-0.0022
406	406	23	515	0.005420	189083000	0.468	210.0	0.0154
407	407	27	514	0.005420	189505000	0.468	470.0	0.0306
408	408	31	513	0.005420	189704000	0.468	700.0	0.0400
409	409	35	512	0.005420	189823000	0.468	1010.0	0.0501
410	410	39	511	0.005420	189899000	0.468	1450.0	0.0618
411	411	101	520	0.010255	186776000	0.885	1420.0	0.0882
412	412	97	519	0.010255	186692000	0.885	650.0	0.0374
413	413	93	518	0.010255	186785000	0.885	20.0	0.0011
414	414	89	517	0.010255	187329000	0.885	-360.0	-0.0173
415	415	85	516	0.010255	188241000	0.885	-400.0	-0.0173
416	416	81	515	0.005420	189081000	0.468	-20.0	-0.0015
417	417	77	514	0.005420	189501000	0.468	220.0	0.0143
418	418	73	513	0.005420	189705000	0.468	470.0	0.0268
419	419	69	512	0.005420	189824000	0.468	810.0	0.0401
420	420	65	511	0.005420	189899000	0.468	1300.0	0.0553
421	421	109	620	0.010255	186776000	0.885	1420.0	0.0882
422	422	113	619	0.010255	186692000	0.885	650.0	0.0374
423	423	117	618	0.010255	186785000	0.885	20.0	0.0011
424	424	121	617	0.010255	187329000	0.885	-360.0	-0.0173
425	425	125	616	0.010255	188241000	0.885	-400.0	-0.0173
426	426	129	615	0.005420	189081000	0.468	-20.0	-0.0015
427	427	133	614	0.005420	189501000	0.468	220.0	0.0143
428	428	137	613	0.005420	189705000	0.468	470.0	0.0268
429	429	141	612	0.005420	189824000	0.468	810.0	0.0401
430	430	145	611	0.005420	189899000	0.468	1300.0	0.0553
431	431	207	620	0.010255	186803000	0.885	720.0	0.0447
432	432	203	619	0.010255	186721000	0.885	330.0	0.0190
433	433	199	618	0.010255	186817000	0.885	0.0	0.0000
434	434	195	617	0.010255	187329000	0.885	-170.0	-0.0082
435	435	191	616	0.010255	188255000	0.885	-50.0	-0.0022
436	436	187	615	0.005420	189083000	0.468	210.0	0.0154
437	437	183	614	0.005420	189505000	0.468	470.0	0.0306
438	438	179	613	0.005420	189704000	0.468	700.0	0.0400
439	439	175	612	0.005420	189823000	0.468	1010.0	0.0501
440	440	171	611	0.005420	189899000	0.468	1450.0	0.0618

2.10 Foundation Spring

Foundation Spring for Analysis							
Statis Spring				P10Pier	P11Pier	P12Pier	P13Pier
Longi.	HorizontalSpring	kN/m	Ass	2444000	3318900	2491600	2272800
	CoupledSpring	kN/rad	Asr	-28039000	-34564000	-32035000	-27232000
	CoupledSpring	kN·m/m	Ars	-28039000	-34564000	-32035000	-27232000
	RotationSpring	kN·m/rad	Arr	694680000	876590000	861530000	694850000
	CoupledSpring	kN/m	Asv	0	0	0	0
	CoupledSpring	kN·m/m	Arv	0	0	0	0
	CoupledSpring	kN/m	Avs	0	0	0	0
	CoupledSpring	kN·m/rad	Avr	0	0	0	0
	VerticalSpring	kN/m	Avv	1E+13	1E+13	1E+13	1E+13
Trans.	HorizontalSpring	kN/m	Ass	2491800	3539900	2705600	2320000
	CoupledSpring	kN/rad	Asr	-29037000	-39176000	-36518000	-28135000
	CoupledSpring	kN·m/m	Ars	-29037000	-39176000	-36518000	-28135000
	RotationSpring	kN·m/rad	Arr	849210000	1.275E+09	1.251E+09	851480000
	CoupledSpring	kN/m	Asv	0	0	0	0
	CoupledSpring	kN·m/m	Arv	0	0	0	0
	CoupledSpring	kN/m	Avs	0	0	0	0
	CoupledSpring	kN·m/rad	Avr	0	0	0	0
	VerticalSpring	kN/m	Avv	1E+13	1E+13	1E+13	1E+13
Dynamic Spring				P10Pier	P11Pier	P12Pier	P13Pier
Longi.	HorizontalSpring	kN/m	Ass	9541000	13640000	9772600	8761100
	CoupledSpring	kN/rad	Asr	-75216000	-98838000	-86988000	-71631000
	CoupledSpring	kN·m/m	Ars	-75216000	-98838000	-86988000	-71631000
	RotationSpring	kN·m/rad	Arr	1.247E+09	1.665E+09	1.567E+09	1.223E+09
	CoupledSpring	kN/m	Asv	0	0	0	0
	CoupledSpring	kN·m/m	Arv	0	0	0	0
	CoupledSpring	kN/m	Avs	0	0	0	0
	CoupledSpring	kN·m/rad	Avr	0	0	0	0
	VerticalSpring	kN/m	Avv	1E+13	1E+13	1E+13	1E+13
Trans.	HorizontalSpring	kN/m	Ass	9679500	14379000	10455000	8895200
	CoupledSpring	kN/rad	Asr	-76631000	-1.09E+08	-96623000	-73030000
	CoupledSpring	kN·m/m	Ars	-76631000	-1.09E+08	-96623000	-73030000
	RotationSpring	kN·m/rad	Arr	1.542E+09	2.47E+09	2.28E+09	1.508E+09
	CoupledSpring	kN/m	Asv	0	0	0	0
	CoupledSpring	kN·m/m	Arv	0	0	0	0
	CoupledSpring	kN/m	Avs	0	0	0	0
	CoupledSpring	kN·m/rad	Avr	0	0	0	0
	VerticalSpring	kN/m	Avv	1E+13	1E+13	1E+13	1E+13

Ass : Horizontal Spring(kN/m)
Asr＝Ars : Coupled Spring (Horizontal and Rotation)(kN/rad, kN.m/m)
Arr : Rotation Spring(kN.m/rad)
Asv＝Avs : Coupled Spring (Vertical and Horizontal) (kN/m)
Arv＝Avr : Coupled Spring (Vertical and Rotation)(kN.m/m, kN/rad)
Avv : Vertical Spring(kN/m)

§3.Eigenvalue Analysis

3.1 Eigenvalue Analysis Results and Rayleigh Damping (All section Stiffness)

(1) Eigenvalue Analysis

Mode	All Section Stiffness LG(0 degree direction)						All Section Stiffness TR(90 degree direction)					
	Frequency Hz	Period sec	Participation Factor 0degree	Participation Factor 90degree	Participation Factor Verti.	Strain Energy propotional damping	Frequency Hz	Period sec	Participation Factor 90degree	Participation Factor 180degree	Participation Factor Verti.	Strain Energy propotional damping
1	0.380	2.633	-0.370	0.000	22.840	0.02210	0.380	2.633	0.000	0.370	22.840	0.02210
2	0.513	1.950	0.000	28.450	0.000	0.02119	0.513	1.950	28.450	0.000	0.000	0.02119
3	0.518	1.929	0.000	16.280	0.000	0.01964	0.518	1.929	16.280	0.000	0.000	0.01964
4	0.527	1.899	21.090	0.000	0.029	0.01713	0.527	1.899	0.000	-21.090	0.029	0.01713
5	0.777	1.287	0.000	-49.460	0.004	0.03316	0.777	1.287	-49.460	0.000	0.004	0.03316
6	0.917	1.091	-1.043	0.000	-67.740	0.01864	0.917	1.091	0.000	1.043	-67.740	0.01864
7	1.068	0.936	-1.824	0.000	0.021	0.01382	1.068	0.936	0.000	1.824	0.021	0.01382
8	1.321	0.757	-5.864	0.000	45.410	0.01942	1.321	0.757	0.000	5.864	45.410	0.01942
9	1.387	0.721	114.500	0.000	1.724	0.11254	1.387	0.721	0.000	-114.500	1.724	0.11254
10	1.701	0.588	-0.002	95.760	-0.006	0.12940	1.701	0.588	95.760	0.002	-0.006	0.12940
11	1.820	0.549	-61.430	-0.188	-0.865	0.16943	1.820	0.549	-0.188	61.430	-0.865	0.16943
12	1.830	0.546	-73.860	-0.069	-0.394	0.06354	1.830	0.546	-0.069	73.860	-0.394	0.06354
13	1.846	0.542	0.164	-101.400	-0.083	0.12152	1.846	0.542	-101.400	-0.164	-0.083	0.12152
14	2.010	0.497	-4.936	0.000	9.296	0.02109	2.010	0.497	0.000	4.936	9.296	0.02109
15	2.035	0.491	-0.008	31.970	0.038	0.11815	2.035	0.491	31.970	0.008	0.038	0.11815
16	2.154	0.464	71.020	0.000	-0.355	0.19014	2.154	0.464	0.000	-71.020	-0.355	0.19014
17	2.220	0.451	-7.077	0.000	0.034	0.01847	2.220	0.451	0.000	7.077	0.034	0.01847
18	2.297	0.435	0.000	-16.640	-0.004	0.08820	2.297	0.435	-16.640	0.000	-0.004	0.08820
19	2.465	0.406	0.007	6.564	-0.088	0.12174	2.465	0.406	6.564	-0.007	-0.088	0.12174
20	2.807	0.356	-0.458	0.000	-13.310	0.02073	2.807	0.356	0.000	0.458	-13.310	0.02073
21	3.111	0.321	-0.899	0.000	-3.680	0.06076	3.111	0.321	0.000	0.899	-3.680	0.06076
22	3.375	0.296	0.001	-55.160	-0.021	0.05563	3.375	0.296	-55.160	-0.001	-0.021	0.05563
23	3.498	0.286	18.820	0.000	0.667	0.02777	3.498	0.286	0.000	-18.820	0.667	0.02777
24	3.880	0.258	-0.847	0.000	21.290	0.02357	3.880	0.258	0.000	0.847	21.290	0.02357
25	4.123	0.243	0.000	-3.805	-0.013	0.02914	4.123	0.243	-3.805	0.000	-0.013	0.02914
26	4.259	0.235	-2.072	0.000	0.115	0.01967	4.259	0.235	0.000	2.072	0.115	0.01967
27	4.389	0.228	0.000	20.460	0.000	0.02698	4.389	0.228	20.460	0.000	0.000	0.02698
28	4.640	0.216	0.000	6.778	0.010	0.05151	4.640	0.216	6.778	0.000	0.010	0.05151
29	4.886	0.205	-1.477	0.000	11.840	0.01709	4.886	0.205	0.000	1.477	11.840	0.01709
30	4.906	0.204	-6.305	0.000	-2.826	0.01238	4.906	0.204	0.000	6.305	-2.826	0.01238
31	4.970	0.201	-0.261	0.000	-14.430	0.01737	4.970	0.201	0.000	0.261	-14.430	0.01737
32	5.359	0.187	-12.860	0.000	-0.465	0.02266	5.359	0.187	0.000	12.860	-0.465	0.02266
33	5.735	0.174	-0.426	0.000	5.686	0.01896	5.735	0.174	0.000	0.426	5.686	0.01896
34	6.012	0.166	0.001	28.540	0.007	0.03398	6.012	0.166	28.540	-0.001	0.007	0.03398
35	6.363	0.157	-10.050	0.000	-0.129	0.02156	6.363	0.157	0.000	10.050	-0.129	0.02156
36	6.676	0.150	-1.070	0.001	2.934	0.02380	6.676	0.150	0.001	1.070	2.934	0.02380
37	6.776	0.148	-0.079	0.000	0.002	0.01967	6.776	0.148	0.000	0.079	0.002	0.01967
38	7.132	0.140	3.983	-0.001	-0.009	0.02031	7.132	0.140	-0.001	-3.983	-0.009	0.02031
39	7.699	0.130	-0.479	-0.001	-2.836	0.02938	7.699	0.130	-0.001	0.479	-2.836	0.02938
40	8.118	0.123	22.860	0.001	0.314	0.03799	8.118	0.123	0.001	-22.860	0.314	0.03799
41	8.399	0.119	0.004	-2.652	-0.007	0.02348	8.399	0.119	-2.652	-0.004	-0.007	0.02348
42	8.571	0.117	-1.645	0.000	8.782	0.02395	8.571	0.117	0.000	1.645	8.782	0.02395
43	9.369	0.107	0.006	-3.585	-0.014	0.06259	9.369	0.107	-3.585	-0.006	-0.014	0.06259
44	10.229	0.098	8.678	0.000	-7.504	0.02343	10.229	0.098	0.000	-8.678	-7.504	0.02343
45	10.235	0.098	8.073	-0.002	8.255	0.02253	10.235	0.098	-0.002	-8.073	8.255	0.02253
46	10.265	0.097	-0.003	35.280	0.006	0.09812	10.265	0.097	35.280	0.003	0.006	0.09812
47	10.308	0.097	-0.022	-2.891	0.047	0.04805	10.308	0.097	-2.891	0.022	0.047	0.04805

§3.Eigenvalue Analysis
3.1 Eigenvalue Analysis Results and Rayleigh Damping (All section Stiffness)

48	10.893	0.092	3.923	−0.003	0.123	0.02056	10.893	0.092	−0.003	−3.923	0.123	0.02056
49	11.453	0.087	0.012	−9.719	−0.012	0.03088	11.453	0.087	−9.719	−0.012	−0.012	0.03088
50	11.645	0.086	3.623	0.005	14.580	0.02613	11.645	0.086	0.005	−3.623	14.580	0.02613
51	11.702	0.085	0.088	6.572	−0.076	0.02217	11.702	0.085	6.572	−0.088	−0.076	0.02217
52	11.950	0.084	26.180	0.097	−4.733	0.11380	11.950	0.084	0.097	−26.180	−4.733	0.11380
53	12.737	0.079	3.326	−0.050	−2.085	0.02208	12.737	0.079	−0.050	−3.326	−2.085	0.02208
54	12.799	0.078	2.625	0.028	−6.160	0.03197	12.799	0.078	0.028	−2.625	−6.160	0.03197
55	12.850	0.078	0.075	−18.900	0.508	0.10732	12.850	0.078	−18.900	−0.075	0.508	0.10732
56	13.132	0.076	−0.005	27.960	−0.239	0.05844	13.132	0.076	27.960	0.005	−0.239	0.05844
57	13.557	0.074	−3.015	0.005	−1.943	0.02497	13.557	0.074	0.005	3.015	−1.943	0.02497
58	14.537	0.069	0.326	−0.003	−0.099	0.01987	14.537	0.069	−0.003	−0.326	−0.099	0.01987
59	15.056	0.066	15.400	−0.002	6.066	0.04267	15.056	0.066	−0.002	−15.400	6.066	0.04267
60	15.136	0.066	0.008	2.617	−0.004	0.04746	15.136	0.066	2.617	−0.008	−0.004	0.04746
61	15.174	0.066	1.627	−0.001	−13.720	0.02110	15.174	0.066	−0.001	−1.627	−13.720	0.02110
62	15.200	0.066	−6.072	0.000	26.620	0.02418	15.200	0.066	0.000	6.072	26.620	0.02418
63	15.355	0.065	−5.549	0.022	−6.586	0.02352	15.355	0.065	0.022	5.549	−6.586	0.02352
64	15.459	0.065	−0.212	5.121	0.023	0.05091	15.459	0.065	5.121	0.212	0.023	0.05091
65	15.526	0.064	13.110	−0.012	3.313	0.04191	15.526	0.064	−0.012	−13.110	3.313	0.04191
66	15.933	0.063	23.350	0.000	3.547	0.13664	15.933	0.063	0.000	−23.350	3.547	0.13664
67	16.895	0.059	−1.992	−0.008	4.261	0.02588	16.895	0.059	−0.008	1.992	4.261	0.02588
68	17.051	0.059	2.946	−0.843	3.535	0.04978	17.051	0.059	−0.843	−2.946	3.535	0.04978
69	17.053	0.059	0.198	14.810	0.303	0.06155	17.053	0.059	14.810	−0.198	0.303	0.06155
70	18.607	0.054	−11.620	−0.003	−2.891	0.03854	18.607	0.054	−0.003	11.620	−2.891	0.03854
71	19.007	0.053	0.006	0.295	0.097	0.02089	19.007	0.053	0.295	−0.006	0.097	0.02089
72	19.564	0.051	3.088	−0.003	−12.100	0.03718	19.564	0.051	−0.003	−3.088	−12.100	0.03718
73	20.143	0.050	0.256	0.000	−0.139	0.01998	20.143	0.050	0.000	−0.256	−0.139	0.01998
74	20.559	0.049	−3.317	−0.003	1.037	0.02248	20.559	0.049	−0.003	3.317	1.037	0.02248
75	21.526	0.046	−0.887	−0.001	17.620	0.02740	21.526	0.046	−0.001	0.887	17.620	0.02740
76	21.781	0.046	−0.003	6.744	−0.082	0.02569	21.781	0.046	6.744	0.003	−0.082	0.02569
77	22.185	0.045	−8.938	0.007	−4.727	0.03715	22.185	0.045	0.007	8.938	−4.727	0.03715
78	22.530	0.044	−1.789	0.004	11.820	0.02262	22.530	0.044	0.004	1.789	11.820	0.02262
79	23.240	0.043	0.001	−2.610	0.009	0.02317	23.240	0.043	−2.610	−0.001	0.009	0.02317
80	23.390	0.043	0.003	3.642	0.051	0.02258	23.390	0.043	3.642	−0.003	0.051	0.02258
81	24.391	0.041	0.013	−3.464	0.246	0.03606	24.391	0.041	−3.464	−0.013	0.246	0.03606
82	24.438	0.041	−0.416	−0.038	−5.189	0.02250	24.438	0.041	−0.038	0.416	−5.189	0.02250
83	24.633	0.041	2.021	0.014	3.157	0.02125	24.633	0.041	0.014	−2.021	3.157	0.02125
84	26.008	0.038	−0.498	−0.087	−57.000	0.04155	26.008	0.038	−0.087	0.498	−57.000	0.04155
85	26.325	0.038	−0.988	−0.035	−33.290	0.02484	26.325	0.038	−0.035	0.988	−33.290	0.02484
86	26.798	0.037	−0.715	−0.004	19.560	0.02504	26.798	0.037	−0.004	0.715	19.560	0.02504
87	27.019	0.037	0.533	−0.018	−36.510	0.02528	27.019	0.037	−0.018	−0.533	−36.510	0.02528
88	27.424	0.036	0.395	0.023	8.501	0.02729	27.424	0.036	0.023	−0.395	8.501	0.02729
89	27.925	0.036	−0.399	0.000	67.990	0.03855	27.925	0.036	0.000	0.399	67.990	0.03855
90	28.118	0.036	0.000	5.653	0.211	0.02864	28.118	0.036	5.653	0.000	0.211	0.02864
91	28.942	0.035	0.008	−0.001	−19.940	0.02134	28.942	0.035	−0.001	−0.008	−19.940	0.02134
92	29.883	0.033	2.000	−0.006	2.720	0.02203	29.883	0.033	−0.006	−2.000	2.720	0.02203
93	30.337	0.033	0.000	2.968	0.007	0.05064	30.337	0.033	2.968	0.000	0.007	0.05064
94	31.395	0.032	0.010	−0.004	9.276	0.02181	31.395	0.032	−0.004	−0.010	9.276	0.02181
95	32.351	0.031	−0.762	0.004	−0.457	0.03000	32.351	0.031	0.004	0.762	−0.457	0.03000
96	33.262	0.030	−0.002	−1.538	0.194	0.03407	33.262	0.030	−1.538	0.002	0.194	0.03407
97	33.291	0.030	−0.121	0.001	57.890	0.03475	33.291	0.030	0.001	0.121	57.890	0.03475
98	33.466	0.030	0.083	0.000	0.298	0.02001	33.466	0.030	0.000	−0.083	0.298	0.02001
99	33.663	0.030	−0.002	−0.928	0.002	0.03034	33.663	0.030	−0.928	0.002	0.002	0.03034
100	34.090	0.029	1.975	0.003	2.510	0.02607	34.090	0.029	0.003	−1.975	2.510	0.02607

(2) Set of Rayleigh Damping

【Longi. Direction】

From the eigenvalue analysis results, the mode which has primary mode in longi. Direction and positive in α, β:

4th Mode and 40th Mode

Therefore, coefficients are follows:

f1	=	0.52670	Hz	(Frequency of 4th Mode)
f2	=	8.11840	Hz	(Frequency of 40th Mode)
h1	=	0.017135		(Attenuation rate of 4th Mode)
h2	=	0.037995		(Attenuation rate of 40th Mode)
α	=	0.097504		
β	=	0.001452		

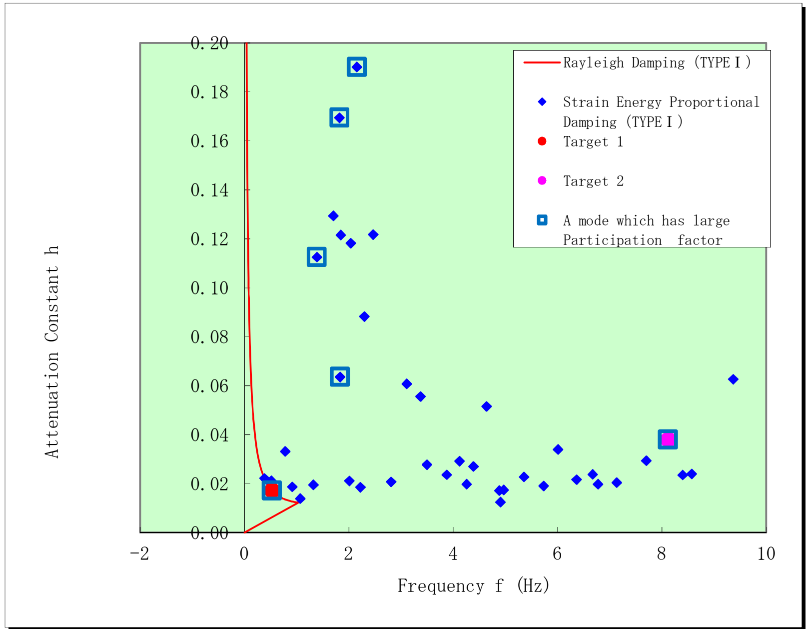
【Trans. Direction】

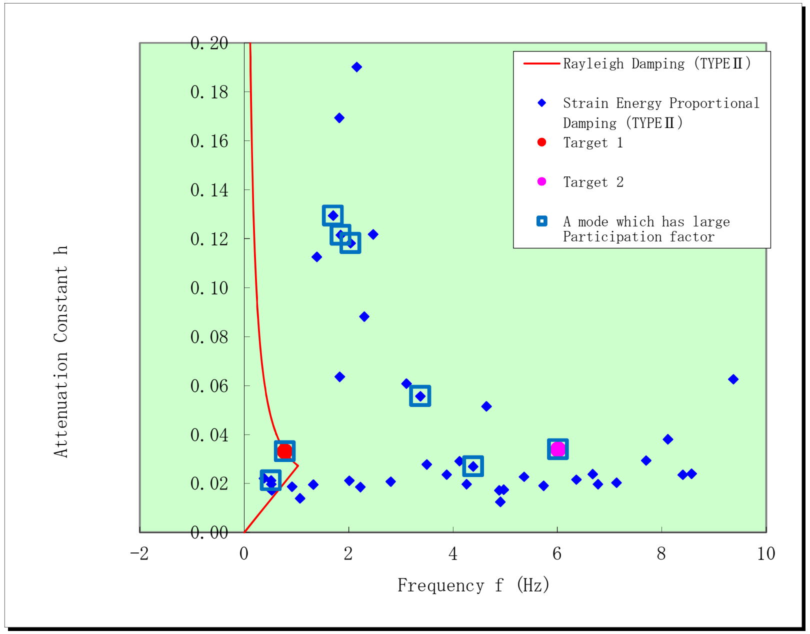
From the eigenvalue analysis results, the mode which has primary mode in longi. Direction and positive in α, β:

5th Mode and 34th Mode

Therefore, coefficients are follows:

f1	=	0.77727	Hz	(Frequency of 5th Mode)
f2	=	6.01150	Hz	(Frequency of 34th Mode)
h1	=	0.033163		(Attenuation rate of 5th Mode)
h2	=	0.033978		(Attenuation rate of 34th Mode)
α	=	0.285787		
β	=	0.001599		





3.2 Eigenvalue Analysis Results and Rayleigh Damping (Yield Stiffness)

(1) Eigenvalue Analysis Results

Mode	Yield Stiffness LG(0 degree direction)						Yield Stiffness TR(90 degree direction)					
	Frequency Hz	Period sec	Participation Factor 0degree	Participation Factor 90degree	Participation Factor Verti.	Strain Energy propotional damping	Frequency Hz	Period sec	Participation Factor 90degree	Participation Factor 180degree	Participation Factor Verti.	Strain Energy propotional damping
1	0.375	2.669	0.921	0.000	22.350	0.01798	0.375	2.669	0.000	-0.921	22.350	0.01798
2	0.487	2.054	0.000	28.450	-0.001	0.02091	0.487	2.054	39.640	0.000	-0.001	0.02091
3	0.505	1.981	0.000	16.280	0.001	0.01932	0.505	1.981	19.310	0.000	0.001	0.01932
4	0.526	1.901	23.160	0.000	-0.122	0.01725	0.526	1.901	0.000	-23.160	-0.122	0.01725
5	0.735	1.361	0.000	-49.460	0.011	0.03062	0.735	1.361	-47.060	0.000	0.011	0.03062
6	0.910	1.100	3.652	0.000	-67.280	0.01614	0.910	1.100	0.000	-3.652	-67.280	0.01614
7	1.068	0.936	-6.109	0.000	-0.184	0.01399	1.068	0.936	0.000	6.109	-0.184	0.01399
8	1.143	0.875	-123.200	0.000	-3.284	0.09338	1.143	0.875	0.000	123.200	-3.284	0.09338
9	1.151	0.869	0.000	0.000	-0.002	0.06811	1.151	0.869	94.340	0.000	-0.002	0.06811
10	1.289	0.776	70.950	95.760	-2.366	0.09212	1.289	0.776	0.058	-70.950	-2.366	0.09212
11	1.317	0.760	1.681	-0.188	46.180	0.01840	1.317	0.760	0.006	-1.681	46.180	0.01840
12	1.434	0.697	-0.053	-0.069	0.159	0.09063	1.434	0.697	98.370	0.053	0.159	0.09063
13	1.571	0.637	-0.002	-101.400	0.008	0.06302	1.571	0.637	-1.032	0.002	0.008	0.06302
14	1.763	0.567	-22.400	0.000	-0.039	0.02853	1.763	0.567	0.001	22.400	-0.039	0.02853
15	1.793	0.558	71.180	31.970	-1.131	0.13351	1.793	0.558	0.000	-71.180	-1.131	0.13351
16	1.914	0.522	-0.009	0.000	0.076	0.06852	1.914	0.522	-30.550	0.009	0.076	0.06852
17	2.002	0.499	-2.420	0.000	-9.181	0.01986	2.002	0.499	0.000	2.420	-9.181	0.01986
18	2.219	0.451	-2.989	-16.640	-0.006	0.01802	2.219	0.451	0.000	2.989	-0.006	0.01802
19	2.236	0.447	0.007	6.564	-0.070	0.03065	2.236	0.447	-1.377	-0.007	-0.070	0.03065
20	2.800	0.357	0.839	0.000	-13.600	0.02109	2.800	0.357	0.000	-0.839	-13.600	0.02109
21	3.012	0.332	-2.450	0.000	2.008	0.04153	3.012	0.332	0.000	2.450	2.008	0.04153
22	3.251	0.308	0.002	-55.160	-0.029	0.03119	3.251	0.308	-36.400	-0.002	-0.029	0.03119
23	3.480	0.287	-14.090	0.000	-0.173	0.02363	3.480	0.287	0.000	14.090	-0.173	0.02363
24	3.873	0.258	-0.492	0.000	-21.320	0.02155	3.873	0.258	0.000	0.492	-21.320	0.02155
25	4.076	0.245	0.001	-3.805	-0.012	0.02397	4.076	0.245	-0.921	-0.001	-0.012	0.02397
26	4.258	0.235	-1.418	0.000	0.052	0.01958	4.258	0.235	0.000	1.418	0.052	0.01958
27	4.334	0.231	0.000	20.460	0.001	0.02922	4.334	0.231	-22.140	0.000	0.001	0.02922
28	4.536	0.220	0.000	6.778	0.004	0.04131	4.536	0.220	3.990	0.000	0.004	0.04131
29	4.879	0.205	-1.452	0.000	12.500	0.01735	4.879	0.205	0.000	1.452	12.500	0.01735
30	4.903	0.204	6.422	0.000	1.802	0.01202	4.903	0.204	0.000	-6.422	1.802	0.01202
31	4.969	0.201	0.084	0.000	14.010	0.01700	4.969	0.201	0.000	-0.084	14.010	0.01700
32	5.346	0.187	14.410	0.000	0.373	0.02335	5.346	0.187	0.000	-14.410	0.373	0.02335
33	5.691	0.176	0.004	0.000	-0.012	0.09021	5.691	0.176	47.290	-0.004	-0.012	0.09021
34	5.730	0.175	0.259	28.540	-5.845	0.01937	5.730	0.175	0.000	-0.259	-5.845	0.01937
35	5.964	0.168	0.014	0.000	-0.036	0.05240	5.964	0.168	14.480	-0.014	-0.036	0.05240
36	6.334	0.158	15.140	0.001	0.082	0.02462	6.334	0.158	0.003	-15.140	0.082	0.02462
37	6.611	0.151	3.476	0.000	-3.179	0.03075	6.611	0.151	0.019	-3.476	-3.179	0.03075
38	6.776	0.148	-0.309	-0.001	0.017	0.01967	6.776	0.148	-0.003	0.309	0.017	0.01967
39	6.902	0.145	34.250	-0.001	-3.414	0.10872	6.902	0.145	1.022	-34.250	-3.414	0.10872
40	7.037	0.142	1.185	0.001	0.419	0.09982	7.037	0.142	-29.320	-1.185	0.419	0.09982
41	7.122	0.140	-5.829	-2.652	-0.386	0.02338	7.122	0.140	-0.190	5.829	-0.386	0.02338
42	7.431	0.135	4.638	0.000	1.700	0.04345	7.431	0.135	-0.019	-4.638	1.700	0.04345
43	7.559	0.132	34.240	-3.585	-0.221	0.05904	7.559	0.132	-0.008	-34.240	-0.221	0.05904
44	7.732	0.129	0.022	0.000	0.054	0.08402	7.732	0.129	-30.820	-0.022	0.054	0.08402
45	8.428	0.119	-0.371	-0.002	8.675	0.02640	8.428	0.119	-0.002	0.371	8.675	0.02640
46	8.505	0.118	-0.015	35.280	-0.095	0.02239	8.505	0.118	-4.487	0.015	-0.095	0.02239
47	8.898	0.112	-29.580	-2.891	-2.439	0.09495	8.898	0.112	0.000	29.580	-2.439	0.09495
48	9.131	0.110	-0.010	-0.003	-0.098	0.07578	9.131	0.110	31.100	0.010	-0.098	0.07578
49	9.804	0.102	-16.020	-9.719	-0.485	0.03382	9.804	0.102	-0.003	16.020	-0.485	0.03382
50	10.164	0.098	0.576	0.005	6.949	0.02788	10.164	0.098	0.003	-0.576	6.949	0.02788

51	10.471	0.095	−1.746	6.572	−11.590	0.04367	10.471	0.095	−0.004	1.746	−11.590	0.04367
52	10.639	0.094	0.001	0.097	0.051	0.02933	10.639	0.094	11.520	−0.001	0.051	0.02933
53	10.867	0.092	−2.876	−0.050	0.650	0.02070	10.867	0.092	−0.002	2.876	0.650	0.02070
54	11.691	0.086	0.001	0.028	−0.035	0.02013	11.691	0.086	−0.468	−0.001	−0.035	0.02013
55	11.958	0.084	10.250	−18.900	−12.960	0.02806	11.958	0.084	−0.002	−10.250	−12.960	0.02806
56	12.123	0.082	−17.780	27.960	−6.451	0.03996	12.123	0.082	0.000	17.780	−6.451	0.03996
57	12.194	0.082	0.000	0.005	−0.005	0.02900	12.194	0.082	11.740	0.000	−0.005	0.02900
58	12.809	0.078	−5.866	−0.003	−0.285	0.02169	12.809	0.078	0.002	5.866	−0.285	0.02169
59	13.226	0.076	−0.004	−0.002	0.039	0.03938	13.226	0.076	5.717	0.004	0.039	0.03938
60	13.361	0.075	−0.578	2.617	3.381	0.02093	13.361	0.075	−0.001	0.578	3.381	0.02093
61	14.483	0.069	−0.154	−0.001	−0.491	0.02590	14.483	0.069	−0.002	0.154	−0.491	0.02590
62	14.537	0.069	0.019	0.000	−0.028	0.01982	14.537	0.069	−0.001	−0.019	−0.028	0.01982
63	14.936	0.067	−0.007	0.022	0.006	0.06434	14.936	0.067	−12.890	0.007	0.006	0.06434
64	15.178	0.066	0.388	5.121	−0.530	0.01951	15.178	0.066	−0.002	−0.388	−0.530	0.01951
65	15.188	0.066	0.000	−0.012	−31.000	0.01956	15.188	0.066	0.001	0.000	−31.000	0.01956
66	15.314	0.065	0.109	0.000	0.004	0.02412	15.314	0.065	−8.332	−0.109	0.004	0.02412
67	15.391	0.065	−1.036	−0.008	−0.077	0.01998	15.391	0.065	−0.004	1.036	−0.077	0.01998
68	15.629	0.064	−0.124	−0.843	−5.155	0.02230	15.629	0.064	0.081	0.124	−5.155	0.02230
69	15.631	0.064	0.116	14.810	0.136	0.02468	15.631	0.064	7.294	−0.116	0.136	0.02468
70	16.921	0.059	0.014	−0.003	5.353	0.01998	16.921	0.059	−0.002	−0.014	5.353	0.01998
71	17.871	0.056	5.103	0.295	0.307	0.02312	17.871	0.056	0.004	−5.103	0.307	0.02312
72	18.978	0.053	−0.035	−0.003	−0.033	0.02042	18.978	0.053	1.345	0.035	−0.033	0.02042
73	19.006	0.053	0.175	0.000	9.698	0.02217	19.006	0.053	0.000	−0.175	9.698	0.02217
74	19.933	0.050	0.058	−0.003	0.065	0.03800	19.933	0.050	−8.294	−0.058	0.065	0.03800
75	20.004	0.050	−9.858	−0.001	−13.540	0.05101	20.004	0.050	−0.405	9.858	−13.540	0.05101
76	20.142	0.050	0.118	6.744	−0.131	0.01997	20.142	0.050	−0.003	−0.118	−0.131	0.01997
77	20.454	0.049	−2.778	0.007	−0.280	0.02082	20.454	0.049	−0.064	2.778	−0.280	0.02082
78	21.100	0.047	0.488	0.004	−2.608	0.05565	21.100	0.047	−10.840	−0.488	−2.608	0.05565
79	21.172	0.047	1.297	−2.610	−18.040	0.02233	21.172	0.047	0.989	−1.297	−18.040	0.02233
80	21.460	0.047	4.321	3.642	4.165	0.02289	21.460	0.047	0.103	−4.321	4.165	0.02289
81	21.776	0.046	−0.058	−3.464	0.352	0.02821	21.776	0.046	−0.602	0.058	0.352	0.02821
82	22.473	0.044	0.148	−0.038	14.060	0.02018	22.473	0.044	−0.017	−0.148	14.060	0.02018
83	22.814	0.044	0.001	0.014	−0.007	0.02595	22.814	0.044	5.063	−0.001	−0.007	0.02595
84	23.433	0.043	−0.012	−0.087	0.158	0.02069	23.433	0.043	−0.425	0.012	0.158	0.02069
85	24.273	0.041	−0.730	−0.035	2.843	0.02101	24.273	0.041	−0.015	0.730	2.843	0.02101
86	24.568	0.041	−1.261	−0.004	−2.990	0.02030	24.568	0.041	0.020	1.261	−2.990	0.02030
87	25.452	0.039	0.007	−0.018	−0.279	0.02715	25.452	0.039	6.041	−0.007	−0.279	0.02715
88	26.104	0.038	−0.800	0.023	47.150	0.02060	26.104	0.038	−0.079	0.800	47.150	0.02060
89	26.304	0.038	−0.498	0.000	−39.450	0.02085	26.304	0.038	0.048	0.498	−39.450	0.02085
90	26.725	0.037	−1.772	5.653	23.280	0.02104	26.725	0.037	−0.005	1.772	23.280	0.02104
91	26.789	0.037	−0.498	−0.001	29.260	0.02179	26.789	0.037	0.004	0.498	29.260	0.02179
92	27.296	0.037	1.552	−0.006	−32.280	0.02113	27.296	0.037	0.045	−1.552	−32.280	0.02113
93	27.541	0.036	−3.047	2.968	59.740	0.02378	27.541	0.036	−0.006	3.047	59.740	0.02378
94	28.312	0.035	0.000	−0.004	−0.026	0.02708	28.312	0.035	1.528	0.000	−0.026	0.02708
95	28.759	0.035	2.266	0.004	21.160	0.02311	28.759	0.035	−0.001	−2.266	21.160	0.02311
96	29.160	0.034	3.494	−1.538	−8.275	0.02450	29.160	0.034	0.003	−3.494	−8.275	0.02450
97	30.371	0.033	−0.002	0.001	0.093	0.02453	30.371	0.033	−3.085	0.002	0.093	0.02453
98	30.431	0.033	6.549	0.000	25.510	0.04205	30.431	0.033	−0.001	−6.549	25.510	0.04205
99	30.717	0.033	0.639	−0.928	9.680	0.02955	30.717	0.033	0.001	−0.639	9.680	0.02955
100	31.074	0.032	0.001	0.003	−0.102	0.02321	31.074	0.032	3.337	−0.001	−0.102	0.02321

(2) Set of Rayleigh Damping

【TYPE I】

From the eigenvalue analysis results, the mode which has primary mode in longi. Direction and positive in α, β:

4th Mode and 36th Mode

Therefore, coefficients are follows:

f1	=	0.52592	Hz	(Frequency of 4th Mode)
f2	=	6.33400	Hz	(Frequency of 36th Mode)
h1	=	0.017252		(Attenuation rate of 4th Mode)
h2	=	0.024623		(Attenuation rate of 36th Mode)
α	=	0.101201		
β	=	0.001174		

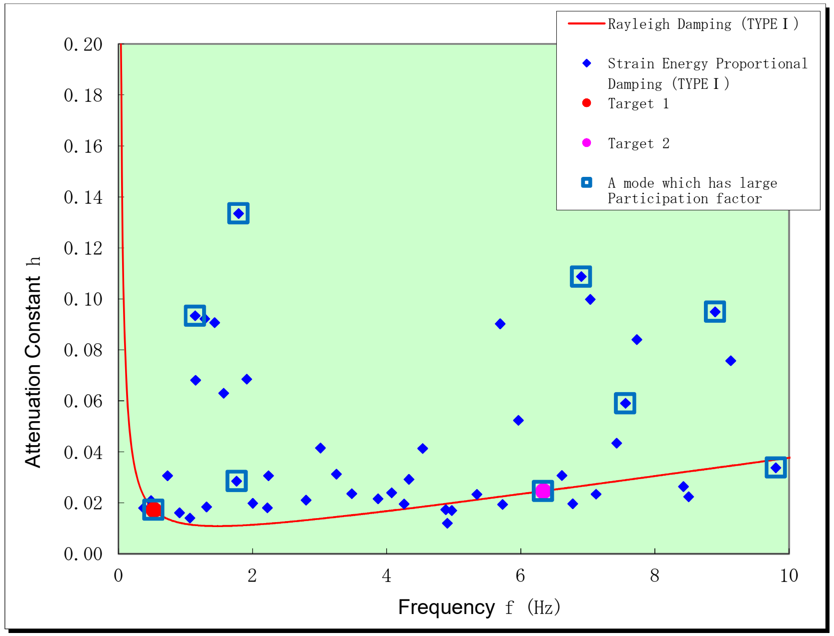
【TYPE II】

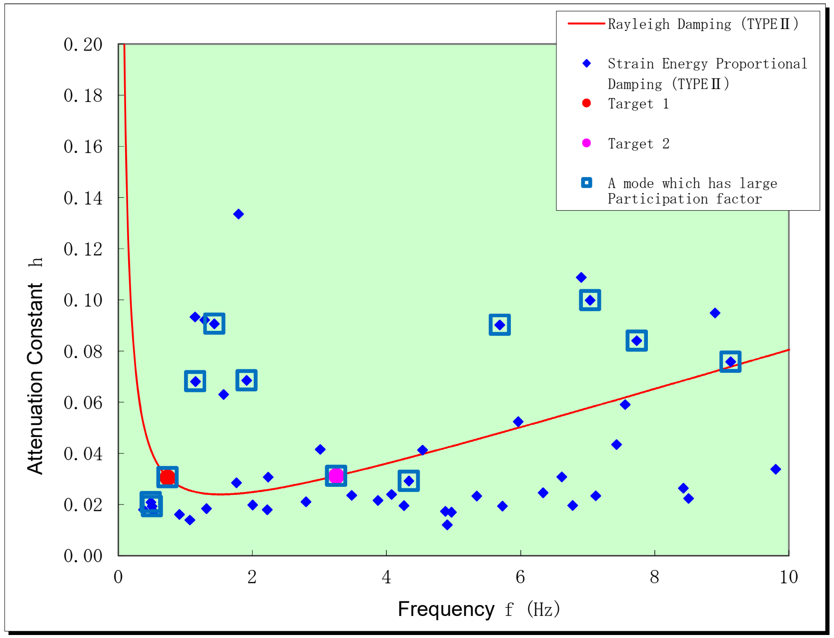
From the eigenvalue analysis results, the mode which has primary mode in longi. Direction and positive in α, β:

5th Mode and 22th Mode

Therefore, coefficients are follows:

f1	=	0.73461	Hz	(Frequency of 5th Mode)
f2	=	3.25110	Hz	(Frequency of 22th Mode)
h1	=	0.030623		(Attenuation rate of 5th Mode)
h2	=	0.031191		(Attenuation rate of 22th Mode)
α	=	0.229339		
β	=	0.002504		





4.1 Superstructure Results

■Superstructure Results (Max and Min)

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	1	(I)	-241.3	236.0	0.0	0.0	-1648.3	2571.1	-1328.9	1260.1	-43.7	43.0	-6468.0	6183.4
		(J)	-241.3	236.0	4532.9	-7070.6	-1648.3	2571.1	-1328.9	1260.1	-17041.4	17826.2	-6468.0	6183.4
	2	(I)	-455.4	447.3	4532.9	-7070.6	-1106.7	3030.9	-1329.1	1260.2	-17041.4	17826.2	-6249.9	5987.4
		(J)	-455.4	447.3	7023.0	-13889.9	-1106.7	3030.9	-1329.1	1260.2	-30513.0	31888.4	-6249.9	5987.4
	3	(I)	-4683.4	-3041.6	7023.0	-13889.9	-2323.0	1220.9	-1330.4	1261.4	-30513.0	31888.4	-6012.5	5754.4
		(J)	-4683.4	-3041.6	12281.3	-16680.9	-2323.0	1220.9	-1330.4	1261.4	-43468.6	45424.2	-6012.5	5754.4
	4	(I)	-4841.6	-2889.4	12281.3	-16680.9	-1772.7	1581.0	-1332.4	1263.0	-43468.6	45424.1	-5796.4	5558.4
		(J)	-4841.6	-2889.4	16299.4	-20276.9	-1772.7	1581.0	-1332.4	1263.0	-55983.1	58473.6	-5796.4	5558.4
	5	(I)	-4999.8	-2737.5	16299.4	-20276.9	-1193.8	1921.8	-1332.4	1263.0	-55983.1	58473.6	-5570.7	5353.0
		(J)	-4999.8	-2737.5	19012.7	-24627.1	-1193.8	1921.8	-1332.4	1263.0	-68035.1	71015.1	-5570.7	5353.0
	6	(I)	-5158.0	-2585.7	19012.7	-24627.1	-590.2	2251.8	-1335.5	1265.6	-68035.0	71015.0	-5335.6	5166.9
		(J)	-5158.0	-2585.7	20365.9	-29691.6	-590.2	2251.8	-1335.5	1265.6	-79603.7	83027.2	-5335.6	5166.9
	7	(I)	-9127.5	-5753.4	20365.9	-29691.6	-1769.8	551.7	-1339.1	1268.6	-79603.7	83027.2	-5054.9	4938.1
		(J)	-9127.5	-5753.4	24380.7	-30921.0	-1769.8	551.7	-1339.1	1268.6	-90559.5	94412.9	-5054.9	4938.1
	8	(I)	-9285.1	-5602.0	24380.7	-30921.0	-1140.2	866.1	-1339.1	1268.6	-90559.5	94412.9	-4802.7	4743.1
		(J)	-9285.1	-5602.0	26939.8	-32802.9	-1140.2	866.1	-1339.1	1268.6	-100992.0	105229.0	-4802.7	4743.1
	9	(I)	-9442.4	-5450.8	26939.8	-32802.9	-502.7	1167.3	-1343.6	1272.3	-100992.0	105229.0	-4542.3	4541.0
		(J)	-9442.4	-5450.8	28015.4	-35322.7	-502.7	1167.3	-1343.6	1272.3	-110884.0	115456.0	-4542.3	4541.0
	10	(I)	-9599.3	-5268.8	28015.4	-35322.7	144.0	1465.4	-1343.6	1272.3	-110884.0	115456.0	-4274.2	4332.9
		(J)	-9599.3	-5268.8	27581.9	-38470.9	144.0	1465.4	-1343.6	1272.3	-120463.0	125078.0	-4274.2	4332.9
	11	(I)	-13285.0	-8183.1	27581.9	-38470.9	-1155.8	-2.1	-1349.0	1276.8	-120463.0	125077.0	-3959.3	4075.5
		(J)	-13285.0	-8183.1	29957.9	-38080.6	-1155.8	-2.1	-1349.0	1276.8	-129633.0	133996.0	-3959.3	4075.5
	12	(I)	-13441.0	-7998.2	29957.9	-38080.6	-624.7	351.7	-1354.8	1281.6	-129633.0	133996.0	-3704.8	3858.5
		(J)	-13441.0	-7998.2	30805.5	-38290.9	-624.7	351.7	-1354.8	1281.6	-138312.0	142281.0	-3704.8	3858.5
	13	(I)	-13603.8	-7814.3	30805.5	-38290.9	-158.5	689.5	-1354.8	1281.6	-138312.0	142281.0	-3491.0	3638.0
		(J)	-13603.8	-7814.3	30123.6	-39091.8	-158.5	689.5	-1354.8	1281.6	-146477.0	149916.0	-3491.0	3638.0
	14	(I)	-13791.1	-7631.3	30123.6	-39091.8	303.9	1127.7	-1361.2	1287.0	-146477.0	149916.0	-3273.7	3414.6
		(J)	-13791.1	-7631.3	27916.8	-40473.0	303.9	1127.7	-1361.2	1287.0	-154118.0	156890.0	-3273.7	3414.6
	15	(I)	-17536.0	-10392.3	27916.8	-40473.0	-1165.8	-262.3	-1367.9	1292.6	-154118.0	156890.0	-3024.7	3145.1
		(J)	-17536.0	-10392.3	28984.4	-38422.0	-1165.8	-262.3	-1367.9	1292.6	-161133.0	163101.0	-3024.7	3145.1
	16	(I)	-17722.2	-10211.5	28984.4	-38422.0	-820.7	368.1	-1367.9	1292.6	-161133.0	163101.0	-2807.1	2917.8
		(J)	-17722.2	-10211.5	28539.7	-36958.4	-820.7	368.1	-1367.9	1292.6	-167619.0	168632.0	-2807.1	2917.8
	17	(I)	-17907.5	-10031.9	28539.7	-36958.4	-551.0	982.3	-1375.1	1298.7	-167619.0	168632.0	-2591.0	2689.1
		(J)	-17907.5	-10031.9	26601.9	-36106.7	-551.0	982.3	-1375.1	1298.7	-173557.0	173493.0	-2591.0	2689.1
	18	(I)	-18092.0	-9853.6	26601.9	-36106.7	-267.2	1578.8	-1375.1	1298.7	-173557.0	173493.0	-2377.1	2460.1
		(J)	-18092.0	-9853.6	23189.4	-35909.0	-267.2	1578.8	-1375.1	1298.7	-178967.0	177670.0	-2377.1	2460.1
	19	(I)	-22039.5	-12730.9	23189.4	-35909.0	-1876.2	-180.7	-1382.7	1305.1	-178967.0	177670.0	-2139.1	2189.1
		(J)	-22039.5	-12730.9	23926.1	-32169.3	-1876.2	-180.7	-1382.7	1305.1	-183723.0	181069.0	-2139.1	2189.1
	20	(I)	-22222.5	-12555.1	23926.1	-32169.3	-1562.4	374.2	-1390.4	1311.7	-183723.0	181069.0	-1930.4	1967.5
		(J)	-22222.5	-12555.1	24897.9	-29127.0	-1562.4	374.2	-1390.4	1311.7	-187945.0	183779.0	-1930.4	1967.5
	21	(I)	-22404.6	-12380.7	24897.9	-29127.0	-1238.1	907.4	-1398.2	1318.4	-187945.0	183779.0	-2017.7	1906.6
		(J)	-22404.6	-12380.7	24737.2	-26762.6	-1238.1	907.4	-1398.2	1318.4	-191615.0	185824.0	-2017.7	1906.6
	22	(I)	-22585.9	-12207.8	24737.2	-26762.6	-913.4	1473.3	-1398.2	1318.4	-191615.0	185824.0	-2217.1	2022.3
		(J)	-22585.9	-12207.8	23310.1	-25085.3	-913.4	1473.3	-1398.2	1318.4	-194754.0	187196.0	-2217.1	2022.3
	23	(I)	-24964.6	-13839.7	23310.1	-25085.3	-1808.8	478.1	-1398.2	1318.4	-194754.0	187196.0	-2444.6	2172.0
		(J)	-24964.6	-13839.7	24057.5	-21464.3	-1808.8	478.1	-1398.2	1318.4	-197272.0	187907.0	-2444.6	2172.0
	24	(I)	-25137.3	-13669.7	24057.5	-21464.3	-1449.6	1031.0	-1414.1	1332.2	-197272.0	187907.0	-2648.5	2310.9
		(J)	-25137.3	-13669.7	23722.4	-19309.2	-1449.6	1031.0	-1414.1	1332.2	-199266.0	189756.0	-2648.5	2310.9
	25	(I)	-25311.5	-13501.3	23722.4	-19309.2	-1065.5	1570.3	-1406.2	1325.3	-199266.0	189756.0	-2848.7	2452.4
		(J)	-25311.5	-13501.3	22317.0	-18309.8	-1065.5	1570.3	-1406.2	1325.3	-200720.0	191076.0	-2848.7	2452.4
	26	(I)	-25488.8	-13334.6	22317.0	-18309.8	-659.2	2091.0	-1421.9	1339.2	-200720.0	191076.0	-3044.3	2604.0
		(J)	-25488.8	-13334.6	19917.1	-19121.7	-659.2	2091.0	-1421.9	1339.2	-201668.0	191899.0	-3044.3	2604.0
	27	(I)	-27998.6	-15142.9	19917.1	-19121.7	-1768.4	781.7	-1421.9	1339.2	-201668.0	191899.0	-3254.2	2842.4
		(J)	-27998.6	-15142.9	21402.9	-18888.7	-1768.4	781.7	-1421.9	1339.2	-202021.0	192163.0	-3254.2	2842.4
	28	(I)	-28166.6	-14979.6	21402.9	-18888.7	-1313.4	1265.7	-1429.7	1346.1	-202021.0	192163.0	-3438.5	3118.8
		(J)	-28166.6	-14979.6	21633.9	-19834.2	-1313.4	1265.7	-1429.7	1346.1	-201884.0	191946.0	-3438.5	3118.8
	29	(I)	-28333.5	-14818.0	21633.9	-19834.2	-835.5	1730.7	-1429.7	1346.1	-201884.0	191946.0	-3616.5	3388.3
		(J)	-28333.5	-14818.0	20578.1	-21516.3	-835.5	1730.7	-1429.7	1346.1	-201255.0	191249.0	-3616.5	3388.3
	30	(I)	-28499.5	-14658.3	20578.1	-21516.3	-401.5	2173.5	-1444.7	1359.7	-201255.0	191249.0	-3787.7	3650.6
		(J)	-28499.5	-14658.3	18224.6	-23891.0	-401.5	2173.5	-1444.7	1359.7	-200148.0	190081.0	-3787.7	3650.6
	31	(I)	-30916.1	-16530.3	18224.6	-23891.0	-1706.3	637.1	-1437.3	1353.0	-200148.0	190081.0	-4002.8	3935.1
		(J)	-30916.1	-16530.3	19391.8	-23360.6	-1706.3	637.1	-1437.3	1353.0	-198536.0	188435.0	-4002.8	3935.1
	32	(I)	-31080.5	-16374.1	19391.8	-23360.6	-1183.0	1043.4	-1451.6	1366.1	-198536.0	188435.0	-4264.6	4181.0
		(J)	-31080.5	-16374.1	19309.5	-23473.4	-1183.0	1043.4	-1451.6	1366.1	-196494.0	186350.0	-4264.6	4181.0
	33	(I)	-31244.1	-16219.7	19309.5	-23473.4	-791.4	1437.9	-1451.6	1366.1	-196494.0	186350.0	-4519.6	4418.1
		(J)	-31244.1	-16219.7	19599.9	-24221.7	-791.4	1437.9	-1451.6	1366.1	-194049.0	183843.0	-4519.6	4418.1
	34	(I)	-31406.8	-16067.2	19599.9	-24221.7	-379.4	1819.2	-1451.6	1366.1	-194049.0	183843.0	-4766.2	4646.6
		(J)	-31406.8	-16067.2	19034.6	-25605.3	-379.4	1819.2	-1451.6	1366.1	-191235.0	180934.0	-4766.2	4646.6
	35	(I)	-33556.8	-17902.6	19034.6	-25605.3	-1815.9	154.7	-1464.5	1378.3	-191235.0	180934.0	-5033.2	4890.9
		(J)	-33556.8	-17902.6	23044.7	-23890.9	-1815.9	154.7	-1464.5	1378.3	-188047.0	177611.0	-5033.2	4890.9
	36	(I)	-33717.7	-17753.7	23044.7	-23890.9	-1370.2	535.0	-1458.4	1372.4	-188047.0	177611.0	-5261.2	5100.5
		(J)	-33717.7	-17753.7	25696.5	-22900.7	-1370.2	535.0	-1458.4	1372.4	-184587.0	173926.0	-5261.2	5100.5
	37	(I)	-33877.8	-17606.3	25696.5	-22900.7	-915.8	962.0	-1470.1	1383.8	-184587.0	173926.0	-5479.7	5300.4
		(J)	-33877.8	-17606.3	26967.9	-23371.9	-915.8	962.0	-1470.1	1383.8	-180935.0	169903.0	-5479.7	5300.4
	38	(I)	-34037.7	-17460.3	26967.9	-23371.9	-452.2	1378.3	-1470.1	1383.8	-180935.0	169903.0	-5687.4	5490.5
		(J)	-34037.7	-17460.3	26839.6	-26109.4	-452.2	1378.3	-1470.1	1383.8	-177167.0	165570.0	-5687.4	5490.5
	39	(I)	-35759.4	-19089.9	26839.6	-26109.4	-2223.8	-377.8	-1475.4	1389.0	-177167.0	165570.0	-5908.5	5691.8
		(J)	-35759.4	-19089.9	31257.9	-25102.2	-2223.8	-377.8	-1475.4	1389.0	-173330.0	160934.0	-5908.5	5691.8
	40	(I)	-35918.6	-18947.3	31257.9	-25102.2	-1722.8	49.4	-1475.4	1389.0	-173330.0	160934.0	-6095.1	5862.2
		(J)	-35918.6	-18947.3	34273.4	-24821.5	-1722.8	49.4	-1475.4	1389.0	-169564.0	156078.0	-6095.1	5862.2

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	41	(I)	-36077.5	-18806.2	34273.4	-24821.5	-1319.5	469.6	-1480.0	1393.7	-169564.0	156078.0	-6270.3	6022.2
		(J)	-36077.5	-18806.2	35906.8	-25265.1	-1319.5	469.6	-1480.0	1393.7	-165941.0	164834.0	-6270.3	6022.2
	42	(I)	-36237.3	-18666.6	35906.8	-25265.1	-934.7	907.2	-1484.3	1398.1	-165941.0	164834.0	-6435.1	6171.9
		(J)	-36237.3	-18666.6	36189.1	-26442.6	-934.7	907.2	-1484.3	1398.1	-162584.0	176196.0	-6435.1	6171.9
	43	(I)	-36397.5	-18528.5	36189.1	-26442.6	-566.1	1355.7	-1484.3	1398.1	-162584.0	176196.0	-6589.3	6311.2
		(J)	-36397.5	-18528.5	35170.8	-28374.4	-566.1	1355.7	-1484.3	1398.1	-169240.0	187812.0	-6589.3	6311.2
	44	(I)	-36559.0	-18391.7	35170.8	-28374.4	-182.4	1821.3	-1487.8	1401.9	-169240.0	187812.0	-6732.5	6439.7
		(J)	-36559.0	-18391.7	32914.5	-31083.2	-182.4	1821.3	-1487.8	1401.9	-176650.0	199622.0	-6732.5	6439.7
	45	(I)	-36722.8	-18256.2	32914.5	-31083.2	217.0	2305.1	-1491.0	1405.3	-176650.0	199622.0	-6866.0	6557.6
		(J)	-36722.8	-18256.2	29464.6	-34610.1	217.0	2305.1	-1491.0	1405.3	-184686.0	211597.0	-6866.0	6557.6
	46	(I)	-36890.0	-18121.9	29464.6	-34610.1	632.2	2789.3	-1491.0	1405.3	-184686.0	211597.0	-6989.6	6665.4
		(J)	-36890.0	-18121.9	26411.1	-39013.3	632.2	2789.3	-1491.0	1405.3	-193307.0	223705.0	-6989.6	6665.4
	47	(I)	-37047.1	-18000.9	26411.1	-39013.3	1019.9	3234.8	-1493.0	1407.8	-193307.0	223705.0	-7092.6	6753.9
		(J)	-37047.1	-18000.9	23287.6	-43283.9	1019.9	3234.8	-1493.0	1407.8	-200788.0	233646.0	-7092.6	6753.9
	48	(I)	-37194.9	-17893.0	23287.6	-43283.9	1375.8	3638.2	-1493.0	1407.8	-200788.0	233646.0	-7178.6	6826.7
		(J)	-37194.9	-17893.0	19446.9	-48188.8	1375.8	3638.2	-1493.0	1407.8	-208732.0	243650.0	-7178.6	6826.7
	49	(I)	-37348.6	-17785.8	19446.9	-48188.8	1735.6	4026.6	-1495.2	1410.5	-208732.0	243650.0	-7259.6	6893.1
		(J)	-37348.6	-17785.8	14899.7	-53733.8	1735.6	4026.6	-1495.2	1410.5	-217148.0	253702.0	-7259.6	6893.1
	50	(I)	-37485.2	-17691.6	14899.7	-53733.8	2058.7	4361.4	-1492.5	1406.9	-217148.0	253702.0	-7325.8	6946.1
		(J)	-37485.2	-17691.6	10958.3	-59289.8	2058.7	4361.4	-1492.5	1406.9	-223840.0	261417.0	-7325.8	6946.1
	51	(I)	-37555.3	-17652.4	10958.3	-59289.8	2177.1	4467.2	-1534.3	1468.0	-223840.0	261417.0	-7354.8	6968.8
		(J)	-37555.3	-17652.4	10664.4	-59704.6	2177.1	4467.2	-1534.3	1468.0	-224323.0	261969.0	-7354.8	6968.8
	52	(I)	-37456.8	-17208.9	3935.8	-55846.5	-4956.0	-2178.2	-539.5	482.3	-224323.0	261969.0	-5653.3	5776.2
		(J)	-37456.8	-17208.9	4187.9	-55413.8	-4956.0	-2178.2	-539.5	482.3	-223846.0	261394.0	-5653.3	5776.2
	53	(I)	-37408.7	-17268.9	4187.9	-55413.8	-4764.0	-1985.1	-194.3	175.9	-223846.0	261394.0	-5643.5	5771.2
		(J)	-37408.7	-17268.9	7469.8	-49645.5	-4764.0	-1985.1	-194.3	175.9	-217181.0	253354.0	-5643.5	5771.2
	54	(I)	-37292.5	-17388.9	7469.8	-49645.5	-4433.0	-1675.5	-214.3	202.8	-217181.0	253354.0	-5622.8	5761.9
		(J)	-37292.5	-17388.9	11171.8	-42688.6	-4433.0	-1675.5	-214.3	202.8	-208468.0	242859.0	-5622.8	5761.9
	55	(I)	-37161.4	-17524.5	11171.8	-42688.6	-4037.4	-1333.6	-214.3	202.8	-208468.0	242859.0	-5599.3	5752.9
		(J)	-37161.4	-17524.5	14316.6	-36442.7	-4037.4	-1333.6	-214.3	202.8	-199766.0	232402.0	-5599.3	5752.9
	56	(I)	-37031.4	-17658.7	14316.6	-36442.7	-3627.0	-1007.3	-221.8	212.7	-199766.0	232402.0	-5575.2	5745.2
		(J)	-37031.4	-17658.7	18123.9	-31632.1	-3627.0	-1007.3	-221.8	212.7	-191069.0	221966.0	-5575.2	5745.2
	57	(I)	-36891.6	-17808.2	18123.9	-31632.1	-3151.3	-658.3	-224.4	216.2	-191069.0	221966.0	-5547.8	5737.4
		(J)	-36891.6	-17808.2	21773.1	-27489.3	-3151.3	-658.3	-224.4	216.2	-180397.0	209216.0	-5547.8	5737.4
	58	(I)	-36758.6	-17971.0	21773.1	-27489.3	-2663.5	-250.5	-224.4	216.2	-180397.0	209216.0	-5515.6	5729.2
		(J)	-36758.6	-17971.0	24269.0	-25475.7	-2663.5	-250.5	-224.4	216.2	-169716.0	196514.0	-5515.6	5729.2
	59	(I)	-36624.7	-18134.8	24269.0	-25475.7	-2185.5	160.1	-229.5	223.1	-169716.0	196514.0	-5480.8	5720.6
		(J)	-36624.7	-18134.8	27184.1	-24392.1	-2185.5	160.1	-229.5	223.1	-159024.0	183861.0	-5480.8	5720.6
	60	(I)	-36489.8	-18296.3	27184.1	-24392.1	-1693.4	563.1	-234.2	229.5	-159024.0	183861.0	-5443.4	5710.9
		(J)	-36489.8	-18296.3	28949.7	-24117.0	-1693.4	563.1	-234.2	229.5	-148325.0	171261.0	-5443.4	5710.9
	61	(I)	-36353.9	-18459.2	28949.7	-24117.0	-1183.5	958.4	-234.2	229.5	-148325.0	171261.0	-5402.6	5699.4
		(J)	-36353.9	-18459.2	29370.3	-24558.2	-1183.5	958.4	-234.2	229.5	-137605.0	158711.0	-5402.6	5699.4
	62	(I)	-36216.8	-18622.4	29370.3	-24558.2	-658.0	1342.8	-238.1	235.0	-137605.0	158711.0	-5357.8	5685.8
		(J)	-36216.8	-18622.4	28422.7	-25638.9	-658.0	1342.8	-238.1	235.0	-126921.0	146212.0	-5357.8	5685.8
	63	(I)	-36078.6	-18784.8	28422.7	-25638.9	-114.5	1758.5	-241.7	240.2	-126921.0	146212.0	-5308.9	5669.3
		(J)	-36078.6	-18784.8	26083.8	-27304.4	-114.5	1758.5	-241.7	240.2	-118991.0	133761.0	-5308.9	5669.3
	64	(I)	-35939.2	-18948.6	26083.8	-27304.4	447.5	2199.7	-241.7	240.2	-118991.0	133761.0	-5255.4	5649.7
		(J)	-35939.2	-18948.6	22336.6	-29514.9	447.5	2199.7	-241.7	240.2	-111070.0	121349.0	-5255.4	5649.7
	65	(I)	-34463.6	-17399.1	22336.6	-29514.9	-1472.0	277.7	-244.5	244.5	-111070.0	121349.0	-5196.8	5629.3
		(J)	-34463.6	-17399.1	23290.8	-28378.3	-1472.0	277.7	-244.5	244.5	-103161.0	108960.0	-5196.8	5629.3
	66	(I)	-34321.4	-17563.8	23290.8	-28378.3	-884.9	693.4	-244.5	244.5	-103161.0	108960.0	-5133.5	5602.7
		(J)	-34321.4	-17563.8	23375.0	-27757.1	-884.9	693.4	-244.5	244.5	-95255.2	97045.7	-5133.5	5602.7
	67	(I)	-34177.8	-17729.3	23375.0	-27757.1	-345.4	1091.8	-248.6	251.6	-95255.2	97045.7	-5065.5	5572.2
		(J)	-34177.8	-17729.3	22746.7	-27645.6	-345.4	1091.8	-248.6	251.6	-88064.5	90893.9	-5065.5	5572.2
	68	(I)	-34032.7	-17896.3	22746.7	-27645.6	90.1	1505.5	-246.9	248.5	-88064.5	90893.9	-4992.2	5538.6
		(J)	-34032.7	-17896.3	20733.2	-28068.6	90.1	1505.5	-246.9	248.5	-82942.7	84798.1	-4992.2	5538.6
	69	(I)	-32203.6	-16114.8	20733.2	-28068.6	-1608.5	-193.4	-249.5	253.9	-82942.7	84798.1	-4911.3	5504.1
		(J)	-32203.6	-16114.8	23044.2	-25712.5	-1608.5	-193.4	-249.5	253.9	-77666.9	78737.4	-4911.3	5504.1
	70	(I)	-32055.3	-16284.9	23044.2	-25712.5	-1151.9	315.5	-249.5	253.9	-77666.9	78737.4	-4848.7	5465.7
		(J)	-32055.3	-16284.9	23944.3	-24392.9	-1151.9	315.5	-249.5	253.9	-72257.4	72705.4	-4848.7	5465.7
	71	(I)	-31905.4	-16454.5	23944.3	-24392.9	-815.5	883.7	-249.5	253.9	-72257.4	72705.4	-4830.8	5426.6
		(J)	-31905.4	-16454.5	23438.9	-23596.3	-815.5	883.7	-249.5	253.9	-71893.1	76562.3	-4830.8	5426.6
	72	(I)	-31753.9	-16625.7	23438.9	-23596.3	-465.4	1463.4	-250.1	256.9	-71893.1	76562.3	-4808.4	5386.9
		(J)	-31753.9	-16625.7	21545.0	-23346.7	-465.4	1463.4	-250.1	256.9	-76256.9	84745.6	-4808.4	5386.9
	73	(I)	-29677.6	-14767.8	21545.0	-23346.7	-1927.7	92.9	-250.1	255.8	-76256.9	84745.6	-4779.0	5347.8
		(J)	-29677.6	-14767.8	23169.4	-20037.0	-1927.7	92.9	-250.1	255.8	-81673.4	92656.0	-4779.0	5347.8
	74	(I)	-29522.7	-14942.0	23169.4	-20037.0	-1540.9	625.4	-249.5	257.2	-81673.4	92656.0	-4744.0	5304.0
		(J)	-29522.7	-14942.0	23457.0	-17853.6	-1540.9	625.4	-249.5	257.2	-89106.2	100288.0	-4744.0	5304.0
	75	(I)	-29366.3	-15117.7	23457.0	-17853.6	-1133.4	1157.9	-249.5	257.2	-89106.2	100288.0	-4701.6	5255.7
		(J)	-29366.3	-15117.7	22436.7	-17420.6	-1133.4	1157.9	-249.5	257.2	-96318.1	107645.0	-4701.6	5255.7
	76	(I)	-29208.2	-15294.8	22436.7	-17420.6	-743.1	1668.3	-248.5	257.2	-96318.1	107645.0	-4651.8	5201.7
		(J)	-29208.2	-15294.8	20144.9	-17772.5	-743.1	1668.3	-248.5	257.2	-103285.0	114706.0	-4651.8	5201.7
	77	(I)	-27009.2	-13475.2	20144.9	-17772.5	-1966.1	545.3	-248.5	257.2	-103285.0	114706.0	-4589.7	5140.7
		(J)	-27009.2	-13475.2	20691.4	-15585.9	-1966.1	545.3	-248.5	257.2	-109960.0	121453.0	-4589.7	5140.7
	78	(I)	-26847.8	-13653.9	20691.4	-15585.9	-1559.5	1008.3	-245.5	255.6	-109960.0	121453.0	-4523.4	5073.4
		(J)	-26847.8	-13653.9	22086.6	-14227.0	-1559.5	1008.3	-245.5	255.6	-116359.0	127898.0	-4523.4	5073.4
	79	(I)	-26684.9	-13834.1	22086.6	-14227.0	-1126.1	1449.1	-247.3	256.8	-116359.0	127898.0	-4448.6	4998.5
		(J)	-26684.9	-13834.1	23457.0	-14329.2	-1126.1	1449.1	-247.3	256.8	-122475.0	134043.0	-4448.6	4998.5
	80	(I)	-26520.4	-14015.6	23457.0	-14329.2	-668.5	1864.0	-243.2	253.6	-122475.0	134043.0	-4365.1	4915.6
		(J)	-26520.4	-14015.6	23595.1	-16403.3	-668.5	1864.0	-243.2	253.6	-128304.0	139887.0	-4365.1	4915.6
	81	(I)	-24352.8	-12346.0	23595.1	-16403.3	-1630.0	966.9	-243.2	253.6	-128304.0	139887.0	-4264.5	4819.2
		(J)	-24352.8	-12346.0	25964.1	-16714.8	-1630.0	966.9	-243.2	253.6	-133793.0	145405.0	-4264.5	4819.2
	82	(I)	-24185.3	-12530.1	25964.1	-16714.8	-1112.6	1381.5	-243.2	253.6	-133793.0	145405.0	-4164.0	4719.4
		(J)	-24185.3	-12530.1	27075.2	-17910.9	-1112.6	1381.5	-243.2	253.6	-138984.0	150631.0	-4164.0	4719.4
	83	(I)	-24016.3	-12715.5	27075.2	-17910.9	-566.8	1772.0	-240.4	251.0	-138984.0	150631.0	-4054.7	4610.6
		(J)	-24016.3	-12715.5	26937.5	-21114.3	-566.8	1772.0	-240.4	251.0	-143875.0	155578.0	-4054.7	4610.6
	84	(I)	-23846.0	-12902.1	26937.5	-21114.3	-17.6	2136.7	-237.4	248.1	-143875.0	155578.0	-3937.0	4493.3
		(J)	-23846.0	-12902.1	25562.6	-25090.4	-17.6	2136.7	-237.4	248.1	-148462.0	160272.0	-3937.0	4493.3
	85	(I)	-20139.7	-9822.3	25562.6	-25090.4	-1725.1	469.0	-234.1	244.8	-148462.0	160272.0	-3794.2	4355.4

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
		(J)	-20139.7	-9822.3	28511.7	-25364.8	-1725.1	469.0	-234.1	244.8	-152683.0	164710.0	-3794.2	4355.4
	86	(I)	-19966.5	-9974.5	28511.7	-25364.8	-1161.0	785.5	-234.1	244.8	-152683.0	164710.0	-3660.4	4219.7
		(J)	-19966.5	-9974.5	30763.0	-26335.9	-1161.0	785.5	-234.1	244.8	-156615.0	168964.0	-3660.4	4219.7
	87	(I)	-19791.9	-10127.5	30763.0	-26335.9	-586.8	1079.7	-230.4	240.9	-156615.0	168964.0	-3518.7	4075.3
		(J)	-19791.9	-10127.5	31670.4	-27960.9	-586.8	1079.7	-230.4	240.9	-160256.0	173056.0	-3518.7	4075.3
	88	(I)	-19616.1	-10281.3	31670.4	-27960.9	4.3	1355.5	-230.4	240.9	-160256.0	173056.0	-3370.0	3921.8
		(J)	-19616.1	-10281.3	31195.0	-30203.2	4.3	1355.5	-230.4	240.9	-163624.0	177006.0	-3370.0	3921.8
	89	(I)	-15973.8	-7240.6	31195.0	-30203.2	-1442.3	-178.8	-226.2	236.4	-163624.0	177006.0	-3190.5	3740.1
		(J)	-15973.8	-7240.6	33807.5	-28995.1	-1442.3	-178.8	-226.2	236.4	-166675.0	180807.0	-3190.5	3740.1
	90	(I)	-15795.5	-7393.8	33807.5	-28995.1	-823.9	92.2	-221.9	231.7	-166675.0	180807.0	-3027.9	3569.2
		(J)	-15795.5	-7393.8	34990.8	-28370.3	-823.9	92.2	-221.9	231.7	-169496.0	184557.0	-3027.9	3569.2
	91	(I)	-15616.1	-7546.0	34990.8	-28370.3	-305.4	513.9	-221.9	231.7	-169496.0	184557.0	-2859.2	3389.9
		(J)	-15616.1	-7546.0	34732.2	-28326.7	-305.4	513.9	-221.9	231.7	-173946.0	188352.0	-2859.2	3389.9
	92	(I)	-15435.5	-7698.9	34732.2	-28326.7	142.5	927.6	-217.2	226.4	-173946.0	188352.0	-2684.3	3202.6
		(J)	-15435.5	-7698.9	33029.4	-28970.4	142.5	927.6	-217.2	226.4	-181154.0	192297.0	-2684.3	3202.6
	93	(I)	-11681.5	-4581.8	33029.4	-28970.4	-1352.0	-311.6	-212.4	220.9	-181154.0	192297.0	-2474.1	2980.9
		(J)	-11681.5	-4581.8	33927.6	-26417.8	-1352.0	-311.6	-212.4	220.9	-187862.0	196338.0	-2474.1	2980.9
	94	(I)	-11499.3	-4733.5	33927.6	-26417.8	-1040.5	262.2	-212.4	220.9	-187862.0	196338.0	-2287.4	2779.4
		(J)	-11499.3	-4733.5	33404.1	-24428.7	-1040.5	262.2	-212.4	220.9	-194123.0	200373.0	-2287.4	2779.4
	95	(I)	-11316.2	-4884.1	33404.1	-24428.7	-750.0	863.1	-207.2	215.0	-194123.0	200373.0	-2125.4	2572.0
		(J)	-11316.2	-4884.1	31476.2	-23014.7	-750.0	863.1	-207.2	215.0	-199922.0	204250.0	-2125.4	2572.0
	96	(I)	-11132.3	-5034.5	31476.2	-23014.7	-451.0	1473.0	-207.2	215.0	-199922.0	204250.0	-1987.7	2359.8
		(J)	-11132.3	-5034.5	28163.9	-22201.5	-451.0	1473.0	-207.2	215.0	-205246.0	207878.0	-1987.7	2359.8
	97	(I)	-7342.8	-1715.2	28163.9	-22201.5	-2093.6	396.5	-201.8	208.7	-205246.0	207878.0	-1813.8	2112.1
		(J)	-7342.8	-1715.2	27278.1	-17756.8	-2093.6	396.5	-201.8	208.7	-210003.0	211124.0	-1813.8	2112.1
	98	(I)	-7230.9	-1862.6	27278.1	-17756.8	-1771.1	977.4	-196.2	202.3	-210003.0	211124.0	-1661.3	1895.2
		(J)	-7230.9	-1862.6	25061.6	-13985.8	-1771.1	977.4	-196.2	202.3	-214261.0	214013.0	-1661.3	1895.2
	99	(I)	-7119.1	-2008.1	25061.6	-13985.8	-1429.6	1544.1	-196.2	202.3	-214261.0	214013.0	-1502.1	1677.2
		(J)	-7119.1	-2008.1	21549.8	-10935.3	-1429.6	1544.1	-196.2	202.3	-218010.0	216517.0	-1502.1	1677.2
	100	(I)	-7006.7	-2150.7	21549.8	-10935.3	-1066.6	2094.9	-190.5	195.6	-218010.0	216517.0	-1337.0	1458.7
		(J)	-7006.7	-2150.7	16788.8	-8659.4	-1066.6	2094.9	-190.5	195.6	-221239.0	218611.0	-1337.0	1458.7
	101	(I)	-2977.7	1415.7	16788.8	-8659.4	-2785.4	1026.2	-185.0	188.8	-221239.0	218611.0	-1131.6	1205.3
		(J)	-2977.7	1415.7	14856.5	-2801.5	-2785.4	1026.2	-185.0	188.8	-223859.0	220204.0	-1131.6	1205.3
	102	(I)	-2907.8	1330.9	14856.5	-2801.5	-2527.9	1342.1	-184.4	183.5	-223859.0	220204.0	-1022.4	1069.5
		(J)	-2907.8	1330.9	14618.0	-1701.8	-2527.9	1342.1	-184.4	183.5	-224430.0	220536.0	-1022.4	1069.5
	103	(I)	-2851.8	1264.2	14618.0	-1701.8	-2318.6	1592.2	-186.7	191.1	-224430.0	220536.0	-960.7	962.1
		(J)	-2851.8	1264.2	13542.6	1055.1	-2318.6	1592.2	-186.7	191.1	-225953.0	221373.0	-960.7	962.1
	104	(I)	-2773.4	1171.4	13542.6	1055.1	-2007.8	1931.4	-184.3	183.4	-225953.0	221373.0	-926.1	860.9
		(J)	-2773.4	1171.4	12198.5	2699.6	-2007.8	1931.4	-184.3	183.4	-227050.0	221896.0	-926.1	860.9
	105	(I)	-2700.3	1085.8	12198.5	2699.6	-1703.5	2237.4	-184.3	183.4	-227050.0	221896.0	-898.3	898.0
		(J)	-2700.3	1085.8	11848.2	1770.0	-1703.5	2237.4	-184.3	183.4	-227916.0	222222.0	-898.3	898.0
	106	(I)	-2624.2	995.9	11848.2	1770.0	-1367.4	2548.8	-183.4	177.2	-227916.0	222222.0	-875.6	936.0
		(J)	-2624.2	995.9	13208.3	-632.3	-1367.4	2548.8	-183.4	177.2	-228607.0	222352.0	-875.6	936.0
	107	(I)	-2572.0	932.9	13208.3	-632.3	-1120.3	2757.3	-184.4	183.5	-228607.0	222352.0	-864.5	961.8
		(J)	-2572.0	932.9	13833.5	-1591.1	-1120.3	2757.3	-184.4	183.5	-228767.0	222337.0	-864.5	961.8
	108	(I)	-2509.9	854.9	13833.5	-1591.1	-807.7	3013.0	-183.6	178.8	-228767.0	222337.0	-903.7	1006.8
		(J)	-2509.9	854.9	15648.5	-7903.9	-807.7	3013.0	-183.6	178.8	-229087.0	221981.0	-903.7	1006.8
	109	(I)	-6220.9	-3171.9	15648.5	-7903.9	-2038.2	1214.2	-182.9	174.1	-229087.0	221981.0	-1076.1	1119.5
		(J)	-6220.9	-3171.9	20136.7	-10688.3	-2038.2	1214.2	-182.9	174.1	-228778.0	221106.0	-1076.1	1119.5
	110	(I)	-6137.9	-3289.9	20136.7	-10688.3	-1482.6	1567.8	-182.1	171.0	-228778.0	221106.0	-1217.8	1226.5
		(J)	-6137.9	-3289.9	23385.8	-14266.4	-1482.6	1567.8	-182.1	171.0	-227946.0	219762.0	-1217.8	1226.5
	111	(I)	-6057.4	-3319.8	23385.8	-14266.4	-906.6	1898.5	-182.1	171.0	-227946.0	219762.0	-1356.5	1330.6
		(J)	-6057.4	-3319.8	25347.0	-18583.7	-906.6	1898.5	-182.1	171.0	-226583.0	217952.0	-1356.5	1330.6
	112	(I)	-5977.6	-3350.6	25347.0	-18583.7	-309.0	2209.9	-181.4	175.5	-226583.0	217952.0	-1491.6	1429.8
		(J)	-5977.6	-3350.6	25971.8	-23592.6	-309.0	2209.9	-181.4	175.5	-224693.0	215696.0	-1491.6	1429.8
	113	(I)	-9437.8	-6703.2	25971.8	-23592.6	-1492.1	493.9	-180.7	179.8	-224693.0	215696.0	-1647.2	1528.7
		(J)	-9437.8	-6703.2	29192.9	-24757.4	-1492.1	493.9	-180.7	179.8	-222195.0	212912.0	-1647.2	1528.7
	114	(I)	-9399.4	-6709.9	29192.9	-24757.4	-872.4	788.3	-180.7	179.8	-222195.0	212912.0	-1773.8	1616.2
		(J)	-9399.4	-6709.9	31004.4	-26543.7	-872.4	788.3	-180.7	179.8	-219186.0	209676.0	-1773.8	1616.2
	115	(I)	-9378.8	-6663.5	31004.4	-26543.7	-304.5	1081.4	-180.0	184.1	-219186.0	209676.0	-1929.3	1798.7
		(J)	-9378.8	-6663.5	31388.0	-28935.7	-304.5	1081.4	-180.0	184.1	-215676.0	206006.0	-1929.3	1798.7
	116	(I)	-9396.1	-6617.4	31388.0	-28935.7	256.0	1407.4	-180.0	184.1	-215676.0	206006.0	-2159.9	1999.9
		(J)	-9396.1	-6617.4	30321.4	-31920.3	256.0	1407.4	-180.0	184.1	-211675.0	201903.0	-2159.9	1999.9
	117	(I)	-13140.7	-9805.0	30321.4	-31920.3	-1024.4	-19.3	-181.2	188.3	-211675.0	201903.0	-2418.0	2228.7
		(J)	-13140.7	-9805.0	31975.8	-31320.6	-1024.4	-19.3	-181.2	188.3	-207110.0	197311.0	-2418.0	2228.7
	118	(I)	-13265.0	-9758.3	31975.8	-31320.6	-479.0	381.0	-184.5	192.4	-207110.0	197311.0	-2639.6	2421.2
		(J)	-13265.0	-9758.3	32167.6	-31310.6	-479.0	381.0	-184.5	192.4	-202077.0	192307.0	-2639.6	2421.2
	119	(I)	-13389.6	-9656.0	32167.6	-31310.6	-37.0	847.4	-184.5	192.4	-202077.0	192307.0	-2856.2	2609.3
		(J)	-13389.6	-9656.0	30898.8	-31898.9	-37.0	847.4	-184.5	192.4	-196598.0	186905.0	-2856.2	2609.3
	120	(I)	-13514.0	-9509.7	30898.8	-31898.9	264.1	1340.4	-188.0	196.3	-196598.0	186905.0	-3067.5	2793.3
		(J)	-13514.0	-9509.7	28181.0	-33096.6	264.1	1340.4	-188.0	196.3	-190676.0	181111.0	-3067.5	2793.3
	121	(I)	-17202.1	-12322.6	28181.0	-33096.6	-1237.0	-58.6	-192.7	200.2	-190676.0	181111.0	-3300.4	3000.9
		(J)	-17202.1	-12322.6	28620.0	-30845.1	-1237.0	-58.6	-192.7	200.2	-184253.0	174888.0	-3300.4	3000.9
	122	(I)	-17325.9	-12177.5	28620.0	-30845.1	-945.1	585.8	-192.7	200.2	-184253.0	174888.0	-3502.2	3177.5
		(J)	-17325.9	-12177.5	27656.0	-29234.0	-945.1	585.8	-192.7	200.2	-177395.0	168307.0	-3502.2	3177.5
	123	(I)	-17449.4	-12033.1	27656.0	-29234.0	-659.5	1211.8	-196.9	203.9	-177395.0	168307.0	-3699.2	3350.0
		(J)	-17449.4	-12033.1	25331.6	-28285.5	-659.5	1211.8	-196.9	203.9	-170113.0	161373.0	-3699.2	3350.0
	124	(I)	-17594.5	-11889.4	25331.6	-28285.5	-372.1	1818.4	-196.9	203.9	-170113.0	161373.0	-3892.0	3517.5
		(J)	-17594.5	-11889.4	21733.1	-28029.6	-372.1	1818.4	-196.9	203.9	-162395.0	154108.0	-3892.0	3517.5
	125	(I)	-21420.5	-14812.6	21733.1	-28029.6	-2064.5	44.9	-200.7	207.5	-162395.0	154108.0	-4101.5	3702.2
		(J)	-21420.5	-14812.6	23176.0	-24984.3	-2064.5	44.9	-200.7	207.5	-154167.0	146487.0	-4101.5	3702.2
	126	(I)	-21609.5	-14670.5	23176.0	-24984.3	-1735.2	625.9	-204.3	211.0	-154167.0	146487.0	-4285.9	3858.2
		(J)	-21609.5	-14670.5	23522.2	-22750.8	-1735.2	625.9	-204.3	211.0	-145499.0	138656.0	-4285.9	3858.2
	127	(I)	-21797.9	-14529.2	23522.2	-22750.8	-1379.9	1182.5	-207.7	214.3	-145499.0	138656.0	-4466.2	4007.9
		(J)	-21797.9	-14529.2	23256.6	-21278.4	-1379.9	1182.5	-207.7	214.3	-136396.0	131480.0	-4466.2	4007.9
	128	(I)	-21985.2	-14388.8	23256.6	-21278.4	-995.7	1713.3	-207.7	214.3	-136396.0	131480.0	-4641.7	4150.6
		(J)	-21985.2	-14388.8	21847.1	-20575.5	-995.7	1713.3	-207.7	214.3	-126863.0	124264.0	-4641.7	4150.6
	129	(I)	-24286.0	-16083.8	21847.1	-20575.5	-1888.7	764.2	-207.7	214.3	-126863.0	124264.0	-4826.7	4300.1
		(J)	-24286.0	-16083.8	22586.9	-18609.0	-1888.7	764.2	-207.7	214.3	-116858.0	116922.0	-4826.7	4300.1

Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
130	(I)	-24471.0	-15944.4	22586.9	-18609.0	-1449.2	1236.8	-213.1	220.5	-116858.0	116922.0	-4992.7	4428.7
	(J)	-24471.0	-15944.4	22112.6	-17467.8	-1449.2	1236.8	-213.1	220.5	-106446.0	109448.0	-4992.7	4428.7
131	(I)	-24654.6	-15806.1	22112.6	-17467.8	-979.6	1683.7	-210.6	217.5	-106446.0	109448.0	-5154.3	4549.8
	(J)	-24654.6	-15806.1	20881.8	-17131.9	-979.6	1683.7	-210.6	217.5	-95646.4	101846.0	-5154.3	4549.8
132	(I)	-24837.1	-15668.7	20881.8	-17131.9	-486.6	2099.9	-215.2	223.2	-95646.4	101846.0	-5311.2	4664.0
	(J)	-24837.1	-15668.7	19251.4	-17685.2	-486.6	2099.9	-215.2	223.2	-84500.1	94112.5	-5311.2	4664.0
133	(I)	-27227.5	-17570.6	19251.4	-17685.2	-1593.5	822.8	-215.2	223.2	-84500.1	94112.5	-5475.0	4780.3
	(J)	-27227.5	-17570.6	20787.8	-18041.5	-1593.5	822.8	-215.2	223.2	-74947.1	86239.8	-5475.0	4780.3
134	(I)	-27407.1	-17404.9	20787.8	-18041.5	-1073.6	1236.9	-217.1	225.8	-74947.1	86239.8	-5625.1	4880.7
	(J)	-27407.1	-17404.9	21071.9	-19136.0	-1073.6	1236.9	-217.1	225.8	-68712.0	78268.9	-5625.1	4880.7
135	(I)	-27585.9	-17232.9	21071.9	-19136.0	-580.4	1646.2	-217.1	225.8	-68712.0	78268.9	-5772.4	4974.0
	(J)	-27585.9	-17232.9	20178.1	-20939.5	-580.4	1646.2	-217.1	225.8	-62140.1	70214.0	-5772.4	4974.0
136	(I)	-27763.9	-17062.2	20178.1	-20939.5	-72.9	2036.4	-220.1	230.6	-62140.1	70214.0	-5917.8	5061.6
	(J)	-27763.9	-17062.2	19522.7	-23415.0	-72.9	2036.4	-220.1	230.6	-55816.7	62089.7	-5917.8	5061.6
137	(I)	-30083.0	-18925.6	19522.7	-23415.0	-1472.6	543.3	-218.8	228.3	-55816.7	62089.7	-6071.2	5150.6
	(J)	-30083.0	-18925.6	22149.1	-23009.2	-1472.6	543.3	-218.8	228.3	-52568.7	53900.6	-6071.2	5150.6
138	(I)	-30258.0	-18776.5	22149.1	-23009.2	-925.8	905.6	-221.0	232.5	-52568.7	53900.6	-6212.9	5229.0
	(J)	-30258.0	-18776.5	23310.3	-23230.9	-925.8	905.6	-221.0	232.5	-54026.2	50574.9	-6212.9	5229.0
139	(I)	-30431.5	-18628.8	23310.3	-23230.9	-403.9	1261.1	-221.0	232.5	-54026.2	50574.9	-6351.1	5311.3
	(J)	-30431.5	-18628.8	22971.8	-24073.4	-403.9	1261.1	-221.0	232.5	-60695.0	49269.5	-6351.1	5311.3
140	(I)	-30603.4	-18470.8	22971.8	-24073.4	2.1	1623.0	-221.0	232.5	-60695.0	49269.5	-6484.2	5456.4
	(J)	-30603.4	-18470.8	21111.2	-25538.5	2.1	1623.0	-221.0	232.5	-67341.1	54594.3	-6484.2	5456.4
141	(I)	-32700.4	-20137.6	21111.2	-25538.5	-1548.7	-16.5	-222.1	235.9	-67341.1	54594.3	-6618.7	5602.9
	(J)	-32700.4	-20137.6	23273.0	-23930.3	-1548.7	-16.5	-222.1	235.9	-73968.6	60033.6	-6618.7	5602.9
142	(I)	-32871.0	-19991.4	23273.0	-23930.3	-1103.0	389.4	-221.7	234.3	-73968.6	60033.6	-6739.8	5734.4
	(J)	-32871.0	-19991.4	23889.6	-23012.2	-1103.0	389.4	-221.7	234.3	-80583.2	67799.9	-6739.8	5734.4
143	(I)	-33040.2	-19846.3	23889.6	-23012.2	-674.0	850.7	-222.1	237.1	-80583.1	67799.9	-6853.8	5859.1
	(J)	-33040.2	-19846.3	23426.0	-23817.4	-674.0	850.7	-222.1	237.1	-87162.1	82044.1	-6853.8	5859.1
144	(I)	-33207.7	-19702.1	23426.0	-23817.4	-329.2	1304.0	-222.1	237.1	-87162.1	82044.1	-6961.5	5976.5
	(J)	-33207.7	-19702.1	22618.4	-25766.6	-329.2	1304.0	-222.1	237.1	-93726.6	96601.7	-6961.5	5976.5
145	(I)	-34931.3	-21147.7	22618.4	-25766.6	-2090.6	-465.4	-222.1	238.1	-93726.5	96601.7	-7066.5	6091.6
	(J)	-34931.3	-21147.7	26432.8	-24050.4	-2090.6	-465.4	-222.1	238.1	-104413.0	111471.0	-7066.5	6091.6
146	(I)	-35097.0	-21003.6	26432.8	-24050.4	-1633.0	28.7	-222.1	238.1	-104413.0	111471.0	-7159.9	6195.0
	(J)	-35097.0	-21003.6	28829.1	-23005.5	-1633.0	28.7	-222.1	238.1	-116775.0	126652.0	-7159.9	6195.0
147	(I)	-35262.4	-20858.3	28829.1	-23005.5	-1299.5	510.1	-221.7	238.9	-116775.0	126652.0	-7246.6	6291.4
	(J)	-35262.4	-20858.3	29829.6	-22637.1	-1299.5	510.1	-221.7	238.9	-129240.0	142147.0	-7246.6	6291.4
148	(I)	-35426.2	-20713.4	29829.6	-22637.1	-955.1	982.6	-221.3	239.4	-129240.0	142147.0	-7326.9	6380.7
	(J)	-35426.2	-20713.4	29470.6	-22963.2	-955.1	982.6	-221.3	239.4	-141826.0	157944.0	-7326.9	6380.7
149	(I)	-35588.3	-20568.1	29470.6	-22963.2	-596.2	1453.1	-221.3	239.4	-141826.0	157944.0	-7401.1	6464.1
	(J)	-35588.3	-20568.1	27806.4	-24011.9	-596.2	1453.1	-221.3	239.4	-154513.0	174026.0	-7401.1	6464.1
150	(I)	-35751.3	-20421.8	27806.4	-24011.9	-223.2	2020.2	-222.3	239.7	-154513.0	174026.0	-7469.9	6541.3
	(J)	-35751.3	-20421.8	24908.3	-25824.0	-223.2	2020.2	-222.3	239.7	-167307.0	190392.0	-7469.9	6541.3
151	(I)	-35913.8	-20274.3	24908.3	-25824.0	165.1	2582.0	-223.1	239.7	-167307.0	190392.0	-7533.7	6613.1
	(J)	-35913.8	-20274.3	21051.6	-28469.8	165.1	2582.0	-223.1	239.7	-180219.0	206992.0	-7533.7	6613.1
152	(I)	-36074.8	-20125.8	21051.6	-28469.8	569.4	3123.2	-223.1	239.7	-180219.0	206992.0	-7593.2	6679.8
	(J)	-36074.8	-20125.8	17822.5	-32085.3	569.4	3123.2	-223.1	239.7	-193263.0	223808.0	-7593.2	6679.8
153	(I)	-36222.1	-19988.1	17822.5	-32085.3	938.3	3593.9	-223.5	239.6	-193263.0	223808.0	-7644.0	6736.9
	(J)	-36222.1	-19988.1	14437.4	-36399.9	938.3	3593.9	-223.5	239.6	-203998.0	237650.0	-7644.0	6736.9
154	(I)	-36354.8	-19863.7	14437.4	-36399.9	1251.5	4006.8	-224.5	239.1	-203998.0	237650.0	-7687.8	6785.2
	(J)	-36354.8	-19863.7	10345.4	-42495.0	1251.5	4006.8	-224.5	239.1	-214845.0	251600.0	-7687.8	6785.2
155	(I)	-36486.4	-19737.4	10345.4	-42495.0	1584.4	4404.4	-224.5	239.1	-214845.0	251600.0	-7730.2	6832.3
	(J)	-36486.4	-19737.4	5550.1	-49663.3	1584.4	4404.4	-224.5	239.1	-225815.0	265672.0	-7730.2	6832.3
156	(I)	-36604.4	-19625.3	5550.1	-49663.3	1890.4	4736.2	-226.8	237.3	-225815.0	265672.0	-7766.9	6872.0
	(J)	-36604.4	-19625.3	1426.2	-55591.1	1890.4	4736.2	-226.8	237.3	-234280.0	276475.0	-7766.9	6872.0
157	(I)	-36652.8	-19568.2	1426.2	-55591.1	2082.4	4928.0	-360.2	331.6	-234279.0	276475.0	-7783.7	6890.3
	(J)	-36652.8	-19568.2	1113.6	-56035.5	2082.4	4928.0	-360.2	331.6	-234888.0	277249.0	-7783.7	6890.3
158	(I)	-36763.7	-16954.7	7175.2	-51159.9	-4592.7	-2280.4	-1121.5	1161.1	-234888.0	277249.0	-7334.3	7153.3
	(J)	-36763.7	-16954.7	7413.1	-50729.2	-4592.7	-2280.4	-1121.5	1161.1	-234377.0	276679.0	-7334.3	7153.3
159	(I)	-36710.0	-17006.1	7413.1	-50729.2	-4483.1	-2172.1	-1090.8	1101.3	-234377.0	276680.0	-7311.1	7115.7
	(J)	-36710.0	-17006.1	10569.1	-44871.0	-4483.1	-2172.1	-1090.8	1101.3	-227294.0	268753.0	-7311.1	7115.7
160	(I)	-36606.6	-17124.7	10569.1	-44871.0	-4145.0	-1858.4	-1092.8	1104.9	-227294.0	268753.0	-7255.9	7033.2
	(J)	-36606.6	-17124.7	14107.3	-39014.6	-4145.0	-1858.4	-1092.8	1104.9	-218313.0	258471.0	-7255.9	7033.2
161	(I)	-36488.1	-17256.3	14107.3	-39014.6	-3751.3	-1523.0	-1091.0	1102.2	-218313.0	258471.0	-7185.5	6937.8
	(J)	-36488.1	-17256.3	16977.2	-33795.9	-3751.3	-1523.0	-1091.0	1102.2	-209663.0	248291.0	-7185.5	6937.8
162	(I)	-36369.1	-17388.9	16977.2	-33795.9	-3363.1	-1172.9	-1091.0	1102.2	-209663.0	248291.0	-7107.0	6840.4
	(J)	-36369.1	-17388.9	21499.3	-29485.4	-3363.1	-1172.9	-1091.0	1102.2	-201360.0	238221.0	-7107.0	6840.4
163	(I)	-36235.7	-17537.7	21499.3	-29485.4	-2924.0	-780.1	-1089.2	1099.8	-201360.0	238221.0	-7010.3	6728.0
	(J)	-36235.7	-17537.7	25987.5	-26225.7	-2924.0	-780.1	-1089.2	1099.8	-191681.0	226039.0	-7010.3	6728.0
164	(I)	-36087.7	-17699.4	25987.5	-26225.7	-2428.3	-356.0	-1089.2	1099.8	-191681.0	226039.0	-6890.7	6598.5
	(J)	-36087.7	-17699.4	29255.6	-23851.4	-2428.3	-356.0	-1089.2	1099.8	-182622.0	214054.0	-6890.7	6598.5
165	(I)	-35938.6	-17862.3	29255.6	-23851.4	-1922.6	57.9	-1086.3	1096.6	-182622.0	214054.0	-6757.9	6464.0
	(J)	-35938.6	-17862.3	31273.0	-22295.4	-1922.6	57.9	-1086.3	1096.6	-174561.0	202298.0	-6757.9	6464.0
166	(I)	-35788.3	-18026.9	31273.0	-22295.4	-1403.5	464.2	-1083.0	1093.0	-174561.0	202298.0	-6611.7	6322.2
	(J)	-35788.3	-18026.9	32009.9	-21496.9	-1403.5	464.2	-1083.0	1093.0	-168282.0	190805.0	-6611.7	6322.2
167	(I)	-35636.9	-18191.0	32009.9	-21496.9	-868.9	867.3	-1083.0	1093.0	-168282.0	190805.0	-6452.2	6174.7
	(J)	-35636.9	-18191.0	31448.6	-21408.8	-868.9	867.3	-1083.0	1093.0	-166973.0	179610.0	-6452.2	6174.7
168	(I)	-35484.3	-18355.7	31448.6	-21408.8	-333.3	1271.6	-1078.9	1088.9	-166973.0	179610.0	-6279.1	6018.9
	(J)	-35484.3	-18355.7	29578.8	-21990.5	-333.3	1271.6	-1078.9	1088.9	-170268.0	168774.0	-6279.1	6018.9
169	(I)	-35330.6	-18522.2	29578.8	-21990.5	115.8	1700.5	-1074.5	1084.5	-170268.0	168774.0	-6092.4	5856.9
	(J)	-35330.6	-18522.2	26399.8	-23215.8	115.8	1700.5	-1074.5	1084.5	-173706.0	158376.0	-6092.4	5856.9
170	(I)	-35175.7	-18690.2	26399.8	-23215.8	562.8	2145.1	-1074.5	1084.5	-173706.0	158376.0	-5892.3	5686.4
	(J)	-35175.7	-18690.2	21910.4	-25074.7	562.8	2145.1	-1074.5	1084.5	-177136.0	155360.0	-5892.3	5686.4
171	(I)	-33605.1	-17238.6	21910.4	-25074.7	-1287.7	309.4	-1069.5	1079.7	-177136.0	155360.0	-5654.6	5485.8
	(J)	-33605.1	-17238.6	22136.8	-23434.4	-1287.7	309.4	-1069.5	1079.7	-180427.0	159548.0	-5654.6	5485.8
172	(I)	-33447.8	-17407.6	22136.8	-23434.4	-818.7	775.3	-1069.5	1079.7	-180427.0	159548.0	-5428.4	5299.9
	(J)	-33447.8	-17407.6	22502.0	-22639.6	-818.7	775.3	-1069.5	1079.7	-183557.0	163407.0	-5428.4	5299.9
173	(I)	-33289.3	-17578.4	22502.0	-22639.6	-360.9	1224.1	-1058.3	1069.3	-183557.0	163407.0	-5189.6	5105.5
	(J)	-33289.3	-17578.4	21563.6	-23134.8	-360.9	1224.1	-1058.3	1069.3	-186480.0	166922.0	-5189.6	5105.5
174	(I)	-33129.7	-17750.8	21563.6	-23134.8	70.9	1721.2	-1064.2	1074.7	-186480.0	166922.0	-4938.8	4903.3

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
		(J)	-33129.7	-17750.8	19283.6	-24203.7	70.9	1721.2	-1064.2	1074.7	-189152.0	170073.0	-4938.8	4903.3
	175	(I)	-31184.6	-16073.2	19283.6	-24203.7	-1683.1	93.5	-1052.0	1063.6	-189152.0	170073.0	-4646.7	4665.5
		(J)	-31184.6	-16073.2	21155.3	-21843.3	-1683.1	93.5	-1052.0	1063.6	-191469.0	172820.0	-4646.7	4665.5
	176	(I)	-31022.5	-16248.5	21155.3	-21843.3	-1212.2	629.4	-1052.0	1063.6	-191469.0	172820.0	-4373.8	4447.0
		(J)	-31022.5	-16248.5	21677.6	-20639.9	-1212.2	629.4	-1052.0	1063.6	-193447.0	175177.0	-4373.8	4447.0
	177	(I)	-30859.2	-16424.3	21677.6	-20639.9	-802.2	1155.2	-1052.0	1063.6	-193447.0	175177.0	-4090.7	4219.6
		(J)	-30859.2	-16424.3	20860.1	-20162.1	-802.2	1155.2	-1052.0	1063.6	-195052.0	177127.0	-4090.7	4219.6
	178	(I)	-30694.7	-16601.9	20860.1	-20162.1	-386.1	1664.9	-1038.7	1051.7	-195052.0	177127.0	-3824.9	3985.4
		(J)	-30694.7	-16601.9	18726.7	-21224.7	-386.1	1664.9	-1038.7	1051.7	-196258.0	178655.0	-3824.9	3985.4
	179	(I)	-28499.2	-14836.2	18726.7	-21224.7	-1992.7	344.3	-1045.5	1057.7	-196258.0	178655.0	-3565.2	3806.8
		(J)	-28499.2	-14836.2	20013.5	-19719.5	-1992.7	344.3	-1045.5	1057.7	-196977.0	179712.0	-3565.2	3806.8
	180	(I)	-28332.1	-15016.9	20013.5	-19719.5	-1545.0	819.6	-1031.6	1045.5	-196977.0	179712.0	-3333.7	3644.3
		(J)	-28332.1	-15016.9	20038.8	-18983.9	-1545.0	819.6	-1031.6	1045.5	-197248.0	180321.0	-3333.7	3644.3
	181	(I)	-28164.0	-15199.2	20038.8	-18983.9	-1079.6	1277.4	-1031.6	1045.5	-197248.0	180321.0	-3097.5	3476.9
		(J)	-28164.0	-15199.2	19004.0	-19009.9	-1079.6	1277.4	-1031.6	1045.5	-197049.0	180469.0	-3097.5	3476.9
	182	(I)	-27994.6	-15383.0	19004.0	-19009.9	-676.0	1715.1	-1024.5	1039.3	-197049.0	180469.0	-2856.9	3304.2
		(J)	-27994.6	-15383.0	18082.7	-19800.3	-676.0	1715.1	-1024.5	1039.3	-196371.0	180147.0	-2856.9	3304.2
	183	(I)	-25677.2	-13627.3	18082.7	-19800.3	-1933.3	621.7	-1024.5	1039.3	-196371.0	180147.0	-2588.5	3109.4
		(J)	-25677.2	-13627.3	21385.5	-19012.4	-1933.3	621.7	-1024.5	1039.3	-195140.0	179305.0	-2588.5	3109.4
	184	(I)	-25505.5	-13813.4	21385.5	-19012.4	-1494.1	1020.3	-1010.0	1026.9	-195140.0	179305.0	-2430.6	2928.7
		(J)	-25505.5	-13813.4	23499.0	-19521.4	-1494.1	1020.3	-1010.0	1026.9	-193401.0	177974.0	-2430.6	2928.7
	185	(I)	-25332.7	-14000.7	23499.0	-19521.4	-1033.1	1437.2	-1017.3	1033.1	-193401.0	177974.0	-2276.7	2745.2
		(J)	-25332.7	-14000.7	24392.1	-20834.9	-1033.1	1437.2	-1017.3	1033.1	-191167.0	176524.0	-2276.7	2745.2
	186	(I)	-25158.9	-14189.4	24392.1	-20834.9	-546.1	1843.0	-1002.8	1020.7	-191167.0	176524.0	-2129.2	2560.2
		(J)	-25158.9	-14189.4	24070.9	-22948.3	-546.1	1843.0	-1002.8	1020.7	-188416.0	176178.0	-2129.2	2560.2
	187	(I)	-22893.5	-12562.2	24070.9	-22948.3	-1457.6	957.6	-1002.8	1020.7	-188416.0	176178.0	-1980.1	2356.0
		(J)	-22893.5	-12562.2	26606.5	-23121.2	-1457.6	957.6	-1002.8	1020.7	-185088.0	175112.0	-1980.1	2356.0
	188	(I)	-22717.5	-12753.4	26606.5	-23121.2	-915.2	1318.9	-1002.8	1020.7	-185088.0	175112.0	-1896.7	2175.2
		(J)	-22717.5	-12753.4	28267.6	-24089.8	-915.2	1318.9	-1002.8	1020.7	-181248.0	173380.0	-1896.7	2175.2
	189	(I)	-22540.6	-12945.9	28267.6	-24089.8	-349.5	1709.0	-995.9	1014.8	-181248.0	173380.0	-2025.7	2001.2
		(J)	-22540.6	-12945.9	28591.2	-25849.9	-349.5	1709.0	-995.9	1014.8	-176892.0	170976.0	-2025.7	2001.2
	190	(I)	-22362.7	-13139.7	28591.2	-25849.9	236.9	2076.5	-989.0	1008.9	-176892.0	170976.0	-2219.4	1979.1
		(J)	-22362.7	-13139.7	27550.9	-28401.1	236.9	2076.5	-989.0	1008.9	-172039.0	167900.0	-2219.4	1979.1
	191	(I)	-18516.6	-10190.1	27550.9	-28401.1	-1451.3	373.3	-982.3	1003.3	-172039.0	167900.0	-2464.5	2209.4
		(J)	-18516.6	-10190.1	30535.1	-28751.5	-1451.3	373.3	-982.3	1003.3	-166581.0	164062.0	-2464.5	2209.4
	192	(I)	-18336.8	-10386.1	30535.1	-28751.5	-837.4	698.8	-982.3	1003.3	-166581.0	164062.0	-2675.9	2421.9
		(J)	-18336.8	-10386.1	32130.9	-29897.2	-837.4	698.8	-982.3	1003.3	-160629.0	159548.0	-2675.9	2421.9
	193	(I)	-18156.2	-10583.0	32130.9	-29897.2	-250.6	1004.4	-975.9	997.9	-160629.0	159548.0	-2887.6	2636.2
		(J)	-18156.2	-10583.0	32336.2	-31642.4	-250.6	1004.4	-975.9	997.9	-154188.0	154362.0	-2887.6	2636.2
	194	(I)	-17974.8	-10781.0	32336.2	-31642.4	304.3	1293.6	-975.9	997.9	-154188.0	154362.0	-3097.4	2848.3
		(J)	-17974.8	-10781.0	31142.5	-33971.7	304.3	1293.6	-975.9	997.9	-147495.0	148509.0	-3097.4	2848.3
	195	(I)	-14240.9	-7904.9	31142.5	-33971.7	-1154.2	-265.5	-970.0	992.9	-147495.0	148509.0	-3345.4	3085.4
		(J)	-14240.9	-7904.9	33086.7	-32943.0	-1154.2	-265.5	-970.0	992.9	-140889.0	141911.0	-3345.4	3085.4
	196	(I)	-14057.7	-8104.3	33086.7	-32943.0	-651.5	185.1	-964.4	988.2	-140889.0	141911.0	-3548.8	3288.7
		(J)	-14057.7	-8104.3	33595.2	-32479.3	-651.5	185.1	-964.4	988.2	-133672.0	134667.0	-3548.8	3288.7
	197	(I)	-13874.0	-8282.5	33595.2	-32479.3	-203.0	706.0	-964.4	988.2	-133672.0	134667.0	-3748.0	3494.9
		(J)	-13874.0	-8282.5	32655.7	-32574.9	-203.0	706.0	-964.4	988.2	-125856.0	126791.0	-3748.0	3494.9
	198	(I)	-13689.6	-8449.6	32655.7	-32574.9	185.1	1213.8	-959.4	984.0	-125856.0	126791.0	-3942.5	3768.1
		(J)	-13689.6	-8449.6	30261.3	-33231.0	185.1	1213.8	-959.4	984.0	-117465.0	118299.0	-3942.5	3768.1
	199	(I)	-9868.5	-5374.1	30261.3	-33231.0	-1324.8	-5.2	-954.7	980.1	-117465.0	118299.0	-4171.7	4071.5
		(J)	-9868.5	-5374.1	30469.9	-30458.5	-1324.8	-5.2	-954.7	980.1	-108381.0	109127.0	-4171.7	4071.5
	200	(I)	-9702.3	-5542.1	30469.9	-30458.5	-975.2	589.0	-954.7	980.1	-108381.0	109127.0	-4355.8	4327.5
		(J)	-9702.3	-5542.1	29236.0	-28270.4	-975.2	589.0	-954.7	980.1	-98743.4	99378.5	-4355.8	4327.5
	201	(I)	-9543.9	-5710.3	29236.0	-28270.4	-690.6	1179.1	-950.7	976.8	-98743.4	99378.6	-4534.5	4573.7
		(J)	-9543.9	-5710.3	26576.5	-26688.0	-690.6	1179.1	-950.7	976.8	-88568.4	89074.5	-4534.5	4573.7
	202	(I)	-9385.3	-5878.9	26576.5	-26688.0	-403.0	1774.6	-950.7	976.8	-88568.4	89074.5	-4747.5	4809.4
		(J)	-9385.3	-5878.9	22515.3	-25743.4	-403.0	1774.6	-950.7	976.8	-77874.9	78239.5	-4747.5	4809.4
	203	(I)	-5310.8	-2611.2	22515.3	-25743.4	-2015.0	717.2	-947.6	974.3	-77874.9	78239.5	-5021.0	5066.4
		(J)	-5310.8	-2611.2	20864.3	-21188.1	-2015.0	717.2	-947.6	974.3	-66570.4	66832.6	-5021.0	5066.4
	204	(I)	-5151.8	-2780.4	20864.3	-21188.1	-1695.1	1305.1	-945.0	972.1	-66570.4	66832.6	-5233.2	5278.8
		(J)	-5151.8	-2780.4	17887.9	-17349.6	-1695.1	1305.1	-945.0	972.1	-54789.3	54947.6	-5233.2	5278.8
	205	(I)	-4992.7	-2949.6	17887.9	-17349.6	-1353.6	1871.5	-945.0	972.1	-54789.3	54947.6	-5436.3	5478.7
		(J)	-4992.7	-2949.6	13634.6	-14277.3	-1353.6	1871.5	-945.0	972.1	-42552.3	42612.5	-5436.3	5478.7
	206	(I)	-4833.4	-3118.8	13634.6	-14277.3	-988.5	2413.4	-943.2	970.6	-42552.4	42612.6	-5629.7	5665.7
		(J)	-4833.4	-3118.8	8160.6	-12025.1	-988.5	2413.4	-943.2	970.6	-29878.3	29856.7	-5629.7	5665.7
	207	(I)	-442.7	484.4	8160.6	-12025.1	-2660.4	1335.2	-942.1	969.7	-29878.3	29856.8	-5861.7	5863.3
		(J)	-442.7	484.4	5156.4	-6039.1	-2660.4	1335.2	-942.1	969.7	-16689.4	16664.3	-5861.7	5863.3
	208	(I)	-233.8	255.6	5156.4	-6039.1	-2196.1	1875.1	-941.9	969.6	-16689.4	16664.3	-6055.4	6041.3
		(J)	-233.8	255.6	0.0	0.0	-2196.1	1875.1	-941.9	969.6	-46.0	51.2	-6055.4	6041.3
	501	(I)	-44278.3	-41435.7	14596.6	-16976.5	-848.4	738.6	0.0	0.0	-49418.6	49388.1	-825.1	863.0
		(J)	-44278.3	-41435.7	14048.9	-16615.2	-848.4	738.6	0.0	0.0	-50154.9	50151.6	-825.1	863.0
	502	(I)	-44244.3	-41401.8	14925.1	-17189.3	-845.4	739.3	0.0	0.0	-48962.8	48917.7	-818.3	860.1
		(J)	-44244.3	-41401.8	14596.6	-16976.5	-845.4	739.3	0.0	0.0	-49418.6	49388.1	-818.3	860.1
	503	(I)	-44154.0	-41311.5	16772.7	-18315.1	-835.8	740.8	0.0	0.0	-46050.9	45946.3	-801.4	852.3
		(J)	-44154.0	-41311.5	14925.1	-17189.3	-835.8	740.8	0.0	0.0	-48962.8	48917.7	-801.4	852.3
	504	(I)	-43990.4	-41148.1	18501.6	-19218.4	-804.1	736.9	0.0	0.0	-42480.2	42364.6	-798.8	830.9
		(J)	-43990.4	-41148.1	16772.7	-18315.1	-804.1	736.9	0.0	0.0	-46050.9	45946.3	-798.8	830.9
	505	(I)	-43818.2	-40976.2	19828.6	-19697.8	-756.5	724.0	0.0	0.0	-38598.7	38525.7	-792.1	794.3
		(J)	-43818.2	-40976.2	18501.6	-19218.4	-756.5	724.0	0.0	0.0	-42480.2	42364.6	-792.1	794.3
	506	(I)	-43646.0	-40804.4	20715.6	-22208.0	-704.1	702.8	0.0	0.0	-34457.8	34476.8	-779.9	769.8
		(J)	-43646.0	-40804.4	19828.6	-19697.8	-704.1	702.8	0.0	0.0	-38598.7	38525.7	-779.9	769.8
	507	(I)	-43473.7	-40632.6	21153.3	-25149.7	-652.2	674.8	0.0	0.0	-30117.1	30258.5	-761.5	761.5
		(J)	-43473.7	-40632.6	20715.6	-22208.0	-652.2	674.8	0.0	0.0	-34457.8	34476.8	-761.5	761.5
	508	(I)	-43301.4	-40460.8	21159.7	-27697.4	-656.0	654.3	0.0	0.0	-25650.4	25913.1	-737.5	744.9
		(J)	-43301.4	-40460.8	21153.3	-25149.7	-656.0	654.3	0.0	0.0	-30117.1	30258.5	-737.5	744.9
	509	(I)	-43129.0	-40289.2	22207.0	-29857.0	-704.7	665.1	0.0	0.0	-21135.1	21570.6	-708.4	719.6
		(J)	-43129.0	-40289.2	21159.7	-27697.4	-704.7	665.1	0.0	0.0	-25650.4	25913.1	-708.4	719.6
	510	(I)	-42956.6	-40117.5	24432.7	-31643.6	-760.2	682.3	0.0	0.0	-16773.7	17553.6	-672.7	685.4
		(J)	-42956.6	-40117.5	22207.0	-29857.0	-760.2	682.3	0.0	0.0	-21135.1	21570.6	-672.7	685.4

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	511	(I)	-42810.0	-39971.7	25846.3	-32685.2	-800.7	706.8	0.0	0.0	-13874.2	14668.6	-636.4	648.4
		(J)	-42810.0	-39971.7	24432.7	-31643.6	-800.7	706.8	0.0	0.0	-16773.7	17553.6	-636.4	648.4
	512	(I)	-37900.4	-35391.2	25596.8	-31716.9	-1001.2	1164.8	0.0	0.0	-11853.2	12635.9	-639.2	644.0
		(J)	-37900.4	-35391.2	25846.3	-32685.2	-1001.2	1164.8	0.0	0.0	-13874.2	14668.6	-639.2	644.0
	513	(I)	-33270.3	-31133.0	23987.3	-29050.6	-1552.1	1553.4	0.0	0.0	-9913.2	10657.1	-649.3	626.5
		(J)	-33270.3	-31133.0	25596.8	-31716.9	-1552.1	1553.4	0.0	0.0	-11853.2	12635.9	-649.3	626.5
	514	(I)	-29062.0	-27297.9	21188.4	-25023.3	-1826.4	1966.5	0.0	0.0	-8071.5	8752.5	-648.6	615.6
		(J)	-29062.0	-27297.9	23987.3	-29050.6	-1826.4	1966.5	0.0	0.0	-9913.2	10657.1	-648.6	615.6
	515	(I)	-25326.3	-23881.9	17509.4	-20127.5	-1835.0	2397.6	0.0	0.0	-6345.5	6943.8	-634.8	593.2
		(J)	-25326.3	-23881.9	21188.4	-25023.3	-1835.0	2397.6	0.0	0.0	-8071.5	8752.5	-634.8	593.2
	516	(I)	-22142.4	-20971.5	13540.1	-14850.0	-2050.9	2589.6	0.0	0.0	-4752.9	5253.1	-606.1	558.0
		(J)	-22142.4	-20971.5	17509.4	-20127.5	-2050.9	2589.6	0.0	0.0	-6345.5	6943.8	-606.1	558.0
	517	(I)	-17223.0	-16478.9	9664.7	-10524.3	-2160.7	2537.7	0.0	0.0	-3354.2	3745.6	-564.6	512.2
		(J)	-17223.0	-16478.9	13540.1	-14850.0	-2160.7	2537.7	0.0	0.0	-4752.9	5253.1	-564.6	512.2
	518	(I)	-12857.9	-12429.6	5642.1	-6324.3	-2008.4	2211.0	0.0	0.0	-2176.8	2457.7	-501.1	447.9
		(J)	-12857.9	-12429.6	9664.7	-10524.3	-2008.4	2211.0	0.0	0.0	-3354.2	3745.6	-501.1	447.9
	519	(I)	-8687.7	-8474.2	2150.0	-2486.0	-1735.8	1913.5	0.0	0.0	-1250.9	1430.4	-416.6	367.5
		(J)	-8687.7	-8474.2	5642.1	-6324.3	-1735.8	1913.5	0.0	0.0	-2176.8	2457.7	-416.6	367.5
	520	(I)	-4512.3	-4418.6	405.7	-370.8	-1065.3	1219.8	0.0	0.0	-609.9	708.8	-310.7	271.3
		(J)	-4512.3	-4418.6	2150.0	-2486.0	-1065.3	1219.8	0.0	0.0	-1250.9	1430.4	-310.7	271.3
	521	(I)	-166.3	-164.4	0.0	0.0	-81.1	74.3	0.0	0.0	0.0	0.0	-140.5	120.8
		(J)	-166.3	-164.4	405.7	-370.8	-81.1	74.3	0.0	0.0	-609.9	708.8	-140.5	120.8
	601	(I)	-43888.9	-41656.4	14974.8	-13428.0	-815.2	717.9	0.0	0.0	-52079.1	51204.3	-907.4	879.9
		(J)	-43888.9	-41656.4	14492.9	-13119.1	-815.2	717.9	0.0	0.0	-52850.6	51990.9	-907.4	879.9
	602	(I)	-43854.9	-41622.4	15263.2	-13617.5	-812.6	719.0	0.0	0.0	-51601.3	50719.3	-898.5	877.0
		(J)	-43854.9	-41622.4	14974.8	-13428.0	-812.6	719.0	0.0	0.0	-52079.1	51204.3	-898.5	877.0
	603	(I)	-43764.6	-41532.2	16858.1	-14773.7	-804.2	721.7	0.0	0.0	-48545.5	47652.1	-874.5	869.0
		(J)	-43764.6	-41532.2	15263.2	-13617.5	-804.2	721.7	0.0	0.0	-51601.3	50719.3	-874.5	869.0
	604	(I)	-43601.2	-41368.8	18306.2	-15802.1	-775.9	719.6	0.0	0.0	-44790.3	43948.8	-824.0	848.3
		(J)	-43601.2	-41368.8	16858.1	-14773.7	-775.9	719.6	0.0	0.0	-48545.5	47652.1	-824.0	848.3
	605	(I)	-43429.1	-41196.9	19369.6	-16373.2	-733.6	708.1	0.0	0.0	-40699.7	39975.1	-818.2	813.3
		(J)	-43429.1	-41196.9	18306.2	-15802.1	-733.6	708.1	0.0	0.0	-44790.3	43948.8	-818.2	813.3
	606	(I)	-43257.0	-41025.0	20024.1	-19371.1	-682.7	687.4	0.0	0.0	-36329.4	35782.3	-806.7	812.4
		(J)	-43257.0	-41025.0	19369.6	-16373.2	-682.7	687.4	0.0	0.0	-40699.7	39975.1	-806.7	812.4
	607	(I)	-43084.9	-40853.1	20256.9	-22214.0	-684.3	659.0	0.0	0.0	-31743.7	31411.3	-788.8	804.4
		(J)	-43084.9	-40853.1	20024.1	-19371.1	-684.3	659.0	0.0	0.0	-36329.4	35782.3	-788.8	804.4
	608	(I)	-42912.7	-40681.2	21708.2	-24684.5	-706.6	652.4	0.0	0.0	-27405.0	27617.9	-765.0	787.3
		(J)	-42912.7	-40681.2	20256.9	-22214.0	-706.6	652.4	0.0	0.0	-31743.7	31411.3	-765.0	787.3
	609	(I)	-42740.5	-40509.4	24096.2	-26780.8	-725.2	656.7	0.0	0.0	-23125.0	23556.5	-735.4	760.5
		(J)	-42740.5	-40509.4	21708.2	-24684.5	-725.2	656.7	0.0	0.0	-27405.0	27617.9	-735.4	760.5
	610	(I)	-42568.2	-40337.7	26273.8	-28509.2	-740.0	660.7	0.0	0.0	-18670.8	19243.2	-698.6	723.8
		(J)	-42568.2	-40337.7	24096.2	-26780.8	-740.0	660.7	0.0	0.0	-23125.0	23556.5	-698.6	723.8
	611	(I)	-42421.8	-40191.7	27649.8	-29513.9	-765.3	672.4	0.0	0.0	-15502.2	16127.2	-674.3	684.5
		(J)	-42421.8	-40191.7	26273.8	-28509.2	-765.3	672.4	0.0	0.0	-18670.8	19243.2	-674.3	684.5
	612	(I)	-37582.2	-35538.7	27284.3	-28680.9	-939.0	1065.3	0.0	0.0	-13285.0	13923.6	-700.6	701.4
		(J)	-37582.2	-35538.7	27649.8	-29513.9	-939.0	1065.3	0.0	0.0	-15502.2	16127.2	-700.6	701.4
	613	(I)	-33023.2	-31223.5	25490.2	-26302.8	-1446.0	1381.6	0.0	0.0	-11146.6	11767.9	-715.8	704.3
		(J)	-33023.2	-31223.5	27284.3	-28680.9	-1446.0	1381.6	0.0	0.0	-13285.0	13923.6	-715.8	704.3
	614	(I)	-28878.7	-27342.5	22455.6	-22692.8	-1718.2	1760.9	0.0	0.0	-9108.0	9683.8	-718.1	695.5
		(J)	-28878.7	-27342.5	25490.2	-26302.8	-1718.2	1760.9	0.0	0.0	-11146.6	11767.9	-718.1	695.5
	615	(I)	-25195.3	-23915.2	18532.2	-18275.4	-1925.1	2164.3	0.0	0.0	-7188.6	7697.9	-705.7	673.5
		(J)	-25195.3	-23915.2	22455.6	-22692.8	-1925.1	2164.3	0.0	0.0	-9108.0	9683.8	-705.7	673.5
	616	(I)	-22050.8	-21001.4	14960.5	-14425.6	-2174.6	2342.4	0.0	0.0	-5409.5	5834.7	-676.2	636.5
		(J)	-22050.8	-21001.4	18532.2	-18275.4	-2174.6	2342.4	0.0	0.0	-7188.6	7697.9	-676.2	636.5
	617	(I)	-17184.2	-16480.7	10615.8	-10527.7	-2279.0	2305.9	0.0	0.0	-3836.8	4167.7	-631.7	586.9
		(J)	-17184.2	-16480.7	14960.5	-14425.6	-2279.0	2305.9	0.0	0.0	-5409.5	5834.7	-631.7	586.9
	618	(I)	-12855.8	-12410.1	6125.7	-6276.0	-2225.6	2154.7	0.0	0.0	-2504.0	2740.1	-561.7	516.0
		(J)	-12855.8	-12410.1	10615.8	-10527.7	-2225.6	2154.7	0.0	0.0	-3836.8	4167.7	-561.7	516.0
	619	(I)	-8694.3	-8452.5	2322.7	-2452.0	-1887.4	1904.6	0.0	0.0	-1448.6	1597.9	-467.7	425.7
		(J)	-8694.3	-8452.5	6125.7	-6276.0	-1887.4	1904.6	0.0	0.0	-2504.0	2740.1	-467.7	425.7
	620	(I)	-4508.8	-4414.4	414.2	-419.9	-1139.3	1199.6	0.0	0.0	-712.4	793.6	-348.8	315.5
		(J)	-4508.8	-4414.4	2322.7	-2452.0	-1139.3	1199.6	0.0	0.0	-1448.6	1597.9	-348.8	315.5
	621	(I)	-166.2	-164.7	0.0	0.0	-82.9	84.1	0.0	0.0	0.0	0.0	-157.4	141.2
		(J)	-166.2	-164.7	414.2	-419.9	-82.9	84.1	0.0	0.0	-712.4	793.6	-157.4	141.2

■Superstructure Results (Longi.)

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	1	(I)	-241.3	236.0	0.0	0.0	-1648.3	2571.1	-9.3	-8.3	-0.1	0.1	-2.8	5.0
		(J)	-241.3	236.0	4532.9	-7070.6	-1648.3	2571.1	-9.3	-8.3	-13.7	7.8	-2.8	5.0
	2	(I)	-455.4	447.3	4532.9	-7070.6	-1106.7	3030.9	-9.3	-8.3	-13.7	7.8	-2.6	4.8
		(J)	-455.4	447.3	7023.0	-13889.9	-1106.7	3030.9	-9.3	-8.3	-24.4	13.7	-2.6	4.8
	3	(I)	-4683.4	-3041.6	7023.0	-13889.9	-2323.0	1220.9	-9.3	-8.3	-24.4	13.7	-2.4	4.6
		(J)	-4683.4	-3041.6	12281.3	-16680.9	-2323.0	1220.9	-9.3	-8.3	-34.7	19.1	-2.4	4.6
	4	(I)	-4841.6	-2889.4	12281.3	-16680.9	-1772.7	1581.0	-9.3	-8.3	-34.7	19.1	-2.2	4.4
		(J)	-4841.6	-2889.4	16299.4	-20276.9	-1772.7	1581.0	-9.3	-8.3	-44.5	24.1	-2.2	4.4
	5	(I)	-4999.8	-2737.5	16299.4	-20276.9	-1193.8	1921.8	-9.3	-8.3	-44.5	24.1	-2.0	4.2
		(J)	-4999.8	-2737.5	19012.7	-24627.1	-1193.8	1921.8	-9.3	-8.3	-53.9	28.7	-2.0	4.2
	6	(I)	-5158.0	-2585.7	19012.7	-24627.1	-590.2	2251.8	-9.3	-8.3	-53.9	28.7	-1.9	4.1
		(J)	-5158.0	-2585.7	20365.9	-29691.6	-590.2	2251.8	-9.3	-8.3	-62.9	32.8	-1.9	4.1
	7	(I)	-9127.5	-5753.4	20365.9	-29691.6	-1769.8	551.7	-9.3	-8.3	-62.9	32.8	-1.8	3.9
		(J)	-9127.5	-5753.4	24380.7	-30921.0	-1769.8	551.7	-9.3	-8.3	-71.5	36.4	-1.8	3.9
	8	(I)	-9285.1	-5602.0	24380.7	-30921.0	-1140.2	866.1	-9.3	-8.3	-71.5	36.4	-1.6	3.7
		(J)	-9285.1	-5602.0	26939.8	-32802.9	-1140.2	866.1	-9.3	-8.3	-79.6	39.6	-1.6	3.7
	9	(I)	-9442.4	-5450.8	26939.8	-32802.9	-502.7	1167.3	-9.3	-8.3	-79.6	39.6	-1.5	3.6
		(J)	-9442.4	-5450.8	28015.4	-35322.7	-502.7	1167.3	-9.3	-8.3	-87.3	42.3	-1.5	3.6
	10	(I)	-9599.3	-5268.8	28015.4	-35322.7	144.0	1465.4	-9.3	-8.3	-87.3	42.3	-1.3	3.4
		(J)	-9599.3	-5268.8	27581.9	-38470.9	144.0	1465.4	-9.3	-8.3	-94.5	44.6	-1.3	3.4
	11	(I)	-13285.0	-8183.1	27581.9	-38470.9	-1155.8	-2.1	-9.3	-8.3	-94.5	44.6	-1.1	3.2
		(J)	-13285.0	-8183.1	29957.9	-38080.6	-1155.8	-2.1	-9.3	-8.3	-101.2	46.8	-1.1	3.2
	12	(I)	-13441.0	-7998.2	29957.9	-38080.6	-624.7	351.7	-9.3	-8.3	-101.2	46.8	-1.0	3.0
		(J)	-13441.0	-7998.2	30805.5	-38290.9	-624.7	351.7	-9.3	-8.3	-107.5	48.7	-1.0	3.0
	13	(I)	-13603.8	-7814.3	30805.5	-38290.9	-158.5	689.5	-9.3	-8.3	-107.5	48.7	-0.8	2.8
		(J)	-13603.8	-7814.3	30123.6	-39091.8	-158.5	689.5	-9.3	-8.3	-113.4	50.3	-0.8	2.8
	14	(I)	-13791.1	-7631.3	30123.6	-39091.8	303.9	1127.7	-9.3	-8.2	-113.4	50.3	-0.6	2.5
		(J)	-13791.1	-7631.3	27916.8	-40473.0	303.9	1127.7	-9.3	-8.2	-118.7	51.4	-0.6	2.5
	15	(I)	-17536.0	-10392.3	27916.8	-40473.0	-1165.8	-262.3	-9.3	-8.2	-118.7	51.4	-0.4	2.3
		(J)	-17536.0	-10392.3	28984.4	-38422.0	-1165.8	-262.3	-9.3	-8.2	-123.5	52.0	-0.4	2.3
	16	(I)	-17722.2	-10211.5	28984.4	-38422.0	-820.7	368.1	-9.3	-8.2	-123.5	52.0	-0.2	2.1
		(J)	-17722.2	-10211.5	28539.7	-36958.4	-820.7	368.1	-9.3	-8.2	-127.8	52.2	-0.2	2.1
	17	(I)	-17907.5	-10031.9	28539.7	-36958.4	-551.0	982.3	-9.3	-8.2	-127.8	52.2	0.0	2.0
		(J)	-17907.5	-10031.9	26601.9	-36106.7	-551.0	982.3	-9.3	-8.2	-131.6	51.8	0.0	2.0
	18	(I)	-18092.0	-9853.6	26601.9	-36106.7	-267.2	1578.8	-9.3	-8.2	-131.6	51.8	0.2	1.8
		(J)	-18092.0	-9853.6	23189.4	-35909.0	-267.2	1578.8	-9.3	-8.2	-134.9	51.0	0.2	1.8
	19	(I)	-22039.5	-12730.9	23189.4	-35909.0	-1876.2	-180.7	-9.3	-8.2	-134.9	51.0	0.2	1.7
		(J)	-22039.5	-12730.9	23926.1	-32169.3	-1876.2	-180.7	-9.3	-8.2	-137.7	49.6	0.2	1.7
	20	(I)	-22222.5	-12555.1	23926.1	-32169.3	-1562.4	374.2	-9.3	-8.2	-137.7	49.6	0.3	1.6
		(J)	-22222.5	-12555.1	24897.9	-29127.0	-1562.4	374.2	-9.3	-8.2	-139.9	47.7	0.3	1.6
	21	(I)	-22404.6	-12380.7	24897.9	-29127.0	-1238.1	907.4	-9.3	-8.2	-139.9	47.7	0.3	1.6
		(J)	-22404.6	-12380.7	24737.2	-26762.6	-1238.1	907.4	-9.3	-8.2	-141.6	45.3	0.3	1.6
	22	(I)	-22585.9	-12207.8	24737.2	-26762.6	-913.4	1473.3	-9.3	-8.2	-141.6	45.3	0.2	1.6
		(J)	-22585.9	-12207.8	23310.1	-25085.3	-913.4	1473.3	-9.3	-8.2	-142.9	42.4	0.2	1.6
	23	(I)	-24964.6	-13839.7	23310.1	-25085.3	-1808.8	478.1	-9.3	-8.2	-142.9	42.4	0.0	1.9
		(J)	-24964.6	-13839.7	24057.5	-21464.3	-1808.8	478.1	-9.3	-8.2	-143.6	39.0	0.0	1.9
	24	(I)	-25137.3	-13669.7	24057.5	-21464.3	-1449.6	1031.0	-9.3	-8.2	-143.6	39.0	-0.2	2.1
		(J)	-25137.3	-13669.7	23722.4	-19309.2	-1449.6	1031.0	-9.3	-8.2	-143.8	35.2	-0.2	2.1
	25	(I)	-25311.5	-13501.3	23722.4	-19309.2	-1065.5	1570.3	-9.3	-8.2	-143.8	35.2	-0.4	2.2
		(J)	-25311.5	-13501.3	22317.0	-18309.8	-1065.5	1570.3	-9.3	-8.2	-143.6	30.9	-0.4	2.2
	26	(I)	-25488.8	-13334.6	22317.0	-18309.8	-659.2	2091.0	-9.3	-8.2	-143.6	30.9	-0.6	2.4
		(J)	-25488.8	-13334.6	19917.1	-19121.7	-659.2	2091.0	-9.3	-8.2	-143.7	26.2	-0.6	2.4
	27	(I)	-27998.6	-15142.9	19917.1	-19121.7	-1768.4	781.7	-9.3	-8.2	-143.7	26.2	-0.8	2.6
		(J)	-27998.6	-15142.9	21402.9	-18888.7	-1768.4	781.7	-9.3	-8.2	-143.5	21.2	-0.8	2.6
	28	(I)	-28166.6	-14979.6	21402.9	-18888.7	-1313.4	1265.7	-9.3	-8.2	-143.5	21.2	-0.9	2.7
		(J)	-28166.6	-14979.6	21633.9	-19834.2	-1313.4	1265.7	-9.3	-8.2	-142.9	15.9	-0.9	2.7
	29	(I)	-28333.5	-14818.0	21633.9	-19834.2	-835.5	1730.7	-9.3	-8.2	-142.9	15.9	-1.1	2.9
		(J)	-28333.5	-14818.0	20578.1	-21516.3	-835.5	1730.7	-9.3	-8.2	-142.0	10.2	-1.1	2.9
	30	(I)	-28499.5	-14658.3	20578.1	-21516.3	-401.5	2173.5	-9.3	-8.2	-142.0	10.2	-1.2	3.0
		(J)	-28499.5	-14658.3	18224.6	-23891.0	-401.5	2173.5	-9.3	-8.2	-141.1	4.1	-1.2	3.0
	31	(I)	-30916.1	-16530.3	18224.6	-23891.0	-1706.3	637.1	-9.3	-8.2	-141.1	4.1	-1.3	3.2
		(J)	-30916.1	-16530.3	19391.8	-23360.6	-1706.3	637.1	-9.3	-8.2	-139.7	-2.1	-1.3	3.2
	32	(I)	-31080.5	-16374.1	19391.8	-23360.6	-1183.0	1043.4	-9.3	-8.2	-139.7	-2.1	-1.4	3.4
		(J)	-31080.5	-16374.1	19309.5	-23473.4	-1183.0	1043.4	-9.3	-8.2	-137.8	-8.5	-1.4	3.4
	33	(I)	-31244.1	-16219.7	19309.5	-23473.4	-791.4	1437.9	-9.3	-8.2	-137.8	-8.5	-1.5	3.5
		(J)	-31244.1	-16219.7	19599.9	-24221.7	-791.4	1437.9	-9.3	-8.2	-135.9	-15.3	-1.5	3.5
	34	(I)	-31406.8	-16067.2	19599.9	-24221.7	-379.4	1819.2	-9.3	-8.2	-135.9	-15.3	-1.5	3.6
		(J)	-31406.8	-16067.2	19034.6	-25605.3	-379.4	1819.2	-9.3	-8.2	-134.1	-22.5	-1.5	3.6
	35	(I)	-33556.8	-17902.6	19034.6	-25605.3	-1815.9	154.7	-9.3	-8.2	-134.1	-22.5	-1.6	3.7
		(J)	-33556.8	-17902.6	23044.7	-23890.9	-1815.9	154.7	-9.3	-8.2	-131.9	-30.0	-1.6	3.7
	36	(I)	-33717.7	-17753.7	23044.7	-23890.9	-1370.2	535.0	-9.3	-8.2	-131.9	-30.0	-1.7	3.9
		(J)	-33717.7	-17753.7	25696.5	-22900.7	-1370.2	535.0	-9.3	-8.2	-129.2	-37.9	-1.7	3.9
	37	(I)	-33877.8	-17606.3	25696.5	-22900.7	-915.8	962.0	-9.3	-8.2	-129.2	-37.9	-1.8	4.0
		(J)	-33877.8	-17606.3	26967.9	-23371.9	-915.8	962.0	-9.3	-8.2	-126.0	-46.1	-1.8	4.0
	38	(I)	-34037.7	-17460.3	26967.9	-23371.9	-452.2	1378.3	-9.3	-8.2	-126.0	-46.1	-2.0	4.1
		(J)	-34037.7	-17460.3	26839.6	-26109.4	-452.2	1378.3	-9.3	-8.2	-122.4	-54.7	-2.0	4.1
	39	(I)	-35759.4	-19089.9	26839.6	-26109.4	-2223.8	-377.8	-9.3	-8.2	-122.4	-54.7	-2.2	4.2
		(J)	-35759.4	-19089.9	31257.9	-25102.2	-2223.8	-377.8	-9.3	-8.2	-118.2	-63.7	-2.2	4.2
	40	(I)	-35918.6	-18947.3	31257.9	-25102.2	-1722.8	49.4	-9.3	-8.2	-118.2	-63.7	-2.3	4.3
		(J)	-35918.6	-18947.3	34273.4	-24821.5	-1722.8	49.4	-9.3	-8.2	-113.7	-72.9	-2.3	4.3

Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
41	(I)	-36077.5	-18806.2	34273.4	-24821.5	-1319.5	469.6	-9.3	-8.2	-113.7	-72.9	-2.5	4.4
	(J)	-36077.5	-18806.2	35906.8	-25265.1	-1319.5	469.6	-9.3	-8.2	-108.8	-78.4	-2.5	4.4
42	(I)	-36237.3	-18666.6	35906.8	-25265.1	-934.7	907.2	-9.3	-8.2	-108.8	-78.4	-2.6	4.6
	(J)	-36237.3	-18666.6	36189.1	-26442.6	-934.7	907.2	-9.3	-8.2	-108.8	-82.5	-2.6	4.6
43	(I)	-36397.5	-18528.5	36189.1	-26442.6	-566.1	1355.7	-9.3	-8.2	-108.8	-82.5	-2.7	4.7
	(J)	-36397.5	-18528.5	35170.8	-28374.4	-566.1	1355.7	-9.3	-8.2	-113.9	-81.7	-2.7	4.7
44	(I)	-36559.0	-18391.7	35170.8	-28374.4	-182.4	1821.3	-9.3	-8.2	-113.9	-81.7	-2.8	4.8
	(J)	-36559.0	-18391.7	32914.5	-31083.2	-182.4	1821.3	-9.3	-8.2	-122.6	-79.8	-2.8	4.8
45	(I)	-36722.8	-18256.2	32914.5	-31083.2	217.0	2305.1	-9.3	-8.1	-122.6	-79.8	-2.9	4.9
	(J)	-36722.8	-18256.2	29464.6	-34610.1	217.0	2305.1	-9.3	-8.1	-132.3	-75.0	-2.9	4.9
46	(I)	-36890.0	-18121.9	29464.6	-34610.1	632.2	2789.3	-9.3	-8.1	-132.3	-75.0	-3.0	5.0
	(J)	-36890.0	-18121.9	26411.1	-39013.3	632.2	2789.3	-9.3	-8.1	-142.2	-69.1	-3.0	5.0
47	(I)	-37047.1	-18000.9	26411.1	-39013.3	1019.9	3234.8	-9.3	-8.1	-142.2	-69.1	-3.1	5.1
	(J)	-37047.1	-18000.9	23287.6	-43283.9	1019.9	3234.8	-9.3	-8.1	-150.5	-63.7	-3.1	5.1
48	(I)	-37194.9	-17893.0	23287.6	-43283.9	1375.8	3638.2	-9.3	-8.1	-150.5	-63.7	-3.2	5.1
	(J)	-37194.9	-17893.0	19446.9	-48188.8	1375.8	3638.2	-9.3	-8.1	-159.5	-58.1	-3.2	5.1
49	(I)	-37348.6	-17785.8	19446.9	-48188.8	1735.6	4026.6	-9.3	-8.1	-159.5	-58.1	-3.2	5.2
	(J)	-37348.6	-17785.8	14899.7	-53733.8	1735.6	4026.6	-9.3	-8.1	-168.7	-52.4	-3.2	5.2
50	(I)	-37485.2	-17691.6	14899.7	-53733.8	2058.7	4361.4	-9.3	-8.1	-168.7	-52.4	-3.3	5.2
	(J)	-37485.2	-17691.6	10958.3	-59289.8	2058.7	4361.4	-9.3	-8.1	-175.7	-48.0	-3.3	5.2
51	(I)	-37555.3	-17652.4	10958.3	-59289.8	2177.1	4467.2	-9.0	-8.0	-175.7	-48.1	-3.3	5.2
	(J)	-37555.3	-17652.4	10664.4	-59704.6	2177.1	4467.2	-9.0	-8.0	-176.2	-47.7	-3.3	5.2
52	(I)	-37456.8	-17208.9	3935.8	-55846.5	-4956.0	-2178.2	-0.2	0.0	-176.2	-47.7	-1.5	0.2
	(J)	-37456.8	-17208.9	4187.9	-55413.8	-4956.0	-2178.2	-0.2	0.0	-176.1	-47.7	-1.5	0.2
53	(I)	-37408.7	-17268.9	4187.9	-55413.8	-4764.0	-1985.1	-0.4	-0.1	-176.1	-47.7	-1.4	0.2
	(J)	-37408.7	-17268.9	7469.8	-49645.5	-4764.0	-1985.1	-0.4	-0.1	-174.5	-47.4	-1.4	0.2
54	(I)	-37292.5	-17388.9	7469.8	-49645.5	-4433.0	-1675.5	-0.3	-0.1	-174.5	-47.4	-1.4	0.1
	(J)	-37292.5	-17388.9	11171.8	-42688.6	-4433.0	-1675.5	-0.3	-0.1	-172.5	-46.9	-1.4	0.1
55	(I)	-37161.4	-17524.5	11171.8	-42688.6	-4037.4	-1333.6	-0.3	-0.1	-172.5	-46.9	-1.4	0.1
	(J)	-37161.4	-17524.5	14316.6	-36442.7	-4037.4	-1333.6	-0.3	-0.1	-170.5	-46.3	-1.4	0.1
56	(I)	-37031.4	-17658.7	14316.6	-36442.7	-3627.0	-1007.3	-0.3	-0.1	-170.5	-46.3	-1.4	0.1
	(J)	-37031.4	-17658.7	18123.9	-31632.1	-3627.0	-1007.3	-0.3	-0.1	-168.8	-45.7	-1.4	0.1
57	(I)	-36891.6	-17808.2	18123.9	-31632.1	-3151.3	-658.3	-0.3	-0.1	-168.8	-45.7	-1.4	0.1
	(J)	-36891.6	-17808.2	21773.1	-27489.3	-3151.3	-658.3	-0.3	-0.1	-166.8	-44.8	-1.4	0.1
58	(I)	-36758.6	-17971.0	21773.1	-27489.3	-2663.5	-250.5	-0.3	-0.1	-166.8	-44.8	-1.4	0.1
	(J)	-36758.6	-17971.0	24269.0	-25475.7	-2663.5	-250.5	-0.3	-0.1	-164.8	-43.9	-1.4	0.1
59	(I)	-36624.7	-18134.8	24269.0	-25475.7	-2185.5	160.1	-0.3	-0.1	-164.8	-43.9	-1.4	0.1
	(J)	-36624.7	-18134.8	27184.1	-24392.1	-2185.5	160.1	-0.3	-0.1	-162.7	-42.8	-1.4	0.1
60	(I)	-36489.8	-18296.3	27184.1	-24392.1	-1693.4	563.1	-0.3	-0.1	-162.7	-42.8	-1.4	0.1
	(J)	-36489.8	-18296.3	28949.7	-24117.0	-1693.4	563.1	-0.3	-0.1	-160.7	-41.8	-1.4	0.1
61	(I)	-36353.9	-18459.2	28949.7	-24117.0	-1183.5	958.4	-0.3	-0.1	-160.7	-41.8	-1.4	0.1
	(J)	-36353.9	-18459.2	29370.3	-24558.2	-1183.5	958.4	-0.3	-0.1	-159.0	-40.6	-1.4	0.1
62	(I)	-36216.8	-18622.4	29370.3	-24558.2	-658.0	1342.8	-0.3	-0.1	-159.0	-40.6	-1.4	0.1
	(J)	-36216.8	-18622.4	28422.7	-25638.9	-658.0	1342.8	-0.3	-0.1	-157.5	-39.4	-1.4	0.1
63	(I)	-36078.6	-18784.8	28422.7	-25638.9	-114.5	1758.5	-0.3	-0.1	-157.5	-39.4	-1.4	0.0
	(J)	-36078.6	-18784.8	26083.8	-27304.4	-114.5	1758.5	-0.3	-0.1	-155.9	-38.1	-1.4	0.0
64	(I)	-35939.2	-18948.6	26083.8	-27304.4	447.5	2199.7	-0.3	-0.1	-155.9	-38.1	-1.3	0.0
	(J)	-35939.2	-18948.6	22336.6	-29514.9	447.5	2199.7	-0.3	-0.1	-154.3	-36.8	-1.3	0.0
65	(I)	-34463.6	-17399.1	22336.6	-29514.9	-1472.0	277.7	-0.3	-0.1	-154.3	-36.8	-1.3	0.0
	(J)	-34463.6	-17399.1	23290.8	-28378.3	-1472.0	277.7	-0.3	-0.1	-152.5	-35.5	-1.3	0.0
66	(I)	-34321.4	-17563.8	23290.8	-28378.3	-884.9	693.4	-0.3	-0.1	-152.5	-35.5	-1.3	0.0
	(J)	-34321.4	-17563.8	23375.0	-27757.1	-884.9	693.4	-0.3	-0.1	-150.7	-34.2	-1.3	0.0
67	(I)	-34177.8	-17729.3	23375.0	-27757.1	-345.4	1091.8	-0.3	-0.1	-150.7	-34.2	-1.3	0.0
	(J)	-34177.8	-17729.3	22746.7	-27645.6	-345.4	1091.8	-0.3	-0.1	-148.7	-33.0	-1.3	0.0
68	(I)	-34032.7	-17896.3	22746.7	-27645.6	90.1	1505.5	-0.3	-0.1	-148.7	-33.0	-1.3	0.0
	(J)	-34032.7	-17896.3	20733.2	-28068.6	90.1	1505.5	-0.3	-0.1	-146.7	-31.8	-1.3	0.0
69	(I)	-32203.6	-16114.8	20733.2	-28068.6	-1608.5	-193.4	-0.3	-0.1	-146.7	-31.8	-1.3	0.0
	(J)	-32203.6	-16114.8	23044.2	-25712.5	-1608.5	-193.4	-0.3	-0.1	-144.4	-30.7	-1.3	0.0
70	(I)	-32055.3	-16284.9	23044.2	-25712.5	-1151.9	315.5	-0.3	-0.1	-144.4	-30.7	-1.3	0.0
	(J)	-32055.3	-16284.9	23944.3	-24392.9	-1151.9	315.5	-0.3	-0.1	-142.1	-29.7	-1.3	0.0
71	(I)	-31905.4	-16454.5	23944.3	-24392.9	-815.5	883.7	-0.3	-0.1	-142.1	-29.7	-1.3	0.0
	(J)	-31905.4	-16454.5	23438.9	-23596.3	-815.5	883.7	-0.3	-0.1	-139.7	-28.9	-1.3	0.0
72	(I)	-31753.9	-16625.7	23438.9	-23596.3	-465.4	1463.4	-0.3	-0.1	-139.7	-28.9	-1.3	0.0
	(J)	-31753.9	-16625.7	21545.0	-23346.7	-465.4	1463.4	-0.3	-0.1	-137.1	-28.1	-1.3	0.0
73	(I)	-29677.6	-14767.8	21545.0	-23346.7	-1927.7	92.9	-0.3	-0.1	-137.1	-28.1	-1.3	0.0
	(J)	-29677.6	-14767.8	23169.4	-20037.0	-1927.7	92.9	-0.3	-0.1	-134.4	-27.5	-1.3	0.0
74	(I)	-29522.7	-14942.0	23169.4	-20037.0	-1540.9	625.4	-0.3	-0.1	-134.4	-27.5	-1.3	0.1
	(J)	-29522.7	-14942.0	23457.0	-17853.6	-1540.9	625.4	-0.3	-0.1	-131.6	-26.9	-1.3	0.1
75	(I)	-29366.3	-15117.7	23457.0	-17853.6	-1133.4	1157.9	-0.3	-0.1	-131.6	-26.9	-1.3	0.1
	(J)	-29366.3	-15117.7	22436.7	-17420.6	-1133.4	1157.9	-0.3	-0.1	-128.8	-26.6	-1.3	0.1
76	(I)	-29208.2	-15294.8	22436.7	-17420.6	-743.1	1668.3	-0.3	-0.1	-128.8	-26.6	-1.3	0.1
	(J)	-29208.2	-15294.8	20144.9	-17772.5	-743.1	1668.3	-0.3	-0.1	-126.1	-26.4	-1.3	0.1
77	(I)	-27009.2	-13475.2	20144.9	-17772.5	-1966.1	545.3	-0.3	-0.1	-126.1	-26.4	-1.4	0.1
	(J)	-27009.2	-13475.2	20691.4	-15585.9	-1966.1	545.3	-0.3	-0.1	-123.6	-26.3	-1.4	0.1
78	(I)	-26847.8	-13653.9	20691.4	-15585.9	-1559.5	1008.3	-0.3	-0.1	-123.6	-26.3	-1.4	0.2
	(J)	-26847.8	-13653.9	22086.6	-14227.0	-1559.5	1008.3	-0.3	-0.1	-120.9	-26.3	-1.4	0.2
79	(I)	-26684.9	-13834.1	22086.6	-14227.0	-1126.1	1449.1	-0.3	-0.1	-120.9	-26.3	-1.4	0.2
	(J)	-26684.9	-13834.1	23457.0	-14329.2	-1126.1	1449.1	-0.3	-0.1	-118.2	-26.4	-1.4	0.2
80	(I)	-26520.4	-14015.6	23457.0	-14329.2	-668.5	1864.0	-0.3	-0.1	-118.2	-26.4	-1.5	0.2
	(J)	-26520.4	-14015.6	23595.1	-16403.3	-668.5	1864.0	-0.3	-0.1	-115.3	-26.7	-1.5	0.2
81	(I)	-24352.8	-12346.0	23595.1	-16403.3	-1630.0	966.9	-0.3	-0.1	-115.3	-26.7	-1.5	0.3
	(J)	-24352.8	-12346.0	25964.1	-16714.8	-1630.0	966.9	-0.3	-0.1	-112.4	-27.1	-1.5	0.3
82	(I)	-24185.3	-12530.1	25964.1	-16714.8	-1112.6	1381.5	-0.3	-0.1	-112.4	-27.1	-1.5	0.3
	(J)	-24185.3	-12530.1	27075.2	-17910.9	-1112.6	1381.5	-0.3	-0.1	-109.3	-27.5	-1.5	0.3
83	(I)	-24016.3	-12715.5	27075.2	-17910.9	-566.8	1772.0	-0.3	0.0	-109.3	-27.5	-1.5	0.4
	(J)	-24016.3	-12715.5	26937.5	-21114.3	-566.8	1772.0	-0.3	0.0	-106.2	-28.0	-1.5	0.4
84	(I)	-23846.0	-12902.1	26937.5	-21114.3	-17.6	2136.7	-0.3	0.0	-106.2	-28.0	-1.6	0.4
	(J)	-23846.0	-12902.1	25562.6	-25090.4	-17.6	2136.7	-0.3	0.0	-103.0	-28.5	-1.6	0.4
85	(I)	-20139.7	-9822.3	25562.6	-25090.4	-1725.1	469.0	-0.3	0.0	-103.0	-28.5	-1.6	0.4

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
		(J)	-20139.7	-9822.3	28511.7	-25364.8	-1725.1	469.0	-0.3	0.0	-99.7	-29.0	-1.6	0.4
	86	(I)	-19966.5	-9974.5	28511.7	-25364.8	-1161.0	785.5	-0.3	0.0	-99.7	-29.0	-1.7	0.5
		(J)	-19966.5	-9974.5	30763.0	-26335.9	-1161.0	785.5	-0.3	0.0	-96.4	-29.5	-1.7	0.5
	87	(I)	-19791.9	-10127.5	30763.0	-26335.9	-586.8	1079.7	-0.3	0.0	-96.4	-29.5	-1.7	0.5
		(J)	-19791.9	-10127.5	31670.4	-27960.9	-586.8	1079.7	-0.3	0.0	-92.9	-30.1	-1.7	0.5
	88	(I)	-19616.1	-10281.3	31670.4	-27960.9	4.3	1355.5	-0.3	0.0	-92.9	-30.1	-1.7	0.5
		(J)	-19616.1	-10281.3	31195.0	-30203.2	4.3	1355.5	-0.3	0.0	-89.4	-30.6	-1.7	0.5
	89	(I)	-15973.8	-7240.6	31195.0	-30203.2	-1442.3	-178.8	-0.3	0.0	-89.4	-30.6	-1.7	0.5
		(J)	-15973.8	-7240.6	33807.5	-28995.1	-1442.3	-178.8	-0.3	0.0	-85.8	-31.0	-1.7	0.5
	90	(I)	-15795.5	-7393.8	33807.5	-28995.1	-823.9	92.2	-0.3	0.0	-85.8	-31.0	-1.7	0.5
		(J)	-15795.5	-7393.8	34990.8	-28370.3	-823.9	92.2	-0.3	0.0	-82.1	-31.6	-1.7	0.5
	91	(I)	-15616.1	-7546.0	34990.8	-28370.3	-305.4	513.9	-0.3	0.0	-82.1	-31.6	-1.8	0.6
		(J)	-15616.1	-7546.0	34732.2	-28326.7	-305.4	513.9	-0.3	0.0	-78.4	-32.1	-1.8	0.6
	92	(I)	-15435.5	-7698.9	34732.2	-28326.7	142.5	927.6	-0.3	0.0	-78.4	-32.1	-1.8	0.6
		(J)	-15435.5	-7698.9	33029.4	-28970.4	142.5	927.6	-0.3	0.0	-74.8	-32.8	-1.8	0.6
	93	(I)	-11681.5	-4581.8	33029.4	-28970.4	-1352.0	-311.6	-0.3	0.0	-74.8	-32.8	-1.8	0.6
		(J)	-11681.5	-4581.8	33927.6	-26417.8	-1352.0	-311.6	-0.3	0.0	-71.1	-33.5	-1.8	0.6
	94	(I)	-11499.3	-4733.5	33927.6	-26417.8	-1040.5	262.2	-0.3	0.0	-71.1	-33.5	-1.8	0.6
		(J)	-11499.3	-4733.5	33404.1	-24428.7	-1040.5	262.2	-0.3	0.0	-67.6	-34.4	-1.8	0.6
	95	(I)	-11316.2	-4884.1	33404.1	-24428.7	-750.0	863.1	-0.2	0.0	-67.6	-34.4	-1.8	0.6
		(J)	-11316.2	-4884.1	31476.2	-23014.7	-750.0	863.1	-0.2	0.0	-64.2	-35.0	-1.8	0.6
	96	(I)	-11132.3	-5034.5	31476.2	-23014.7	-451.0	1473.0	-0.2	0.0	-64.2	-35.0	-1.9	0.6
		(J)	-11132.3	-5034.5	28163.9	-22201.5	-451.0	1473.0	-0.2	0.0	-61.1	-34.9	-1.9	0.6
	97	(I)	-7342.8	-1715.2	28163.9	-22201.5	-2093.6	396.5	-0.2	0.0	-61.1	-34.9	-1.9	0.6
		(J)	-7342.8	-1715.2	27278.1	-17756.8	-2093.6	396.5	-0.2	0.0	-58.0	-34.8	-1.9	0.6
	98	(I)	-7230.9	-1862.6	27278.1	-17756.8	-1771.1	977.4	-0.2	0.0	-58.0	-34.8	-1.9	0.6
		(J)	-7230.9	-1862.6	25061.6	-13985.8	-1771.1	977.4	-0.2	0.0	-55.1	-34.7	-1.9	0.6
	99	(I)	-7119.1	-2008.1	25061.6	-13985.8	-1429.6	1544.1	-0.2	0.0	-55.1	-34.7	-1.8	0.6
		(J)	-7119.1	-2008.1	21549.8	-10935.3	-1429.6	1544.1	-0.2	0.0	-53.0	-34.6	-1.8	0.6
	100	(I)	-7006.7	-2150.7	21549.8	-10935.3	-1066.6	2094.9	-0.2	0.0	-53.0	-34.6	-1.8	0.6
		(J)	-7006.7	-2150.7	16788.8	-8659.4	-1066.6	2094.9	-0.2	0.0	-52.0	-33.4	-1.8	0.6
	101	(I)	-2977.7	1415.7	16788.8	-8659.4	-2785.4	1026.2	-0.2	0.0	-52.0	-33.4	-1.8	0.6
		(J)	-2977.7	1415.7	14856.5	-2801.5	-2785.4	1026.2	-0.2	0.0	-51.5	-31.9	-1.8	0.6
	102	(I)	-2907.8	1330.9	14856.5	-2801.5	-2527.9	1342.1	-0.2	0.0	-51.5	-31.9	-1.8	0.6
		(J)	-2907.8	1330.9	14618.0	-1701.8	-2527.9	1342.1	-0.2	0.0	-51.4	-31.3	-1.8	0.6
	103	(I)	-2851.8	1264.2	14618.0	-1701.8	-2318.6	1592.2	-0.2	0.0	-51.4	-31.3	-1.8	0.6
		(J)	-2851.8	1264.2	13542.6	1055.1	-2318.6	1592.2	-0.2	0.0	-51.1	-29.4	-1.8	0.6
	104	(I)	-2773.4	1171.4	13542.6	1055.1	-2007.8	1931.4	-0.2	0.0	-51.1	-29.4	-1.8	0.6
		(J)	-2773.4	1171.4	12198.5	2699.6	-2007.8	1931.4	-0.2	0.0	-50.9	-27.5	-1.8	0.6
	105	(I)	-2700.3	1085.8	12198.5	2699.6	-1703.5	2237.4	-0.2	0.0	-50.9	-27.5	-1.8	0.6
		(J)	-2700.3	1085.8	11848.2	1770.0	-1703.5	2237.4	-0.2	0.0	-51.2	-25.5	-1.8	0.6
	106	(I)	-2624.2	995.9	11848.2	1770.0	-1367.4	2548.8	-0.2	0.0	-51.2	-25.5	-1.7	0.6
		(J)	-2624.2	995.9	13208.3	-632.3	-1367.4	2548.8	-0.2	0.0	-51.5	-22.6	-1.7	0.6
	107	(I)	-2572.0	932.9	13208.3	-632.3	-1120.3	2757.3	-0.2	0.0	-51.5	-22.6	-1.7	0.6
		(J)	-2572.0	932.9	13833.5	-1591.1	-1120.3	2757.3	-0.2	0.0	-51.7	-21.7	-1.7	0.6
	108	(I)	-2509.9	854.9	13833.5	-1591.1	-807.7	3013.0	-0.2	0.0	-51.7	-21.7	-1.7	0.6
		(J)	-2509.9	854.9	15648.5	-7903.9	-807.7	3013.0	-0.2	0.0	-52.2	-18.1	-1.7	0.6
	109	(I)	-6220.9	-3171.9	15648.5	-7903.9	-2038.2	1214.2	-0.2	0.0	-52.2	-18.1	-1.7	0.5
		(J)	-6220.9	-3171.9	20136.7	-10688.3	-2038.2	1214.2	-0.2	0.0	-52.7	-14.6	-1.7	0.5
	110	(I)	-6137.9	-3289.9	20136.7	-10688.3	-1482.6	1567.8	-0.2	0.0	-52.7	-14.6	-1.6	0.5
		(J)	-6137.9	-3289.9	23385.8	-14266.4	-1482.6	1567.8	-0.2	0.0	-53.2	-11.1	-1.6	0.5
	111	(I)	-6057.4	-3319.8	23385.8	-14266.4	-906.6	1898.5	-0.2	0.0	-53.2	-11.1	-1.6	0.5
		(J)	-6057.4	-3319.8	25347.0	-18583.7	-906.6	1898.5	-0.2	0.0	-53.6	-7.8	-1.6	0.5
	112	(I)	-5977.6	-3350.6	25347.0	-18583.7	-309.0	2209.9	-0.2	0.0	-53.6	-7.8	-1.6	0.4
		(J)	-5977.6	-3350.6	25971.8	-23592.6	-309.0	2209.9	-0.2	0.0	-54.1	-4.6	-1.6	0.4
	113	(I)	-9437.8	-6703.2	25971.8	-23592.6	-1492.1	493.9	-0.2	0.0	-54.1	-4.6	-1.5	0.4
		(J)	-9437.8	-6703.2	29192.9	-24757.4	-1492.1	493.9	-0.2	0.0	-54.4	-1.6	-1.5	0.4
	114	(I)	-9399.4	-6709.9	29192.9	-24757.4	-872.4	788.3	-0.2	0.0	-54.4	-1.6	-1.5	0.3
		(J)	-9399.4	-6709.9	31004.4	-26543.7	-872.4	788.3	-0.2	0.0	-54.7	1.3	-1.5	0.3
	115	(I)	-9378.8	-6663.5	31004.4	-26543.7	-304.5	1081.4	-0.2	0.0	-54.7	1.3	-1.5	0.3
		(J)	-9378.8	-6663.5	31388.0	-28935.7	-304.5	1081.4	-0.2	0.0	-54.8	4.1	-1.5	0.3
	116	(I)	-9396.1	-6617.4	31388.0	-28935.7	256.0	1407.4	-0.2	0.0	-54.8	4.1	-1.5	0.2
		(J)	-9396.1	-6617.4	30321.4	-31920.3	256.0	1407.4	-0.2	0.0	-54.9	6.8	-1.5	0.2
	117	(I)	-13140.7	-9805.0	30321.4	-31920.3	-1024.4	-19.3	-0.2	0.0	-54.9	6.8	-1.4	0.2
		(J)	-13140.7	-9805.0	31975.8	-31320.6	-1024.4	-19.3	-0.2	0.0	-54.8	9.4	-1.4	0.2
	118	(I)	-13265.0	-9758.3	31975.8	-31320.6	-479.0	381.0	-0.2	0.0	-54.8	9.4	-1.4	0.1
		(J)	-13265.0	-9758.3	32167.6	-31310.6	-479.0	381.0	-0.2	0.0	-54.6	11.9	-1.4	0.1
	119	(I)	-13389.6	-9656.0	32167.6	-31310.6	-37.0	847.4	-0.2	0.0	-54.6	11.9	-1.3	0.1
		(J)	-13389.6	-9656.0	30898.8	-31898.9	-37.0	847.4	-0.2	0.0	-54.2	14.4	-1.3	0.1
	120	(I)	-13514.0	-9509.7	30898.8	-31898.9	264.1	1340.4	-0.2	0.0	-54.2	14.4	-1.3	0.0
		(J)	-13514.0	-9509.7	28181.0	-33096.6	264.1	1340.4	-0.2	0.0	-53.7	16.9	-1.3	0.0
	121	(I)	-17202.1	-12322.6	28181.0	-33096.6	-1237.0	-58.6	-0.2	0.0	-53.7	16.9	-1.2	-0.1
		(J)	-17202.1	-12322.6	28620.0	-30845.1	-1237.0	-58.6	-0.2	0.0	-53.1	19.4	-1.2	-0.1
	122	(I)	-17325.9	-12177.5	28620.0	-30845.1	-945.1	585.8	-0.2	0.0	-53.1	19.4	-1.2	-0.1
		(J)	-17325.9	-12177.5	27656.0	-29234.0	-945.1	585.8	-0.2	0.0	-52.3	21.8	-1.2	-0.1
	123	(I)	-17449.4	-12033.1	27656.0	-29234.0	-659.5	1211.8	-0.2	0.0	-52.3	21.8	-1.2	-0.2
		(J)	-17449.4	-12033.1	25331.6	-28285.5	-659.5	1211.8	-0.2	0.0	-51.3	24.1	-1.2	-0.2
	124	(I)	-17594.5	-11889.4	25331.6	-28285.5	-372.1	1818.4	-0.2	0.0	-51.3	24.1	-1.2	-0.2
		(J)	-17594.5	-11889.4	21733.1	-28029.6	-372.1	1818.4	-0.2	0.0	-50.2	26.3	-1.2	-0.2
	125	(I)	-21420.5	-14812.6	21733.1	-28029.6	-2064.5	44.9	-0.2	0.0	-50.2	26.3	-1.2	-0.2
		(J)	-21420.5	-14812.6	23176.0	-24984.3	-2064.5	44.9	-0.2	0.0	-48.9	28.3	-1.2	-0.2
	126	(I)	-21609.5	-14670.5	23176.0	-24984.3	-1735.2	625.9	-0.2	0.0	-48.9	28.3	-1.2	-0.2
		(J)	-21609.5	-14670.5	23522.2	-22750.8	-1735.2	625.9	-0.2	0.0	-47.5	30.2	-1.2	-0.2
	127	(I)	-21797.9	-14529.2	23522.2	-22750.8	-1379.9	1182.5	-0.2	0.0	-47.5	30.2	-1.2	-0.2
		(J)	-21797.9	-14529.2	23256.6	-21278.4	-1379.9	1182.5	-0.2	0.0	-45.9	31.8	-1.2	-0.2
	128	(I)	-21985.2	-14388.8	23256.6	-21278.4	-995.7	1713.3	-0.2	0.0	-45.9	31.8	-1.2	-0.1
		(J)	-21985.2	-14388.8	21847.1	-20575.5	-995.7	1713.3	-0.2	0.0	-44.1	33.4	-1.2	-0.1
	129	(I)	-24286.0	-16083.8	21847.1	-20575.5	-1888.7	764.2	-0.2	0.0	-44.1	33.4	-1.2	-0.1
		(J)	-24286.0	-16083.8	22586.9	-18609.0	-1888.7	764.2	-0.2	0.0	-42.3	34.7	-1.2	-0.1

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	130	(I)	-24471.0	-15944.4	22586.9	-18609.0	-1449.2	1236.8	-0.2	0.0	-42.3	34.7	-1.3	-0.1
		(J)	-24471.0	-15944.4	22112.6	-17467.8	-1449.2	1236.8	-0.2	0.0	-40.3	35.8	-1.3	-0.1
	131	(I)	-24654.6	-15806.1	22112.6	-17467.8	-979.6	1683.7	-0.2	0.0	-40.3	35.8	-1.4	-0.1
		(J)	-24654.6	-15806.1	20881.8	-17131.9	-979.6	1683.7	-0.2	0.0	-38.2	36.8	-1.4	-0.1
	132	(I)	-24837.1	-15668.7	20881.8	-17131.9	-486.6	2099.9	-0.2	0.0	-38.2	36.8	-1.4	0.0
		(J)	-24837.1	-15668.7	19251.4	-17685.2	-486.6	2099.9	-0.2	0.0	-36.0	37.5	-1.4	0.0
	133	(I)	-27227.5	-17570.6	19251.4	-17685.2	-1593.5	822.8	-0.2	0.0	-36.0	37.5	-1.5	0.1
		(J)	-27227.5	-17570.6	20787.8	-18041.5	-1593.5	822.8	-0.2	0.0	-33.8	38.1	-1.5	0.1
	134	(I)	-27407.1	-17404.9	20787.8	-18041.5	-1073.6	1236.9	-0.2	0.0	-33.8	38.1	-1.5	0.1
		(J)	-27407.1	-17404.9	21071.9	-19136.0	-1073.6	1236.9	-0.2	0.0	-31.5	38.6	-1.5	0.1
	135	(I)	-27585.9	-17232.9	21071.9	-19136.0	-580.4	1646.2	-0.2	0.0	-31.5	38.6	-1.6	0.2
		(J)	-27585.9	-17232.9	20178.1	-20939.5	-580.4	1646.2	-0.2	0.0	-29.2	38.8	-1.6	0.2
	136	(I)	-27763.9	-17062.2	20178.1	-20939.5	-72.9	2036.4	-0.2	0.0	-29.2	38.8	-1.6	0.2
		(J)	-27763.9	-17062.2	19522.7	-23415.0	-72.9	2036.4	-0.2	0.0	-26.8	39.0	-1.6	0.2
	137	(I)	-30083.0	-18925.6	19522.7	-23415.0	-1472.6	543.3	-0.2	0.0	-26.8	39.0	-1.7	0.3
		(J)	-30083.0	-18925.6	22149.1	-23009.2	-1472.6	543.3	-0.2	0.0	-24.3	39.0	-1.7	0.3
	138	(I)	-30258.0	-18776.5	22149.1	-23009.2	-925.8	905.6	-0.2	0.0	-24.3	39.0	-1.7	0.3
		(J)	-30258.0	-18776.5	23310.3	-23230.9	-925.8	905.6	-0.2	0.0	-21.7	39.0	-1.7	0.3
	139	(I)	-30431.5	-18628.8	23310.3	-23230.9	-403.9	1261.1	-0.2	0.0	-21.7	39.0	-1.8	0.4
		(J)	-30431.5	-18628.8	22971.8	-24073.4	-403.9	1261.1	-0.2	0.0	-19.1	39.0	-1.8	0.4
	140	(I)	-30603.4	-18470.8	22971.8	-24073.4	2.1	1623.0	-0.2	0.0	-19.1	39.0	-1.8	0.4
		(J)	-30603.4	-18470.8	21111.2	-25538.5	2.1	1623.0	-0.2	0.0	-16.4	39.8	-1.8	0.4
	141	(I)	-32700.4	-20137.6	21111.2	-25538.5	-1548.7	-16.5	-0.2	0.0	-16.4	39.8	-1.9	0.5
		(J)	-32700.4	-20137.6	23273.0	-23930.3	-1548.7	-16.5	-0.2	0.0	-13.5	41.7	-1.9	0.5
	142	(I)	-32871.0	-19991.4	23273.0	-23930.3	-1103.0	389.4	-0.2	0.0	-13.5	41.7	-1.9	0.5
		(J)	-32871.0	-19991.4	23889.6	-23012.2	-1103.0	389.4	-0.2	0.0	-10.6	43.7	-1.9	0.5
	143	(I)	-33040.2	-19846.3	23889.6	-23012.2	-674.0	850.7	-0.2	0.0	-10.6	43.7	-2.0	0.6
		(J)	-33040.2	-19846.3	23426.0	-23817.4	-674.0	850.7	-0.2	0.0	-9.9	45.6	-2.0	0.6
	144	(I)	-33207.7	-19702.1	23426.0	-23817.4	-329.2	1304.0	-0.2	0.0	-9.9	45.6	-2.1	0.7
		(J)	-33207.7	-19702.1	22618.4	-25766.6	-329.2	1304.0	-0.2	0.0	-9.1	47.5	-2.1	0.7
	145	(I)	-34931.3	-21147.7	22618.4	-25766.6	-2090.6	-465.4	-0.2	0.0	-9.1	47.5	-2.1	0.7
		(J)	-34931.3	-21147.7	26432.8	-24050.4	-2090.6	-465.4	-0.2	0.0	-8.4	49.4	-2.1	0.7
	146	(I)	-35097.0	-21003.6	26432.8	-24050.4	-1633.0	28.7	-0.2	0.0	-8.4	49.4	-2.2	0.8
		(J)	-35097.0	-21003.6	28829.1	-23005.5	-1633.0	28.7	-0.2	0.0	-7.8	51.3	-2.2	0.8
	147	(I)	-35262.4	-20858.3	28829.1	-23005.5	-1299.5	510.1	-0.2	0.0	-7.8	51.3	-2.2	0.8
		(J)	-35262.4	-20858.3	29829.6	-22637.1	-1299.5	510.1	-0.2	0.0	-7.1	53.4	-2.2	0.8
	148	(I)	-35426.2	-20713.4	29829.6	-22637.1	-955.1	982.6	-0.2	0.0	-7.1	53.4	-2.3	0.9
		(J)	-35426.2	-20713.4	29470.6	-22963.2	-955.1	982.6	-0.2	0.0	-6.5	55.6	-2.3	0.9
	149	(I)	-35588.3	-20568.1	29470.6	-22963.2	-596.2	1453.1	-0.2	0.0	-6.5	55.6	-2.4	0.9
		(J)	-35588.3	-20568.1	27806.4	-24011.9	-596.2	1453.1	-0.2	0.0	-5.9	58.0	-2.4	0.9
	150	(I)	-35751.3	-20421.8	27806.4	-24011.9	-223.2	2020.2	-0.2	0.0	-5.9	58.0	-2.4	0.9
		(J)	-35751.3	-20421.8	24908.3	-25824.0	-223.2	2020.2	-0.2	0.0	-6.5	61.2	-2.4	0.9
	151	(I)	-35913.8	-20274.3	24908.3	-25824.0	165.1	2582.0	-0.2	0.0	-6.5	61.2	-2.4	1.0
		(J)	-35913.8	-20274.3	21051.6	-28469.8	165.1	2582.0	-0.2	0.0	-7.3	64.8	-2.4	1.0
	152	(I)	-36074.8	-20125.8	21051.6	-28469.8	569.4	3123.2	-0.2	0.0	-7.3	64.8	-2.5	1.0
		(J)	-36074.8	-20125.8	17822.5	-32085.3	569.4	3123.2	-0.2	0.0	-8.2	68.7	-2.5	1.0
	153	(I)	-36222.1	-19988.1	17822.5	-32085.3	938.3	3593.9	-0.2	0.0	-8.2	68.7	-2.5	1.0
		(J)	-36222.1	-19988.1	14437.4	-36399.9	938.3	3593.9	-0.2	0.0	-9.2	72.2	-2.5	1.0
	154	(I)	-36354.8	-19863.7	14437.4	-36399.9	1251.5	4006.8	-0.2	0.0	-9.2	72.2	-2.5	1.1
		(J)	-36354.8	-19863.7	10345.4	-42495.0	1251.5	4006.8	-0.2	0.0	-10.2	75.8	-2.5	1.1
	155	(I)	-36486.4	-19737.4	10345.4	-42495.0	1584.4	4404.4	-0.2	0.0	-10.2	75.8	-2.6	1.1
		(J)	-36486.4	-19737.4	5550.1	-49663.3	1584.4	4404.4	-0.2	0.0	-11.4	79.5	-2.6	1.1
	156	(I)	-36604.4	-19625.3	5550.1	-49663.3	1890.4	4736.2	-0.3	0.0	-11.4	79.5	-2.6	1.1
		(J)	-36604.4	-19625.3	1426.2	-55591.1	1890.4	4736.2	-0.3	0.0	-12.4	82.4	-2.6	1.1
	157	(I)	-36652.8	-19568.2	1426.2	-55591.1	2082.4	4928.0	-0.2	0.0	-12.4	82.4	-2.6	1.1
		(J)	-36652.8	-19568.2	1113.6	-56035.5	2082.4	4928.0	-0.2	0.0	-12.5	82.6	-2.6	1.1
	158	(I)	-36763.7	-16954.7	7175.2	-51159.9	-4592.7	-2280.4	0.0	0.4	-12.5	82.6	-2.3	2.9
		(J)	-36763.7	-16954.7	7413.1	-50729.2	-4592.7	-2280.4	0.0	0.4	-12.3	82.4	-2.3	2.9
	159	(I)	-36710.0	-17006.1	7413.1	-50729.2	-4483.1	-2172.1	-0.1	0.4	-12.3	82.4	-2.3	2.9
		(J)	-36710.0	-17006.1	10569.1	-44871.0	-4483.1	-2172.1	-0.1	0.4	-9.2	78.6	-2.3	2.9
	160	(I)	-36606.6	-17124.7	10569.1	-44871.0	-4145.0	-1858.4	-0.1	0.4	-9.2	78.6	-2.2	2.9
		(J)	-36606.6	-17124.7	14107.3	-39014.6	-4145.0	-1858.4	-0.1	0.4	-5.4	73.7	-2.2	2.9
	161	(I)	-36488.1	-17256.3	14107.3	-39014.6	-3751.3	-1523.0	-0.1	0.4	-5.4	73.7	-2.2	2.8
		(J)	-36488.1	-17256.3	16977.2	-33795.9	-3751.3	-1523.0	-0.1	0.4	-1.9	69.1	-2.2	2.8
	162	(I)	-36369.1	-17388.9	16977.2	-33795.9	-3363.1	-1172.9	-0.1	0.4	-1.9	69.1	-2.2	2.8
		(J)	-36369.1	-17388.9	21499.3	-29485.4	-3363.1	-1172.9	-0.1	0.4	1.5	64.5	-2.2	2.8
	163	(I)	-36235.7	-17537.7	21499.3	-29485.4	-2924.0	-780.1	-0.1	0.4	1.5	64.5	-2.1	2.7
		(J)	-36235.7	-17537.7	25987.5	-26225.7	-2924.0	-780.1	-0.1	0.4	5.3	59.2	-2.1	2.7
	164	(I)	-36087.7	-17699.4	25987.5	-26225.7	-2428.3	-356.0	-0.1	0.4	5.3	59.2	-2.1	2.7
		(J)	-36087.7	-17699.4	29255.6	-23851.4	-2428.3	-356.0	-0.1	0.4	8.2	54.5	-2.1	2.7
	165	(I)	-35938.6	-17862.3	29255.6	-23851.4	-1922.6	57.9	-0.1	0.4	8.2	54.5	-2.0	2.6
		(J)	-35938.6	-17862.3	31273.0	-22295.4	-1922.6	57.9	-0.1	0.4	10.9	50.8	-2.0	2.6
	166	(I)	-35788.3	-18026.9	31273.0	-22295.4	-1403.5	464.2	-0.1	0.4	10.9	50.8	-1.9	2.6
		(J)	-35788.3	-18026.9	32009.9	-21496.9	-1403.5	464.2	-0.1	0.4	12.1	48.3	-1.9	2.6
	167	(I)	-35636.9	-18191.0	32009.9	-21496.9	-868.9	867.3	-0.1	0.4	12.1	48.3	-1.9	2.5
		(J)	-35636.9	-18191.0	31448.6	-21408.8	-868.9	867.3	-0.1	0.4	12.1	47.9	-1.9	2.5
	168	(I)	-35484.3	-18355.7	31448.6	-21408.8	-333.3	1271.6	-0.1	0.4	12.1	47.9	-1.8	2.4
		(J)	-35484.3	-18355.7	29578.8	-21990.5	-333.3	1271.6	-0.1	0.4	10.7	47.9	-1.8	2.4
	169	(I)	-35330.6	-18522.2	29578.8	-21990.5	115.8	1700.5	-0.1	0.4	10.7	47.9	-1.7	2.3
		(J)	-35330.6	-18522.2	26399.8	-23215.8	115.8	1700.5	-0.1	0.4	9.0	48.1	-1.7	2.3
	170	(I)	-35175.7	-18690.2	26399.8	-23215.8	562.8	2145.1	-0.1	0.4	9.0	48.1	-1.6	2.2
		(J)	-35175.7	-18690.2	21910.4	-25074.7	562.8	2145.1	-0.1	0.4	7.2	48.3	-1.6	2.2
	171	(I)	-33605.1	-17238.6	21910.4	-25074.7	-1287.7	309.4	-0.1	0.4	7.2	48.3	-1.5	2.1
		(J)	-33605.1	-17238.6	22136.8	-23434.4	-1287.7	309.4	-0.1	0.4	4.6	48.4	-1.5	2.1
	172	(I)	-33447.8	-17407.6	22136.8	-23434.4	-818.7	775.3	-0.1	0.4	4.6	48.4	-1.4	2.0
		(J)	-33447.8	-17407.6	22502.0	-22639.6	-818.7	775.3	-0.1	0.4	0.2	49.6	-1.4	2.0
	173	(I)	-33289.3	-17578.4	22502.0	-22639.6	-360.9	1224.1	-0.1	0.3	0.2	49.6	-1.3	1.9
		(J)	-33289.3	-17578.4	21563.6	-23134.8	-360.9	1224.1	-0.1	0.3	-3.9	52.1	-1.3	1.9
	174	(I)	-33129.7	-17750.8	21563.6	-23134.8	70.9	721.2	-0.1	0.4	-3.9	52.1	-1.2	1.8

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
		(J)	-33129.7	-17750.8	19283.6	-24203.7	70.9	1721.2	-0.1	0.4	-7.8	54.3	-1.2	1.8
	175	(I)	-31184.6	-16073.2	19283.6	-24203.7	-1683.1	93.5	-0.1	0.3	-7.8	54.3	-1.1	1.7
		(J)	-31184.6	-16073.2	21155.3	-21843.3	-1683.1	93.5	-0.1	0.3	-11.4	56.2	-1.1	1.7
	176	(I)	-31022.5	-16248.5	21155.3	-21843.3	-1212.2	629.4	-0.1	0.3	-11.4	56.2	-1.0	1.6
		(J)	-31022.5	-16248.5	21677.6	-20639.9	-1212.2	629.4	-0.1	0.3	-14.7	57.9	-1.0	1.6
	177	(I)	-30859.2	-16424.3	21677.6	-20639.9	-802.2	1155.2	-0.1	0.3	-14.7	57.9	-0.9	1.6
		(J)	-30859.2	-16424.3	20860.1	-20162.1	-802.2	1155.2	-0.1	0.3	-17.8	59.4	-0.9	1.6
	178	(I)	-30694.7	-16601.9	20860.1	-20162.1	-386.1	1664.9	-0.1	0.3	-17.8	59.4	-0.9	1.5
		(J)	-30694.7	-16601.9	18726.7	-21224.7	-386.1	1664.9	-0.1	0.3	-20.5	60.9	-0.9	1.5
	179	(I)	-28499.2	-14836.2	18726.7	-21224.7	-1992.7	344.3	-0.1	0.3	-20.5	60.9	-0.8	1.4
		(J)	-28499.2	-14836.2	20013.5	-19719.5	-1992.7	344.3	-0.1	0.3	-22.9	62.1	-0.8	1.4
	180	(I)	-28332.1	-15016.9	20013.5	-19719.5	-1545.0	819.6	-0.1	0.3	-22.9	62.1	-0.7	1.3
		(J)	-28332.1	-15016.9	20038.8	-18983.9	-1545.0	819.6	-0.1	0.3	-25.0	63.2	-0.7	1.3
	181	(I)	-28164.0	-15199.2	20038.8	-18983.9	-1079.6	1277.4	-0.1	0.3	-25.0	63.2	-0.6	1.2
		(J)	-28164.0	-15199.2	19004.0	-19009.9	-1079.6	1277.4	-0.1	0.3	-26.9	64.0	-0.6	1.2
	182	(I)	-27994.6	-15383.0	19004.0	-19009.9	-676.0	1715.1	-0.1	0.3	-26.9	64.0	-0.5	1.2
		(J)	-27994.6	-15383.0	18082.7	-19800.3	-676.0	1715.1	-0.1	0.3	-28.4	64.5	-0.5	1.2
	183	(I)	-25677.2	-13627.3	18082.7	-19800.3	-1933.3	621.7	-0.1	0.3	-28.4	64.5	-0.4	1.1
		(J)	-25677.2	-13627.3	21385.5	-19012.4	-1933.3	621.7	-0.1	0.3	-29.7	64.9	-0.4	1.1
	184	(I)	-25505.5	-13813.4	21385.5	-19012.4	-1494.1	1020.3	-0.1	0.3	-29.7	64.9	-0.4	1.0
		(J)	-25505.5	-13813.4	23499.0	-19521.4	-1494.1	1020.3	-0.1	0.3	-30.7	65.0	-0.4	1.0
	185	(I)	-25332.7	-14000.7	23499.0	-19521.4	-1033.1	1437.2	-0.1	0.3	-30.7	65.0	-0.3	1.0
		(J)	-25332.7	-14000.7	24392.1	-20834.9	-1033.1	1437.2	-0.1	0.3	-31.8	64.9	-0.3	1.0
	186	(I)	-25158.9	-14189.4	24392.1	-20834.9	-546.1	1843.0	-0.1	0.3	-31.8	64.9	-0.2	0.9
		(J)	-25158.9	-14189.4	24070.9	-22948.3	-546.1	1843.0	-0.1	0.3	-33.0	64.5	-0.2	0.9
	187	(I)	-22893.5	-12562.2	24070.9	-22948.3	-1457.6	957.6	-0.1	0.3	-33.0	64.5	-0.2	0.8
		(J)	-22893.5	-12562.2	26606.5	-23121.2	-1457.6	957.6	-0.1	0.3	-33.9	63.9	-0.2	0.8
	188	(I)	-22717.5	-12753.4	26606.5	-23121.2	-915.2	1318.9	-0.1	0.3	-33.9	63.9	-0.1	0.8
		(J)	-22717.5	-12753.4	28267.6	-24089.8	-915.2	1318.9	-0.1	0.3	-34.6	63.2	-0.1	0.8
	189	(I)	-22540.6	-12945.9	28267.6	-24089.8	-349.5	1709.0	-0.1	0.3	-34.6	63.2	-0.1	0.8
		(J)	-22540.6	-12945.9	28591.2	-25849.9	-349.5	1709.0	-0.1	0.3	-35.1	62.2	-0.1	0.8
	190	(I)	-22362.7	-13139.7	28591.2	-25849.9	236.9	2076.5	-0.1	0.3	-35.1	62.2	-0.2	0.8
		(J)	-22362.7	-13139.7	27550.9	-28401.1	236.9	2076.5	-0.1	0.3	-35.3	61.1	-0.2	0.8
	191	(I)	-18516.6	-10190.1	27550.9	-28401.1	-1451.3	373.3	-0.1	0.3	-35.3	61.1	-0.3	0.8
		(J)	-18516.6	-10190.1	30535.1	-28751.5	-1451.3	373.3	-0.1	0.3	-35.2	60.0	-0.3	0.8
	192	(I)	-18336.8	-10386.1	30535.1	-28751.5	-837.4	698.8	-0.1	0.3	-35.2	60.0	-0.3	0.9
		(J)	-18336.8	-10386.1	32130.9	-29897.2	-837.4	698.8	-0.1	0.3	-34.9	58.6	-0.3	0.9
	193	(I)	-18156.2	-10583.0	32130.9	-29897.2	-250.6	1004.4	-0.1	0.3	-34.9	58.6	-0.4	1.0
		(J)	-18156.2	-10583.0	32336.2	-31642.4	-250.6	1004.4	-0.1	0.3	-34.4	56.9	-0.4	1.0
	194	(I)	-17974.8	-10781.0	32336.2	-31642.4	304.3	1293.6	-0.1	0.3	-34.4	56.9	-0.5	1.0
		(J)	-17974.8	-10781.0	31142.5	-33971.7	304.3	1293.6	-0.1	0.3	-33.8	54.9	-0.5	1.0
	195	(I)	-14240.9	-7904.9	31142.5	-33971.7	-1154.2	-265.5	-0.1	0.3	-33.8	54.9	-0.5	1.1
		(J)	-14240.9	-7904.9	33086.7	-32943.0	-1154.2	-265.5	-0.1	0.3	-33.0	52.7	-0.5	1.1
	196	(I)	-14057.7	-8104.3	33086.7	-32943.0	-651.5	185.1	-0.1	0.3	-33.0	52.7	-0.6	1.2
		(J)	-14057.7	-8104.3	33595.2	-32479.3	-651.5	185.1	-0.1	0.3	-32.0	50.2	-0.6	1.2
	197	(I)	-13874.0	-8282.5	33595.2	-32479.3	-203.0	706.0	-0.1	0.3	-32.0	50.2	-0.6	1.3
		(J)	-13874.0	-8282.5	32655.7	-32574.9	-203.0	706.0	-0.1	0.3	-30.8	47.4	-0.6	1.3
	198	(I)	-13689.6	-8449.6	32655.7	-32574.9	185.1	1213.8	-0.1	0.3	-30.8	47.4	-0.7	1.4
		(J)	-13689.6	-8449.6	30261.3	-33231.0	185.1	1213.8	-0.1	0.3	-29.3	44.4	-0.7	1.4
	199	(I)	-9868.5	-5374.1	30261.3	-33231.0	-1324.8	-5.2	-0.1	0.3	-29.3	44.4	-0.8	1.5
		(J)	-9868.5	-5374.1	30469.9	-30458.5	-1324.8	-5.2	-0.1	0.3	-27.6	41.1	-0.8	1.5
	200	(I)	-9702.3	-5542.1	30469.9	-30458.5	-975.2	589.0	-0.1	0.3	-27.6	41.1	-0.9	1.6
		(J)	-9702.3	-5542.1	29236.0	-28270.4	-975.2	589.0	-0.1	0.3	-25.5	37.5	-0.9	1.6
	201	(I)	-9543.9	-5710.3	29236.0	-28270.4	-690.6	1179.1	-0.1	0.3	-25.5	37.5	-1.0	1.7
		(J)	-9543.9	-5710.3	26576.5	-26688.0	-690.6	1179.1	-0.1	0.3	-23.2	33.8	-1.0	1.7
	202	(I)	-9385.3	-5878.9	26576.5	-26688.0	-403.0	1774.6	-0.1	0.3	-23.2	33.8	-1.1	1.8
		(J)	-9385.3	-5878.9	22515.3	-25743.4	-403.0	1774.6	-0.1	0.3	-20.7	29.8	-1.1	1.8
	203	(I)	-5310.8	-2611.2	22515.3	-25743.4	-2015.0	717.2	-0.1	0.3	-20.7	29.8	-1.2	1.9
		(J)	-5310.8	-2611.2	20864.3	-21188.1	-2015.0	717.2	-0.1	0.3	-17.9	25.5	-1.2	1.9
	204	(I)	-5151.8	-2780.4	20864.3	-21188.1	-1695.1	1305.1	-0.1	0.3	-17.9	25.5	-1.3	2.0
		(J)	-5151.8	-2780.4	17887.9	-17349.6	-1695.1	1305.1	-0.1	0.3	-14.9	21.0	-1.3	2.0
	205	(I)	-4992.7	-2949.6	17887.9	-17349.6	-1353.6	1871.5	-0.1	0.3	-14.9	21.0	-1.4	2.1
		(J)	-4992.7	-2949.6	13634.6	-14277.3	-1353.6	1871.5	-0.1	0.3	-11.7	16.3	-1.4	2.1
	206	(I)	-4833.4	-3118.8	13634.6	-14277.3	-988.5	2413.4	-0.1	0.3	-11.7	16.3	-1.5	2.2
		(J)	-4833.4	-3118.8	8160.6	-12025.1	-988.5	2413.4	-0.1	0.3	-8.2	11.5	-1.5	2.2
	207	(I)	-442.7	484.4	8160.6	-12025.1	-2660.4	1335.2	-0.1	0.3	-8.2	11.5	-1.6	2.3
		(J)	-442.7	484.4	5156.4	-6039.1	-2660.4	1335.2	-0.1	0.3	-4.6	6.4	-1.6	2.3
	208	(I)	-233.8	255.6	5156.4	-6039.1	-2196.1	1875.1	-0.1	0.3	-4.6	6.4	-1.7	2.3
		(J)	-233.8	255.6	0.0	0.0	-2196.1	1875.1	-0.1	0.3	0.0	0.0	-1.7	2.3
	501	(I)	-44278.3	-41435.7	14596.6	-16976.5	-848.4	738.6	0.0	0.0	-1.8	1.7	-0.2	0.2
		(J)	-44278.3	-41435.7	14048.9	-16615.2	-848.4	738.6	0.0	0.0	-1.8	1.8	-0.2	0.2
	502	(I)	-44244.3	-41401.8	14925.1	-17189.3	-845.4	739.3	0.0	0.0	-1.8	1.7	-0.2	0.2
		(J)	-44244.3	-41401.8	14596.6	-16976.5	-845.4	739.3	0.0	0.0	-1.8	1.7	-0.2	0.2
	503	(I)	-44154.0	-41311.5	16772.7	-18315.1	-835.8	740.8	0.0	0.0	-1.8	1.8	-0.2	0.2
		(J)	-44154.0	-41311.5	14925.1	-17189.3	-835.8	740.8	0.0	0.0	-1.8	1.7	-0.2	0.2
	504	(I)	-43990.4	-41148.1	18501.6	-19218.4	-804.1	736.9	0.0	0.0	-1.8	1.9	-0.1	0.1
		(J)	-43990.4	-41148.1	16772.7	-18315.1	-804.1	736.9	0.0	0.0	-1.8	1.8	-0.1	0.1
	505	(I)	-43818.2	-40976.2	19828.6	-19697.8	-756.5	724.0	0.0	0.0	-2.1	2.1	-0.1	0.1
		(J)	-43818.2	-40976.2	18501.6	-19218.4	-756.5	724.0	0.0	0.0	-1.8	1.9	-0.1	0.1
	506	(I)	-43646.0	-40804.4	20715.6	-22208.0	-704.1	702.8	0.0	0.0	-2.3	2.3	-0.1	0.1
		(J)	-43646.0	-40804.4	19828.6	-19697.8	-704.1	702.8	0.0	0.0	-2.1	2.1	-0.1	0.1
	507	(I)	-43473.7	-40632.6	21153.3	-25149.7	-652.2	674.8	0.0	0.0	-2.3	2.3	0.0	0.0
		(J)	-43473.7	-40632.6	20715.6	-22208.0	-652.2	674.8	0.0	0.0	-2.3	2.3	0.0	0.0
	508	(I)	-43301.4	-40460.8	21159.7	-27697.4	-656.0	654.3	0.0	0.0	-2.2	2.2	0.0	0.0
		(J)	-43301.4	-40460.8	21153.3	-25149.7	-656.0	654.3	0.0	0.0	-2.3	2.3	0.0	0.0
	509	(I)	-43129.0	-40289.2	22207.0	-29857.0	-704.7	665.1	0.0	0.0	-1.9	1.9	-0.1	0.1
		(J)	-43129.0	-40289.2	21159.7	-27697.4	-704.7	665.1	0.0	0.0	-2.2	2.2	-0.1	0.1
	510	(I)	-42956.6	-40117.5	24432.7	-31643.6	-760.2	682.3	0.0	0.0	-1.6	1.6	-0.1	0.1
		(J)	-42956.6	-40117.5	22207.0	-29857.0	-760.2	682.3	0.0	0.0	-1.9	1.9	-0.1	0.1

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	511	(I)	-42810.0	-39971.7	25846.3	-32685.2	-800.7	706.8	0.0	0.0	-1.5	1.6	-0.1	0.1
		(J)	-42810.0	-39971.7	24432.7	-31643.6	-800.7	706.8	0.0	0.0	-1.6	1.6	-0.1	0.1
	512	(I)	-37900.4	-35391.2	25596.8	-31716.9	-1001.2	1164.8	0.0	0.0	-1.4	1.5	-0.1	0.1
		(J)	-37900.4	-35391.2	25846.3	-32685.2	-1001.2	1164.8	0.0	0.0	-1.5	1.6	-0.1	0.1
	513	(I)	-33270.3	-31133.0	23987.3	-29050.6	-1552.1	1553.4	0.0	0.0	-1.4	1.5	-0.1	0.1
		(J)	-33270.3	-31133.0	25596.8	-31716.9	-1552.1	1553.4	0.0	0.0	-1.4	1.5	-0.1	0.1
	514	(I)	-29062.0	-27297.9	21188.4	-25023.3	-1826.4	1966.5	0.0	0.0	-1.3	1.4	-0.1	0.1
		(J)	-29062.0	-27297.9	23987.3	-29050.6	-1826.4	1966.5	0.0	0.0	-1.4	1.5	-0.1	0.1
	515	(I)	-25326.3	-23881.9	17509.4	-20127.5	-1835.0	2397.6	0.0	0.0	-1.1	1.3	-0.1	0.1
		(J)	-25326.3	-23881.9	21188.4	-25023.3	-1835.0	2397.6	0.0	0.0	-1.3	1.4	-0.1	0.1
	516	(I)	-22142.4	-20971.5	13540.1	-14850.0	-2050.9	2589.6	0.0	0.0	-1.0	1.1	-0.1	0.1
		(J)	-22142.4	-20971.5	17509.4	-20127.5	-2050.9	2589.6	0.0	0.0	-1.1	1.3	-0.1	0.1
	517	(I)	-17223.0	-16478.9	9664.7	-10524.3	-2160.7	2537.7	0.0	0.0	-0.9	0.9	-0.1	0.1
		(J)	-17223.0	-16478.9	13540.1	-14850.0	-2160.7	2537.7	0.0	0.0	-1.0	1.1	-0.1	0.1
	518	(I)	-12857.9	-12429.6	5642.1	-6324.3	-2008.4	2211.0	0.0	0.0	-0.7	0.7	-0.1	0.1
		(J)	-12857.9	-12429.6	9664.7	-10524.3	-2008.4	2211.0	0.0	0.0	-0.9	0.9	-0.1	0.1
	519	(I)	-8687.7	-8474.2	2150.0	-2486.0	-1735.8	1913.5	0.0	0.0	-0.5	0.5	-0.1	0.1
		(J)	-8687.7	-8474.2	5642.1	-6324.3	-1735.8	1913.5	0.0	0.0	-0.7	0.7	-0.1	0.1
	520	(I)	-4512.3	-4418.6	405.7	-370.8	-1065.3	1219.8	0.0	0.0	-0.3	0.3	-0.1	0.1
		(J)	-4512.3	-4418.6	2150.0	-2486.0	-1065.3	1219.8	0.0	0.0	-0.5	0.5	-0.1	0.1
	521	(I)	-166.3	-164.4	0.0	0.0	-81.1	74.3	0.0	0.0	0.0	0.0	-0.1	0.1
		(J)	-166.3	-164.4	405.7	-370.8	-81.1	74.3	0.0	0.0	-0.3	0.3	-0.1	0.1
	601	(I)	-43888.9	-41656.4	14974.8	-13428.0	-815.2	717.9	0.0	0.0	-1.7	1.6	-0.1	0.2
		(J)	-43888.9	-41656.4	14492.9	-13119.1	-815.2	717.9	0.0	0.0	-1.7	1.5	-0.1	0.2
	602	(I)	-43854.9	-41622.4	15263.2	-13617.5	-812.6	719.0	0.0	0.0	-1.8	1.6	-0.1	0.2
		(J)	-43854.9	-41622.4	14974.8	-13428.0	-812.6	719.0	0.0	0.0	-1.7	1.6	-0.1	0.2
	603	(I)	-43764.6	-41532.2	16858.1	-14773.7	-804.2	721.7	0.0	0.0	-1.9	1.8	-0.1	0.1
		(J)	-43764.6	-41532.2	15263.2	-13617.5	-804.2	721.7	0.0	0.0	-1.8	1.6	-0.1	0.1
	604	(I)	-43601.2	-41368.8	18306.2	-15802.1	-775.9	719.6	0.0	0.0	-2.0	2.1	-0.1	0.1
		(J)	-43601.2	-41368.8	16858.1	-14773.7	-775.9	719.6	0.0	0.0	-1.9	1.8	-0.1	0.1
	605	(I)	-43429.1	-41196.9	19369.6	-16373.2	-733.6	708.1	0.0	0.0	-2.2	2.3	-0.1	0.1
		(J)	-43429.1	-41196.9	18306.2	-15802.1	-733.6	708.1	0.0	0.0	-2.0	2.1	-0.1	0.1
	606	(I)	-43257.0	-41025.0	20024.1	-19371.1	-682.7	687.4	0.0	0.0	-2.3	2.5	0.0	0.1
		(J)	-43257.0	-41025.0	19369.6	-16373.2	-682.7	687.4	0.0	0.0	-2.2	2.3	0.0	0.1
	607	(I)	-43084.9	-40853.1	20256.9	-22214.0	-684.3	659.0	0.0	0.0	-2.3	2.5	0.0	0.0
		(J)	-43084.9	-40853.1	20024.1	-19371.1	-684.3	659.0	0.0	0.0	-2.3	2.5	0.0	0.0
	608	(I)	-42912.7	-40681.2	21708.2	-24684.5	-706.6	652.4	0.0	0.0	-2.2	2.3	0.0	0.0
		(J)	-42912.7	-40681.2	20256.9	-22214.0	-706.6	652.4	0.0	0.0	-2.3	2.5	0.0	0.0
	609	(I)	-42740.5	-40509.4	24096.2	-26780.8	-725.2	656.7	0.0	0.0	-2.0	2.0	-0.1	0.1
		(J)	-42740.5	-40509.4	21708.2	-24684.5	-725.2	656.7	0.0	0.0	-2.2	2.3	-0.1	0.1
	610	(I)	-42568.2	-40337.7	26273.8	-28509.2	-740.0	660.7	0.0	0.0	-1.8	1.8	-0.1	0.1
		(J)	-42568.2	-40337.7	24096.2	-26780.8	-740.0	660.7	0.0	0.0	-2.0	2.0	-0.1	0.1
	611	(I)	-42421.8	-40191.7	27649.8	-29513.9	-765.3	672.4	0.0	0.0	-1.7	1.6	-0.1	0.1
		(J)	-42421.8	-40191.7	26273.8	-28509.2	-765.3	672.4	0.0	0.0	-1.8	1.8	-0.1	0.1
	612	(I)	-37582.2	-35538.7	27284.3	-28680.9	-939.0	1065.3	0.0	0.0	-1.6	1.5	-0.1	0.1
		(J)	-37582.2	-35538.7	27649.8	-29513.9	-939.0	1065.3	0.0	0.0	-1.7	1.6	-0.1	0.1
	613	(I)	-33023.2	-31223.5	25490.2	-26302.8	-1446.0	1381.6	0.0	0.0	-1.5	1.4	-0.1	0.1
		(J)	-33023.2	-31223.5	27284.3	-28680.9	-1446.0	1381.6	0.0	0.0	-1.6	1.5	-0.1	0.1
	614	(I)	-28878.7	-27342.5	22455.6	-22692.8	-1718.2	1760.9	0.0	0.0	-1.4	1.3	-0.1	0.1
		(J)	-28878.7	-27342.5	25490.2	-26302.8	-1718.2	1760.9	0.0	0.0	-1.5	1.4	-0.1	0.1
	615	(I)	-25195.3	-23915.2	18532.2	-18275.4	-1925.1	2164.3	0.0	0.0	-1.2	1.2	-0.1	0.1
		(J)	-25195.3	-23915.2	22455.6	-22692.8	-1925.1	2164.3	0.0	0.0	-1.4	1.3	-0.1	0.1
	616	(I)	-22050.8	-21001.4	14960.5	-14425.6	-2174.6	2342.4	0.0	0.0	-1.0	1.0	-0.1	0.1
		(J)	-22050.8	-21001.4	18532.2	-18275.4	-2174.6	2342.4	0.0	0.0	-1.2	1.2	-0.1	0.1
	617	(I)	-17184.2	-16480.7	10615.8	-10527.7	-2279.0	2305.9	0.0	0.0	-0.8	0.8	-0.1	0.1
		(J)	-17184.2	-16480.7	14960.5	-14425.6	-2279.0	2305.9	0.0	0.0	-1.0	1.0	-0.1	0.1
	618	(I)	-12855.8	-12410.1	6125.7	-6276.0	-2225.6	2154.7	0.0	0.0	-0.6	0.6	-0.1	0.1
		(J)	-12855.8	-12410.1	10615.8	-10527.7	-2225.6	2154.7	0.0	0.0	-0.8	0.8	-0.1	0.1
	619	(I)	-8694.3	-8452.5	2322.7	-2452.0	-1887.4	1904.6	0.0	0.0	-0.4	0.4	-0.1	0.1
		(J)	-8694.3	-8452.5	6125.7	-6276.0	-1887.4	1904.6	0.0	0.0	-0.6	0.6	-0.1	0.1
	620	(I)	-4508.8	-4414.4	414.2	-419.9	-1139.3	1199.6	0.0	0.0	-0.2	0.2	-0.1	0.1
		(J)	-4508.8	-4414.4	2322.7	-2452.0	-1139.3	1199.6	0.0	0.0	-0.4	0.4	-0.1	0.1
	621	(I)	-166.2	-164.7	0.0	0.0	-82.9	84.1	0.0	0.0	0.0	0.0	0.0	0.0
		(J)	-166.2	-164.7	414.2	-419.9	-82.9	84.1	0.0	0.0	-0.2	0.2	0.0	0.0

■Superstructure Results (Trans.)

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	1	(I)	1.0	1.0	0.0	0.0	375.9	376.2	-1328.9	1260.1	-43.7	43.0	-6468.0	6183.4
		(J)	1.0	1.0	-1033.8	-1034.5	375.9	376.2	-1328.9	1260.1	-17041.4	17826.2	-6468.0	6183.4
	2	(I)	2.4	2.4	-1033.8	-1034.5	875.9	876.2	-1329.1	1260.2	-17041.4	17826.2	-6249.9	5987.4
		(J)	2.4	2.4	-3004.7	-3005.9	875.9	876.2	-1329.1	1260.2	-30513.0	31888.4	-6249.9	5987.4
	3	(I)	-3911.0	-3911.0	-3004.7	-3005.9	-570.1	-569.9	-1330.4	1261.4	-30513.0	31888.4	-6012.5	5754.4
		(J)	-3911.0	-3911.0	-1722.0	-1723.5	-570.1	-569.9	-1330.4	1261.4	-43468.6	45424.2	-6012.5	5754.4
	4	(I)	-3909.8	-3909.8	-1722.0	-1723.5	-120.3	-120.1	-1332.4	1263.0	-43468.6	45424.1	-5796.4	5558.4
		(J)	-3909.8	-3909.8	-1451.5	-1453.2	-120.3	-120.1	-1332.4	1263.0	-55983.1	58473.6	-5796.4	5558.4
	5	(I)	-3908.6	-3908.6	-1451.5	-1453.2	329.7	329.9	-1332.4	1263.0	-55983.1	58473.6	-5570.7	5353.0
		(J)	-3908.6	-3908.6	-2193.6	-2195.4	329.7	329.9	-1332.4	1263.0	-68035.1	71015.1	-5570.7	5353.0
	6	(I)	-3907.4	-3907.4	-2193.6	-2195.4	779.6	779.7	-1335.5	1265.6	-68035.0	71015.0	-5335.6	5166.9
		(J)	-3907.4	-3907.4	-3947.7	-3949.8	779.6	779.7	-1335.5	1265.6	-79603.7	83027.2	-5335.6	5166.9
	7	(I)	-7523.4	-7523.4	-3947.7	-3949.8	-616.0	-615.8	-1339.1	1268.6	-79603.7	83027.2	-5054.9	4938.1
		(J)	-7523.4	-7523.4	-2561.9	-2564.1	-616.0	-615.8	-1339.1	1268.6	-90559.5	94412.9	-5054.9	4938.1
	8	(I)	-7522.3	-7522.2	-2561.9	-2564.1	-166.0	-165.8	-1339.1	1268.6	-90559.5	94412.9	-4802.7	4743.1
		(J)	-7522.3	-7522.2	-2188.7	-2190.9	-166.0	-165.8	-1339.1	1268.6	-100992.0	105229.0	-4802.7	4743.1
	9	(I)	-7521.1	-7521.1	-2188.7	-2190.9	283.7	283.9	-1343.6	1272.3	-100992.0	105229.0	-4542.3	4541.0
		(J)	-7521.1	-7521.1	-2827.2	-2829.4	283.7	283.9	-1343.6	1272.3	-110884.0	115456.0	-4542.3	4541.0
	10	(I)	-7520.0	-7519.9	-2827.2	-2829.4	733.7	733.9	-1343.6	1272.3	-110884.0	115456.0	-4274.2	4332.9
		(J)	-7520.0	-7519.9	-4478.2	-4480.5	733.7	733.9	-1343.6	1272.3	-120463.0	125078.0	-4274.2	4332.9
	11	(I)	-10895.3	-10895.2	-4478.2	-4480.5	-645.4	-645.3	-1349.0	1276.8	-120463.0	125077.0	-3959.3	4075.5
		(J)	-10895.3	-10895.2	-3026.2	-3028.4	-645.4	-645.3	-1349.0	1276.8	-129633.0	133996.0	-3959.3	4075.5
	12	(I)	-10894.2	-10894.1	-3026.2	-3028.4	-195.9	-195.8	-1354.8	1281.6	-129633.0	133996.0	-3704.8	3858.5
		(J)	-10894.2	-10894.1	-2585.6	-2587.7	-195.9	-195.8	-1354.8	1281.6	-138312.0	142281.0	-3704.8	3858.5
	13	(I)	-10893.1	-10893.0	-2585.6	-2587.7	254.1	254.3	-1354.8	1281.6	-138312.0	142281.0	-3491.0	3638.0
		(J)	-10893.1	-10893.0	-3157.5	-3159.6	254.1	254.3	-1354.8	1281.6	-146477.0	149916.0	-3491.0	3638.0
	14	(I)	-10892.0	-10891.9	-3157.5	-3159.6	703.6	703.8	-1361.2	1287.0	-146477.0	149916.0	-3273.7	3414.6
		(J)	-10892.0	-10891.9	-4740.8	-4742.8	703.6	703.8	-1361.2	1287.0	-154118.0	156890.0	-3273.7	3414.6
	15	(I)	-14167.1	-14167.0	-4740.8	-4742.8	-751.8	-751.7	-1367.9	1292.6	-154118.0	156890.0	-3024.7	3145.1
		(J)	-14167.1	-14167.0	-3049.4	-3051.3	-751.8	-751.7	-1367.9	1292.6	-161133.0	163101.0	-3024.7	3145.1
	16	(I)	-14166.1	-14165.9	-3049.4	-3051.3	-301.8	-301.7	-1367.9	1292.6	-161133.0	163101.0	-2807.1	2917.8
		(J)	-14166.1	-14165.9	-2370.6	-2372.3	-301.8	-301.7	-1367.9	1292.6	-167619.0	168632.0	-2807.1	2917.8
	17	(I)	-14165.0	-14164.9	-2370.6	-2372.3	147.5	147.7	-1375.1	1298.7	-167619.0	168632.0	-2591.0	2689.1
		(J)	-14165.0	-14164.9	-2702.8	-2704.4	147.5	147.7	-1375.1	1298.7	-173557.0	173493.0	-2591.0	2689.1
	18	(I)	-14164.0	-14163.9	-2702.8	-2704.4	597.5	597.7	-1375.1	1298.7	-173557.0	173493.0	-2377.1	2460.1
		(J)	-14164.0	-14163.9	-4047.6	-4049.0	597.5	597.7	-1375.1	1298.7	-178967.0	177670.0	-2377.1	2460.1
	19	(I)	-17570.6	-17570.5	-4047.6	-4049.0	-1110.1	-1109.9	-1382.7	1305.1	-178967.0	177670.0	-2139.1	2189.1
		(J)	-17570.6	-17570.5	-1550.2	-1551.5	-1110.1	-1109.9	-1382.7	1305.1	-183723.0	181069.0	-2139.1	2189.1
	20	(I)	-17569.6	-17569.5	-1550.2	-1551.5	-660.9	-660.7	-1390.4	1311.7	-183723.0	181069.0	-1930.4	1967.5
		(J)	-17569.6	-17569.5	-63.5	-64.7	-660.9	-660.7	-1390.4	1311.7	-187945.0	183779.0	-1930.4	1967.5
	21	(I)	-17568.6	-17568.5	-63.5	-64.7	-211.6	-211.4	-1398.2	1318.4	-187945.0	183779.0	-2017.7	1906.6
		(J)	-17568.6	-17568.5	412.5	411.3	-211.6	-211.4	-1398.2	1318.4	-191615.0	185824.0	-2017.7	1906.6
	22	(I)	-17567.6	-17567.5	412.5	411.3	238.4	238.6	-1398.2	1318.4	-191615.0	185824.0	-2217.1	2022.3
		(J)	-17567.6	-17567.5	-124.1	-125.3	238.4	238.6	-1398.2	1318.4	-194754.0	187196.0	-2217.1	2022.3
	23	(I)	-19545.7	-19545.6	-124.1	-125.3	-680.3	-680.1	-1398.2	1318.4	-194754.0	187196.0	-2444.6	2172.0
		(J)	-19545.7	-19545.6	1406.4	1405.1	-680.3	-680.1	-1398.2	1318.4	-197272.0	187907.0	-2444.6	2172.0
	24	(I)	-19544.7	-19544.6	1406.4	1405.1	-232.0	-231.8	-1414.1	1332.2	-197272.0	187907.0	-2648.5	2310.9
		(J)	-19544.7	-19544.6	1928.2	1926.8	-232.0	-231.8	-1414.1	1332.2	-199266.0	189756.0	-2648.5	2310.9
	25	(I)	-19543.8	-19543.6	1928.2	1926.8	218.9	219.0	-1406.2	1325.3	-199266.0	189756.0	-2848.7	2452.4
		(J)	-19543.8	-19543.6	1435.6	1434.1	218.9	219.0	-1406.2	1325.3	-200720.0	191076.0	-2848.7	2452.4
	26	(I)	-19542.9	-19542.7	1435.6	1434.1	667.1	667.3	-1421.9	1339.2	-200720.0	191076.0	-3044.3	2604.0
		(J)	-19542.9	-19542.7	-65.5	-67.1	667.1	667.3	-1421.9	1339.2	-201668.0	191899.0	-3044.3	2604.0
	27	(I)	-21638.2	-21638.1	-65.5	-67.1	-518.5	-518.4	-1421.9	1339.2	-201668.0	191899.0	-3254.2	2842.4
		(J)	-21638.2	-21638.1	1101.0	1099.3	-518.5	-518.4	-1421.9	1339.2	-202021.0	192163.0	-3254.2	2842.4
	28	(I)	-21637.3	-21637.2	1101.0	1099.3	-69.5	-69.3	-1429.7	1346.1	-202021.0	192163.0	-3438.5	3118.8
		(J)	-21637.3	-21637.2	1257.1	1255.4	-69.5	-69.3	-1429.7	1346.1	-201884.0	191946.0	-3438.5	3118.8
	29	(I)	-21636.4	-21636.3	1257.1	1255.4	380.5	380.7	-1429.7	1346.1	-201884.0	191946.0	-3616.5	3388.3
		(J)	-21636.4	-21636.3	400.7	399.0	380.5	380.7	-1429.7	1346.1	-201255.0	191249.0	-3616.5	3388.3
	30	(I)	-21635.6	-21635.5	400.7	399.0	828.6	828.8	-1444.7	1359.7	-201255.0	191249.0	-3787.7	3650.6
		(J)	-21635.6	-21635.5	-1463.8	-1465.6	828.6	828.8	-1444.7	1359.7	-200148.0	190081.0	-3787.7	3650.6
	31	(I)	-23699.0	-23698.9	-1463.8	-1465.6	-584.3	-584.2	-1437.3	1353.0	-200148.0	190081.0	-4002.8	3935.1
		(J)	-23699.0	-23698.9	-149.1	-151.0	-584.3	-584.2	-1437.3	1353.0	-198536.0	188435.0	-4002.8	3935.1
	32	(I)	-23698.1	-23698.0	-149.1	-151.0	-136.4	-136.3	-1451.6	1366.1	-198536.0	188435.0	-4264.6	4181.0
		(J)	-23698.1	-23698.0	157.8	155.9	-136.4	-136.3	-1451.6	1366.1	-196494.0	186350.0	-4264.6	4181.0
	33	(I)	-23697.3	-23697.2	157.8	155.9	313.6	313.7	-1451.6	1366.1	-196494.0	186350.0	-4519.6	4418.1
		(J)	-23697.3	-23697.2	-547.8	-549.8	313.6	313.7	-1451.6	1366.1	-194049.0	183843.0	-4519.6	4418.1
	34	(I)	-23696.5	-23696.3	-547.8	-549.8	763.6	763.7	-1451.6	1366.1	-194049.0	183843.0	-4766.2	4646.6
		(J)	-23696.5	-23696.3	-2266.0	-2267.9	763.6	763.7	-1451.6	1366.1	-191235.0	180934.0	-4766.2	4646.6
	35	(I)	-25606.0	-25605.8	-2266.0	-2267.9	-868.3	-868.2	-1464.5	1378.3	-191235.0	180934.0	-5033.2	4890.9
		(J)	-25606.0	-25605.8	-312.4	-314.2	-868.3	-868.2	-1464.5	1378.3	-188047.0	177611.0	-5033.2	4890.9
	36	(I)	-25605.2	-25605.1	-312.4	-314.2	-417.2	-417.1	-1458.4	1372.4	-188047.0	177611.0	-5261.2	5100.5
		(J)	-25605.2	-25605.1	626.1	624.4	-417.2	-417.1	-1458.4	1372.4	-184587.0	173926.0	-5261.2	5100.5
	37	(I)	-25604.4	-25604.2	626.1	624.4	30.5	30.7	-1470.1	1383.8	-184587.0	173926.0	-5479.7	5300.4
		(J)	-25604.4	-25604.2	557.2	555.6	30.5	30.7	-1470.1	1383.8	-180935.0	169903.0	-5479.7	5300.4
	38	(I)	-25603.6	-25603.5	557.2	555.6	480.5	480.7	-1470.1	1383.8	-180935.0	169903.0	-5687.4	5490.5
		(J)	-25603.6	-25603.5	-524.2	-525.6	480.5	480.7	-1470.1	1383.8	-177167.0	165570.0	-5687.4	5490.5
	39	(I)	-27207.6	-27207.4	-524.2	-525.6	-1326.5	-1326.3	-1475.4	1389.0	-177167.0	165570.0	-5908.5	5691.8
		(J)	-27207.6	-27207.4	2460.1	2458.8	-1326.5	-1326.3	-1475.4	1389.0	-173330.0	160934.0	-5908.5	5691.8
	40	(I)	-27206.9	-27206.7	2460.1	2458.8	-876.5	-876.3	-1475.4	1389.0	-173330.0	160934.0	-6095.1	5862.2
		(J)	-27206.9	-27206.7	4432.0	4430.7	-876.5	-876.3	-1475.4	1389.0	-169564.0	156078.0	-6095.1	5862.2

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	41	(I)	-27206.1	-27205.9	4432.0	4430.7	-427.7	-427.5	-1480.0	1393.7	-169564.0	156078.0	-6270.3	6022.2
		(J)	-27206.1	-27205.9	5394.1	5392.9	-427.7	-427.5	-1480.0	1393.7	-165941.0	164834.0	-6270.3	6022.2
	42	(I)	-27205.3	-27205.2	5394.1	5392.9	21.1	21.2	-1484.3	1398.1	-165941.0	164834.0	-6435.1	6171.9
		(J)	-27205.3	-27205.2	5346.4	5345.3	21.1	21.2	-1484.3	1398.1	-162584.0	176196.0	-6435.1	6171.9
	43	(I)	-27204.6	-27204.4	5346.4	5345.3	471.1	471.3	-1484.3	1398.1	-162584.0	176196.0	-6589.3	6311.2
		(J)	-27204.6	-27204.4	4286.2	4285.2	471.1	471.3	-1484.3	1398.1	-169240.0	187812.0	-6589.3	6311.2
	44	(I)	-27203.9	-27203.8	4286.2	4285.2	919.9	920.0	-1487.8	1401.9	-169240.0	187812.0	-6732.5	6439.7
		(J)	-27203.9	-27203.8	2216.2	2215.2	919.9	920.0	-1487.8	1401.9	-176650.0	199622.0	-6732.5	6439.7
	45	(I)	-27203.3	-27203.1	2216.2	2215.2	1368.7	1368.9	-1491.0	1405.3	-176650.0	199622.0	-6866.0	6557.6
		(J)	-27203.3	-27203.1	-863.5	-864.5	1368.7	1368.9	-1491.0	1405.3	-184686.0	211597.0	-6866.0	6557.6
	46	(I)	-27202.6	-27202.4	-863.5	-864.5	1818.7	1818.9	-1491.0	1405.3	-184686.0	211597.0	-6989.6	6665.4
		(J)	-27202.6	-27202.4	-4955.7	-4956.8	1818.7	1818.9	-1491.0	1405.3	-193307.0	223705.0	-6989.6	6665.4
	47	(I)	-27202.1	-27201.9	-4955.7	-4956.8	2225.9	2226.2	-1493.0	1407.8	-193307.0	223705.0	-7092.6	6753.9
		(J)	-27202.1	-27201.9	-9036.6	-9038.0	2225.9	2226.2	-1493.0	1407.8	-200788.0	233646.0	-7092.6	6753.9
	48	(I)	-27201.6	-27201.4	-9036.6	-9038.0	2592.6	2592.8	-1493.0	1407.8	-200788.0	233646.0	-7178.6	6826.7
		(J)	-27201.6	-27201.4	-13789.9	-13791.6	2592.6	2592.8	-1493.0	1407.8	-208732.0	243650.0	-7178.6	6826.7
	49	(I)	-27201.2	-27201.0	-13789.9	-13791.6	2957.8	2958.0	-1495.2	1410.5	-208732.0	243650.0	-7259.6	6893.1
		(J)	-27201.2	-27201.0	-19212.4	-19214.6	2957.8	2958.0	-1495.2	1410.5	-217148.0	253702.0	-7259.6	6893.1
	50	(I)	-27200.4	-27200.3	-19212.4	-19214.6	3283.3	3283.6	-1492.5	1406.9	-217148.0	253702.0	-7325.8	6946.1
		(J)	-27200.4	-27200.3	-23809.1	-23811.6	3283.3	3283.6	-1492.5	1406.9	-223840.0	261417.0	-7325.8	6946.1
	51	(I)	-27205.3	-27205.1	-23809.1	-23811.6	3392.5	3392.8	-1534.3	1468.0	-223840.0	261417.0	-7354.8	6968.8
		(J)	-27205.3	-27205.1	-24148.4	-24150.9	3392.5	3392.8	-1534.3	1468.0	-224323.0	261969.0	-7354.8	6968.8
	52	(I)	-28201.2	-28201.0	-28350.1	-28351.9	-3558.0	-3557.8	-539.5	482.3	-224323.0	261969.0	-5653.3	5776.2
		(J)	-28201.2	-28201.0	-27994.3	-27996.1	-3558.0	-3557.8	-539.5	482.3	-223846.0	261394.0	-5653.3	5776.2
	53	(I)	-28206.3	-28206.0	-27994.3	-27996.1	-3365.7	-3365.5	-194.3	175.9	-223846.0	261394.0	-5643.5	5771.2
		(J)	-28206.3	-28206.0	-23282.5	-23284.2	-3365.7	-3365.5	-194.3	175.9	-217181.0	253354.0	-5643.5	5771.2
	54	(I)	-28205.4	-28205.2	-23282.5	-23284.2	-3046.2	-3046.0	-214.3	202.8	-217181.0	253354.0	-5622.8	5761.9
		(J)	-28205.4	-28205.2	-17698.2	-17699.6	-3046.2	-3046.0	-214.3	202.8	-208468.0	242859.0	-5622.8	5761.9
	55	(I)	-28204.9	-28204.7	-17698.2	-17699.6	-2679.5	-2679.4	-214.3	202.8	-208468.0	242859.0	-5599.3	5752.9
		(J)	-28204.9	-28204.7	-12785.8	-12787.1	-2679.5	-2679.4	-214.3	202.8	-199766.0	232402.0	-5599.3	5752.9
	56	(I)	-28204.3	-28204.0	-12785.8	-12787.1	-2314.4	-2314.2	-221.8	212.7	-199766.0	232402.0	-5575.2	5745.2
		(J)	-28204.3	-28204.0	-8543.0	-8544.2	-2314.4	-2314.2	-221.8	212.7	-191069.0	221966.0	-5575.2	5745.2
	57	(I)	-28203.7	-28203.5	-8543.0	-8544.2	-1906.6	-1906.5	-224.4	216.2	-191069.0	221966.0	-5547.8	5737.4
		(J)	-28203.7	-28203.5	-4253.3	-4254.4	-1906.6	-1906.5	-224.4	216.2	-180397.0	209216.0	-5547.8	5737.4
	58	(I)	-28203.1	-28202.9	-4253.3	-4254.4	-1456.6	-1456.5	-224.4	216.2	-180397.0	209216.0	-5515.6	5729.2
		(J)	-28203.1	-28202.9	-976.1	-977.1	-1456.6	-1456.5	-224.4	216.2	-169716.0	196514.0	-5515.6	5729.2
	59	(I)	-28202.5	-28202.3	-976.1	-977.1	-1007.9	-1007.8	-229.5	223.1	-169716.0	196514.0	-5480.8	5720.6
		(J)	-28202.5	-28202.3	1291.4	1290.5	-1007.9	-1007.8	-229.5	223.1	-159024.0	183861.0	-5480.8	5720.6
	60	(I)	-28201.9	-28201.7	1291.4	1290.5	-559.1	-559.0	-234.2	229.5	-159024.0	183861.0	-5443.4	5710.9
		(J)	-28201.9	-28201.7	2549.3	2548.4	-559.1	-559.0	-234.2	229.5	-148325.0	171261.0	-5443.4	5710.9
	61	(I)	-28201.4	-28201.1	2549.3	2548.4	-109.1	-109.0	-234.2	229.5	-148325.0	171261.0	-5402.6	5699.4
		(J)	-28201.4	-28201.1	2794.8	2793.7	-109.1	-109.0	-234.2	229.5	-137605.0	158711.0	-5402.6	5699.4
	62	(I)	-28200.9	-28200.6	2794.8	2793.7	339.6	339.7	-238.1	235.0	-137605.0	158711.0	-5357.8	5685.8
		(J)	-28200.9	-28200.6	2030.5	2029.4	339.6	339.7	-238.1	235.0	-126921.0	146212.0	-5357.8	5685.8
	63	(I)	-28200.4	-28200.1	2030.5	2029.4	788.4	788.5	-241.7	240.2	-126921.0	146212.0	-5308.9	5669.3
		(J)	-28200.4	-28200.1	256.6	255.3	788.4	788.5	-241.7	240.2	-118991.0	133761.0	-5308.9	5669.3
	64	(I)	-28199.9	-28199.6	256.6	255.3	1238.4	1238.5	-241.7	240.2	-118991.0	133761.0	-5255.4	5649.7
		(J)	-28199.9	-28199.6	-2529.9	-2531.2	1238.4	1238.5	-241.7	240.2	-111070.0	121349.0	-5255.4	5649.7
	65	(I)	-26594.9	-26594.7	-2529.9	-2531.2	-577.3	-577.2	-244.5	244.5	-111070.0	121349.0	-5196.8	5629.3
		(J)	-26594.9	-26594.7	-1230.9	-1232.4	-577.3	-577.2	-244.5	244.5	-103161.0	108960.0	-5196.8	5629.3
	66	(I)	-26594.4	-26594.2	-1230.9	-1232.4	-127.3	-127.3	-244.5	244.5	-103161.0	108960.0	-5133.5	5602.7
		(J)	-26594.4	-26594.2	-944.5	-946.0	-127.3	-127.3	-244.5	244.5	-95255.2	97045.7	-5133.5	5602.7
	67	(I)	-26594.0	-26593.8	-944.5	-946.0	320.3	320.4	-248.6	251.6	-95255.2	97045.7	-5065.5	5572.2
		(J)	-26594.0	-26593.8	-1665.2	-1666.8	320.3	320.4	-248.6	251.6	-88064.5	90893.9	-5065.5	5572.2
	68	(I)	-26593.5	-26593.3	-1665.2	-1666.8	771.5	771.6	-246.9	248.5	-88064.5	90893.9	-4992.2	5538.6
		(J)	-26593.5	-26593.3	-3401.2	-3402.8	771.5	771.6	-246.9	248.5	-82942.7	84798.1	-4992.2	5538.6
	69	(I)	-24683.2	-24683.0	-3401.2	-3402.8	-866.5	-866.4	-249.5	253.9	-82942.7	84798.1	-4911.3	5504.1
		(J)	-24683.2	-24683.0	-1451.6	-1453.2	-866.5	-866.4	-249.5	253.9	-77666.9	78737.4	-4911.3	5504.1
	70	(I)	-24682.7	-24682.5	-1451.6	-1453.2	-416.5	-416.4	-249.5	253.9	-77666.9	78737.4	-4848.7	5465.7
		(J)	-24682.7	-24682.5	-514.6	-516.2	-416.5	-416.4	-249.5	253.9	-72257.4	72705.4	-4848.7	5465.7
	71	(I)	-24682.3	-24682.1	-514.6	-516.2	33.5	33.6	-249.5	253.9	-72257.4	72705.4	-4830.8	5426.6
		(J)	-24682.3	-24682.1	-590.1	-591.6	33.5	33.6	-249.5	253.9	-71893.1	76562.3	-4830.8	5426.6
	72	(I)	-24681.9	-24681.8	-590.1	-591.6	481.3	481.4	-250.1	256.9	-71893.1	76562.3	-4808.4	5386.9
		(J)	-24681.9	-24681.8	-1673.2	-1674.6	481.3	481.4	-250.1	256.9	-76256.9	84745.6	-4808.4	5386.9
	73	(I)	-22615.7	-22615.5	-1673.2	-1674.6	-938.0	-937.9	-250.1	255.8	-76256.9	84745.6	-4779.0	5347.8
		(J)	-22615.7	-22615.5	437.1	435.8	-938.0	-937.9	-250.1	255.8	-81673.4	92656.0	-4779.0	5347.8
	74	(I)	-22615.2	-22615.0	437.1	435.8	-490.0	-489.9	-249.5	257.2	-81673.4	92656.0	-4744.0	5304.0
		(J)	-22615.2	-22615.0	1539.4	1538.2	-490.0	-489.9	-249.5	257.2	-89106.2	100288.0	-4744.0	5304.0
	75	(I)	-22614.9	-22614.7	1539.4	1538.2	-40.0	-39.9	-249.5	257.2	-89106.2	100288.0	-4701.6	5255.7
		(J)	-22614.9	-22614.7	1629.2	1628.1	-40.0	-39.9	-249.5	257.2	-96318.1	107645.0	-4701.6	5255.7
	76	(I)	-22614.5	-22614.3	1629.2	1628.1	409.0	409.1	-248.5	257.2	-96318.1	107645.0	-4651.8	5201.7
		(J)	-22614.5	-22614.3	708.8	707.8	409.0	409.1	-248.5	257.2	-103285.0	114706.0	-4651.8	5201.7
	77	(I)	-20522.8	-20522.7	708.8	707.8	-776.3	-776.2	-248.5	257.2	-103285.0	114706.0	-4589.7	5140.7
		(J)	-20522.8	-20522.7	2455.4	2454.5	-776.3	-776.2	-248.5	257.2	-109960.0	121453.0	-4589.7	5140.7
	78	(I)	-20522.5	-20522.3	2455.4	2454.5	-328.2	-328.1	-245.5	255.6	-109960.0	121453.0	-4523.4	5073.4
		(J)	-20522.5	-20522.3	3193.6	3192.8	-328.2	-328.1	-245.5	255.6	-116359.0	127898.0	-4523.4	5073.4
	79	(I)	-20522.2	-20522.0	3193.6	3192.8	122.7	122.8	-247.3	256.8	-116359.0	127898.0	-4448.6	4998.5
		(J)	-20522.2	-20522.0	2917.2	2916.6	122.7	122.8	-247.3	256.8	-122475.0	134043.0	-4448.6	4998.5
	80	(I)	-20521.9	-20521.7	2917.2	2916.6	570.9	571.0	-243.2	253.6	-122475.0	134043.0	-4365.1	4915.6
		(J)	-20521.9	-20521.7	1632.5	1631.9	570.9	571.0	-243.2	253.6	-128304.0	139887.0	-4365.1	4915.6
	81	(I)	-18543.8	-18543.7	1632.5	1631.9	-349.6	-349.5	-243.2	253.6	-128304.0	139887.0	-4264.5	4819.2
		(J)	-18543.8	-18543.7	2418.9	2418.3	-349.6	-349.5	-243.2	253.6	-133793.0	145405.0	-4264.5	4819.2
	82	(I)	-18543.6	-18543.4	2418.9	2418.3	100.4	100.5	-243.2	253.6	-133793.0	145405.0	-4164.0	4719.4
		(J)	-18543.6	-18543.4	2192.9	2192.1	100.4	100.5	-243.2	253.6	-138984.0	150631.0	-4164.0	4719.4
	83	(I)	-18543.3	-18543.1	2192.9	2192.1	549.6	549.7	-240.4	251.0	-138984.0	150631.0	-4054.7	4610.6
		(J)	-18543.3	-18543.1	956.2	955.4	549.6	549.7	-240.4	251.0	-143875.0	155578.0	-4054.7	4610.6
	84	(I)	-18543.1	-18542.9	956.2	955.4	998.8	998.9	-237.4	248.1	-143875.0	155578.0	-3937.0	4493.3
		(J)	-18543.1	-18542.9	-1291.1	-1292.1	998.8	998.9	-237.4	248.1	-148462.0	160272.0	-3937.0	4493.3
	85	(I)	-15141.3	-15141.1	-1291.1	-1292.1	-708.8	708.7	-234.1	244.8	-148462.0	160272.0	-3794.2	4355.4

	Elem. No.		Axial		Bending M Y		Shear Z		Torsion M		Bending M Z		Shear Y	
			(kN)		(kN・m)		(kN)		(kN・m)		(kN・m)		(kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
		(J)	-15141.3	-15141.1	303.8	302.6	-708.8	-708.7	-234.1	244.8	-152683.0	164710.0	-3794.2	4355.4
	86	(I)	-15141.1	-15140.9	303.8	302.6	-258.8	-258.7	-234.1	244.8	-152683.0	164710.0	-3660.4	4219.7
		(J)	-15141.1	-15140.9	886.1	884.8	-258.8	-258.7	-234.1	244.8	-156615.0	168964.0	-3660.4	4219.7
	87	(I)	-15140.9	-15140.7	886.1	884.8	190.5	190.6	-230.4	240.9	-156615.0	168964.0	-3518.7	4075.3
		(J)	-15140.9	-15140.7	457.4	456.0	190.5	190.6	-230.4	240.9	-160256.0	173056.0	-3518.7	4075.3
	88	(I)	-15140.7	-15140.5	457.4	456.0	640.5	640.6	-230.4	240.9	-160256.0	173056.0	-3370.0	3921.8
		(J)	-15140.7	-15140.5	-983.7	-985.3	640.5	640.6	-230.4	240.9	-163624.0	177006.0	-3370.0	3921.8
	89	(I)	-11864.4	-11864.2	-983.7	-985.3	-818.2	-818.2	-226.2	236.4	-163624.0	177006.0	-3190.5	3740.1
		(J)	-11864.4	-11864.2	857.2	855.6	-818.2	-818.2	-226.2	236.4	-166675.0	180807.0	-3190.5	3740.1
	90	(I)	-11864.2	-11864.0	857.2	855.6	-368.7	-368.7	-221.9	231.7	-166675.0	180807.0	-3027.9	3569.2
		(J)	-11864.2	-11864.0	1686.9	1685.2	-368.7	-368.7	-221.9	231.7	-169496.0	184557.0	-3027.9	3569.2
	91	(I)	-11864.0	-11863.9	1686.9	1685.2	81.3	81.3	-221.9	231.7	-169496.0	184557.0	-2859.2	3389.9
		(J)	-11864.0	-11863.9	1504.0	1502.3	81.3	81.3	-221.9	231.7	-173946.0	188352.0	-2859.2	3389.9
	92	(I)	-11863.9	-11863.7	1504.0	1502.3	530.7	530.8	-217.2	226.4	-173946.0	188352.0	-2684.3	3202.6
		(J)	-11863.9	-11863.7	309.8	308.1	530.7	530.8	-217.2	226.4	-181154.0	192297.0	-2684.3	3202.6
	93	(I)	-8499.9	-8499.7	309.8	308.1	-844.3	-844.2	-212.4	220.9	-181154.0	192297.0	-2474.1	2980.9
		(J)	-8499.9	-8499.7	2209.4	2207.7	-844.3	-844.2	-212.4	220.9	-187862.0	196338.0	-2474.1	2980.9
	94	(I)	-8499.8	-8499.6	2209.4	2207.7	-394.3	-394.2	-212.4	220.9	-187862.0	196338.0	-2287.4	2779.4
		(J)	-8499.8	-8499.6	3096.5	3094.8	-394.3	-394.2	-212.4	220.9	-194123.0	200373.0	-2287.4	2779.4
	95	(I)	-8499.7	-8499.5	3096.5	3094.8	55.3	55.4	-207.2	215.0	-194123.0	200373.0	-2125.4	2572.0
		(J)	-8499.7	-8499.5	2971.9	2970.2	55.3	55.4	-207.2	215.0	-199922.0	204250.0	-2125.4	2572.0
	96	(I)	-8499.6	-8499.4	2971.9	2970.2	505.3	505.4	-207.2	215.0	-199922.0	204250.0	-1987.7	2359.8
		(J)	-8499.6	-8499.4	1834.7	1833.2	505.3	505.4	-207.2	215.0	-205246.0	207878.0	-1987.7	2359.8
	97	(I)	-4897.1	-4896.9	1834.7	1833.2	-885.2	-885.1	-201.8	208.7	-205246.0	207878.0	-1813.8	2112.1
		(J)	-4897.1	-4896.9	3826.2	3824.9	-885.2	-885.1	-201.8	208.7	-210003.0	211124.0	-1813.8	2112.1
	98	(I)	-4897.0	-4896.8	3826.2	3824.9	-435.4	-435.3	-196.2	202.3	-210003.0	211124.0	-1661.3	1895.2
		(J)	-4897.0	-4896.8	4805.7	4804.5	-435.4	-435.3	-196.2	202.3	-214261.0	214013.0	-1661.3	1895.2
	99	(I)	-4896.9	-4896.8	4805.7	4804.5	14.6	14.7	-196.2	202.3	-214261.0	214013.0	-1502.1	1677.2
		(J)	-4896.9	-4896.8	4772.7	4771.7	14.6	14.7	-196.2	202.3	-218010.0	216517.0	-1502.1	1677.2
	100	(I)	-4896.9	-4896.7	4772.7	4771.7	464.4	464.5	-190.5	195.6	-218010.0	216517.0	-1337.0	1458.7
		(J)	-4896.9	-4896.7	3727.7	3726.8	464.4	464.5	-190.5	195.6	-221239.0	218611.0	-1337.0	1458.7
	101	(I)	-1000.8	-1000.6	3727.7	3726.8	-975.1	-974.9	-185.0	188.8	-221239.0	218611.0	-1131.6	1205.3
		(J)	-1000.8	-1000.6	5921.4	5920.6	-975.1	-974.9	-185.0	188.8	-223859.0	220204.0	-1131.6	1205.3
	102	(I)	-1000.7	-1000.6	5921.4	5920.6	-694.1	-694.0	-184.4	183.5	-223859.0	220204.0	-1022.4	1069.5
		(J)	-1000.7	-1000.6	6310.1	6309.3	-694.1	-694.0	-184.4	183.5	-224430.0	220536.0	-1022.4	1069.5
	103	(I)	-1000.7	-1000.6	6310.1	6309.3	-469.0	-468.9	-186.7	191.1	-224430.0	220536.0	-960.7	962.1
		(J)	-1000.7	-1000.6	7102.6	7101.9	-469.0	-468.9	-186.7	191.1	-225953.0	221373.0	-960.7	962.1
	104	(I)	-1000.7	-1000.6	7102.6	7101.9	-150.1	-150.0	-184.3	183.4	-225953.0	221373.0	-926.1	860.9
		(J)	-1000.7	-1000.6	7327.6	7327.0	-150.1	-150.0	-184.3	183.4	-227050.0	221896.0	-926.1	860.9
	105	(I)	-1000.7	-1000.6	7327.6	7327.0	149.9	150.0	-184.3	183.4	-227050.0	221896.0	-898.3	898.0
		(J)	-1000.7	-1000.6	7102.7	7102.1	149.9	150.0	-184.3	183.4	-227916.0	222222.0	-898.3	898.0
	106	(I)	-1000.7	-1000.6	7102.7	7102.1	468.8	469.0	-183.4	177.2	-227916.0	222222.0	-875.6	936.0
		(J)	-1000.7	-1000.6	6310.3	6309.6	468.8	469.0	-183.4	177.2	-228607.0	222352.0	-875.6	936.0
	107	(I)	-1000.7	-1000.6	6310.3	6309.6	693.9	694.0	-184.4	183.5	-228607.0	222352.0	-864.5	961.8
		(J)	-1000.7	-1000.6	5921.7	5921.0	693.9	694.0	-184.4	183.5	-228767.0	222337.0	-864.5	961.8
	108	(I)	-1000.8	-1000.6	5921.7	5921.0	974.9	975.0	-183.6	178.8	-228767.0	222337.0	-903.7	1006.8
		(J)	-1000.8	-1000.6	3728.2	3727.4	974.9	975.0	-183.6	178.8	-229087.0	221981.0	-903.7	1006.8
	109	(I)	-4896.8	-4896.7	3728.2	3727.4	-464.5	-464.4	-182.9	174.1	-229087.0	221981.0	-1076.1	1119.5
		(J)	-4896.8	-4896.7	4773.3	4772.4	-464.5	-464.4	-182.9	174.1	-228778.0	221106.0	-1076.1	1119.5
	110	(I)	-4896.8	-4896.7	4773.3	4772.4	-14.7	-14.6	-182.1	171.0	-228778.0	221106.0	-1217.8	1226.5
		(J)	-4896.8	-4896.7	4806.5	4805.4	-14.7	-14.6	-182.1	171.0	-227946.0	219762.0	-1217.8	1226.5
	111	(I)	-4896.9	-4896.8	4806.5	4805.4	435.3	435.4	-182.1	171.0	-227946.0	219762.0	-1356.5	1330.6
		(J)	-4896.9	-4896.8	3827.1	3825.8	435.3	435.4	-182.1	171.0	-226583.0	217952.0	-1356.5	1330.6
	112	(I)	-4897.0	-4896.9	3827.1	3825.8	885.0	885.1	-181.4	175.5	-226583.0	217952.0	-1491.6	1429.8
		(J)	-4897.0	-4896.9	1835.7	1834.3	885.0	885.1	-181.4	175.5	-224693.0	215696.0	-1491.6	1429.8
	113	(I)	-8499.4	-8499.3	1835.7	1834.3	-505.4	-505.4	-180.7	179.8	-224693.0	215696.0	-1647.2	1528.7
		(J)	-8499.4	-8499.3	2972.9	2971.4	-505.4	-505.4	-180.7	179.8	-222195.0	212912.0	-1647.2	1528.7
	114	(I)	-8499.5	-8499.4	2972.9	2971.4	-55.4	-55.4	-180.7	179.8	-222195.0	212912.0	-1773.8	1616.2
		(J)	-8499.5	-8499.4	3097.6	3096.0	-55.4	-55.4	-180.7	179.8	-219186.0	209676.0	-1773.8	1616.2
	115	(I)	-8499.7	-8499.5	3097.6	3096.0	394.2	394.3	-180.0	184.1	-219186.0	209676.0	-1929.3	1798.7
		(J)	-8499.7	-8499.5	2210.6	2209.0	394.2	394.3	-180.0	184.1	-215676.0	206006.0	-1929.3	1798.7
	116	(I)	-8499.8	-8499.6	2210.6	2209.0	844.2	844.3	-180.0	184.1	-215676.0	206006.0	-2159.9	1999.9
		(J)	-8499.8	-8499.6	311.1	309.4	844.2	844.3	-180.0	184.1	-211675.0	201903.0	-2159.9	1999.9
	117	(I)	-11863.7	-11863.6	311.1	309.4	-530.8	-530.7	-181.2	188.3	-211675.0	201903.0	-2418.0	2228.7
		(J)	-11863.7	-11863.6	1505.3	1503.6	-530.8	-530.7	-181.2	188.3	-207110.0	197311.0	-2418.0	2228.7
	118	(I)	-11863.8	-11863.7	1505.3	1503.6	-81.3	-81.3	-184.5	192.4	-207110.0	197311.0	-2639.6	2421.2
		(J)	-11863.8	-11863.7	1688.2	1686.5	-81.3	-81.3	-184.5	192.4	-202077.0	192307.0	-2639.6	2421.2
	119	(I)	-11864.0	-11863.9	1688.2	1686.5	368.7	368.7	-184.5	192.4	-202077.0	192307.0	-2856.2	2609.3
		(J)	-11864.0	-11863.9	858.6	856.9	368.7	368.7	-184.5	192.4	-196598.0	186905.0	-2856.2	2609.3
	120	(I)	-11864.2	-11864.1	858.6	856.9	818.2	818.2	-188.0	196.3	-196598.0	186905.0	-3067.5	2793.3
		(J)	-11864.2	-11864.1	-982.4	-983.9	818.2	818.2	-188.0	196.3	-190676.0	181111.0	-3067.5	2793.3
	121	(I)	-15140.5	-15140.3	-982.4	-983.9	-640.6	-640.5	-192.7	200.2	-190676.0	181111.0	-3300.4	3000.9
		(J)	-15140.5	-15140.3	458.8	457.3	-640.6	-640.5	-192.7	200.2	-184253.0	174888.0	-3300.4	3000.9
	122	(I)	-15140.7	-15140.5	458.8	457.3	-190.6	-190.5	-192.7	200.2	-184253.0	174888.0	-3502.2	3177.5
		(J)	-15140.7	-15140.5	887.4	886.1	-190.6	-190.5	-192.7	200.2	-177395.0	168307.0	-3502.2	3177.5
	123	(I)	-15140.9	-15140.8	887.4	886.1	258.8	258.8	-196.9	203.9	-177395.0	168307.0	-3699.2	3350.0
		(J)	-15140.9	-15140.8	305.0	303.8	258.8	258.8	-196.9	203.9	-170113.0	161373.0	-3699.2	3350.0
	124	(I)	-15141.1	-15141.0	305.0	303.8	708.8	708.8	-196.9	203.9	-170113.0	161373.0	-3892.0	3517.5
		(J)	-15141.1	-15141.0	-1289.9	-1290.9	708.8	708.8	-196.9	203.9	-162395.0	154108.0	-3892.0	3517.5
	125	(I)	-18542.8	-18542.7	-1289.9	-1290.9	-998.9	-998.8	-200.7	207.5	-162395.0	154108.0	-4101.5	3702.2
		(J)	-18542.8	-18542.7	957.4	956.5	-998.9	-998.8	-200.7	207.5	-154167.0	146487.0	-4101.5	3702.2
	126	(I)	-18543.1	-18543.0	957.4	956.5	-549.7	-549.6	-204.3	211.0	-154167.0	146487.0	-4285.9	3858.2
		(J)	-18543.1	-18543.0	2194.0	2193.2	-549.7	-549.6	-204.3	211.0	-145499.0	138656.0	-4285.9	3858.2
	127	(I)	-18543.3	-18543.2	2194.0	2193.2	-100.5	-100.4	-207.7	214.3	-145499.0	138656.0	-4466.2	4007.9
		(J)	-18543.3	-18543.2	2420.0	2419.3	-100.5	-100.4	-207.7	214.3	-136396.0	131480.0	-4466.2	4007.9
	128	(I)	-18543.6	-18543.5	2420.0	2419.3	349.5	349.6	-207.7	214.3	-136396.0	131480.0	-4641.7	4150.6
		(J)	-18543.6	-18543.5	1633.5	1632.9	349.5	349.6	-207.7	214.3	-126863.0	124264.0	-4641.7	4150.6
	129	(I)	-20521.6	-20521.5	1633.5	1632.9	-571.0	-570.9	-207.7	214.3	-126863.0	124264.0	-4826.7	4300.1
		(J)	-20521.6	-20521.5	2918.1	2917.5	-571.0	-570.9	-207.7	214.3	-116858.0	116922.0	-4826.7	4300.1

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	130	(I)	-20521.9	-20521.8	2918.1	2917.5	-122.8	-122.7	-213.1	220.5	-116858.0	116922.0	-4992.7	4428.7
		(J)	-20521.9	-20521.8	3194.3	3193.8	-122.8	-122.7	-213.1	220.5	-106446.0	109448.0	-4992.7	4428.7
	131	(I)	-20522.2	-20522.1	3194.3	3193.8	328.1	328.2	-210.6	217.5	-106446.0	109448.0	-5154.3	4549.8
		(J)	-20522.2	-20522.1	2456.1	2455.4	328.1	328.2	-210.6	217.5	-95646.4	101846.0	-5154.3	4549.8
	132	(I)	-20522.6	-20522.5	2456.1	2455.4	776.3	776.4	-215.2	223.2	-95646.4	101846.0	-5311.2	4664.0
		(J)	-20522.6	-20522.5	709.4	708.7	776.3	776.4	-215.2	223.2	-84500.1	94112.5	-5311.2	4664.0
	133	(I)	-22614.3	-22614.2	709.4	708.7	-409.1	-409.0	-215.2	223.2	-84500.1	94112.5	-5475.0	4780.3
		(J)	-22614.3	-22614.2	1629.8	1628.9	-409.1	-409.0	-215.2	223.2	-74947.1	86239.8	-5475.0	4780.3
	134	(I)	-22614.6	-22614.5	1629.8	1628.9	39.9	40.0	-217.1	225.8	-74947.1	86239.8	-5625.1	4880.7
		(J)	-22614.6	-22614.5	1540.0	1538.9	39.9	40.0	-217.1	225.8	-68712.0	78268.9	-5625.1	4880.7
	135	(I)	-22615.0	-22614.9	1540.0	1538.9	489.9	490.0	-217.1	225.8	-68712.0	78268.9	-5772.4	4974.0
		(J)	-22615.0	-22614.9	437.6	436.4	489.9	490.0	-217.1	225.8	-62140.1	70214.0	-5772.4	4974.0
	136	(I)	-22615.4	-22615.3	437.6	436.4	937.9	938.0	-220.1	230.6	-62140.1	70214.0	-5917.8	5061.6
		(J)	-22615.4	-22615.3	-1672.8	-1674.0	937.9	938.0	-220.1	230.6	-55816.7	62089.7	-5917.8	5061.6
	137	(I)	-24681.7	-24681.6	-1672.8	-1674.0	-481.3	-481.3	-218.8	228.3	-55816.7	62089.7	-6071.2	5150.6
		(J)	-24681.7	-24681.6	-589.7	-591.1	-481.3	-481.3	-218.8	228.3	-52568.7	53900.6	-6071.2	5150.6
	138	(I)	-24682.0	-24682.0	-589.7	-591.1	-33.5	-33.5	-221.0	232.5	-52568.7	53900.6	-6212.9	5229.0
		(J)	-24682.0	-24682.0	-514.3	-515.7	-33.5	-33.5	-221.0	232.5	-54026.2	50574.9	-6212.9	5229.0
	139	(I)	-24682.5	-24682.4	-514.3	-515.7	416.5	416.5	-221.0	232.5	-54026.2	50574.9	-6351.1	5311.3
		(J)	-24682.5	-24682.4	-1451.4	-1452.9	416.5	416.5	-221.0	232.5	-60695.0	49269.5	-6351.1	5311.3
	140	(I)	-24682.9	-24682.8	-1451.4	-1452.9	866.5	866.5	-221.0	232.5	-60695.0	49269.5	-6484.2	5456.4
		(J)	-24682.9	-24682.8	-3401.0	-3402.4	866.5	866.5	-221.0	232.5	-67341.1	54594.3	-6484.2	5456.4
	141	(I)	-26593.2	-26593.1	-3401.0	-3402.4	-771.5	-771.5	-222.1	235.9	-67341.1	54594.3	-6618.7	5602.9
		(J)	-26593.2	-26593.1	-1665.1	-1666.5	-771.5	-771.5	-222.1	235.9	-73968.6	60033.6	-6618.7	5602.9
	142	(I)	-26593.7	-26593.6	-1665.1	-1666.5	-320.3	-320.3	-221.7	234.3	-73968.6	60033.6	-6739.8	5734.4
		(J)	-26593.7	-26593.6	-944.3	-945.8	-320.3	-320.3	-221.7	234.3	-80583.2	67799.9	-6739.8	5734.4
	143	(I)	-26594.2	-26594.1	-944.3	-945.8	127.3	127.3	-222.1	237.1	-80583.1	67799.9	-6853.8	5859.1
		(J)	-26594.2	-26594.1	-1230.8	-1232.2	127.3	127.3	-222.1	237.1	-87162.1	82044.1	-6853.8	5859.1
	144	(I)	-26594.6	-26594.5	-1230.8	-1232.2	577.3	577.3	-222.1	237.1	-87162.1	82044.1	-6961.5	5976.5
		(J)	-26594.6	-26594.5	-2529.8	-2531.1	577.3	577.3	-222.1	237.1	-93726.6	96601.7	-6961.5	5976.5
	145	(I)	-28199.6	-28199.5	-2529.8	-2531.1	-1238.4	-1238.4	-222.1	238.1	-93726.5	96601.7	-7066.5	6091.6
		(J)	-28199.6	-28199.5	256.6	255.4	-1238.4	-1238.4	-222.1	238.1	-104413.0	111471.0	-7066.5	6091.6
	146	(I)	-28200.1	-28200.0	256.6	255.4	-788.4	-788.4	-222.1	238.1	-104413.0	111471.0	-7159.9	6195.0
		(J)	-28200.1	-28200.0	2030.5	2029.4	-788.4	-788.4	-222.1	238.1	-116775.0	126652.0	-7159.9	6195.0
	147	(I)	-28200.6	-28200.5	2030.5	2029.4	-339.7	-339.6	-221.7	238.9	-116775.0	126652.0	-7246.6	6291.4
		(J)	-28200.6	-28200.5	2794.8	2793.7	-339.7	-339.6	-221.7	238.9	-129240.0	142147.0	-7246.6	6291.4
	148	(I)	-28201.1	-28201.0	2794.8	2793.7	109.0	109.1	-221.3	239.4	-129240.0	142147.0	-7326.9	6380.7
		(J)	-28201.1	-28201.0	2549.3	2548.3	109.0	109.1	-221.3	239.4	-141826.0	157944.0	-7326.9	6380.7
	149	(I)	-28201.6	-28201.5	2549.3	2548.3	559.0	559.1	-221.3	239.4	-141826.0	157944.0	-7401.1	6464.1
		(J)	-28201.6	-28201.5	1291.3	1290.5	559.0	559.1	-221.3	239.4	-154513.0	174026.0	-7401.1	6464.1
	150	(I)	-28202.2	-28202.1	1291.3	1290.5	1007.8	1007.9	-222.3	239.7	-154513.0	174026.0	-7469.9	6541.3
		(J)	-28202.2	-28202.1	-976.3	-977.1	1007.8	1007.9	-222.3	239.7	-167307.0	190392.0	-7469.9	6541.3
	151	(I)	-28202.9	-28202.7	-976.3	-977.1	1456.5	1456.6	-223.1	239.7	-167307.0	190392.0	-7533.7	6613.1
		(J)	-28202.9	-28202.7	-4253.7	-4254.3	1456.5	1456.6	-223.1	239.7	-180219.0	206992.0	-7533.7	6613.1
	152	(I)	-28203.4	-28203.3	-4253.7	-4254.3	1906.5	1906.6	-223.1	239.7	-180219.0	206992.0	-7593.2	6679.8
		(J)	-28203.4	-28203.3	-8543.5	-8544.1	1906.5	1906.6	-223.1	239.7	-193263.0	223808.0	-7593.2	6679.8
	153	(I)	-28204.0	-28203.9	-8543.5	-8544.1	2314.3	2314.4	-223.5	239.6	-193263.0	223808.0	-7644.0	6736.9
		(J)	-28204.0	-28203.9	-12786.3	-12787.0	2314.3	2314.4	-223.5	239.6	-203998.0	237650.0	-7644.0	6736.9
	154	(I)	-28204.6	-28204.5	-12786.3	-12787.0	2679.4	2679.5	-224.5	239.1	-203998.0	237650.0	-7687.8	6785.2
		(J)	-28204.6	-28204.5	-17698.8	-17699.6	2679.4	2679.5	-224.5	239.1	-214845.0	251600.0	-7687.8	6785.2
	155	(I)	-28205.1	-28205.0	-17698.8	-17699.6	3046.1	3046.2	-224.5	239.1	-214845.0	251600.0	-7730.2	6832.3
		(J)	-28205.1	-28205.0	-23283.1	-23284.1	3046.1	3046.2	-224.5	239.1	-225815.0	265672.0	-7730.2	6832.3
	156	(I)	-28206.1	-28205.9	-23283.1	-23284.1	3365.6	3365.7	-226.8	237.3	-225815.0	265672.0	-7766.9	6872.0
		(J)	-28206.1	-28205.9	-27994.9	-27996.0	3365.6	3365.7	-226.8	237.3	-234280.0	276475.0	-7766.9	6872.0
	157	(I)	-28201.0	-28200.8	-27994.9	-27996.0	3557.9	3558.0	-360.2	331.6	-234279.0	276475.0	-7783.7	6890.3
		(J)	-28201.0	-28200.8	-28350.7	-28351.8	3557.9	3558.0	-360.2	331.6	-234888.0	277249.0	-7783.7	6890.3
	158	(I)	-27205.1	-27204.9	-24149.4	-24150.4	-3392.7	-3392.6	-1121.5	1161.1	-234888.0	277249.0	-7334.3	7153.3
		(J)	-27205.1	-27204.9	-23810.2	-23811.2	-3392.7	-3392.6	-1121.5	1161.1	-234377.0	276679.0	-7334.3	7153.3
	159	(I)	-27200.2	-27200.0	-23810.2	-23811.2	-3283.5	-3283.4	-1090.8	1101.3	-234377.0	276680.0	-7311.1	7115.7
		(J)	-27200.2	-27200.0	-19213.4	-19214.2	-3283.5	-3283.4	-1090.8	1101.3	-227294.0	268753.0	-7311.1	7115.7
	160	(I)	-27201.0	-27200.8	-19213.4	-19214.2	-2958.0	-2957.9	-1092.8	1104.9	-227294.0	268753.0	-7255.9	7033.2
		(J)	-27201.0	-27200.8	-13790.7	-13791.3	-2958.0	-2957.9	-1092.8	1104.9	-218313.0	258471.0	-7255.9	7033.2
	161	(I)	-27201.3	-27201.1	-13790.7	-13791.3	-2592.8	-2592.7	-1091.0	1102.2	-218313.0	258471.0	-7185.5	6937.8
		(J)	-27201.3	-27201.1	-9037.3	-9037.7	-2592.8	-2592.7	-1091.0	1102.2	-209663.0	248291.0	-7185.5	6937.8
	162	(I)	-27201.9	-27201.7	-9037.3	-9037.7	-2226.1	-2226.0	-1091.0	1102.2	-209663.0	248291.0	-7107.0	6840.4
		(J)	-27201.9	-27201.7	-4956.2	-4956.6	-2226.1	-2226.0	-1091.0	1102.2	-201360.0	238221.0	-7107.0	6840.4
	163	(I)	-27202.4	-27202.2	-4956.2	-4956.6	-1818.8	-1818.7	-1089.2	1099.8	-201360.0	238221.0	-7010.3	6728.0
		(J)	-27202.4	-27202.2	-863.9	-864.4	-1818.8	-1818.7	-1089.2	1099.8	-191681.0	226039.0	-7010.3	6728.0
	164	(I)	-27203.1	-27202.9	-863.9	-864.4	-1368.8	-1368.7	-1089.2	1099.8	-191681.0	226039.0	-6890.7	6598.5
		(J)	-27203.1	-27202.9	2215.9	2215.3	-1368.8	-1368.7	-1089.2	1099.8	-182622.0	214054.0	-6890.7	6598.5
	165	(I)	-27203.7	-27203.5	2215.9	2215.3	-920.0	-919.9	-1086.3	1096.6	-182622.0	214054.0	-6757.9	6464.0
		(J)	-27203.7	-27203.5	4285.9	4285.2	-920.0	-919.9	-1086.3	1096.6	-174561.0	202298.0	-6757.9	6464.0
	166	(I)	-27204.4	-27204.2	4285.9	4285.2	-471.2	-471.2	-1083.0	1093.0	-174561.0	202298.0	-6611.7	6322.2
		(J)	-27204.4	-27204.2	5346.2	5345.3	-471.2	-471.2	-1083.0	1093.0	-168282.0	190805.0	-6611.7	6322.2
	167	(I)	-27205.1	-27204.9	5346.2	5345.3	-21.2	-21.2	-1083.0	1093.0	-168282.0	190805.0	-6452.2	6174.7
		(J)	-27205.1	-27204.9	5394.0	5393.0	-21.2	-21.2	-1083.0	1093.0	-166973.0	179610.0	-6452.2	6174.7
	168	(I)	-27205.9	-27205.7	5394.0	5393.0	427.6	427.6	-1078.9	1088.9	-166973.0	179610.0	-6279.1	6018.9
		(J)	-27205.9	-27205.7	4432.0	4430.8	427.6	427.6	-1078.9	1088.9	-170268.0	168774.0	-6279.1	6018.9
	169	(I)	-27206.6	-27206.5	4432.0	4430.8	876.4	876.4	-1074.5	1084.5	-170268.0	168774.0	-6092.4	5856.9
		(J)	-27206.6	-27206.5	2460.2	2458.9	876.4	876.4	-1074.5	1084.5	-173706.0	158376.0	-6092.4	5856.9
	170	(I)	-27207.4	-27207.2	2460.2	2458.9	1326.4	1326.4	-1074.5	1084.5	-173706.0	158376.0	-5892.3	5686.4
		(J)	-27207.4	-27207.2	-524.2	-525.5	1326.4	1326.4	-1074.5	1084.5	-177136.0	155360.0	-5892.3	5686.4
	171	(I)	-25603.4	-25603.2	-524.2	-525.5	-480.6	-480.6	-1069.5	1079.7	-177136.0	155360.0	-5654.6	5485.8
		(J)	-25603.4	-25603.2	557.3	555.8	-480.6	-480.6	-1069.5	1079.7	-180427.0	159548.0	-5654.6	5485.8
	172	(I)	-25604.2	-25604.0	557.3	555.8	-30.6	-30.6	-1069.5	1079.7	-180427.0	159548.0	-5428.4	5299.9
		(J)	-25604.2	-25604.0	626.2	624.7	-30.6	-30.6	-1069.5	1079.7	-183557.0	163407.0	-5428.4	5299.9
	173	(I)	-25605.0	-25604.8	626.2	624.7	417.1	417.1	-1058.3	1069.3	-183557.0	163407.0	-5189.6	5105.5
		(J)	-25605.0	-25604.8	-312.3	-313.8	417.1	417.1	-1058.3	1069.3	-186480.0	166922.0	-5189.6	5105.5
	174	(I)	-25605.8	-25605.6	-312.3	-313.8	868.2	868.3	-1064.2	1074.7	-186480.0	166922.0	-4938.8	4903.3

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
		(J)	-25605.8	-25605.6	-2265.9	-2267.4	868.2	868.3	-1064.2	1074.7	-189152.0	170073.0	-4938.8	4903.3
	175	(I)	-23696.2	-23696.1	-2265.9	-2267.4	-763.6	-763.6	-1052.0	1063.6	-189152.0	170073.0	-4646.7	4665.5
		(J)	-23696.2	-23696.1	-547.7	-549.2	-763.6	-763.6	-1052.0	1063.6	-191469.0	172820.0	-4646.7	4665.5
	176	(I)	-23697.1	-23697.0	-547.7	-549.2	-313.6	-313.6	-1052.0	1063.6	-191469.0	172820.0	-4373.8	4447.0
		(J)	-23697.1	-23697.0	157.9	156.5	-313.6	-313.6	-1052.0	1063.6	-193447.0	175177.0	-4373.8	4447.0
	177	(I)	-23697.9	-23697.8	157.9	156.5	136.3	136.4	-1052.0	1063.6	-193447.0	175177.0	-4090.7	4219.6
		(J)	-23697.9	-23697.8	-149.0	-150.3	136.3	136.4	-1052.0	1063.6	-195052.0	177127.0	-4090.7	4219.6
	178	(I)	-23698.8	-23698.7	-149.0	-150.3	584.2	584.3	-1038.7	1051.7	-195052.0	177127.0	-3824.9	3985.4
		(J)	-23698.8	-23698.7	-1463.6	-1464.8	584.2	584.3	-1038.7	1051.7	-196258.0	178655.0	-3824.9	3985.4
	179	(I)	-21635.4	-21635.2	-1463.6	-1464.8	-828.7	-828.7	-1045.5	1057.7	-196258.0	178655.0	-3565.2	3806.8
		(J)	-21635.4	-21635.2	401.0	399.9	-828.7	-828.7	-1045.5	1057.7	-196977.0	179712.0	-3565.2	3806.8
	180	(I)	-21636.2	-21636.1	401.0	399.9	-380.7	-380.6	-1031.6	1045.5	-196977.0	179712.0	-3333.7	3644.3
		(J)	-21636.2	-21636.1	1257.3	1256.4	-380.7	-380.6	-1031.6	1045.5	-197248.0	180321.0	-3333.7	3644.3
	181	(I)	-21637.1	-21637.0	1257.3	1256.4	69.3	69.4	-1031.6	1045.5	-197248.0	180321.0	-3097.5	3476.9
		(J)	-21637.1	-21637.0	1101.2	1100.4	69.3	69.4	-1031.6	1045.5	-197049.0	180469.0	-3097.5	3476.9
	182	(I)	-21638.0	-21637.9	1101.2	1100.4	518.4	518.4	-1024.5	1039.3	-197049.0	180469.0	-2856.9	3304.2
		(J)	-21638.0	-21637.9	-65.3	-65.9	518.4	518.4	-1024.5	1039.3	-196371.0	180147.0	-2856.9	3304.2
	183	(I)	-19542.6	-19542.5	-65.3	-65.9	-667.3	-667.2	-1024.5	1039.3	-196371.0	180147.0	-2588.5	3109.4
		(J)	-19542.6	-19542.5	1435.9	1435.5	-667.3	-667.2	-1024.5	1039.3	-195140.0	179305.0	-2588.5	3109.4
	184	(I)	-19543.5	-19543.4	1435.9	1435.5	-219.0	-218.9	-1010.0	1026.9	-195140.0	179305.0	-2430.6	2928.7
		(J)	-19543.5	-19543.4	1928.5	1928.3	-219.0	-218.9	-1010.0	1026.9	-193401.0	177974.0	-2430.6	2928.7
	185	(I)	-19544.5	-19544.4	1928.5	1928.3	231.8	231.9	-1017.3	1033.1	-193401.0	177974.0	-2276.7	2745.2
		(J)	-19544.5	-19544.4	1406.8	1406.6	231.8	231.9	-1017.3	1033.1	-191167.0	176524.0	-2276.7	2745.2
	186	(I)	-19545.5	-19545.4	1406.8	1406.6	680.1	680.2	-1002.8	1020.7	-191167.0	176524.0	-2129.2	2560.2
		(J)	-19545.5	-19545.4	-123.5	-123.8	680.1	680.2	-1002.8	1020.7	-188416.0	176178.0	-2129.2	2560.2
	187	(I)	-17567.4	-17567.3	-123.5	-123.8	-238.5	-238.4	-1002.8	1020.7	-188416.0	176178.0	-1980.1	2356.0
		(J)	-17567.4	-17567.3	413.2	412.7	-238.5	-238.4	-1002.8	1020.7	-185088.0	175112.0	-1980.1	2356.0
	188	(I)	-17568.3	-17568.2	413.2	412.7	211.5	211.6	-1002.8	1020.7	-185088.0	175112.0	-1896.7	2175.2
		(J)	-17568.3	-17568.2	-62.6	-63.3	211.5	211.6	-1002.8	1020.7	-181248.0	173380.0	-1896.7	2175.2
	189	(I)	-17569.3	-17569.3	-62.6	-63.3	660.7	660.8	-995.9	1014.8	-181248.0	173380.0	-2025.7	2001.2
		(J)	-17569.3	-17569.3	-1549.2	-1550.1	660.7	660.8	-995.9	1014.8	-176892.0	170976.0	-2025.7	2001.2
	190	(I)	-17570.4	-17570.3	-1549.2	-1550.1	1109.9	1110.0	-989.0	1008.9	-176892.0	170976.0	-2219.4	1979.1
		(J)	-17570.4	-17570.3	-4046.5	-4047.6	1109.9	1110.0	-989.0	1008.9	-172039.0	167900.0	-2219.4	1979.1
	191	(I)	-14163.7	-14163.7	-4046.5	-4047.6	-597.7	-597.6	-982.3	1003.3	-172039.0	167900.0	-2464.5	2209.4
		(J)	-14163.7	-14163.7	-2701.7	-2702.9	-597.7	-597.6	-982.3	1003.3	-166581.0	164062.0	-2464.5	2209.4
	192	(I)	-14164.8	-14164.7	-2701.7	-2702.9	-147.7	-147.6	-982.3	1003.3	-166581.0	164062.0	-2675.9	2421.9
		(J)	-14164.8	-14164.7	-2369.4	-2370.8	-147.7	-147.6	-982.3	1003.3	-160629.0	159548.0	-2675.9	2421.9
	193	(I)	-14165.8	-14165.8	-2369.4	-2370.8	301.7	301.8	-975.9	997.9	-160629.0	159548.0	-2887.6	2636.2
		(J)	-14165.8	-14165.8	-3048.2	-3049.8	301.7	301.8	-975.9	997.9	-154188.0	154362.0	-2887.6	2636.2
	194	(I)	-14166.9	-14166.8	-3048.2	-3049.8	751.7	751.7	-975.9	997.9	-154188.0	154362.0	-3097.4	2848.3
		(J)	-14166.9	-14166.8	-4739.5	-4741.2	751.7	751.7	-975.9	997.9	-147495.0	148509.0	-3097.4	2848.3
	195	(I)	-10891.9	-10891.8	-4739.5	-4741.2	-703.7	-703.6	-970.0	992.9	-147495.0	148509.0	-3345.4	3085.4
		(J)	-10891.9	-10891.8	-3156.2	-3158.0	-703.7	-703.6	-970.0	992.9	-140889.0	141911.0	-3345.4	3085.4
	196	(I)	-10892.9	-10892.9	-3156.2	-3158.0	-254.2	-254.1	-964.4	988.2	-140889.0	141911.0	-3548.8	3288.7
		(J)	-10892.9	-10892.9	-2584.4	-2586.2	-254.2	-254.1	-964.4	988.2	-133672.0	134667.0	-3548.8	3288.7
	197	(I)	-10894.0	-10894.0	-2584.4	-2586.2	195.8	195.9	-964.4	988.2	-133672.0	134667.0	-3748.0	3494.9
		(J)	-10894.0	-10894.0	-3025.0	-3026.8	195.8	195.9	-964.4	988.2	-125856.0	126791.0	-3748.0	3494.9
	198	(I)	-10895.1	-10895.1	-3025.0	-3026.8	645.4	645.4	-959.4	984.0	-125856.0	126791.0	-3942.5	3768.1
		(J)	-10895.1	-10895.1	-4477.1	-4478.9	645.4	645.4	-959.4	984.0	-117465.0	118299.0	-3942.5	3768.1
	199	(I)	-7519.9	-7519.8	-4477.1	-4478.9	-733.8	-733.7	-954.7	980.1	-117465.0	118299.0	-4171.7	4071.5
		(J)	-7519.9	-7519.8	-2826.2	-2827.9	-733.8	-733.7	-954.7	980.1	-108381.0	109127.0	-4171.7	4071.5
	200	(I)	-7521.0	-7521.0	-2826.2	-2827.9	-283.8	-283.7	-954.7	980.1	-108381.0	109127.0	-4355.8	4327.5
		(J)	-7521.0	-7521.0	-2187.8	-2189.4	-283.8	-283.7	-954.7	980.1	-98743.4	99378.5	-4355.8	4327.5
	201	(I)	-7522.2	-7522.1	-2187.8	-2189.4	165.9	165.9	-950.7	976.8	-98743.4	99378.6	-4534.5	4573.7
		(J)	-7522.2	-7522.1	-2561.2	-2562.7	165.9	165.9	-950.7	976.8	-88568.4	89074.5	-4534.5	4573.7
	202	(I)	-7523.3	-7523.3	-2561.2	-2562.7	615.9	615.9	-950.7	976.8	-88568.4	89074.5	-4747.5	4809.4
		(J)	-7523.3	-7523.3	-3947.0	-3948.4	615.9	615.9	-950.7	976.8	-77874.9	78239.5	-4747.5	4809.4
	203	(I)	-3907.4	-3907.3	-3947.0	-3948.4	-779.6	-779.6	-947.6	974.3	-77874.9	78239.5	-5021.0	5066.4
		(J)	-3907.4	-3907.3	-2193.0	-2194.2	-779.6	-779.6	-947.6	974.3	-66570.4	66832.6	-5021.0	5066.4
	204	(I)	-3908.5	-3908.5	-2193.0	-2194.2	-329.8	-329.7	-945.0	972.1	-66570.4	66832.6	-5233.2	5278.8
		(J)	-3908.5	-3908.5	-1451.1	-1452.1	-329.8	-329.7	-945.0	972.1	-54789.3	54947.6	-5233.2	5278.8
	205	(I)	-3909.7	-3909.7	-1451.1	-1452.1	120.2	120.3	-945.0	972.1	-54789.3	54947.6	-5436.3	5478.7
		(J)	-3909.7	-3909.7	-1721.8	-1722.5	120.2	120.3	-945.0	972.1	-42552.3	42612.5	-5436.3	5478.7
	206	(I)	-3910.9	-3910.9	-1721.8	-1722.5	570.0	570.1	-943.2	970.6	-42552.4	42612.6	-5629.7	5665.7
		(J)	-3910.9	-3910.9	-3004.5	-3005.1	570.0	570.1	-943.2	970.6	-29878.3	29856.7	-5629.7	5665.7
	207	(I)	2.4	2.4	-3004.5	-3005.1	-876.0	-875.9	-942.1	969.7	-29878.3	29856.8	-5861.7	5863.3
		(J)	2.4	2.4	-1033.7	-1034.0	-876.0	-875.9	-942.1	969.7	-16689.4	16664.3	-5861.7	5863.3
	208	(I)	1.0	1.0	-1033.7	-1034.0	-376.0	-375.9	-941.9	969.6	-16689.4	16664.3	-6055.4	6041.3
		(J)	1.0	1.0	0.0	0.0	-376.0	-375.9	-941.9	969.6	-46.0	51.2	-6055.4	6041.3
	501	(I)	-42757.9	-42757.8	-544.6	-545.0	4.7	4.8	0.0	0.0	-49418.6	49388.1	-825.1	863.0
		(J)	-42757.9	-42757.8	-549.3	-549.7	4.7	4.8	0.0	0.0	-50154.9	50151.6	-825.1	863.0
	502	(I)	-42723.9	-42723.8	-541.7	-542.2	4.7	4.8	0.0	0.0	-48962.8	48917.7	-818.3	860.1
		(J)	-42723.9	-42723.8	-544.6	-545.0	4.7	4.8	0.0	0.0	-49418.6	49388.1	-818.3	860.1
	503	(I)	-42633.6	-42633.5	-524.5	-525.0	4.7	4.8	0.0	0.0	-46050.9	45946.3	-801.4	852.3
		(J)	-42633.6	-42633.5	-541.7	-542.2	4.7	4.8	0.0	0.0	-48962.8	48917.7	-801.4	852.3
	504	(I)	-42470.2	-42470.1	-505.4	-506.0	4.7	4.8	0.0	0.0	-42480.2	42364.6	-798.8	830.9
		(J)	-42470.2	-42470.1	-524.5	-525.0	4.7	4.8	0.0	0.0	-46050.9	45946.3	-798.8	830.9
	505	(I)	-42298.2	-42298.1	-486.3	-486.9	4.8	4.8	0.0	0.0	-38598.7	38525.7	-792.1	794.3
		(J)	-42298.2	-42298.1	-505.4	-506.0	4.8	4.8	0.0	0.0	-42480.2	42364.6	-792.1	794.3
	506	(I)	-42126.2	-42126.1	-467.2	-467.9	4.8	4.8	0.0	0.0	-34457.8	34476.8	-779.9	769.8
		(J)	-42126.2	-42126.1	-486.3	-486.9	4.8	4.8	0.0	0.0	-38598.7	38525.7	-779.9	769.8
	507	(I)	-41954.2	-41954.1	-448.1	-448.9	4.8	4.8	0.0	0.0	-30117.1	30258.5	-761.5	761.5
		(J)	-41954.2	-41954.1	-467.2	-467.9	4.8	4.8	0.0	0.0	-34457.8	34476.8	-761.5	761.5
	508	(I)	-41782.2	-41782.1	-429.0	-429.8	4.8	4.8	0.0	0.0	-25650.4	25913.1	-737.5	744.9
		(J)	-41782.2	-41782.1	-448.1	-448.9	4.8	4.8	0.0	0.0	-30117.1	30258.5	-737.5	744.9
	509	(I)	-41610.2	-41610.1	-409.8	-410.8	4.8	4.8	0.0	0.0	-21135.1	21570.6	-708.4	719.6
		(J)	-41610.2	-41610.1	-429.0	-429.8	4.8	4.8	0.0	0.0	-25650.4	25913.1	-708.4	719.6
	510	(I)	-41438.2	-41438.1	-390.7	-391.7	4.8	4.8	0.0	0.0	-16773.7	17553.6	-672.7	685.4
		(J)	-41438.2	-41438.1	-409.8	-410.8	4.8	4.8	0.0	0.0	-21135.1	21570.6	-672.7	685.4

	Elem. No.		Axial (kN)		Bending M Y (kN・m)		Shear Z (kN)		Torsion M (kN・m)		Bending M Z (kN・m)		Shear Y (kN)	
			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
	511	(I)	-41292.0	-41291.9	-377.4	-378.4	4.8	4.8	0.0	0.0	-13874.2	14668.6	-636.4	648.4
		(J)	-41292.0	-41291.9	-390.7	-391.7	4.8	4.8	0.0	0.0	-16773.7	17553.6	-636.4	648.4
	512	(I)	-36551.1	-36551.0	-355.8	-356.8	10.8	10.8	0.0	0.0	-11853.2	12635.9	-639.2	644.0
		(J)	-36551.1	-36551.0	-377.4	-378.4	10.8	10.8	0.0	0.0	-13874.2	14668.6	-639.2	644.0
	513	(I)	-32119.7	-32119.7	-323.5	-324.4	16.1	16.2	0.0	0.0	-9913.2	10657.1	-649.3	626.5
		(J)	-32119.7	-32119.7	-355.8	-356.8	16.1	16.2	0.0	0.0	-11853.2	12635.9	-649.3	626.5
	514	(I)	-28111.6	-28111.6	-277.7	-278.3	22.9	23.0	0.0	0.0	-8071.5	8752.5	-648.6	615.6
		(J)	-28111.6	-28111.6	-323.5	-324.4	22.9	23.0	0.0	0.0	-9913.2	10657.1	-648.6	615.6
	515	(I)	-24558.8	-24558.8	-232.6	-233.1	22.5	22.6	0.0	0.0	-6345.5	6943.8	-634.8	593.2
		(J)	-24558.8	-24558.8	-277.7	-278.3	22.5	22.6	0.0	0.0	-8071.5	8752.5	-634.8	593.2
	516	(I)	-21529.6	-21529.6	-182.5	-182.8	25.1	25.2	0.0	0.0	-4752.9	5253.1	-606.1	558.0
		(J)	-21529.6	-21529.6	-232.6	-233.1	25.1	25.2	0.0	0.0	-6345.5	6943.8	-606.1	558.0
	517	(I)	-16841.1	-16841.1	-132.6	-132.8	25.0	25.0	0.0	0.0	-3354.2	3745.6	-564.6	512.2
		(J)	-16841.1	-16841.1	-182.5	-182.8	25.0	25.0	0.0	0.0	-4752.9	5253.1	-564.6	512.2
	518	(I)	-12634.9	-12634.8	-72.0	-72.2	30.3	30.3	0.0	0.0	-2176.8	2457.7	-501.1	447.9
		(J)	-12634.9	-12634.8	-132.6	-132.8	30.3	30.3	0.0	0.0	-3354.2	3745.6	-501.1	447.9
	519	(I)	-8571.7	-8571.7	-26.4	-26.5	22.8	22.8	0.0	0.0	-1250.9	1430.4	-416.6	367.5
		(J)	-8571.7	-8571.7	-72.0	-72.2	22.8	22.8	0.0	0.0	-2176.8	2457.7	-416.6	367.5
	520	(I)	-4459.5	-4459.5	0.0	0.0	13.2	13.2	0.0	0.0	-609.9	708.8	-310.7	271.3
		(J)	-4459.5	-4459.5	-26.4	-26.5	13.2	13.2	0.0	0.0	-1250.9	1430.4	-310.7	271.3
	521	(I)	-165.5	-165.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-140.5	120.8
		(J)	-165.5	-165.5	0.0	0.0	0.0	0.0	0.0	0.0	-609.9	708.8	-140.5	120.8
	601	(I)	-42757.6	-42757.6	545.0	544.6	-4.8	-4.8	0.0	0.0	-52079.1	51204.3	-907.4	879.9
		(J)	-42757.6	-42757.6	549.6	549.3	-4.8	-4.8	0.0	0.0	-52850.6	51990.9	-907.4	879.9
	602	(I)	-42723.7	-42723.6	542.1	541.7	-4.8	-4.8	0.0	0.0	-51601.3	50719.3	-898.5	877.0
		(J)	-42723.7	-42723.6	545.0	544.6	-4.8	-4.8	0.0	0.0	-52079.1	51204.3	-898.5	877.0
	603	(I)	-42633.4	-42633.3	525.0	524.5	-4.8	-4.8	0.0	0.0	-48545.5	47652.1	-874.5	869.0
		(J)	-42633.4	-42633.3	542.1	541.7	-4.8	-4.8	0.0	0.0	-51601.3	50719.3	-874.5	869.0
	604	(I)	-42470.0	-42469.9	506.0	505.4	-4.8	-4.8	0.0	0.0	-44790.3	43948.8	-824.0	848.3
		(J)	-42470.0	-42469.9	525.0	524.5	-4.8	-4.8	0.0	0.0	-48545.5	47652.1	-824.0	848.3
	605	(I)	-42298.0	-42297.9	486.9	486.3	-4.8	-4.8	0.0	0.0	-40699.7	39975.1	-818.2	813.3
		(J)	-42298.0	-42297.9	506.0	505.4	-4.8	-4.8	0.0	0.0	-44790.3	43948.8	-818.2	813.3
	606	(I)	-42126.0	-42125.9	467.9	467.2	-4.8	-4.8	0.0	0.0	-36329.4	35782.3	-806.7	812.4
		(J)	-42126.0	-42125.9	486.9	486.3	-4.8	-4.8	0.0	0.0	-40699.7	39975.1	-806.7	812.4
	607	(I)	-41954.0	-41953.9	448.9	448.1	-4.8	-4.8	0.0	0.0	-31743.7	31411.3	-788.8	804.4
		(J)	-41954.0	-41953.9	467.9	467.2	-4.8	-4.8	0.0	0.0	-36329.4	35782.3	-788.8	804.4
	608	(I)	-41782.0	-41781.9	429.8	429.0	-4.8	-4.8	0.0	0.0	-27405.0	27617.9	-765.0	787.3
		(J)	-41782.0	-41781.9	448.9	448.1	-4.8	-4.8	0.0	0.0	-31743.7	31411.3	-765.0	787.3
	609	(I)	-41610.0	-41609.9	410.8	409.9	-4.8	-4.8	0.0	0.0	-23125.0	23556.5	-735.4	760.5
		(J)	-41610.0	-41609.9	429.8	429.0	-4.8	-4.8	0.0	0.0	-27405.0	27617.9	-735.4	760.5
	610	(I)	-41438.0	-41437.9	391.7	390.8	-4.8	-4.8	0.0	0.0	-18670.8	19243.2	-698.6	723.8
		(J)	-41438.0	-41437.9	410.8	409.9	-4.8	-4.8	0.0	0.0	-23125.0	23556.5	-698.6	723.8
	611	(I)	-41291.8	-41291.7	378.4	377.5	-4.8	-4.8	0.0	0.0	-15502.2	16127.2	-674.3	684.5
		(J)	-41291.8	-41291.7	391.7	390.8	-4.8	-4.8	0.0	0.0	-18670.8	19243.2	-674.3	684.5
	612	(I)	-36550.8	-36550.8	356.7	355.9	-10.8	-10.8	0.0	0.0	-13285.0	13923.6	-700.6	701.4
		(J)	-36550.8	-36550.8	378.4	377.5	-10.8	-10.8	0.0	0.0	-15502.2	16127.2	-700.6	701.4
	613	(I)	-32119.5	-32119.5	324.3	323.6	-16.2	-16.1	0.0	0.0	-11146.6	11767.9	-715.8	704.3
		(J)	-32119.5	-32119.5	356.7	355.9	-16.2	-16.1	0.0	0.0	-13285.0	13923.6	-715.8	704.3
	614	(I)	-28111.4	-28111.4	278.3	277.8	-23.0	-22.9	0.0	0.0	-9108.0	9683.8	-718.1	695.5
		(J)	-28111.4	-28111.4	324.3	323.6	-23.0	-22.9	0.0	0.0	-11146.6	11767.9	-718.1	695.5
	615	(I)	-24558.6	-24558.5	233.1	232.7	-22.6	-22.5	0.0	0.0	-7188.6	7697.9	-705.7	673.5
		(J)	-24558.6	-24558.5	278.3	277.8	-22.6	-22.5	0.0	0.0	-9108.0	9683.8	-705.7	673.5
	616	(I)	-21529.4	-21529.3	182.8	182.6	-25.1	-25.1	0.0	0.0	-5409.5	5834.7	-676.2	636.5
		(J)	-21529.4	-21529.3	233.1	232.7	-25.1	-25.1	0.0	0.0	-7188.6	7697.9	-676.2	636.5
	617	(I)	-16840.9	-16840.9	132.8	132.7	-25.0	-25.0	0.0	0.0	-3836.8	4167.7	-631.7	586.9
		(J)	-16840.9	-16840.9	182.8	182.6	-25.0	-25.0	0.0	0.0	-5409.5	5834.7	-631.7	586.9
	618	(I)	-12634.7	-12634.7	72.2	72.1	-30.3	-30.3	0.0	0.0	-2504.0	2740.1	-561.7	516.0
		(J)	-12634.7	-12634.7	132.8	132.7	-30.3	-30.3	0.0	0.0	-3836.8	4167.7	-561.7	516.0
	619	(I)	-8571.6	-8571.6	26.5	26.5	-22.8	-22.8	0.0	0.0	-1448.6	1597.9	-467.7	425.7
		(J)	-8571.6	-8571.6	72.2	72.1	-22.8	-22.8	0.0	0.0	-2504.0	2740.1	-467.7	425.7
	620	(I)	-4459.4	-4459.4	0.0	0.0	-13.2	-13.2	0.0	0.0	-712.4	793.6	-348.8	315.5
		(J)	-4459.4	-4459.4	26.5	26.5	-13.2	-13.2	0.0	0.0	-1448.6	1597.9	-348.8	315.5
	621	(I)	-165.5	-165.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-157.4	141.2
		(J)	-165.5	-165.5	0.0	0.0	0.0	0.0	0.0	0.0	-712.4	793.6	-157.4	141.2

4.2 Evaluation of Cable

■Evaluation of Cable

	Elem. No.	Cable Axial Force (kN)				Evaluation for Max			Evaluation for Min		
		Analysis in Longi.		Analysis in Trans.		Max (kN)	Limit (kN)	Judge	Min (kN)	Limit (kN)	Judge
		Max	Min	Max	Min						
P11 Tower Side Span	401	5103.3	3758.2	4390.8	4390.8	5103.3	7308.0	○	3758.2	0.0	○
	402	4588.0	3689.3	4101.8	4101.8	4588.0	7308.0	○	3689.3	0.0	○
	403	4262.0	3560.0	3881.0	3881.0	4262.0	7308.0	○	3560.0	0.0	○
	404	4340.8	3383.2	3831.0	3831.0	4340.8	7308.0	○	3383.2	0.0	○
	405	4737.3	3535.0	4074.6	4074.6	4737.3	7308.0	○	3535.0	0.0	○
	406	2804.4	2067.9	2438.2	2438.2	2804.4	3862.8	○	2067.9	0.0	○
	407	3097.0	2277.8	2692.2	2692.1	3097.0	3862.8	○	2277.8	0.0	○
	408	3273.5	2380.1	2816.2	2816.1	3273.5	3862.8	○	2380.1	0.0	○
	409	3381.1	2274.7	2860.8	2860.7	3381.1	3862.8	○	2274.7	0.0	○
	410	3344.3	2117.7	2807.7	2807.6	3344.3	3862.8	○	2117.7	0.0	○
P11 Tower Main Span	411	4965.0	3754.4	4371.0	4371.0	4965.0	7308.0	○	3754.4	0.0	○
	412	4519.4	3657.8	4086.1	4086.1	4519.4	7308.0	○	3657.8	0.0	○
	413	4161.3	3529.2	3867.7	3867.7	4161.3	7308.0	○	3529.2	0.0	○
	414	4202.1	3510.6	3832.4	3832.4	4202.1	7308.0	○	3510.6	0.0	○
	415	4526.1	3644.5	4069.3	4069.3	4526.1	7308.0	○	3644.5	0.0	○
	416	2760.6	2159.0	2438.1	2438.1	2760.6	3862.8	○	2159.0	0.0	○
	417	3047.4	2362.4	2688.0	2688.0	3047.4	3862.8	○	2362.4	0.0	○
	418	3294.4	2431.8	2821.5	2821.5	3294.4	3862.8	○	2431.8	0.0	○
	419	3505.0	2300.6	2864.8	2864.8	3505.0	3862.8	○	2300.6	0.0	○
	420	3561.4	2123.6	2814.6	2814.5	3561.4	3862.8	○	2123.6	0.0	○
P12 Tower Main Span	421	5050.7	3737.0	4370.9	4370.9	5050.7	7308.0	○	3737.0	0.0	○
	422	4501.8	3651.2	4086.1	4086.0	4501.8	7308.0	○	3651.2	0.0	○
	423	4219.2	3600.9	3867.7	3867.7	4219.2	7308.0	○	3600.9	0.0	○
	424	4232.9	3422.0	3832.4	3832.4	4232.9	7308.0	○	3422.0	0.0	○
	425	4561.3	3590.4	4069.3	4069.2	4561.3	7308.0	○	3590.4	0.0	○
	426	2768.7	2112.4	2438.1	2438.1	2768.7	3862.8	○	2112.4	0.0	○
	427	3072.2	2315.4	2688.0	2688.0	3072.2	3862.8	○	2315.4	0.0	○
	428	3240.1	2361.3	2821.5	2821.5	3240.1	3862.8	○	2361.3	0.0	○
	429	3408.2	2256.3	2864.8	2864.8	3408.2	3862.8	○	2256.3	0.0	○
	430	3481.9	2117.8	2814.6	2814.5	3481.9	3862.8	○	2117.8	0.0	○
P12 Tower Side Span	431	5011.1	3725.9	4390.8	4390.8	5011.1	7308.0	○	3725.9	0.0	○
	432	4510.7	3656.0	4101.7	4101.7	4510.7	7308.0	○	3656.0	0.0	○
	433	4176.4	3530.8	3880.9	3880.9	4176.4	7308.0	○	3530.8	0.0	○
	434	4178.4	3461.2	3830.9	3830.9	4178.4	7308.0	○	3461.2	0.0	○
	435	4563.9	3583.0	4074.6	4074.6	4563.9	7308.0	○	3583.0	0.0	○
	436	2759.3	2167.0	2438.2	2438.2	2759.3	3862.8	○	2167.0	0.0	○
	437	3063.1	2332.3	2692.1	2692.1	3063.1	3862.8	○	2332.3	0.0	○
	438	3211.6	2393.1	2816.2	2816.2	3211.6	3862.8	○	2393.1	0.0	○
	439	3370.8	2349.0	2860.8	2860.7	3370.8	3862.8	○	2349.0	0.0	○
	440	3421.8	2238.5	2807.7	2807.7	3421.8	3862.8	○	2238.5	0.0	○

P10 Pier　Longi. Direction Section Calculation Result

	Elem. No.	Bending Moment (kN·m) Max	Bending Moment (kN·m) Min	Axial (kN) Max	Axial (kN) Min	Bending Moment (kN·m)	Axial (kN)	Bending Stress (N/mm2) σc σca=15	Bending Stress (N/mm2) σs σsa=300	Judge	Shear Force (kN) Max	Shear Force (kN) Min	Shear Force (kN) Selected	Shear Stress τ (N/mm2)	Shear Stress τa (N/mm2)	Shear-rebar required (cm2)	Shear-rebar Actual (cm2)	Judge
(Top)	6010	51135.9	-26954.4	-26178.8	-41699.1	51135.9	41699.1				10496.7	-10553.4	10553.4					
(Curved Part)	6011	71089.1	-46660.2	-30821.2	-24066.4	71089.1	30821.2				12266.2	-12292.3	12292.3					
	6012	93152.3	-68759.3	-34612.6	-28276.2	93152.3	34612.6				13599.4	-13593.7	13599.4					
	6013	116815.0	-92524.7	-37790.8	-31755.4	116815.0	37790.8				14641.5	-14592.3	14641.5					
P10 Pier	6014	144279.0	-120182.0	-41037.8	-34963.1	144279.0	41037.8	3.0	59.9	○	15630.3	-15537.2	15630.3	0.202	0.223		30.968	○
	6015	173250.0	-149437.0	-44428.2	-38277.1	173250.0	44428.2	3.7	84.5	○	16565.0	-16456.3	16565.0	0.214	0.218		30.968	○
	6016	203597.0	-180218.0	-47818.2	-41663.0	203597.0	47818.2	4.4	111.8	○	17493.9	-17315.4	17493.9	0.226	0.214	0.796	30.968	○
	6017	235347.0	-212487.0	-51208.2	-45049.3	235347.0	51208.2	5.2	141.5	○	18526.4	-18279.2	18526.4	0.240	0.211	1.855	30.968	○
	6018	268612.0	-246312.0	-54598.0	-48436.1	268612.0	54598.0	6.0	173.7	○	19595.3	-19238.8	19595.3	0.254	0.208	2.910	30.968	○
	6019	301556.0	-280462.0	-57987.4	-51823.4	301556.0	57987.4	6.8	205.8	○	20621.2	-19908.7	20621.2	0.267	0.206	3.890	30.968	○
	6020	337526.0	-317815.0	-61376.8	-55211.1	337526.0	61376.8	7.6	242.2	○	21463.6	-20705.8	21463.6	0.278	0.204	4.711	30.968	○
	6021	344978.0	-325483.0	-63410.2	-57921.6	344978.0	63410.2	7.8	245.3	○	22136.3	-21285.5	22136.3	0.286	0.205	5.245	30.968	○
	6022	352344.0	-333235.0	-64088.2	-59277.0	352344.0	64088.2	8.0	252.8	○	22314.9	-21419.3	22314.9	0.289	0.204	5.416	30.968	○
	6023	359803.0	-341074.0	-64766.0	-59954.7	359803.0	64766.0	8.2	260.4	○	22490.9	-21550.1	22490.9	0.291	0.204	5.584	30.968	○
	6024	367302.0	-348967.0	-65443.8	-60632.4	367302.0	65443.8	8.3	268.1	○	22664.5	-21678.1	22664.5	0.293	0.204	5.750	30.968	○
(Bottom)	6025	374855.0	-356903.0	-66121.6	-61310.1	374855.0	66121.6	8.5	275.9	○	22835.7	-21803.5	22835.7	0.295	0.203	5.913	30.968	○

P11 Pier　Longi. Direction Section Calculation Result

	Elem. No.	Bending Moment (kN·m) Max	Bending Moment (kN·m) Min	Axial (kN) Max	Axial (kN) Min	Bending Moment (kN·m)	Axial (kN)	Bending Stress (N/mm2) σc σca=15	Bending Stress (N/mm2) σs σsa=300	Judge	Shear Force (kN) Max	Shear Force (kN) Min	Shear Force (kN) Selected	Shear Stress τ (N/mm2)	Shear Stress τa (N/mm2)	Shear-rebar required (cm2)	Shear-rebar Actual (cm2)	Judge
(Top)	6106	44364.0	-45939.5	-56319.0	-52324.2	45939.5	56319.0				22055.3	-21153.9	22055.3					
(Curved Part)	6107	68787.0	-71722.7	-58798.8	-54800.8	71722.7	58798.8				22926.4	-21709.3	22926.4					
	6108	93755.9	-98351.9	-61092.4	-57091.6	98351.9	61092.4				23677.7	-22194.6	23677.7					
	6109	119210.0	-125718.0	-63255.8	-59252.6	125718.0	63255.8				24334.6	-22626.0	24334.6					
P11 Pier	6110	158534.0	-168351.0	-65954.0	-61948.0	168351.0	65954.0	2.8	26.1	○	25086.0	-23198.5	25086.0	0.324	0.286	2.451	30.968	○
	6111	198796.0	-212307.0	-69201.2	-65192.2	212307.0	69201.2	3.6	46.6	○	25869.8	-23943.0	25869.8	0.334	0.272	4.012	30.968	○
	6112	239904.0	-257396.0	-72448.4	-68436.6	257396.0	72448.4	4.4	71.0	○	26532.6	-24609.2	26532.6	0.343	0.262	5.177	30.968	○
	6113	281802.0	-303396.0	-75695.4	-71681.0	303396.0	75695.4	5.3	97.9	○	27080.6	-25192.2	27080.6	0.350	0.255	6.074	30.968	○
	6114	325171.0	-348946.0	-78942.2	-74925.6	348946.0	78942.2	6.1	125.7	○	27498.9	-25696.0	27498.9	0.355	0.250	6.742	30.968	○
	6115	369526.0	-396304.0	-82188.6	-78170.6	396304.0	82188.6	7.0	155.5	○	27926.2	-26178.7	27926.2	0.361	0.246	7.357	30.968	○
	6116	414686.0	-444111.0	-85435.2	-81415.6	444111.0	85435.2	7.9	186.1	○	28398.4	-26620.5	28398.4	0.367	0.243	7.956	30.968	○
	6117	460532.0	-492394.0	-88681.4	-84660.8	492394.0	88681.4	8.8	217.5	○	29013.9	-27027.3	29013.9	0.375	0.240	8.636	30.968	○
	6118	507005.0	-541112.0	-91927.4	-87906.2	541112.0	91927.4	9.6	249.4	○	29733.7	-27395.4	29733.7	0.384	0.238	9.374	30.968	○
	6119	516323.0	-550936.0	-93875.0	-89853.4	550936.0	93875.0	9.8	253.4	○	30231.3	-27632.5	30231.3	0.391	0.238	9.779	30.968	○
	6120	525692.0	-560722.0	-94524.2	-90502.6	560722.0	94524.2	10.0	259.9	○	30383.1	-27698.5	30383.1	0.393	0.238	9.930	30.968	○
	6121	535080.0	-570520.0	-95173.4	-91151.6	570520.0	95173.4	10.2	266.3	○	30534.2	-27764.5	30534.2	0.395	0.237	10.080	30.968	○
	6122	544481.0	-580342.0	-95822.4	-91800.8	580342.0	95822.4	10.3	272.8	○	30687.6	-27828.8	30687.6	0.397	0.237	10.230	30.968	○
(Bottom)	6123	553906.0	-590183.0	-96471.6	-92450.0	590183.0	96471.6	10.5	279.3	○	30839.6	-27891.5	30839.6	0.399	0.237	10.379	30.968	○

P12 Pier　Longi. Direction Section Calculation Result

	Elem. No.	Bending Moment(kN·m)		Axial(kN)		Bending Moment	Axial	Bending Stress (N/mm2)		Judge	Shear Force(kN)			Shear Stress		Shear-rebar		Judge
								σc	σs					τ	τa	required	Actual	
		Max	Min	Max	Min	(kN·m)	(kN)	σca=15	σsa=300		Max	Min	Selected	(N/mm2)	(N/mm2)	(cm2)	(cm2)	
(Top)	6206	38560.8	-44448.9	-55489.6	-52740.0	44448.9	55489.6				21347.0	-18458.3	21347.0					
(Curved Part)	6207	60029.6	-69419.2	-57968.6	-55217.8	69419.2	57968.6				22206.6	-19083.4	22206.6					
	6208	82111.4	-95218.7	-60261.4	-57509.6	95218.7	60261.4				22959.7	-19628.3	22959.7					
	6209	104737.0	-121768.0	-62424.2	-59671.4	121768.0	62424.2				23631.2	-20111.2	23631.2					
P12 Pier	6210	139884.0	-163184.0	-65121.8	-62367.8	163184.0	65121.8	2.7	24.3	○	24418.0	-20699.1	24418.0	0.316	0.288	1.796	30.968	○
	6211	176073.0	-205999.0	-68368.2	-65613.0	205999.0	68368.2	3.5	43.8	○	25257.7	-21402.4	25257.7	0.326	0.273	3.422	30.968	○
	6212	213203.0	-250040.0	-71614.6	-68858.2	250040.0	71614.6	4.3	67.3	○	25993.0	-21994.5	25993.0	0.336	0.263	4.661	30.968	○
	6213	251154.0	-295119.0	-74860.8	-72103.6	295119.0	74860.8	5.1	93.3	○	26624.5	-22541.6	26624.5	0.344	0.256	5.638	30.968	○
	6214	289841.0	-339917.0	-78107.0	-75349.0	339917.0	78107.0	6.0	120.4	○	27144.6	-23106.5	27144.6	0.351	0.251	6.400	30.968	○
	6215	328923.0	-386629.0	-81353.2	-78594.4	386629.0	81353.2	6.8	149.6	○	27718.1	-23684.4	27718.1	0.358	0.247	7.143	30.968	○
	6216	369438.0	-433995.0	-84599.2	-81839.8	433995.0	84599.2	7.7	179.9	○	28363.5	-24240.9	28363.5	0.367	0.244	7.892	30.968	○
	6217	410869.0	-482029.0	-87845.2	-85085.4	482029.0	87845.2	8.6	211.0	○	29123.1	-24736.0	29123.1	0.376	0.241	8.697	30.968	○
	6218	453107.0	-530784.0	-91091.0	-88331.0	530784.0	91091.0	9.5	242.9	○	29980.2	-25187.0	29980.2	0.388	0.238	9.554	30.968	○
	6219	461591.0	-540664.0	-93038.6	-90278.4	540664.0	93038.6	9.6	246.9	○	30551.6	-25448.3	30551.6	0.395	0.239	10.021	30.968	○
	6220	470140.0	-550502.0	-93687.6	-90927.6	550502.0	93687.6	9.8	253.4	○	30725.6	-25538.1	30725.6	0.397	0.238	10.192	30.968	○
	6221	478711.0	-560385.0	-94336.8	-91576.8	560385.0	94336.8	10.0	259.9	○	30897.6	-25626.6	30897.6	0.399	0.238	10.360	30.968	○
	6222	487320.0	-570280.0	-94986.0	-92225.8	570280.0	94986.0	10.2	266.5	○	31069.7	-25716.2	31069.7	0.402	0.237	10.527	30.968	○
(Bottom)	6223	495947.0	-580222.0	-95635.2	-92875.0	580222.0	95635.2	10.3	273.1	○	31242.6	-25840.4	31242.6	0.404	0.237	10.694	30.968	○

P13 Pier　Longi. Direction Section Calculation Result

	Elem. No.	Bending Moment(kN·m)		Axial(kN)		Bending Moment	Axial	Bending Stress (N/mm2)		Judge	Shear Force(kN)			Shear Stress		Shear-rebar		Judge
								σc	σs					τ	τa	required	Actual	
		Max	Min	Max	Min	(kN·m)	(kN)	σca=15	σsa=300		Max	Min	Selected	(N/mm2)	(N/mm2)	(cm2)	(cm2)	
(Top)	6310	14460.3	-36151.7	-22319.4	-18153.3	36151.7	22319.4				8256.8	-7907.2	8256.8					
(Curved Part)	6311	30931.4	-53261.4	-26960.8	-22792.2	53261.4	26960.8				10537.8	-10148.2	10537.8					
	6312	50144.1	-73105.3	-30751.8	-26581.0	73105.3	30751.8				12230.5	-11834.2	12230.5					
	6313	71457.3	-95025.1	-33929.4	-29757.0	95025.1	33929.4				13511.6	-13130.4	13511.6					
P13 Pier	6314	96863.2	-121035.0	-37176.0	-33002.2	121035.0	37176.0	2.5	43.8	○	14689.8	-14343.8	14689.8	0.190	0.227		30.968	○
	6315	124267.0	-148916.0	-40565.6	-36390.6	148916.0	40565.6	3.1	66.3	○	15796.3	-15498.4	15796.3	0.204	0.221		30.968	○
	6316	153460.0	-178472.0	-43955.2	-39779.0	178472.0	43955.2	3.8	92.1	○	16835.8	-16557.5	16835.8	0.218	0.216	0.116	30.968	○
	6317	184452.0	-209637.0	-47344.6	-43167.4	209637.0	47344.6	4.6	120.8	○	17949.6	-17652.8	17949.6	0.232	0.212	1.280	30.968	○
	6318	217267.0	-242456.0	-50734.0	-46556.0	242456.0	50734.0	5.4	152.2	○	19308.3	-18846.2	19308.3	0.250	0.209	2.602	30.968	○
	6319	251838.0	-274776.0	-54123.2	-49944.6	274776.0	54123.2	6.2	183.3	○	20683.7	-19993.3	20683.7	0.268	0.207	3.886	30.968	○
	6320	285258.0	-309642.0	-57512.4	-53333.4	309642.0	57512.4	7.0	218.1	○	21763.5	-20856.8	21763.5	0.282	0.205	4.914	30.968	○
	6321	291535.0	-317174.0	-59545.8	-55366.8	317174.0	59545.8	7.1	221.3	○	22850.3	-21589.0	22850.3	0.296	0.205	5.791	30.968	○
	6322	298892.0	-324758.0	-60223.6	-56044.6	324758.0	60223.6	7.3	229.1	○	23123.8	-21770.9	23123.8	0.299	0.205	6.045	30.968	○
	6323	306338.0	-332424.0	-60901.4	-56722.2	332424.0	60901.4	7.5	237.0	○	23394.1	-21948.3	23394.1	0.303	0.204	6.296	30.968	○
	6324	313851.0	-340197.0	-61579.2	-57400.0	340197.0	61579.2	7.7	245.1	○	23661.1	-22121.6	23661.1	0.306	0.204	6.543	30.968	○
(Bottom)	6325	321410.0	-348034.0	-62257.0	-58077.8	348034.0	62257.0	7.9	253.2	○	23925.3	-22291.0	23925.3	0.310	0.204	6.787	30.968	○

P10 Pier Trans. Direction Section Calculation Result

	Elem. No.	Bending Moment(kN·m)		Axial(kN)		Bending Moment	Axial	Bending Stress (N/mm2)		Judge	Shear Force(kN)			Shear Stress		Shear-rebar		Judge
								σc	σs					τ	τa	required	Actual	
		Max	Min	Max	Min	(kN·m)	(kN)	σca=15	σsa=300		Max	Min	Selected	(N/mm2)	(N/mm2)	(cm2)	(cm2)	
(Top)	16010	95762.7	-89533.8	-24083.6	-23981.8	95762.7	24083.6				14516.4	-14586.6	14586.6					
(Curved Part)	16011	121789.0	-115829.0	-28724.0	-28621.6	121789.0	28724.0				16245.0	-16081.2	16245.0					
	16012	149606.0	-144279.0	-32514.0	-32411.0	149606.0	32514.0				17560.7	-17218.9	17560.7					
	16013	178836.0	-174348.0	-35691.0	-35587.6	178836.0	35691.0				18586.7	-18102.4	18586.7					
P10 Pier	16014	212200.0	-208915.0	-38936.8	-38833.0	212200.0	38936.8	3.5	82.2	○	19565.9	-18935.3	19565.9	0.253	0.197	2.246	23.226	○
	16015	246965.0	-245065.0	-42326.0	-42221.8	246965.0	42326.0	4.2	106.8	○	20522.9	-19725.0	20522.9	0.265	0.194	2.863	23.226	○
	16016	283021.0	-282717.0	-45715.0	-45610.6	283021.0	45715.0	4.9	133.4	○	21445.3	-20507.0	21445.3	0.277	0.192	3.439	23.226	○
	16017	320327.0	-321768.0	-49104.2	-48999.4	321768.0	49104.2	5.7	163.5	○	22393.1	-21512.9	22393.1	0.289	0.189	4.020	23.226	○
	16018	358778.0	-362237.0	-52493.2	-52388.2	362237.0	52493.2	6.5	195.9	○	23360.9	-22515.7	23360.9	0.302	0.188	4.598	23.226	○
	16019	397772.0	-400379.0	-55882.2	-55777.0	400379.0	55882.2	7.3	225.8	○	24305.9	-23482.2	24305.9	0.314	0.186	5.142	23.226	○
	16020	427466.0	-430603.0	-59271.2	-59165.8	430603.0	59271.2	7.9	246.5	○	24479.9	-24389.9	24479.9	0.316	0.186	5.251	23.226	○
	16021	433856.0	-437549.0	-61304.4	-61199.2	437549.0	61304.4	7.9	245.7	○	25680.8	-24923.5	25680.8	0.332	0.186	5.851	23.226	○
	16022	441611.0	-445623.0	-61982.2	-61877.0	445623.0	61982.2	8.1	252.2	○	25846.5	-25096.3	25846.5	0.334	0.186	5.947	23.226	○
	16023	449669.0	-453764.0	-62660.0	-62554.8	453764.0	62660.0	8.3	258.8	○	26011.6	-25267.2	26011.6	0.336	0.186	6.043	23.226	○
	16024	457710.0	-461950.0	-63337.8	-63232.4	461950.0	63337.8	8.4	265.5	○	26173.8	-25434.4	26173.8	0.338	0.186	6.137	23.226	○
(Bottom)	16025	465796.0	-470199.0	-64015.6	-63910.2	470199.0	64015.6	8.6	272.3	○	26332.8	-25602.3	26332.8	0.340	0.185	6.229	23.226	○

P11 Pier Trans. Direction Section Calculation Result

	Elem. No.	Bending Moment(kN·m)		Axial(kN)		Bending Moment	Axial	Bending Stress (N/mm2)		Judge	Shear Force(kN)			Shear Stress		Shear-rebar		Judge
								σc	σs					τ	τa	required	Actual	
		Max	Min	Max	Min	(kN·m)	(kN)	σca=15	σsa=300		Max	Min	Selected	(N/mm2)	(N/mm2)	(cm2)	(cm2)	
(Top)	16106	96437.0	-88251.4	-54159.6	-54159.2	96437.0	54159.6				12215.8	-13147.1	13147.1					
(Curved Part)	16107	111739.0	-100879.0	-56637.8	-56637.4	111739.0	56637.8				12530.0	-13623.7	13623.7					
	16108	127530.0	-113851.0	-58930.0	-58929.8	127530.0	58930.0				12807.3	-14055.9	14055.9					
	16109	143778.0	-127120.0	-61092.4	-61092.0	143778.0	61092.4				13056.8	-14456.0	14456.0					
P11 Pier	16110	169159.0	-147712.0	-63789.2	-63788.8	169159.0	63789.2	2.1	10.5	○	13351.6	-14946.1	14946.1	0.193	0.288		23.226	○
	16111	195512.0	-168883.0	-67034.8	-67034.4	195512.0	67034.8	2.5	16.0	○	13674.8	-15520.4	15520.4	0.201	0.278		23.226	○
	16112	222816.0	-190605.0	-70280.6	-70280.2	222816.0	70280.6	2.8	22.8	○	13969.1	-16080.3	16080.3	0.208	0.271		23.226	○
	16113	251034.0	-214491.0	-73526.4	-73526.0	251034.0	73526.4	3.2	31.1	○	14232.0	-16627.0	16627.0	0.215	0.264		23.226	○
	16114	280162.0	-238936.0	-76772.0	-76771.6	280162.0	76772.0	3.7	40.9	○	14469.0	-17164.5	17164.5	0.222	0.259		23.226	○
	16115	310234.0	-263734.0	-80017.8	-80017.4	310234.0	80017.8	4.1	52.1	○	14696.3	-17727.6	17727.6	0.229	0.254		23.226	○
	16116	341271.0	-288883.0	-83263.6	-83263.2	341271.0	83263.6	4.6	64.8	○	14914.2	-18307.5	18307.5	0.237	0.250		23.226	○
	16117	373293.0	-314342.0	-86509.2	-86508.8	373293.0	86509.2	5.2	78.8	○	15126.5	-18888.8	18888.8	0.244	0.246		23.226	○
	16118	406287.0	-340049.0	-89755.0	-89754.6	406287.0	89755.0	5.7	94.1	○	15345.1	-19467.5	19467.5	0.252	0.243	0.346	23.226	○
	16119	413002.0	-345217.0	-91702.4	-91702.0	413002.0	91702.4	5.8	94.8	○	15479.0	-19811.2	19811.2	0.256	0.244	0.512	23.226	○
	16120	419753.0	-350393.0	-92351.6	-92351.2	419753.0	92351.6	5.9	98.0	○	15525.8	-19925.9	19925.9	0.258	0.243	0.595	23.226	○
	16121	426542.0	-355577.0	-93000.6	-93000.4	426542.0	93000.6	6.0	101.3	○	15571.8	-20040.3	20040.3	0.259	0.242	0.677	23.226	○
	16122	433368.0	-360769.0	-93649.8	-93649.4	433368.0	93649.8	6.2	104.6	○	15620.9	-20154.4	20154.4	0.261	0.242	0.759	23.226	○
(Bottom)	16123	440242.0	-365969.0	-94299.0	-94298.6	440242.0	94299.0	6.3	108.0	○	15691.4	-20268.8	20268.8	0.262	0.241	0.841	23.226	○

P12 Pier Trans. Direction Section Calculation Result

	Elem. No.	Bending Moment (kN·m) Max	Bending Moment (kN·m) Min	Axial (kN) Max	Axial (kN) Min	Bending Moment (kN·m)	Axial (kN)	Bending Stress (N/mm2) σc σca=15	Bending Stress (N/mm2) σs σsa=300	Judge	Shear Force (kN) Max	Shear Force (kN) Min	Shear Force (kN) Selected	Shear Stress τ (N/mm2)	Shear Stress τa (N/mm2)	Shear-rebar required (cm2)	Shear-rebar Actual (cm2)	Judge
(Top)	16206	104123. 0	-95467. 3	-54159. 2	-54159. 2	104123. 0	54159. 2				14558. 9	-14919. 1	14919. 1					
(Curved Part)	16207	121548. 0	-110769. 0	-56637. 6	-56637. 4	121548. 0	56637. 6				15020. 7	-15513. 8	15513. 8					
	16208	139583. 0	-126615. 0	-58929. 8	-58929. 6	139583. 0	58929. 8				15430. 2	-16049. 5	16049. 5					
	16209	158171. 0	-142941. 0	-61092. 0	-61091. 8	158171. 0	61092. 0				15800. 0	-16540. 6	16540. 6					
P12 Pier	16210	187273. 0	-168942. 0	-63788. 8	-63788. 6	187273. 0	63788. 8	2. 4	15. 6	○	16241. 1	-17136. 6	17136. 6	0. 222	0. 278		23. 226	○
	16211	217543. 0	-197384. 0	-67034. 6	-67034. 4	217543. 0	67034. 6	2. 8	23. 7	○	16772. 0	-17824. 6	17824. 6	0. 231	0. 268		23. 226	○
	16212	248920. 0	-226641. 0	-70280. 2	-70280. 2	248920. 0	70280. 2	3. 2	33. 8	○	17330. 8	-18486. 4	18486. 4	0. 239	0. 261		23. 226	○
	16213	281376. 0	-256664. 0	-73526. 0	-73525. 8	281376. 0	73526. 0	3. 7	45. 9	○	17862. 2	-19124. 9	19124. 9	0. 247	0. 255		23. 226	○
	16214	314854. 0	-287415. 0	-76771. 8	-76771. 6	314854. 0	76771. 8	4. 3	59. 8	○	18374. 3	-19746. 3	19746. 3	0. 255	0. 250	0. 225	23. 226	○
	16215	349396. 0	-318928. 0	-80017. 4	-80017. 4	349396. 0	80017. 4	4. 9	75. 5	○	18903. 8	-20392. 4	20392. 4	0. 264	0. 246	0. 733	23. 226	○
	16216	385020. 0	-351748. 0	-83263. 2	-83263. 0	385020. 0	83263. 2	5. 5	92. 8	○	19440. 3	-21056. 7	21056. 7	0. 272	0. 242	1. 227	23. 226	○
	16217	421710. 0	-385467. 0	-86509. 0	-86508. 8	421710. 0	86509. 0	6. 1	111. 5	○	19965. 7	-21722. 0	21722. 0	0. 281	0. 239	1. 702	23. 226	○
	16218	456654. 0	-420096. 0	-89754. 6	-89754. 6	456654. 0	89754. 6	6. 7	129. 5	○	20478. 4	-22347. 0	22347. 0	0. 289	0. 236	2. 126	23. 226	○
	16219	461745. 0	-427123. 0	-91702. 0	-91702. 0	461745. 0	91702. 0	6. 8	128. 8	○	20771. 7	-22778. 0	22778. 0	0. 295	0. 237	2. 327	23. 226	○
	16220	468920. 0	-434193. 0	-92351. 2	-92351. 0	468920. 0	92351. 2	6. 9	132. 6	○	20869. 1	-22909. 1	22909. 1	0. 296	0. 236	2. 414	23. 226	○
	16221	476207. 0	-441300. 0	-93000. 4	-93000. 2	476207. 0	93000. 4	7. 0	136. 4	○	20967. 0	-23039. 8	23039. 8	0. 298	0. 236	2. 501	23. 226	○
	16222	483586. 0	-446483. 0	-93649. 6	-93649. 4	483586. 0	93649. 6	7. 1	140. 3	○	21056. 2	-23171. 0	23171. 0	0. 300	0. 235	2. 589	23. 226	○
(Bottom)	16223	491047. 0	-452398. 0	-94298. 6	-94298. 6	491047. 0	94298. 6	7. 3	144. 4	○	21151. 0	-23301. 6	23301. 6	0. 301	0. 235	2. 675	23. 226	○

P13 Pier Trans. Direction Section Calculation Result

	Elem. No.	Bending Moment (kN·m) Max	Bending Moment (kN·m) Min	Axial (kN) Max	Axial (kN) Min	Bending Moment (kN·m)	Axial (kN)	Bending Stress (N/mm2) σc σca=15	Bending Stress (N/mm2) σs σsa=300	Judge	Shear Force (kN) Max	Shear Force (kN) Min	Shear Force (kN) Selected	Shear Stress τ (N/mm2)	Shear Stress τa (N/mm2)	Shear-rebar required (cm2)	Shear-rebar Actual (cm2)	Judge
(Top)	16310	87471. 1	-81812. 0	-20031. 4	-20030. 8	87471. 1	20031. 4				13308. 3	-14150. 0	14150. 0					
(Curved Part)	16311	113031. 0	-105398. 0	-24671. 4	-24670. 8	113031. 0	24671. 4				14831. 5	-15803. 7	15803. 7					
	16312	140607. 0	-130846. 0	-28461. 0	-28460. 6	140607. 0	28461. 0				16007. 0	-17070. 9	17070. 9					
	16313	169770. 0	-158356. 0	-31637. 8	-31637. 4	169770. 0	31637. 8				16935. 5	-18070. 0	18070. 0					
P13 Pier	16314	203278. 0	-189996. 0	-34883. 6	-34883. 0	203278. 0	34883. 6	3. 4	87. 7	○	17828. 5	-19036. 7	19036. 7	0. 246	0. 194	2. 088	23. 226	○
	16315	238367. 0	-223176. 0	-38272. 6	-38272. 0	238367. 0	38272. 6	4. 1	113. 3	○	18696. 5	-20000. 8	20000. 8	0. 259	0. 191	2. 698	23. 226	○
	16316	274941. 0	-257784. 0	-41661. 4	-41661. 0	274941. 0	41661. 4	4. 9	140. 9	○	19524. 9	-20945. 2	20945. 2	0. 271	0. 189	3. 278	23. 226	○
	16317	313007. 0	-293791. 0	-45050. 4	-45049. 8	313007. 0	45050. 4	5. 6	170. 6	○	20361. 5	-21921. 0	21921. 0	0. 283	0. 187	3. 860	23. 226	○
	16318	352586. 0	-331160. 0	-48439. 2	-48438. 8	352586. 0	48439. 2	6. 4	202. 2	○	21179. 5	-22936. 7	22936. 7	0. 297	0. 186	4. 452	23. 226	○
	16319	392174. 0	-369806. 0	-51828. 2	-51827. 6	392174. 0	51828. 2	7. 2	234. 1	○	21948. 6	-23950. 4	23950. 4	0. 310	0. 184	5. 030	23. 226	○
	16320	422167. 0	-403935. 0	-55217. 2	-55216. 6	422167. 0	55217. 2	7. 8	254. 5	○	22321. 7	-24407. 8	24407. 8	0. 316	0. 184	5. 281	23. 226	○
	16321	429053. 0	-410682. 0	-57250. 4	-57250. 0	429053. 0	57250. 4	7. 9	253. 6	○	23037. 8	-25489. 2	25489. 2	0. 330	0. 185	5. 817	23. 226	○
	16322	437000. 0	-418383. 0	-57928. 2	-57927. 8	437000. 0	57928. 2	8. 1	260. 0	○	23166. 6	-25679. 3	25679. 3	0. 332	0. 185	5. 925	23. 226	○
	16323	445104. 0	-426168. 0	-58606. 0	-58605. 6	445104. 0	58606. 0	8. 2	266. 6	○	23293. 2	-25867. 8	25867. 8	0. 334	0. 184	6. 031	23. 226	○
	16324	453319. 0	-433986. 0	-59283. 8	-59283. 4	453319. 0	59283. 8	8. 4	273. 4	○	23417. 4	-26054. 2	26054. 2	0. 337	0. 184	6. 137	23. 226	○
(Bottom)	16325	461586. 0	-441787. 0	-59961. 6	-59961. 2	461586. 0	59961. 6	8. 6	280. 2	○	23539. 6	-26238. 6	26238. 6	0. 339	0. 184	6. 241	23. 226	○

■Bending Response of Pier (Reference)

1. Allowable plastic rate for bottom of column

Longi.	Avarage	Allowance	Judge
P1	0.663	1.000	OK
P2	0.777	1.000	OK
P3	0.752	1.000	OK
P4	0.562	1.000	OK

Trans.	Avarage	Allowance	Judge
P1	0.476	1.000	OK
P2	0.097	1.000	OK
P3	0.216	1.000	OK
P4	0.494	1.000	OK

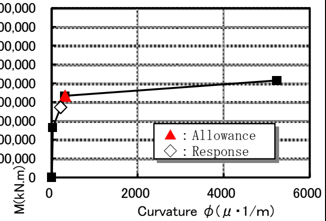
2. Response Curvature of bottom of column

Longi.

【P1 Pier】

M－φ	φ(μ·1/m)	M(kN·m)
Bottom	0	0
c	29.0	266,792
y	312.0	432,776
u	5,242.0	515,038
Allowance	312.0	432,776
Response	207.0	371,168

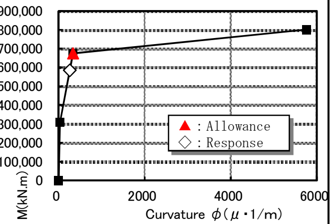
Allowable Rate μa= 1.000
Response Rate μ= Elastic
Judge 0.K



【P2 Pier】

M－φ	φ(μ·1/m)	M(kN·m)
Bottom	0	0
c	32.0	309,576
y	333.0	675,844
u	5,775.0	801,708
Allowance	333.0	675,844
Response	258.6	585,314

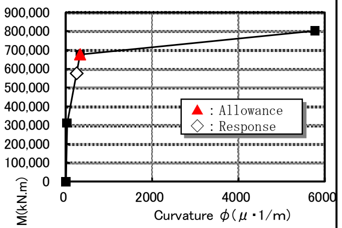
Allowable Rate μa= 1.000
Response Rate μ= Elastic
Judge 0.K



【P3 Pier】

M－φ	φ(μ·1/m)	M(kN·m)
Bottom	0	0
c	32.0	309,576
y	333.0	675,843
u	5,775.0	801,707
Allowance	333.0	675,843
Response	250.4	575,323

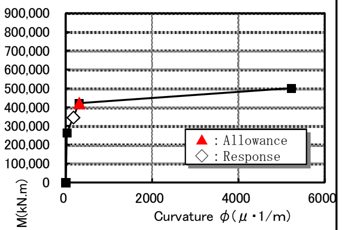
Allowable Rate μa= 1.000
Response Rate μ= Elastic
Judge 0.K



【P4 Pier】

M－φ	φ(μ·1/m)	M(kN·m)
Bottom	0	0
c	28.0	261,932
y	311.0	420,781
u	5,230.0	500,913
Allowance	311.0	420,781
Response	174.8	344,337

Allowable Rate μa= 1.000
Response Rate μ= Elastic
Judge 0.K

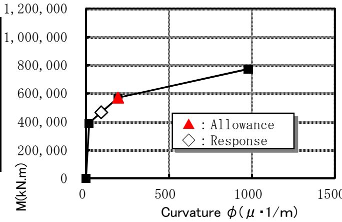


Trans.

【P1 Pier】

M－φ	φ(μ·1/m)	M(kN·m)
Bottom	0	0
c	18.0	391,239
y	193.0	568,451
u	978.0	772,494
Allowance	193.0	568,451
Response	91.8	466,019

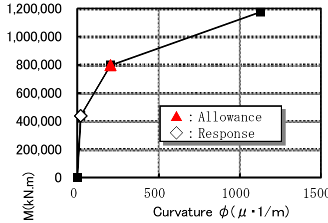
Allowable Rate μa= 1.000
Response Rate μ= Elastic
Judge 0.K



【P2 Pier】

M－φ	φ(μ·1/m)	M(kN·m)
Bottom	0	0
c	20.0	440,732
y	204.0	796,083
u	1,129.0	1,175,608
Allowance	204.0	796,083
Response	19.8	436,805

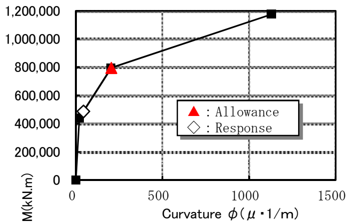
Allowable Rate μa= 1.000
Response Rate μ= Elastic
Judge 0.K



【P3 Pier】

M－φ	φ(μ·1/m)	M(kN·m)
Bottom	0	0
c	20.0	440,732
y	204.0	796,082
u	1,129.0	1,175,606
Allowance	204.0	796,082
Response	44.1	487,263

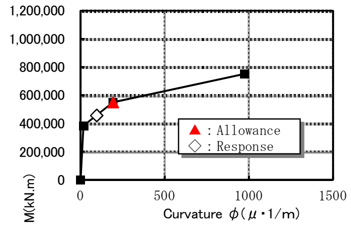
Allowable Rate μa= 1.000
Response Rate μ= Elastic
Judge 0.K



【P4 Pier】

M－φ	φ(μ·1/m)	M(kN·m)
Bottom	0	0
c	18.0	384,113
y	192.0	550,223
u	976.0	751,484
Allowance	192.0	550,223
Response	94.9	457,552

Allowable Rate μa= 1.000
Response Rate μ= Elastic
Judge 0.K



4.4 Analysis Results of Bearing

■Reaction Force of Bearing

Analysis In Longi.Direction

			Vertical Force		Horizontal (Longi.)		Horizontal (Trans.)	
			Max (kN)	Min (kN)	Max (kN)	Min (kN)	Max (kN)	Min (kN)
P10 Pier	L	Rocking Bearing	1097.5	-1009.9	0.0	0.0	0.0	0.0
	CL	Horizontal Bearing	0.0	0.0	0.0	0.0	4.1	-4.2
	R	Rocking Bearing	1097.4	-1010.3	0.0	0.0	0.0	0.0
P11 Pier	L	Pin-roller Bearing	12402.7	12396.8	0.0	0.0	0.0	0.0
	CL	Pivot Bearing	48297.4	44317.5	20067.1	-20419.4	4.7	-4.6
	R	Pin-roller Bearing	12402.7	12396.9	0.0	0.0	0.0	0.0
P12 Pier	L	Pin-roller Bearing	12402.3	12397.4	0.0	0.0	0.0	0.0
	CL	Pivot Bearing	47471.8	44730.7	19234.0	-17744.9	4.1	-4.0
	R	Pin-roller Bearing	12402.1	12397.4	0.0	0.0	0.0	0.0
P13 Pier	L	Rocking Bearing	1212.7	-821.5	0.0	0.0	0.0	0.0
	CL	Horizontal Bearing	0.0	0.0	0.0	0.0	2.1	-2.1
	R	Rocking Bearing	1212.0	-821.5	0.0	0.0	0.0	0.0

Analysis In Trans.Direction

			Vertical Force		Horizontal (Longi.)		Horizontal (Trans.)	
			Max (kN)	Min (kN)	Max (kN)	Min (kN)	Max (kN)	Min (kN)
P10 Pier	L	Rocking Bearing	2060.4	-1907.7	0.0	0.0	0.0	0.0
	CL	Horizontal Bearing	0.0	0.0	0.0	0.0	6696.1	-6385.0
	R	Rocking Bearing	2082.6	-1885.5	0.0	0.0	0.0	0.0
P11 Pier	L	Pin-roller Bearing	20422.1	3951.1	0.0	0.0	0.0	0.0
	CL	Pivot Bearing	46145.9	46145.5	976.6	976.2	12274.5	-11636.1
	R	Pin-roller Bearing	20848.4	4377.5	0.0	0.0	0.0	0.0
P12 Pier	L	Pin-roller Bearing	20764.2	3452.3	0.0	0.0	0.0	0.0
	CL	Pivot Bearing	46145.8	46145.6	976.5	976.3	13820.4	-13692.4
	R	Pin-roller Bearing	21347.2	4035.3	0.0	0.0	0.0	0.0
P13 Pier	L	Rocking Bearing	2045.2	-1813.8	0.0	0.0	0.0	0.0
	CL	Horizontal Bearing	0.0	0.0	0.0	0.0	6218.9	-6255.5
	R	Rocking Bearing	1988.6	-1870.3	0.0	0.0	0.0	0.0

Max and Min

			Vertical Force		Horizontal (Longi.)		Horizontal (Trans.)	
			Max (kN)	Min (kN)	Max (kN)	Min (kN)	Max (kN)	Min (kN)
P10 Pier	L	Rocking Bearing	2060.4	-1907.7	0.0	0.0	0.0	0.0
	CL	Horizontal Bearing	0.0	0.0	0.0	0.0	6696.1	-6385.0
	R	Rocking Bearing	2082.6	-1885.5	0.0	0.0	0.0	0.0
P11 Pier	L	Pin-roller Bearing	20422.1	3951.1	0.0	0.0	0.0	0.0
	CL	Pivot Bearing	48297.4	44317.5	20067.1	-20419.4	12274.5	-11636.1
	R	Pin-roller Bearing	20848.4	4377.5	0.0	0.0	0.0	0.0
P12 Pier	L	Pin-roller Bearing	20764.2	3452.3	0.0	0.0	0.0	0.0
	CL	Pivot Bearing	47471.8	44730.7	19234.0	-17744.9	13820.4	-13692.4
	R	Pin-roller Bearing	21347.2	4035.3	0.0	0.0	0.0	0.0
P13 Pier	L	Rocking Bearing	2045.2	-1813.8	0.0	0.0	0.0	0.0
	CL	Horizontal Bearing	0.0	0.0	0.0	0.0	6218.9	-6255.5
	R	Rocking Bearing	1988.6	-1870.3	0.0	0.0	0.0	0.0

■Bearing Displacement (Relative displacement of top and bottom)

Analysis in Longi. Direction

			Longi. Displacement		Trans. Displacement	
			Max	Min	Max	Min
			(m)	(m)	(m)	(m)
P10 Pier	CL	Horizontal Bearing	0.067	-0.085	0.000	0.000
P13 Pier	CL	Horizontal Bearing	0.087	-0.075	0.000	0.000

Analysis in Trans. Direction

			Longi. Displacement		Trans. Displacement	
			Max	Min	Max	Min
			(kN)	(kN)	(kN)	(kN)
P10 Pier	CL	Horizontal Bearing	-0.011	-0.011	0.000	0.000
P13 Pier	CL	Horizontal Bearing	0.010	0.010	0.000	0.000

4.5_Bottom of Column Simultaneity Stress Resultants

Longi.

	Stress Resultants		Axial (kN)	Shear (kN)	Bending Moment (kN·m)
P10 Pier	Shear	Max	-64625.8	21803.5	-370230.0
		Min	-64394.2	-22835.7	356633.0
	Bending Moment	Max	-64422.2	-22756.9	356903.0
		Min	-64711.0	20836.6	-374855.0
P11 Pier	Shear	Max	-93272.0	27891.5	-552108.0
		Min	-95587.4	-30839.6	564659.0
	Bending Moment	Max	-95256.4	-28637.3	590183.0
		Min	-93380.0	27709.3	-553906.0
P12 Pier	Shear	Max	-94230.0	25840.4	-459108.0
		Min	-93958.6	-31242.6	555154.0
	Bending Moment	Max	-93774.0	-28814.9	580222.0
		Min	-94163.4	25618.0	-495947.0
P13 Pier	Shear	Max	-59663.6	-20894.1	348034.0
		Min	-59314.0	-23925.3	333486.0
	Bending Moment	Max	-59663.6	-20894.1	348034.0
		Min	-59840.2	20635.7	-321410.0

Trans.

	Stress Resultants		Axial (kN)	Shear (kN)	Bending Moment (kN·m)
P10 Pier	Shear	Max	-63986.6	25602.3	-465681.0
		Min	-63943.4	-26332.8	453519.0
	Bending Moment	Max	-63921.0	-23647.4	470199.0
		Min	-63985.6	25571.2	-465796.0
P11 Pier	Shear	Max	-94298.8	20268.8	-439530.0
		Min	-94298.8	-15691.4	352634.0
	Bending Moment	Max	-94298.8	-15294.0	365969.0
		Min	-94298.8	20217.6	-440242.0
P12 Pier	Shear	Max	-94298.6	23301.6	-479329.0
		Min	-94298.6	-21151.0	450624.0
	Bending Moment	Max	-94298.6	-20596.9	452398.0
		Min	-94298.6	22257.9	-491047.0
P13 Pier	Shear	Max	-59961.2	26238.6	-447780.0
		Min	-59961.4	-23539.6	435268.0
	Bending Moment	Max	-59961.6	-22848.1	441787.0
		Min	-59961.2	22724.7	-461586.0

Cable Stayed Bridge

4) Superstructure Design

- Contents -

1. Desing Conditions for the Bridge Design

1.1 Design Conditions

− General Conditions

Item	Design Conditions			Remark
Design objective	Construction of new bridges and improvement of Thanlyin Chin Kat Road			
	Project length	3,644.341 m		
	River bridge	Length	2031.000 m	
		Superstructure	Steel cable-stayed bridge 448.000 m Steel box girder bridge 1,033.000 m (257 m, 776 m) PC box girder Bridge 550.000 m (250 m, 300 m)	
		Substructure	Wall pier, hammerhead pier, reverse-T abutment	
		Foundation	Steel pipe sheet pile (SPSP), cast-in-situ pile	
	Flyover	Length	602.000 m	
		Superstructure	Steel box girder bridge180.000 m Steel I girder bridge 122.000 m PC I girder bridge 300.000 m (60 m, 180 m, 60 m)	
		Substructure	Hammerhead pier, reverse-T abutment	
		Foundation	Cast-in-situ pile	
	On-ramp bridge	Length	115.200 m	
		Superstructure	PC I girder bridge 115.200 m	
		Substructure	Hammerhead pier, reverse-T abutment	
		Foundation	Cast-in-situ pile	
	Road improvement	Approach road Thanlyin side 357 m, Thaketa side 430 m		
		Arterial road 834.341 m		
	Intersection	Star City intersection, Shukinthar intersection, Yadanar intersection		
	Toll collection	Thaketa side (both northbound and southbound)		
Bridge name	Bago River Bridge			
Line name	Thanlyin Chin Kat Road			
Road design standards	Specifications for Road Design (Japan), June 2015, Japan Road Association (JRA) AASHTO A Policy on Geometric Design of Highways and Streets, 6th Edition (2011) for vertical clearance 5.0 m ASEAN Highway standard for traffic lane width 3.5 m Road Design Criteria in Myanmar, Department of Highway, Ministry of Construction (2015) for general reference			
Structural design standards	AASHTO LRFD Bridge Design 7th Edition (2014) for calculations of live load and collision force Specifications for Highway Bridge, March 2012, JRA Specifications for Earthwork for Road, June 2009, JRA Guidelines for Road Embankment, April 2010, JRA Guidelines for Road Revetment, July 2012, JRA Guidelines for Soft Soil Treatment, August 2012, JRA Guidelines for Design of Pile Foundations, March 2015, JRA Guidelines for Construction of Steel Pipe Pile Foundations, December 1997, JRA Other Relevant Standards and/or Documents			

- Road Design Conditions

<table>
<tr><th>Item</th><th>Design conditions</th><th>Remark</th></tr>
<tr><td>Road classification</td><td>Bago River Bridge Equivalent to Class 2-2
Flyover Equivalent to Class 4-1
On-ramp Equivalent to Class C
Improvement of Thanlyin Chin Kat Road Equivalent to Class 4-1</td><td></td></tr>
<tr><td>Design speed</td><td>Bago River Bridge, Flyover 60 km/h
On-ramp 30 km/h
Thanlyin Chin Kat Road 40 km/h</td><td></td></tr>
<tr><td>Design traffic volume</td><td>Bago River Bridge
44,356 vehicle/day (northbound 25,352 v/d, southbound 19,004 v/d)
Trucks 6,173 vehicle/day (northbound 2,829 v/d, southbound 3,344 v/d)
Flyover
22,216 vehicle/day (northbound 12,061 v/d, southbound 9,662 v/d)
Trucks 6,173 vehicle/day (northbound 1,549 v/d, southbound 2,090 v/d)</td><td>Supplemental survey results, YUTRA Master Plan Case, 2035 time point</td></tr>
<tr><td>Planar road alignments</td><td>Bago River Bridge to Flyover
<table>
<tr><td>SP</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>0+000.000</td><td>0+024.970</td><td>0+076.170</td><td>0+161.513</td><td>0+212.713</td><td>0+521.900</td></tr>
<tr><td>R=∞</td><td>A=160</td><td>R=-500</td><td>A=160</td><td>R=∞</td><td>R=-2000</td></tr>
<tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr>
<tr><td>0+857.522</td><td>2+627.420</td><td>2+680.992</td><td>2+724.080</td><td>2+777.651</td><td>2+782.486</td></tr>
<tr><td>R=∞</td><td>A=150</td><td>R=-420</td><td>A=150</td><td>R=∞</td><td>A=130</td></tr>
<tr><td>12</td><td>13</td><td>14</td><td>EP</td><td></td><td></td></tr>
<tr><td>2+835.298</td><td>2+961.571</td><td>3+014.383</td><td>3+644.341</td><td></td><td></td></tr>
<tr><td>R=320</td><td>A=130</td><td>R=∞</td><td>-</td><td></td><td></td></tr>
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On-ramp
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<tr><td>R=∞</td><td>R=-140</td><td>R=∞</td><td>A=50</td><td>R=-58</td><td>A=50</td></tr>
<tr><td>6</td><td>7</td><td>EP</td><td></td><td></td><td></td></tr>
<tr><td>0+410.587</td><td>0+535.778</td><td>0+643.083</td><td></td><td></td><td></td></tr>
<tr><td>R=∞</td><td>R=-1000</td><td>-</td><td></td><td></td><td></td></tr>
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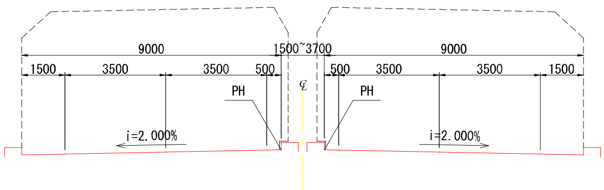
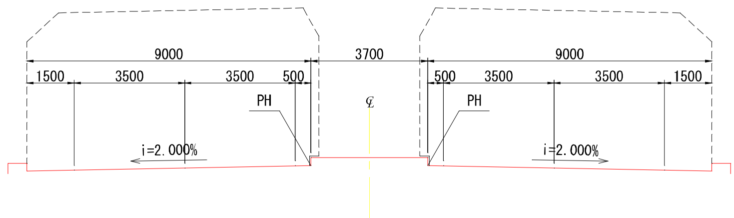
<tr><td>Profiles</td><td>Bago River Bridge to Flyover
<table>
<tr><td>0+0.000</td><td>0+228.003</td><td>0+700.000</td><td>1+88.000</td><td>2+140.000</td><td>2+517.727</td></tr>
<tr><td>5.695</td><td>5.467</td><td>17.267</td><td>18.431</td><td>15.275</td><td>5.832</td></tr>
<tr><td>-0.100</td><td>2.500</td><td>0.300</td><td>-0.300</td><td>-2.500</td><td>3.000</td></tr>
<tr><td>2+830.000</td><td>2+960.000</td><td>3+160.000</td><td>3+475.000</td><td>3+500.000</td><td></td></tr>
<tr><td>15.200</td><td>15.850</td><td>14.420</td><td>4.970</td><td>5.000</td><td></td></tr>
<tr><td>0.500</td><td>-0.715</td><td>-3.000</td><td>-0.300</td><td>-</td><td></td></tr>
</table>
On-ramp
<table>
<tr><td>0+0.000</td><td>0+150.000</td><td>0.329.942</td><td>0+490.000</td><td>0+540.000</td><td></td></tr>
<tr><td>4.470</td><td>4.470</td><td>5.010</td><td>13.780</td><td>14.878</td><td></td></tr>
<tr><td>level</td><td>0.300</td><td>5.479</td><td>2.197</td><td>-</td><td></td></tr>
</table></td><td></td></tr>
<tr><td>Cant</td><td>Bago River Bridge 2% crossfall (Max. 4% camber)
Flyover 2% crossfall (Max. 6% camber)
On-ramp 2% camber (Max. 9% camber)</td><td></td></tr>
</table>

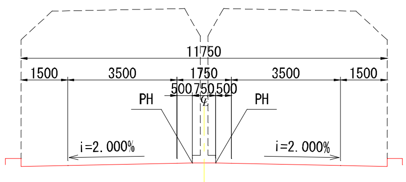
<table>
<tr>
<td>Cross section</td>
<td>
Bago River Bridge (PC box girder and Steel box girder)

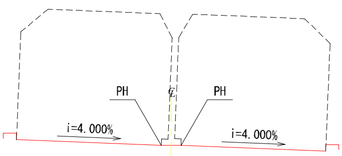


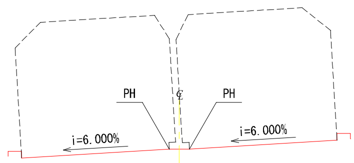
Bago River Bridge (Steel cable-stayed bridge)



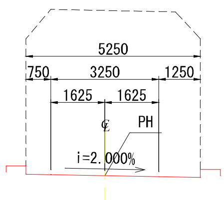
Flyover (crossfall, 4% camber and 6% camber)

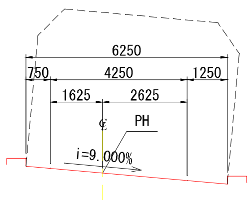






On-ramp (2% camber and 9% camber)

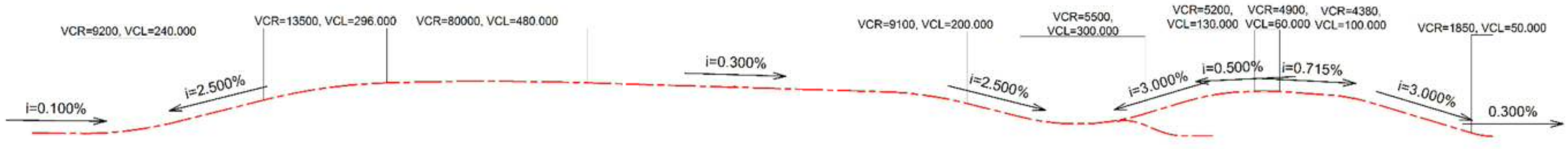




</td>
<td></td>
</tr>
<tr>
<td>Widening</td>
<td>Bago River Bridge　no widening but median
Flyover　no widening
On-ramp　1.00 m widening at R = 58 section</td>
<td></td>
</tr>
</table>

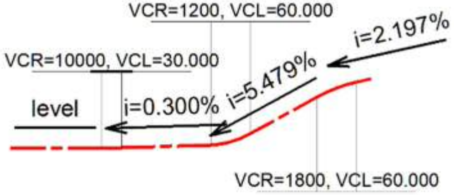
Figure Planar Alignment

Source: JICA Study Team



Source: JICA Study Team

Figure Vertical Alignment (Main Road)



Source: JICA Study Team

Figure Vertical Alignment (On-ramp)

- River Conditions

Item	Design Conditions	Remark
River name	Bago River	
Navigation	Pier P10 to P13 will be the navigation after construction. Pier P7 to P20 will also be the navigation in the future.	Agreement with DWIR
Clearance	Vertical height and width shall be secured between Pier P7 to P20 as Thanlyin Bridge	Agreement with DWIR
Design discharge	16,169 m^3/s (100-year return period)	

Design high water level (HWL)

Load combination	Supposition	Water level (MSL＋m)	River flow (m/s)
Normal	Full/low tide of spring tide	+3.18／-2.39	0
Wind	Highest HWL	+4.99	0
Collision at navigation span	Full tide of spring tide	+3.18	0
Collision at side span	Maximum river flow at flood of 100year return period	+2.53	1.19
Earthquake	Normal water level	+0.29	0.60
During construction	5year return period	+4.34	0.65

Design riverbed and scouring depth

	P6	P7	P8	P9	P10
Riverbed height	0.41	-3.59	-5.35	-4.82	-4.55
Foundation height	-2.48	-6.38	-6.34	-6.35	-9.10
Maximum scouring depth	-3.41	-8.91	-9.42	-9.31	-11.27

P11	P12	P13	P14	P15	P16	P17	P18
-5.41	-7.96	-8.02	-6.28	-5.09	-5.26	-6.70	-6.99
-9.10	-9.10	-9.10	-8.06	-8.06	-8.06	-8.06	-8.06
-12.13	-13.67	-13.48	-11.43	-10.84	-10.36	-9.70	-10.00

P19	P20	P21	P22	P23	P24	P25
-6.88	-6.55	-6.15	-4.61	-0.05	4.11	4.04
-8.06	-7.28	-7.55	-7.59	-2.39	3.73	3.78
-9.78	-9.53	-8.56	-7.48	-2.07	3.98	3.92

Item	Design Conditions	Remark
Reference height	Benchmark survey result at Monkey Point MSL = CDL + 2.814 m All the height in the Project will be expressed as the height from MSL	

- Soil Conditions

<table>
<tr><th>Item</th><th>Design Conditions</th><th>Remark</th></tr>
<tr><td>Survey outlines</td><td>Shown in Figure 4.1.15</td><td></td></tr>
<tr><td>Profile</td><td>Shown in Figure 4.1.14</td><td></td></tr>
<tr><td>Design soil parameters</td><td>Riverbed (P7 to P22)
<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Soil name</th><th rowspan="2">N-value</th><th colspan="3">Unit weight (kN/m^3)</th><th>Internal friction angle</th><th>Cohesive strength</th><th>Deformation Modulus</th></tr>
<tr><th>γ_t</th><th>γ_{sat}</th><th>γ'</th><th>φ (°)</th><th>c (kN/m^2)</th><th>E_{50} (kN/m^2)</th></tr>
<tr><td>1</td><td>River sediments</td><td>3</td><td>17.0</td><td>18.0</td><td>8.0</td><td>29</td><td>-</td><td>1,200</td></tr>
<tr><td>2</td><td>CLAY-I</td><td>1</td><td>17.5</td><td>17.5</td><td>7.5</td><td>-</td><td>10</td><td>900</td></tr>
<tr><td>3</td><td>Clayey SAND-A</td><td>3</td><td>17.5</td><td>18.5</td><td>8.5</td><td>28</td><td>-</td><td>1,200</td></tr>
<tr><td>4</td><td>Silty SAND-I</td><td>13</td><td>17.0</td><td>18.0</td><td>8.0</td><td>33</td><td>-</td><td>5,200</td></tr>
<tr><td>5</td><td>Sandy CLAY-II</td><td>9</td><td>17.5</td><td>17.5</td><td>7.5</td><td>-</td><td>54</td><td>6,300</td></tr>
<tr><td>6</td><td>CLAY-AII</td><td>7</td><td>17.5</td><td>17.5</td><td>7.5</td><td>-</td><td>42</td><td>4,900</td></tr>
<tr><td>7</td><td>Clayey SAND-B</td><td>13</td><td>17.0</td><td>18.0</td><td>8.0</td><td>32</td><td>-</td><td>9,100</td></tr>
<tr><td>8</td><td>Silty SAND-A</td><td>25</td><td>17.0</td><td>18.0</td><td>8.0</td><td>33</td><td>-</td><td>17,500</td></tr>
<tr><td>9</td><td>CLAY-AIII</td><td>18</td><td>18.0</td><td>18.0</td><td>8.0</td><td>-</td><td>108</td><td>12,600</td></tr>
<tr><td>10</td><td>Clayey SAND-C</td><td>20</td><td>17.0</td><td>18.0</td><td>8.0</td><td>33</td><td>-</td><td>14,000</td></tr>
<tr><td>11</td><td>Silty SAND-II</td><td>30</td><td>17.0</td><td>18.0</td><td>8.0</td><td>34</td><td>-</td><td>21,000</td></tr>
<tr><td>12</td><td>Clayey SAND-I</td><td>35</td><td>19.0</td><td>20.0</td><td>10.0</td><td>34</td><td>-</td><td>24,500</td></tr>
<tr><td>13</td><td>Clayey SAND-II</td><td>50</td><td>19.0</td><td>20.0</td><td>10.0</td><td>35</td><td>-</td><td>35,000</td></tr>
</table>
</td><td></td></tr>
<tr><td>Bearing layer</td><td>Stable sand layer of more than 30 SPT value or clay layer of more than 20 SPT value</td><td></td></tr>
<tr><td>Liquefaction</td><td>Considered</td><td></td></tr>
<tr><td>Regional subsidence</td><td>Not considered in the Project</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
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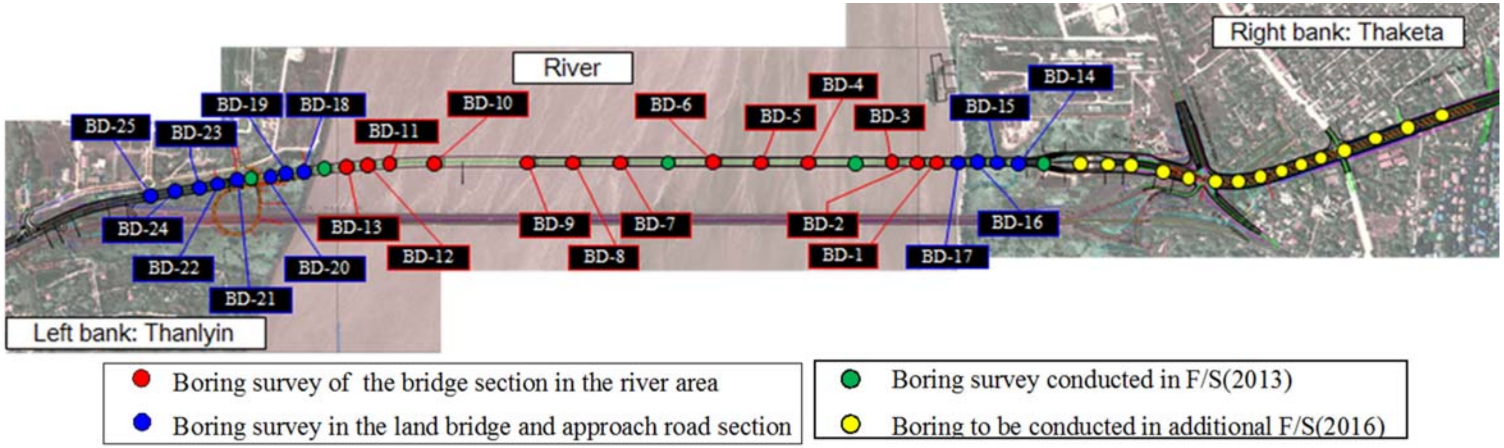


Figure　Survey Points

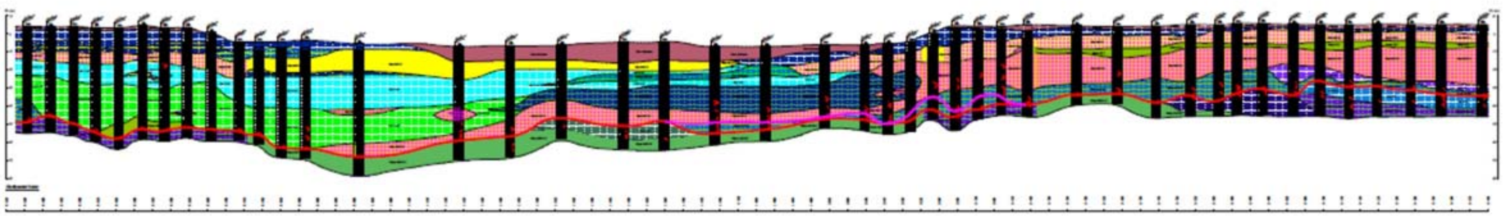


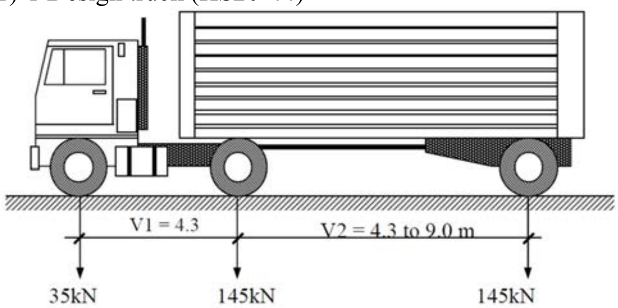
Figure　Profile of Soil Layer

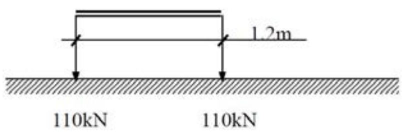
- Natural Conditions

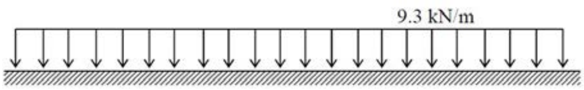
Item	Design Conditions	Remark
Temperature	39.2 to 11.3 (Celsius) at Kaba-Aye metrological station, 1991 to 2015	
Wind speed	42.9 m/s (Cyclone Nargis, 27 April 2008)	
Rainfall amount	149 mm/h (3-year return period, 10-minute rainfall intensity)	

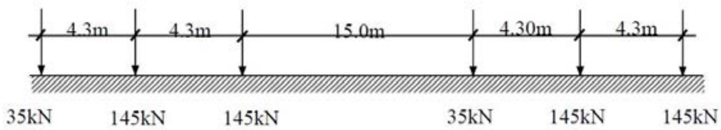
- Design Conditions

<table>
<tr><th>Item</th><th>Design Conditions</th><th>Remark</th></tr>
<tr><td>Dead load</td><td>These values are used for unit self-weight of the materials.
<table>
<tr><th>Materials</th><th>Unit Self-weight (kN/m^3)</th></tr>
<tr><td>Steels</td><td>77.0</td></tr>
<tr><td>Cast steel</td><td>71.0</td></tr>
<tr><td>Aluminum</td><td>27.5</td></tr>
<tr><td>Reinforced concrete</td><td>24.5</td></tr>
<tr><td>Prestressed concrete</td><td>24.5</td></tr>
<tr><td>Concrete</td><td>23.0</td></tr>
<tr><td>Mortar, cement</td><td>21.0</td></tr>
<tr><td>Timber</td><td>8.0</td></tr>
<tr><td>Bitumen</td><td>11.0</td></tr>
<tr><td>Asphalt concrete</td><td>22.5</td></tr>
</table></td><td>JSHB 2.2.1</td></tr>
<tr><td>Live load</td><td>1. AASHTO HL-93
Combination of these two different types of loads is considered.
(1) design truck or design tandem
(2) design lane load

(1)-1 Design truck (HS20-44)


(1)-2 Design tandem


(2) Design lane load


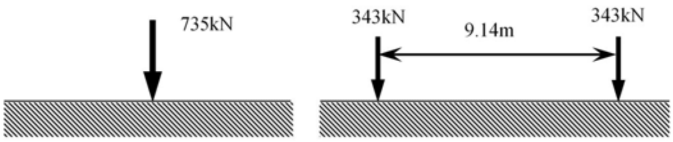
(3) Two design trucks for negative moment

</td><td>AASHTO LRFD Bridge design specifications, 3.6.1

3.6.1.3

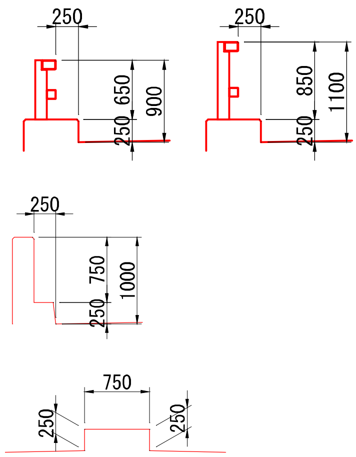
3.6.1.1</td></tr>
</table>

<table>
<tr><td></td><td>Types of combination
1) (1)-1 □(2)
2) (1)-2 □(2)
3) (3)×0.9□(2)×0.9

Multiple presence factor
Table 3.6.1.1.2-1—Multiple Presence Factors, m
<table><tr><th>Number of Loaded Lanes</th><th>Multiple Presence Factors, m</th></tr><tr><td>1</td><td>1.20</td></tr><tr><td>2</td><td>1.00</td></tr><tr><td>3</td><td>0.85</td></tr><tr><td>>3</td><td>0.65</td></tr></table>
Nominal lane width shall be 3.0 m.

2. Special vehicular load (75 t and 35 t x 2 concentration load)
</td><td>MOC direction</td></tr>
<tr><td>Calculation method of inertia force</td><td>Calculation method of inertia force shall comply with JSHB.</td><td>JSHB V 6.3.2</td></tr>
<tr><td>Impact coefficient</td><td>Equivalent to L-load in JSHB.
Steel bridge $i = 20/(50+L)$
PC bridge $i = 10/(25+L)$
Impact coefficients of pylon and cable of the cable-stayed bridge are applied based on the result of experiments.
pylon: $i = 0.15$, cable: $i = 0.20$</td><td>JSHB I 2.2.3</td></tr>
<tr><td>Effect of temperature change</td><td>Reference temperature: 25 °C
Main structure
RC, PC: +10 °C to +40 °C (25 °C ± 15 °C), relative difference between members: 5 °C
Steel: +10 °C to +40 °C (25 °C ± 15 °C), relative difference between members: 15 °C
Bearings, expansion joints
RC, PC: +5 °C to +45 °C (25 °C ± 20 °C)
Steel: 0 °C to +50 °C (25 °C ± 25 °C)</td><td></td></tr>
<tr><td>Effect on concrete</td><td>Prestressed force, Influence of creep and drying shrinkage shall be considered.</td><td>JSHB I 2.2.4, 2.2.5</td></tr>
<tr><td>Wind load</td><td>100 mph (44.4 m/s), Basic wind speed in Yangon City</td><td>MOC instruction</td></tr>
<tr><td>Flowing water pressure</td><td>Flowing water pressure shall be considered.</td><td>JSHB I 2.2.7</td></tr>
<tr><td>Hydrodynamic pressure</td><td>Hydrodynamic pressure during earthquake shall be considered.</td><td>JSHB I 2.2.7</td></tr>
<tr><td>Collision force</td><td>Collision force by barge shall be considered.</td><td></td></tr>
<tr><td>Effect of earthquake</td><td>Effect of earthquake shall be considered.
$k_h = 0.30$ at project site, $k_{hgL0} = 0.18$</td><td></td></tr>
</table>

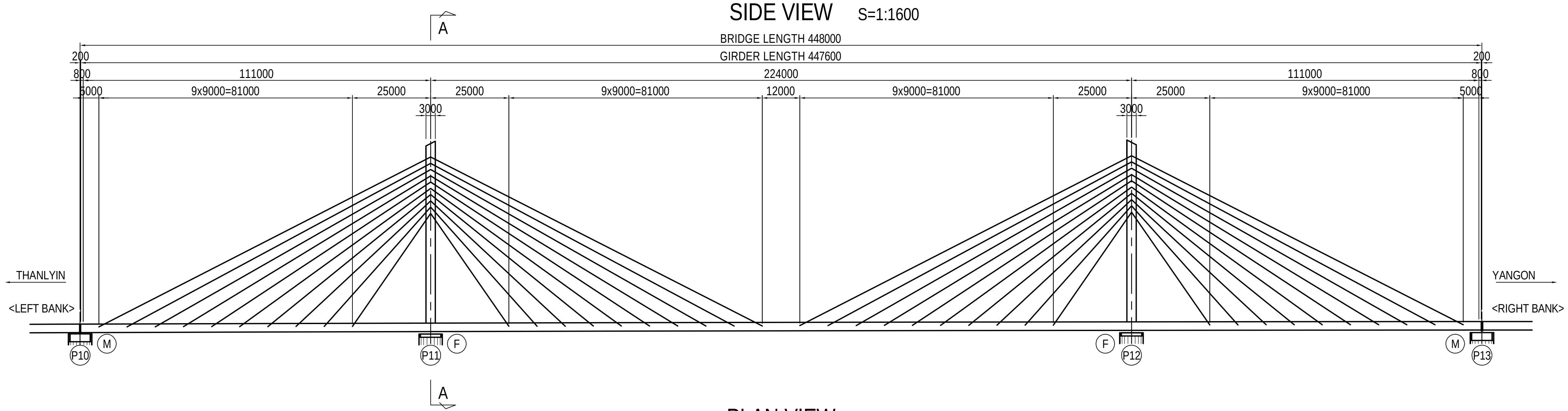
- Bridge Attachments

Item	Design Conditions	Remark
Railings	Bago River Bridge Steel railing Road side H = 1,100 mm Median side H = 900 mm Design force: more than 130 kJ (Class A) Flyover Concrete barrier Roadside H = 1,000 mm Design force: more than 160 kJ (Class Sc) Median side H = 250 mm (raised median) On-ramp Steel railing H = 900 (same as Bago River Bridge median) Shapes  	
Noise barrier	Not considered	
Guard fence	Not considered	
Lighting	Considered	
Equipment	Bago River Bridge Water pipe (φ45 cm × 2 lanes) W = 6.0 kN/m 0.7 kN/m^2 for all width is considered as future installation plan Flyover and On-ramp bridge Not installed	YCDC water resources department
Inspection ladder	Bago River Bridge (steel girder) Installation of inspection ladder in steel box girder Flyover, On-ramp bridge, PC girder of Bago River Bridge Not installed	
Drainage	Steel catch pit (manufactured product) will collect surface water. Discharged water will be drained directly to the river where the drainage pipe is on the river, and will be gathered and drained to the channel where the drainage pipe is on land. Design rainfall intensity: 149 mm/h	
Pavement	Steel cable-stayed girder, steel box girder Polymer-modified asphalt pavement, t = 80 mm PC box girder, Flyover Normal asphalt, t = 80 mm	
Waterproofing layer	Install under pavement (liquid coating)	

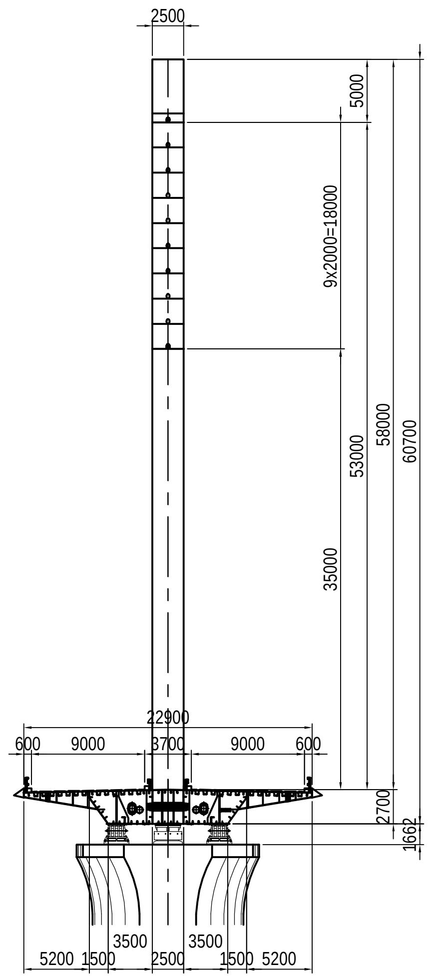
１．２．　GeneralView of Superstructure

GENERAL VIEW OF STEEL CABLE STAYED BRIDGE (1)

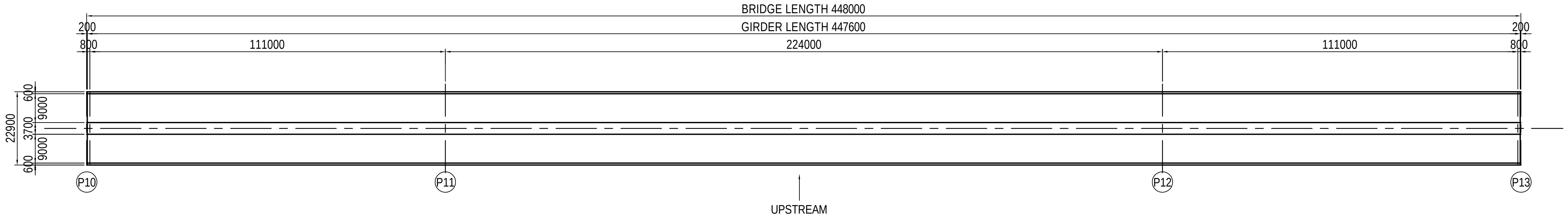
SIDE VIEW S=1:1600



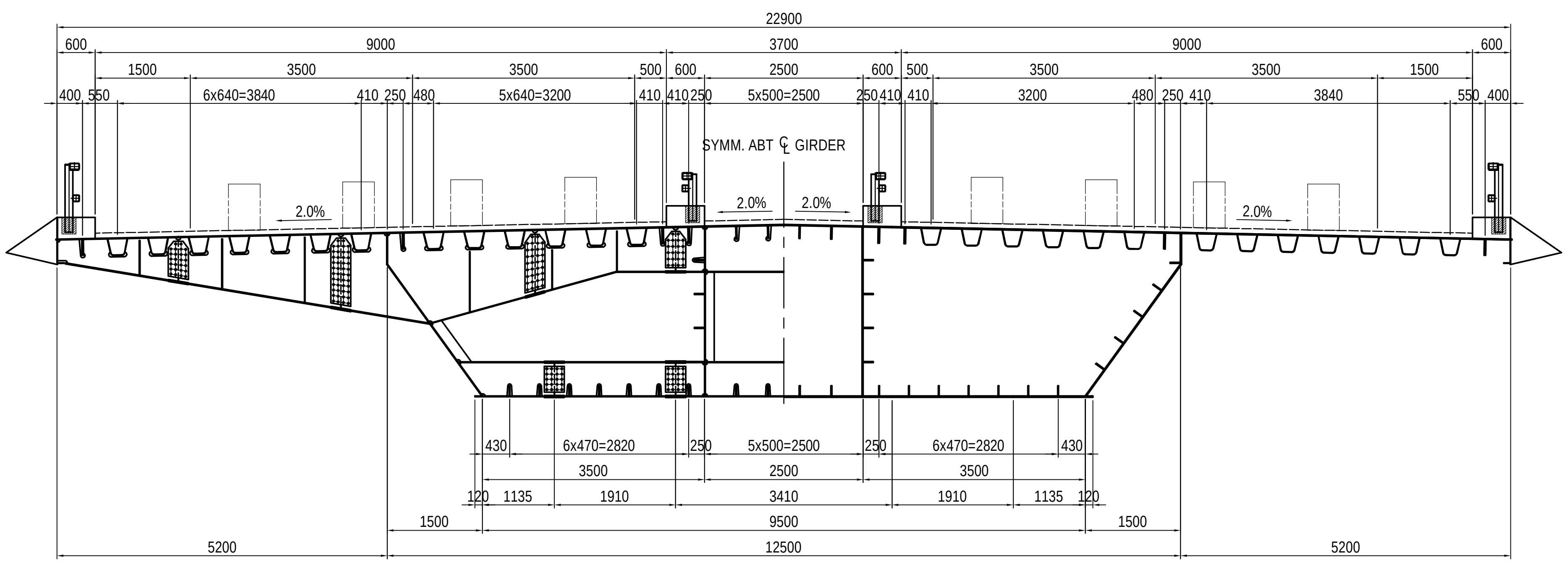
CROSS-SECTION A-A S=1:600



PLAN VIEW S=1:1600



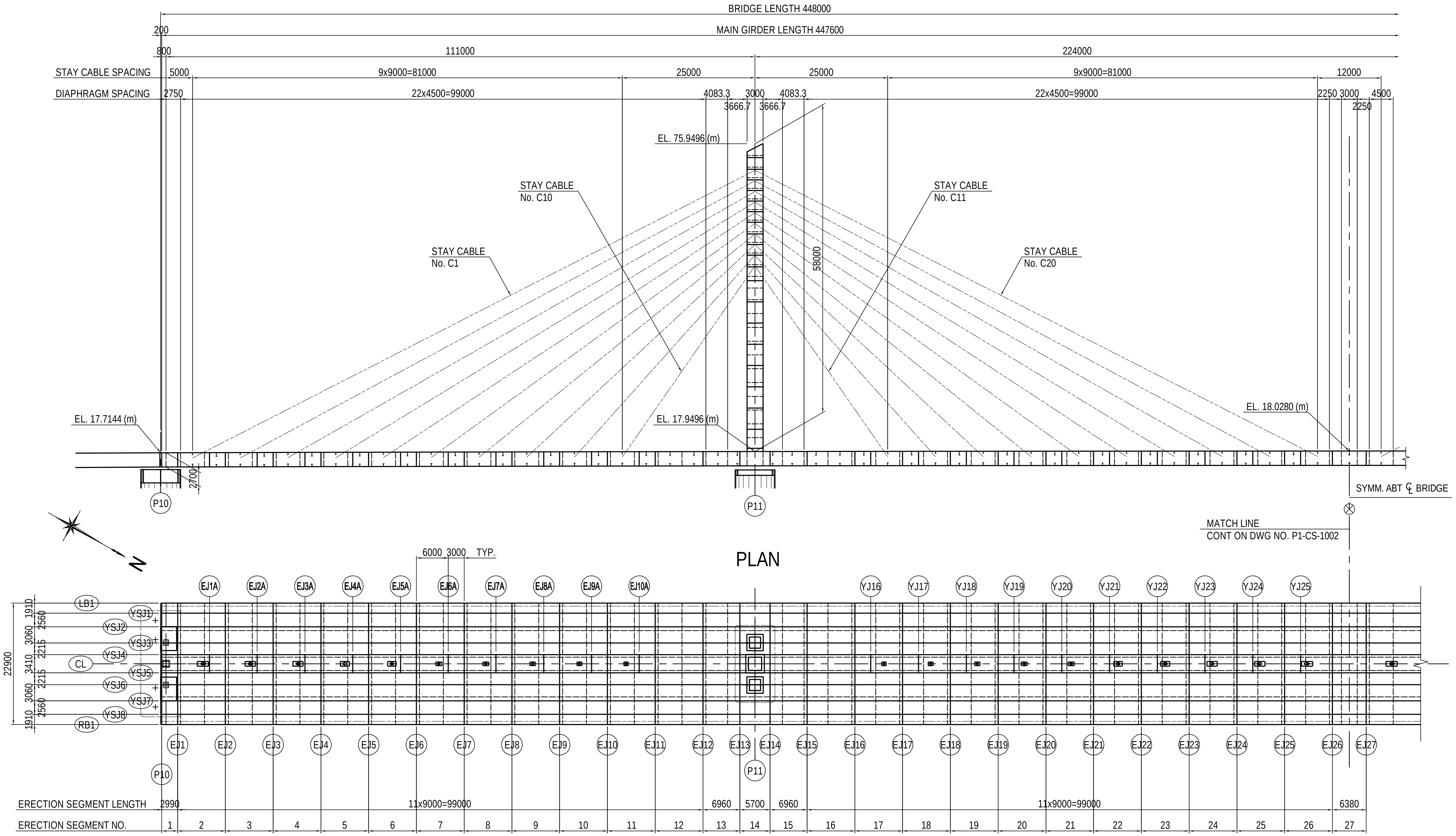
STANDARD HALF CROSS-SECTION S=1:100



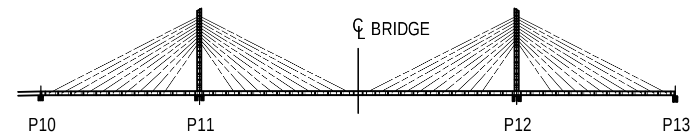
PROJECT NAME	FINANCED BY	COUNTERPART	JICA STUDY TEAM		NAME	SIGNATURE	DATE	DRAWING TITLE	PACKAGE
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	REPUBLIC OF THE UNION OF MYANMAR MINISTRY OF CONSTRUCTION DEPARTMENT OF BRIDGE	NIPPON KOEI CO., LTD. ORIENTAL CONSULTANTS GLOBAL CO., LTD. METROPOLITAN EXPRESSWAY COMPANY LIMITED CHODAI CO.,LTD. NIPPON ENGINEERING CONSULTANTS CO.,LTD.	PREPARED BY	T.TOMODA			GENERAL VIEW OF STEEL CABLE STAYED BRIDGE (1)	1
				CHECKED BY	T. HAYAKAWA				DWG No.
				APPROVED BY	Y. SANO				P1-CS-0002

GENERAL VIEW OF MAIN GIRDER (1) S=1:800

ELEVATION

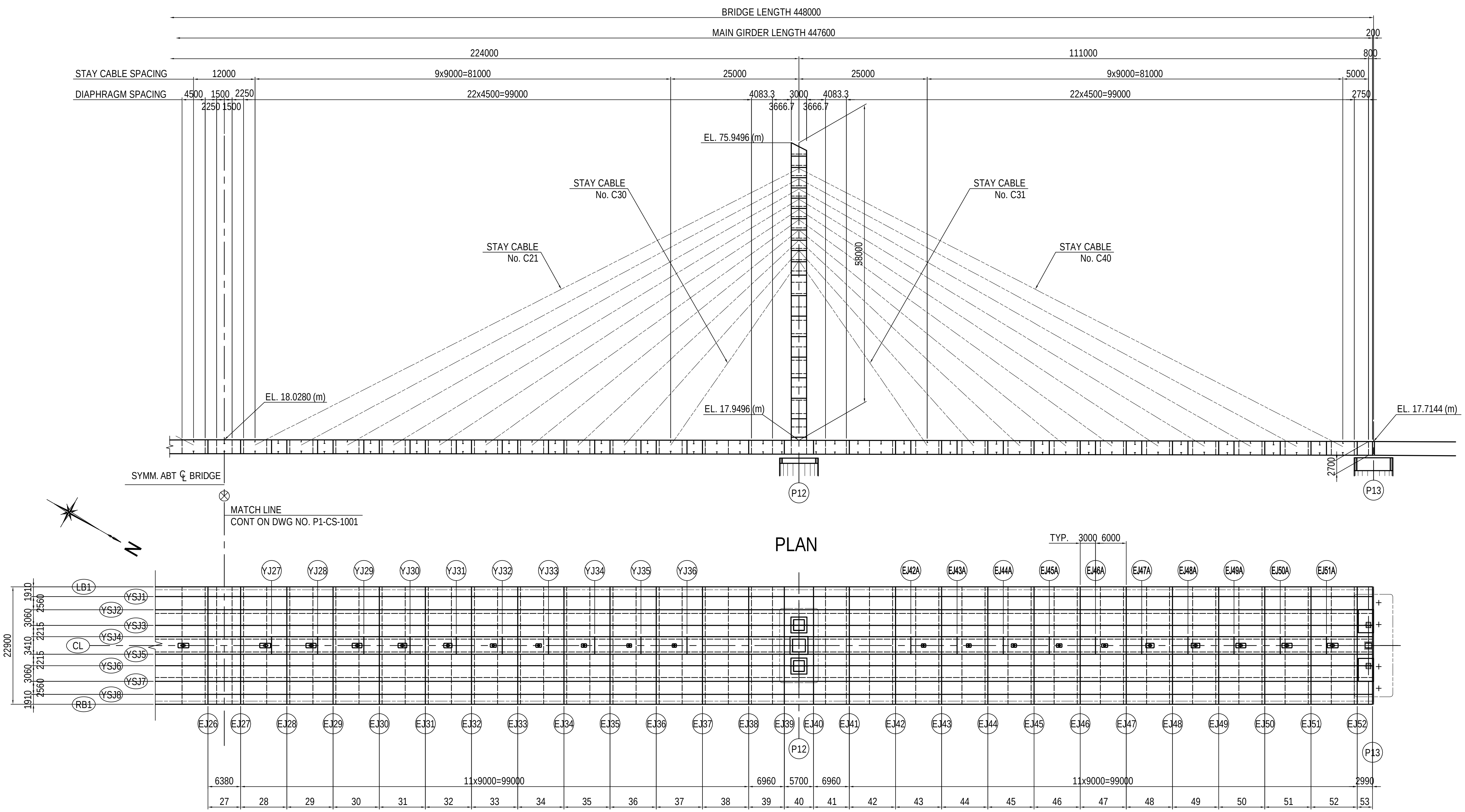


KEY PLAN

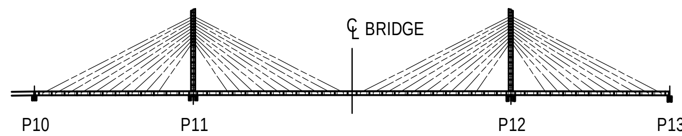


PROJECT NAME	FINANCED BY	COUNTERPART	JICA STUDY TEAM		NAME	SIGNATURE	DATE	DRAWING TITLE	PACKAGE
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	REPUBLIC OF THE UNION OF MYANMAR MINISTRY OF CONSTRUCTION DEPARTMENT OF BRIDGE	NIPPON KOEI CO., LTD. ORIENTAL CONSULTANTS GLOBAL CO., LTD. METROPOLITAN EXPRESSWAY COMPANY LIMITED CHODAI CO.,LTD. NIPPON ENGINEERING CONSULTANTS CO.,LTD.	PREPARED BY	T.TOMODA			GENERAL VIEW OF MAIN GIRDER (1)	1
				CHECKED BY	T. HAYAKAWA				DWG No.
				APPROVED BY	Y. SANO				P1-CS-1001

GENERAL VIEW OF MAIN GIRDER (2) S=1:800



KEY PLAN

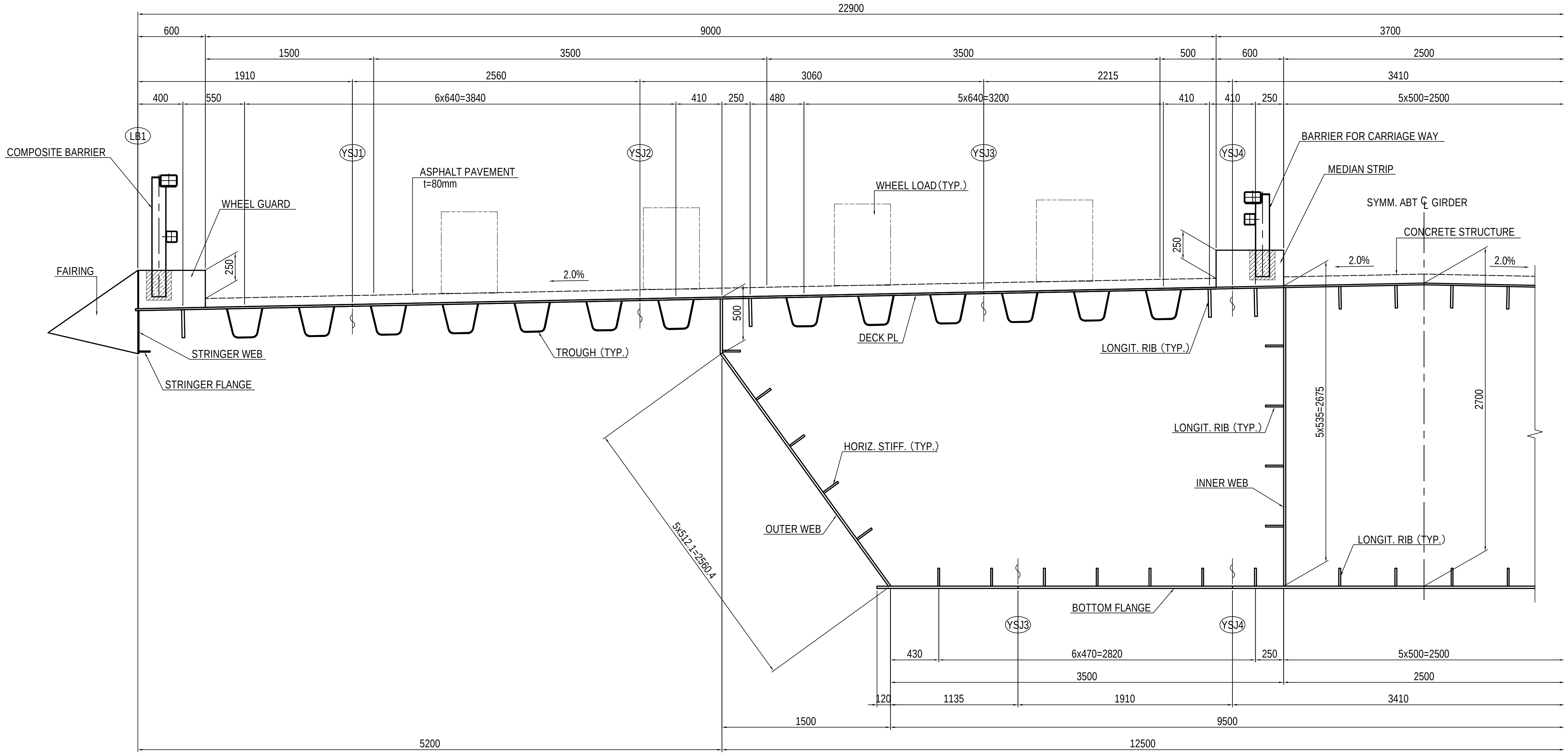


PROJECT NAME	FINANCED BY	COUNTERPART	JICA STUDY TEAM
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	REPUBLIC OF THE UNION OF MYANMAR MINISTRY OF CONSTRUCTION DEPARTMENT OF BRIDGE	NIPPON KOEI CO., LTD. ORIENTAL CONSULTANTS GLOBAL CO., LTD. METROPOLITAN EXPRESSWAY COMPANY LIMITED CHODAI CO.,LTD. NIPPON ENGINEERING CONSULTANTS CO.,LTD.

	NAME	SIGNATURE	DATE	DRAWING TITLE	PACKAGE
PREPARED BY	T.TOMODA			GENERAL VIEW OF MAIN GIRDER (2)	1
CHECKED BY	T. HAYAKAWA				DWG No.
APPROVED BY	Y. SANO				P1-CS-1002

GENERAL VIEW OF MAIN GIRDER (9) S=1:40

SECTION OUTLINES
TYPICAL SECTION



PROJECT NAME	FINANCED BY	COUNTERPART	JICA STUDY TEAM		NAME	SIGNATURE	DATE	DRAWING TITLE	PACKAGE
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	REPUBLIC OF THE UNION OF MYANMAR MINISTRY OF CONSTRUCTION DEPARTMENT OF BRIDGE	NIPPON KOEI CO., LTD. ORIENTAL CONSULTANTS GLOBAL CO., LTD. METROPOLITAN EXPRESSWAY COMPANY LIMITED CHODAI CO.,LTD. NIPPON ENGINEERING CONSULTANTS CO.,LTD.	PREPARED BY	T.TOMODA			GENERAL VIEW OF MAIN GIRDER (9)	1
				CHECKED BY	T. HAYAKAWA				DWG No.
				APPROVED BY	Y. SANO				P1-CS-1009

2. Design for Steel Deck Slab

2.1 Design Principle

1) Application of Equivalent Lattice Method

The Equivalent Lattice Method was used for the analysis of the steel deck. The Equivalent Lattice Method models the steel deck, stiffened by the attachment of the longitudinal and transverse ribs to the deck plate, as a plane lattice and applies the standard displacement method for analysis.

2) Selected Stiffness for Analysis

a) Bending Stiffness of Material

The bending stiffness of the longitudinal and transverse ribs was obtained from the Specifications for Highway Bridges II Steel Bridges - Table 9.4.2, with consideration of the effective width of the deck plate as a flange. The effective width was calculated by setting the equivalent effective length of the transverse ribs as L at the central section and 2L at the overhanging section.

Furthermore, torsional stiffness shall be taken into consideration for the longitudinal U Ribs. Also, a virtual beam for load distribution shall be created at equivalent intervals of the transverse ribs to incorporate the load distribution created by the deck plate on the longitudinal rib section.

b) Torsional Stiffness of U Ribs

Each longitudinal rib shall be considered as a rod member that does not undergo cross sectional deformation. Hence, the torsional stiffness (with only simple torsion resistance) does not decrease and shall be considered 100% effective as determined by the following equation:

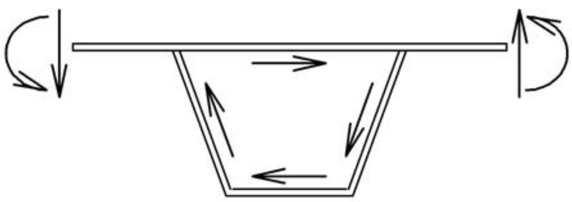
Torsional Stiffness = $4 \cdot A2/\{(u/tR) + (a/tP)\}$

A: Enclosed cross sectional area of U Rib   u: Expanded width of U Rib

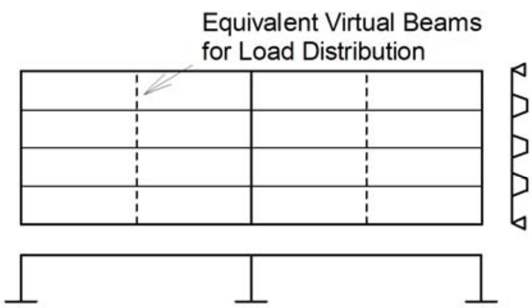
a: Upside width of U Rib   tR: Thickness of U Rib   tP: Thickness of deck plate

c) Calculation of Equivalent Virtual Beams for Load Distribution

The virtual beam for load distribution, which provides the load distribution to the longitudinal ribs, shall have an equivalent bending stiffness as a rigid frame structure created between the deck plate and the perimeter of the U Rib. Since this rigid frame structure extends along the longitudinal direction, the equivalent second moment of area for unit length is determined first, and in the lattice model, a load distribution beam is created at every interval of the transverse rib where the bending stiffness shall be concentrated.



Rigid frame structure created between deck plate and perimeter of U-rib



Equivalent Lattice Model

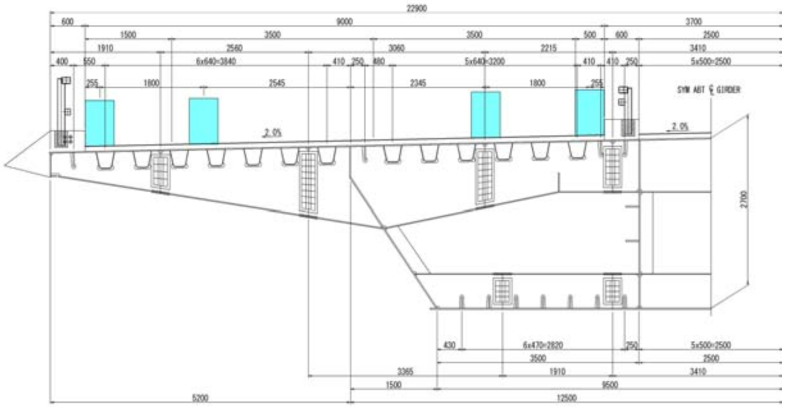
3) Section Force through Analysis of Influence Line

The maximum and minimum section forces for every member of the longitudinal and transverse ribs are calculated by analyzing the effect of the influence line at every point.

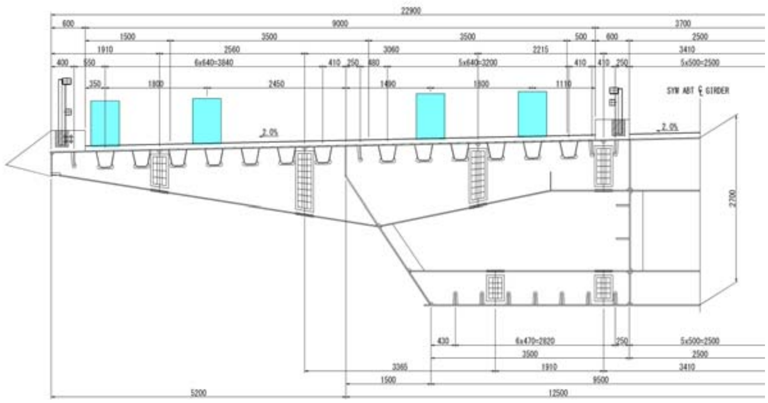
4) AASHTO Configuration of Live Load

The AASHTO Design Live Load was considered as the design load of the steel deck. Based on AASHTO, more severe live load of Design Truck or Design Tandem shall be applied, while tire contact area is 250 mm (length) x 510 mm (width). The design load on the steel deck was set as shown in the figure below.

<Live Load Position-1>



<Live Load Position-2>



2.2 Load Strength

(１) Dead Load

Pavement (Road way)		$0.080\ m * 22.50\ kN/m^3$	=	$1.80\ kN/m^2$
Steel Weight			=	$2.50\ kN/m^2$
Curb (left)	= 4.90 kN/m	dictance from inside of curb	=	0.300 m
(right)	= 4.90 kN/m		=	0.300 m
Railing (left)	= 0.70 kN/m		=	0.300 m
(right)	= 0.70 kN/m		=	0.300 m

Median : refer load strength for each model

Additional Load (total width) = $0.70\ kN/m^2$

(２) Live Load

Design Truck , Design Tandem

※） only for road way

(３) Impact factor

Longitudinal Rib i = 0.4

Transverse Rib, Bracket i = 20/(50+L) L:Span for Trans. Rib or Bracket (m)

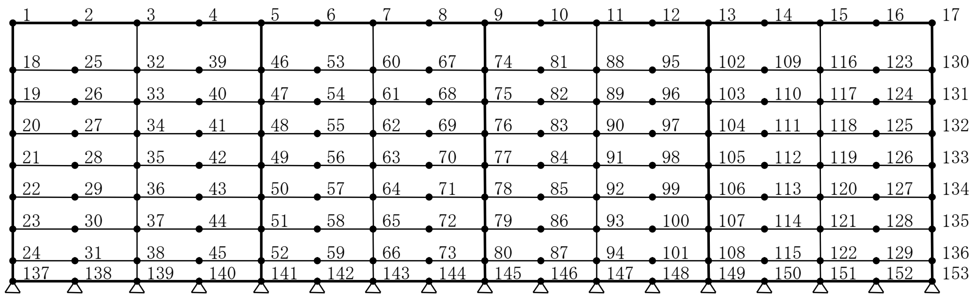
2.3 Equivalent Lattice Analysis (Excerpt)

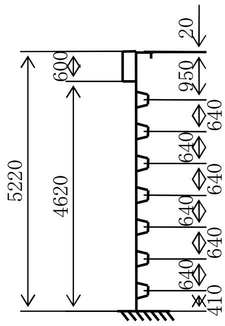
2.3.1 Design Truck-1

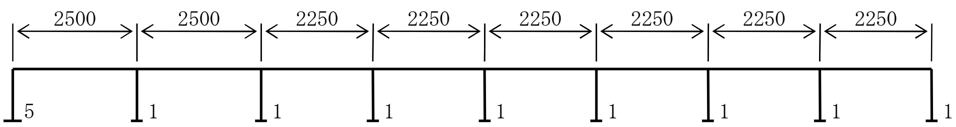
1. Analysis Model

（1）Model－１ (1st Crossing ～ 5th Crossing、G-1 Left Overhanging Section)

（ａ）Frame Shape and Dead Load Strength







Pavement(Road Way)	1.80 kN/m^2
Railing(Left)	0.70 kN/m
Curb(Left)	4.90 kN/m
Steel Weight	2.50 kN/m^2
Additional	0.70 kN/m^2

（ｂ）Cross Section

Deck Plate Thickness　　16 mm

Longitudinal Rib

Sec- 1　U.RIB 320 * 240 *　8

Stringer

Sec- 1　WEB PL　384 *　9　FLG PL　100 * 10

Bracket

Sec- 1　WEB PL 1300 *　9　FLG PL　240 * 15

Sec- 5　WEB PL 1300 * 10　FLG PL　370 * 15

(Rigidity: Avarage of edge and base)

２. Analysis Results

（１） Model-1 （1st Crossing ～ 5th Crossing、G-1 Left Overhanging Section)

Increase Factor for Steel Deck dut to the B-live load (JSHBⅡ9.4.2)

Member	Section	Trans. Rib Spacing L(m)	Longi. Rib Spacing B(m)	k0	Increase Factor kd
Bracket	Sec-1	5.200	2.500	1.100	1.080
	Sec-5	5.200	2.500	1.100	1.080

Increase Factor for Member Length due to T-live load (JSHBⅠ2.2.2)

Member	Section	Longi. Member Length L(m)	Increase Factor kp
Longi. Rib	Sec-1	2.500	1.000
Stringer	Sec-1	2.500	1.000
Bracket	Sec-1	5.200	1.038
	Sec-5	5.200	1.038

(a) Stress Resultants

Member	Section	Case	Node	Load	Bending Moment(kN·m)	Shear Force (kN)
Longi. Rib	Sec-1	Bending Max	25	Dead Load	4.05	0.04
				T-load	47.17	43.70
				Total	51.21	43.73
				Increased Total	51.21	43.73
		Bending Min	32	Dead Load	-0.13	-6.72
				T-load	-15.29	-48.75
				Total	-15.42	-55.47
				Increased Total	-15.42	-55.47
		Shear Max	18	Dead Load	0.00	6.61
				T-load	0.00	88.32
				Total	0.00	94.94
				Increased Total	0.00	94.94
Stringer	Sec-1	Bending Max	3	Dead Load	2.31	-5.91
				T-load	31.33	12.55
				Total	33.64	6.64
				Increased Total	33.64	6.64
		Bending Min	15	Dead Load	1.61	-5.10
				T-load	-19.40	-16.36
				Total	-17.79	-21.46
				Increased Total	-17.79	-21.46
		Shear Max	5	Dead Load	-0.91	-8.12
				T-load	-7.16	-15.38
				Total	-8.08	-23.50
				Increased Total	-8.08	-23.50

Member	Section	Case	Node	Load	Bending Moment(kN·m)	Shear Force (kN)
Bracket	Sec-1	Bending Max	116	Dead Load	-9.54	-22.24
				T-load	20.68	-53.98
				Total	11.14	-76.21
				Increased Total	13.63	-82.72
		Bending Min	139	Dead Load	-206.62	-71.75
				T-load	-535.75	-225.17
				Total	-742.37	-296.92
				Increased Total	-806.93	-324.06
		Shear Max	38	Dead Load	-177.20	-71.75
				T-load	-443.43	-225.17
				Total	-620.63	-296.92
				Increased Total	-674.06	-324.06
	Sec-5	Bending Min	137	Dead Load	-119.52	-35.82
				T-load	-736.37	-274.47
				Total	-855.89	-310.29
				Increased Total	-944.62	-343.36
		Shear Max	24	Dead Load	-104.83	-35.82
				T-load	-619.13	-281.05
				Total	-723.96	-316.87
				Increased Total	-798.56	-350.74

(b) Live Load Displacement

Member	Section	Node	Load	Disp.(mm)
Longi. Rib	Sec-1	18	T-load	2.12
			Increased Total	2.12
Stringer	Sec-1	1	T-load	2.78
			Increased Total	2.78
Bracket	Sec-1	3	T-load	2.35
			Increased Total	2.44
	Sec-5	1	T-load	2.78
			Increased Total	2.89

(2) Desing Stress Resultants and Displacement at All Model

（a） Summary of Stress Resultants

Member	Section	Case	Bending Moment(kN·m)	Shear Force(kN)	Model
Longi. Rib	Sec-1	Beiding Max	51.21	43.73	Model-1
		Bending Min	-23.56	94.94	Model-3
		Shear Max	-15.42	94.94	Model-1
	Sec-2	Beiding Max	1.63	-0.26	Model-5
		Bending Min	-1.55	-3.49	Model-5
		Shear Max	-1.55	-3.49	Model-5
Stringer	Sec-1	Beiding Max	33.64	6.64	Model-1
		Bending Min	-17.79	-23.50	Model-1
		Shear Max	-17.79	-23.50	Model-1
Trans. Rib	Sec-2	Beiding Max	7.50	6.15	Model-5
		Bending Min	-7.50	12.59	Model-5
		Shear Max	-7.50	-12.59	Model-5
	Sec-6	Beiding Max	147.76	39.23	Model-3
		Bending Min	-147.76	-157.09	Model-3
		Shear Max	-147.76	-157.09	Model-3
Bracket	Sec-1	Beiding Max	13.63	-82.72	Model-1
		Bending Min	-806.93	-324.06	Model-1
		Shear Max	-806.93	-324.06	Model-1
	Sec-5	Bending Min	-944.62	-350.74	Model-1
		Shear Max	-944.62	-350.74	Model-1
Cross Beam	Sec-3	Beiding Max	3.40	0.00	Model-5
		Bending Min	-3.40	5.64	Model-5
		Shear Max	-3.40	-5.64	Model-5
	Sec-4	Beiding Max	8.18	0.00	Model-5
		Bending Min	-8.18	13.49	Model-5
		Shear Max	-8.18	-13.49	Model-5

（b） Summary of Live Load Displacement

Member	Section	Displacement(mm)	Model
Longi. Rib	Sec-1	2.12	Model-1
	Sec-2	0.00	Model-0
Stringer	Sec-1	2.78	Model-1
Trans. Rib	Sec-2	0.00	Model-0
	Sec-6	0.78	Model-3
Bracket	Sec-1	2.44	Model-1
	Sec-5	2.89	Model-1
Cross Beam	Sec-3	0.00	Model-0
	Sec-4	0.00	Model-0

２．３．２　Design Truck－２

1. Analysis Results

(1) Desing Stress Resultants and Displacement at All Model

（a）Summary of Stress Resultants

Member	Section	Case	Bending Moment(kN·m)	Shear Force(kN)	Model
Longi. Rib	Sec-1	Bending Max	55.67	48.02	Model-1
		Bending Min	-30.35	-107.30	Model-3
		Shear Max	-28.46	-107.71	Model-4
	Sec-2	Bending Max	1.63	-0.26	Model-5
		Bending Min	-1.55	-3.49	Model-5
		Shear Max	-1.55	-3.49	Model-5
Stringer	Sec-1	Bending Max	31.88	5.93	Model-1
		Bending Min	-16.33	-22.61	Model-1
		Shear Max	-16.33	-22.61	Model-1
Trans. Rib	Sec-2	Bending Max	7.50	6.15	Model-5
		Bending Min	-7.50	12.59	Model-5
		Shear Max	-7.50	-12.59	Model-5
	Sec-6	Bending Max	154.34	61.71	Model-3
		Bending Min	-154.34	166.12	Model-3
		Shear Max	-154.34	166.12	Model-3
Bracket	Sec-1	Bending Max	22.10	-85.46	Model-1
		Bending Min	-789.99	-326.97	Model-1
		Shear Max	-789.99	-326.97	Model-1
	Sec-5	Bending Min	-916.75	-351.55	Model-1
		Shear Max	-916.75	-351.55	Model-1
Cross Beam	Sec-3	Bending Max	3.40	0.00	Model-5
		Bending Min	-3.40	5.64	Model-5
		Shear Max	-3.40	-5.64	Model-5
	Sec-4	Bending Max	8.18	0.00	Model-5
		Bending Min	-8.18	13.49	Model-5
		Shear Max	-8.18	-13.49	Model-5

（b）Summary of Live Load Displacement

Member	Section	Displacement(mm)	Model
Longi. Rib	Sec-1	2.10	Model-1
	Sec-2	0.00	Model-0
Stringer	Sec-1	2.64	Model-1
Trans. Rib	Sec-2	0.00	Model-0
	Sec-6	0.77	Model-3
Bracket	Sec-1	2.31	Model-1
	Sec-5	2.74	Model-1
Cross Beam	Sec-3	0.00	Model-0
	Sec-4	0.00	Model-0

２．３．３　Design Tandem－１

1. Analysis Results

(1) Desing Stress Resultants and Displacement at All Model

（ａ）Summary of Stress Resultants

Member	Section	Case	Bending Moment(kN·m)	Shear Force(kN)	Model
Longi. Rib	Sec-1	Bending Max	47.17	39.45	Model-1
		Bending Min	-21.71	-108.15	Model-3
		Shear Max	-15.54	-108.15	Model-1
	Sec-2	Bending Max	1.63	-0.26	Model-5
		Bending Min	-1.55	-3.49	Model-5
		Shear Max	-1.55	-3.49	Model-5
Stringer	Sec-1	Bending Max	37.85	4.15	Model-1
		Bending Min	-16.87	-27.89	Model-1
		Shear Max	-16.87	-27.89	Model-1
Trans. Rib	Sec-2	Bending Max	7.50	6.15	Model-5
		Bending Min	-7.50	12.59	Model-5
		Shear Max	-7.50	-12.59	Model-5
	Sec-6	Bending Max	187.74	49.73	Model-3
		Bending Min	-187.74	-197.38	Model-3
		Shear Max	-187.74	-197.38	Model-3
Bracket	Sec-1	Bending Max	16.68	-107.56	Model-1
		Bending Min	-952.74	-400.50	Model-1
		Shear Max	-952.74	-400.50	Model-1
	Sec-5	Bending Min	-1095.01	-396.10	Model-1
		Shear Max	-1095.01	-396.10	Model-1
Cross Beam	Sec-3	Bending Max	3.40	0.00	Model-5
		Bending Min	-3.40	5.64	Model-5
		Shear Max	-3.40	-5.64	Model-5
	Sec-4	Bending Max	8.18	0.00	Model-5
		Bending Min	-8.18	13.49	Model-5
		Shear Max	-8.18	-13.49	Model-5

（ｂ）Summary of Live Load Displacement

Member	Section	Displacement(mm)	Model
Longi. Rib	Sec-1	2.52	Model-1
	Sec-2	0.00	Model-0
Stringer	Sec-1	3.31	Model-1
Trans. Rib	Sec-2	0.00	Model-0
	Sec-6	1.02	Model-3
Bracket	Sec-1	2.96	Model-1
	Sec-5	3.44	Model-1
Cross Beam	Sec-3	0.00	Model-0
	Sec-4	0.00	Model-0

２．３．４　Design Tandem－２

1.　Analysis Results

(1) Desing Stress Resultants and Displacement at All Model

（ａ）Summary of Stress Resultants

Member	Section	Case	Bending Moment(kN･m)	Shear Force(kN)	Model
Longi. Rib	Sec-1	Bending Max	50.41	42.59	Model-1
		Bending Min	-28.39	-123.28	Model-3
		Shear Max	-28.39	-123.28	Model-3
	Sec-2	Bending Max	1.63	-0.26	Model-5
		Bending Min	-1.55	-3.49	Model-5
		Shear Max	-1.55	-3.49	Model-5
Stringer	Sec-1	Bending Max	37.58	8.01	Model-1
		Bending Min	-16.47	-27.61	Model-1
		Shear Max	-16.47	-27.61	Model-1
Trans. Rib	Sec-2	Bending Max	7.50	6.15	Model-5
		Bending Min	-7.50	12.59	Model-5
		Shear Max	-7.50	-12.59	Model-5
	Sec-6	Bending Max	195.76	76.47	Model-3
		Bending Min	-195.76	211.59	Model-3
		Shear Max	-195.76	211.59	Model-3
Bracket	Sec-1	Bending Max	28.02	-110.57	Model-1
		Bending Min	-933.43	-405.44	Model-1
		Shear Max	-933.43	-405.44	Model-1
	Sec-5	Bending Min	-1061.43	-395.98	Model-1
		Shear Max	-1061.43	-395.98	Model-1
Cross Beam	Sec-3	Bending Max	3.40	0.00	Model-5
		Bending Min	-3.40	5.64	Model-5
		Shear Max	-3.40	-5.64	Model-5
	Sec-4	Bending Max	8.18	0.00	Model-5
		Bending Min	-8.18	13.49	Model-5
		Shear Max	-8.18	-13.49	Model-5

（ｂ）Summary of Live Load Displacement

Member	Section	Displacement(mm)	Model
Longi. Rib	Sec-1	2.39	Model-1
	Sec-2	0.00	Model-0
Stringer	Sec-1	3.14	Model-1
Trans. Rib	Sec-2	0.00	Model-0
	Sec-6	1.01	Model-3
Bracket	Sec-1	2.80	Model-1
	Sec-5	3.26	Model-1
Cross Beam	Sec-3	0.00	Model-0
	Sec-4	0.00	Model-0

２．４　Calculation for Longitudinal Rib (Excerpt)

The “Design Truck-2” which has maximum stress resultants was selected as a claculation case.

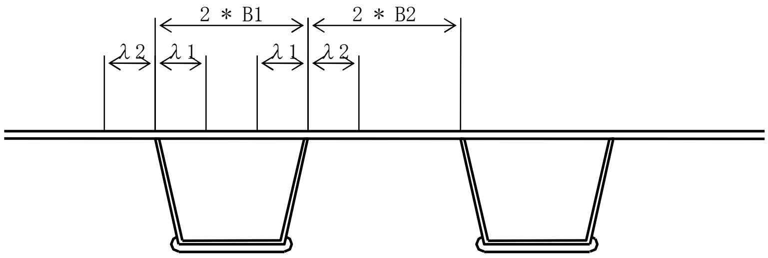
１. Cross-section Calculation for Longitudinal Rib

（1）Model-1　Sec-1(at Span)

Stress Resultants and Calculation Conditions

For Cross Section	M	=	55.67 kN·m	S	=	48.02 kN
For Joint	Mj	=	55.67 kN·m	Sj	=	48.02 kN

Effective Width



＊Equivalent Span Length　L = 0.6 * LC = 0.6 * 250.0 = 150.0 cm

LC : Trans. Rib Spacing (Longi. Rib Span Length)

B1 = 16.2 cm

B2 = 15.8 cm

B1 / L = 16.2 / 150.0 = 0.11

$\lambda 1 = \{1.06 - 3.2 * (B1 / L) + 4.5 * (B1 / L)^2\} * B1$

$= \{1.06 - 3.2 * (0.11) + 4.5 * (0.11)^2\} * B1$

$= 12.4$ cm

B2 / L = 15.8 / 150.0 = 0.11

$\lambda 2 = \{1.06 - 3.2 * (B2 / L) + 4.5 * (B2 / L)^2\} * B2$

$= \{1.06 - 3.2 * (0.11) + 4.5 * (0.11)^2\} * B2$

$= 12.2$ cm

＊Total of Effective Width

$\lambda = (\lambda 1 + \lambda 2) * 2 = (12.4 + 12.2) * 2$

$= 49.3$ cm

Cross Section Property

	$A(cm^2)$	Y(cm)	$AY(cm^3)$	$I(cm^4)$
1-DECK　PL　493 * 16 (SM400)	78.84	-16.01	-1262.2	20208.2
1-U.RIB 320 * 240 * 8 (SM400)	53.90	0.00	0.0	3315.0
	132.74		-1262.2	23523.2

e = -1262.2 / 132.74 = -9.51 cm

$I = 23523.2 - 132.74 * -9.51^2 = 11521\ cm^4$

Yu = -7.30 cm,　YL = 18.50 cm

$Wu = -1578\ cm^3$,　$WL = 623\ cm^3$

Stress

Bending Stress

$\sigma u = 55.67 * 10^6 / (-1578 * 10^3) = -35\ N/mm^2 < \sigma ca = 140\ N/mm^2$

$\sigma L = 55.67 * 10^6 / (623 * 10^3) = 89\ N/mm^2 < \sigma ta = 140\ N/mm^2$

Shear Stress

$\tau = 48.02 * 10^3 / (38.7 * 10^2) = 12\ N/mm^2 < \tau a = 80\ N/mm^2$

Composite Stress

$\kappa = (89 / 140)^2 + (12 / 80)^2 = 0.43 < 1.2$

At Joint

Bending Stress

$\sigma u = 55.67 * 10^6 / (-1578 * 10^3) = -35\ N/mm^2 < \sigma ca = 140\ N/mm^2$

$\sigma L = 55.67 * 10^6 / (623 * 10^3) = 89\ N/mm^2 < \sigma ta = 140\ N/mm^2$

Shear Stress

$\tau = 48.02 * 10^3 / (38.7 * 10^2) = 12\ N/mm^2 < \tau a = 80\ N/mm^2$

Composite Stress

$\kappa = (89 / 140)^2 + (12 / 80)^2 = 0.43 < 1.2$

Evaluation for Live Load Displacement

$\delta = 2.1\ mm < \delta a$

$\delta a = L / 500 = 2500 / 500 = 5.0\ mm$

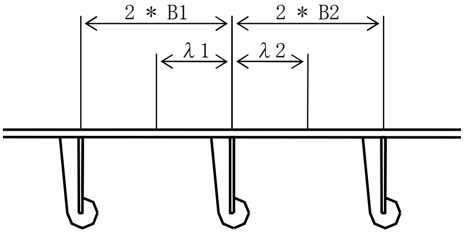
(2) Model-5 Sec-2(at span)

Stress Resultants and Calculation Conditions

For Cross Section M = 1.63 kN·m S = 0.26 kN

For Joints Mj = 1.63 kN·m Sj = 0.26 kN

Effective Width



*Equivalent Span Length L = 0.6 * LC = 0.6 * 250.0 = 150.0 cm

LC : Trans. Rib Spacing (Longi. Rib Span Length)

B1 = 25.0 cm

B2 = 25.0 cm

B1 / L = 25.0 / 150.0 = 0.17

$\lambda 1 = \{1.06 - 3.2 * (B1 / L) + 4.5 * (B1 / L)^2\} * B1$

$= \{1.06 - 3.2 * (0.17) + 4.5 * (0.17)^2\} * B1$

$= 16.3$ cm

B2 / L = 25.0 / 150.0 = 0.17

$\lambda 2 = \{1.06 - 3.2 * (B2 / L) + 4.5 * (B2 / L)^2\} * B2$

$= \{1.06 - 3.2 * (0.17) + 4.5 * (0.17)^2\} * B2$

$= 16.3$ cm

*Total of Effective Width

$\lambda = \lambda 1 + \lambda 2 = 16.3 + 16.3$

$= 32.6$ cm

Cross Section Property

				$A(cm^2)$	Y(cm)	$AY(cm^3)$	$I(cm^4)$
1-DECK	PL	326 * 16	(SM400)	52.13	-10.80	-563.0	6080.8
1-RIB	PL	200 * 20	(SM400)	40.00	0.00	0.0	1333.3
				92.13		-563.0	7414.2

e = -563.0 / 92.13 = -6.11 cm

$I = 7414.2 - 92.13 * -6.11^2 = 3973\ cm^4$

Yu = -5.49 cm, YL = 16.11 cm

$Wu = -724\ cm^3$, $WL = 247\ cm^3$

Stress

Bending Stress

$\sigma u = 1.63 * 10^6 / (-724 * 10^3) = -2\ N/mm^2 < \sigma ca = 140\ N/mm^2$

$\sigma L = 1.63 * 10^6 / (247 * 10^3) = 7\ N/mm^2 < \sigma ta = 140\ N/mm^2$

Shear Stress

$\tau = 0.26 * 10^3 / (40.0 * 10^2) = 0\ N/mm^2 < \tau a = 80\ N/mm^2$

Composite Stress

$\kappa = (7 / 140)^2 + (0 / 80)^2 = 0.00 < 1.2$

At Joint

Bending Stress

$\sigma u = 1.63 * 10^6 / (-724 * 10^3) = -2\ N/mm^2 < \sigma ca = 140\ N/mm^2$

$\sigma L = 1.63 * 10^6 / (247 * 10^3) = 7\ N/mm^2 < \sigma ta = 140\ N/mm^2$

Shear Stress

$\tau = 0.26 * 10^3 / (40.0 * 10^2) = 0\ N/mm^2 < \tau a = 80\ N/mm^2$

Composite Stress

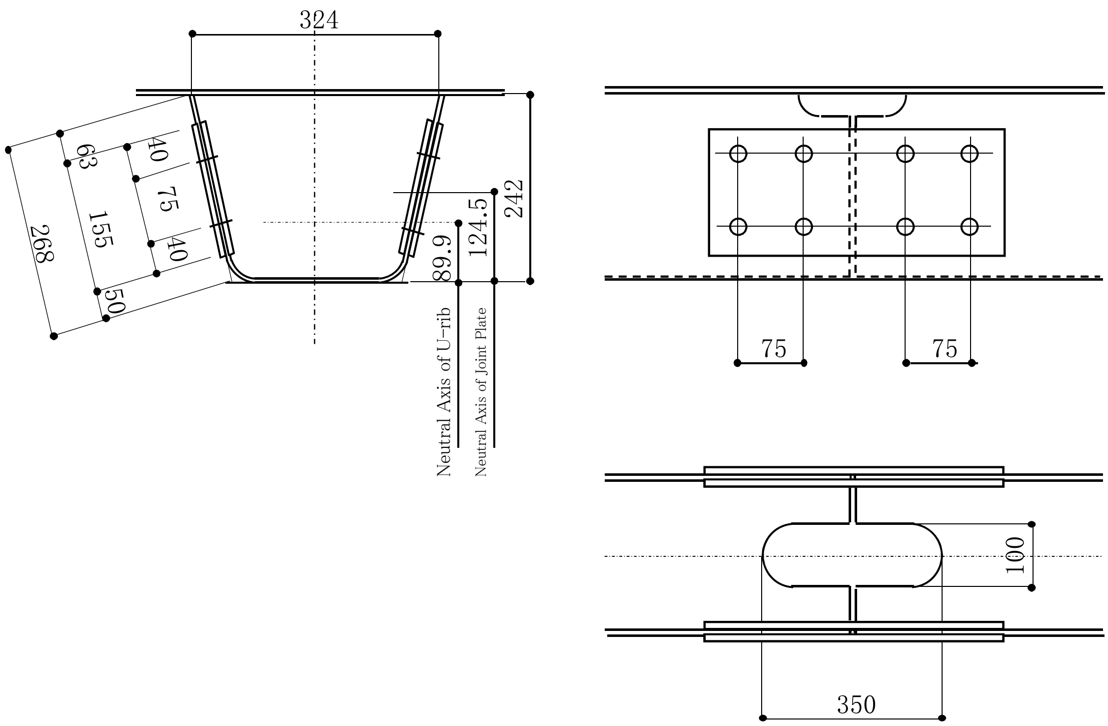
$\kappa = (7 / 140)^2 + (0 / 80)^2 = 0.00 < 1.2$

2. Longitidinal Rib Joint Calculation

(1) U-rib 320 x 240 x 8 (SM400)

1) Cross Section Property

Longi. Rib Section	U −	320 × 240 × 8		
Longi. Rib Area	Ar	=	53.90	cm^2
Longi. Rib Center of Gravity	ex	=	89.9	mm
Longi. Rib I	Ir	=	3315	cm^4



2) Calculation of Joint Plate

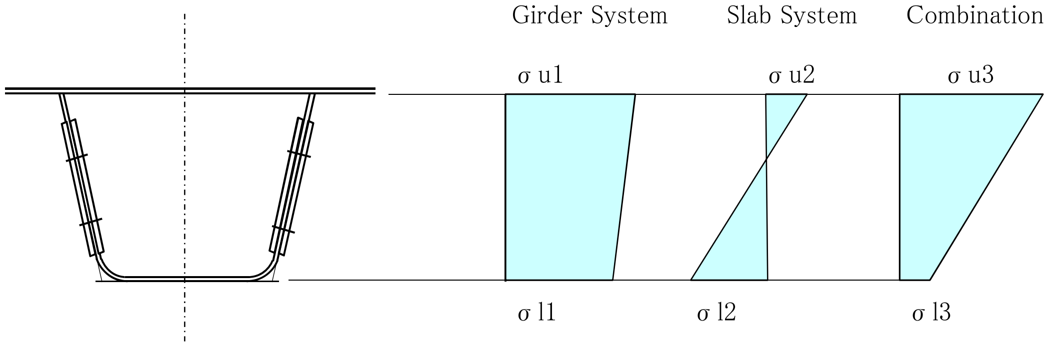
4 − SPL PL 155 × 19 (SS400)

Aspl = 118 cm^2 > Ar

$$Ispl = 4 \times \frac{1.9 \times 15.5^3}{12} + 118 \times (12.45 - 8.99)^2$$

$$= 3769 \ cm^4 > Ir$$

3) Design Stress



σ u1	=	−75	N/mm^2	Girder System Max	Section P11
σ l1	=	−62	N/mm^2	〃	〃
σ 1	=	−69	N/mm^2	Girder System Ave.	
σ u2	=	−35	N/mm^2	Slab System Max	at Mmax
σ l2	=	89	N/mm^2	〃	〃
σ 2	=	27	N/mm^2	Slab System Ave.	〃
σ u2’	=	19	N/mm^2	Slab System Max	at Mmin
σ l2’	=	−49	N/mm^2	〃	〃
σ 2’	=	−15	N/mm^2	Slab System Ave.	〃

σ u3 = (σ u1 + σ u2) / 1.4 = −79 N/mm^2
σ l3 = (σ l1 + σ l2) / 1.4 = 19 N/mm^2
σ 3 = (σ u3 + σ l3) / 2 = −30 N/mm^2
σ u3’ = (σ u1 + σ u2’) / 1.4 = −40 N/mm^2
σ l3’ = (σ l1 + σ l2’) / 1.4 = −79 N/mm^2
σ 3’ = (σ u3’ + σ l3’) / 2 = −60 N/mm^2
75% Stress of Strength 0.75 σ a = 105 N/mm^2

Maximum Stress
σ max = 27 N/mm^2 … Maximum Tensile Stress
σ min = −69 N/mm^2 … Maximum Compressive Stress
Design Stress is
σ = 105 N/mm^2

4) Design for Bolt

HTB M22 (S10T) 2 plane friction ρ a = 108000 N/No.

Number of Bolts n = 8 Nos.

Design Shear Force S = 140000 N

$$\rho = \sqrt{\left(\frac{\sigma \times Ar}{n}\right)^2 + \left(\frac{S}{n}\right)^2}$$

$$= \sqrt{\left(\frac{105 \times 5390}{8}\right)^2 + \left(\frac{140000}{8}\right)^2}$$

$$= 72876 \text{ N} < \rho a$$

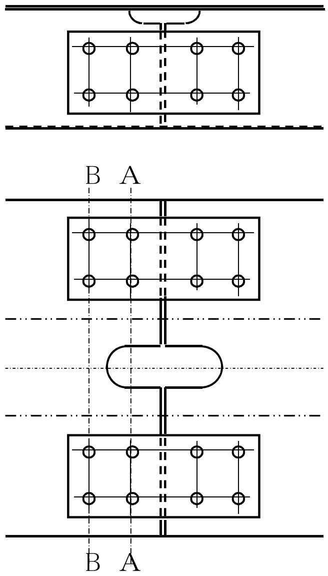
5) Evaluation of Plate

A-A SEC.

$$\sigma n = \frac{\sigma \times Ar}{Arn} \times \frac{\Sigma n - n}{\Sigma n}$$

B-B SEC.

$$\sigma n = \frac{\sigma \times Ar}{Arn}$$



ここに

σ ; Maximum Stress

Compressive σ = 69 N/mm^2

Tensile σ = 27 N/mm^2

Ar ; Longi. Rib Area (cm^2) = 53.90 cm^2

Arn ; Longi. Rib Net Area (cm^2)

In case of compressive stress

Arn = Ar − 10.0 × 0.8 = 45.90 cm^2

In case of tensile stress

A-A SEC.

Arn = (Ar − (4 × 2.7 + 10.0) × 0.8)× 1.1 = 40.99 cm^2

Σn ; No. of Bolt per one side = 8

n ; No. of Bolt at outside A-A SEC = 4

B-B SEC.

Arn = (Ar − (4 × 2.7) × 0.8)× 1.1 = 49.79 cm^2

・Evaluation (in case of compresive stress)

$$\sigma n = \frac{69 \times 5390}{4590} \times \frac{8 - 4}{8} = 40 \quad N/mm2 < \sigma a$$

・Evaluation (in case of tensile stress)

A-A SEC.

$$\sigma n = \frac{27 \times 5390}{4099} \times \frac{8 - 4}{8} = 18 \quad N/mm2 < \sigma a$$

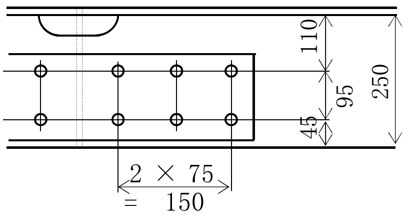
B-B SEC.

$$\sigma n = \frac{27 \times 5390}{4979} = 29 \quad N/mm2 < \sigma a$$

(2) PL-rib 250 x 24 (SM400)

1) Cross Section Property

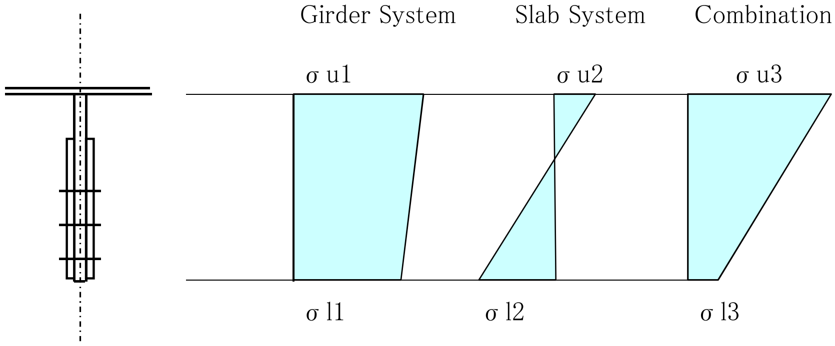
PL 250 × 24 Ar = 60 cm^2



2) Calculation of Joint Plate

					A (cm^2)		
	(SM400)						
2 —	SPL	175	×	18	63.0	>	Ar

3) Design Stress



σ u1	=	-75	N/mm²	Girder System Max	Section P11
σ l1	=	-62	N/mm²	〃	〃
σ 1	=	-69	N/mm²	Girder System Ave.	
σ u2	=	-35	N/mm²	Slab System Max	at Mmax
σ l2	=	89	N/mm²	〃	〃
σ 2	=	27	N/mm²	Slab System Ave.	〃
σ u2'	=	19	N/mm²	Slab System Max	at Mmin
σ l2'	=	-49	N/mm²	〃	〃
σ 2'	=	-15	N/mm²	Slab System Ave.	〃

σ u3 = (σ u1 + σ u2) / 1.4 = -79 N/mm²
σ l3 = (σ l1 + σ l2) / 1.4 = 19 N/mm²
σ 3 = (σ u3 + σ l3) / 2 = -30 N/mm²
σ u3' = (σ u1 + σ u2') / 1.4 = -40 N/mm²
σ l3' = (σ l1 + σ l2') / 1.4 = -79 N/mm²
σ 3' = (σ u3' + σ l3') / 2 = -60 N/mm²
75% Stress of Strength 0.75 σ a = 105 N/mm²

Maximum Stress
σ max = 27 N/mm² … Maximum Tensile Stress
σ min = -69 N/mm² … Maximum Compressive Stress

Design Stress
σ = 105 N/mm²

4) **Design for Bolt** HTB M22 (S10T) 2 plane friction

Required No. of Bolts nreq $\quad nreq = \dfrac{105 \times 6000}{108000} = 5.8 \rightarrow\rightarrow 6$ nos.

5) Evaluation of Plate

Longi. Rib Net Area Arn $\quad nreq = (6000 - (27 + 27) \times 24) \times 1.1$

$= 5174\ mm^2$

Hole deduction Stress σt $\quad \sigma t = 27 \times 6000 / 5174 = 31\ N/mm^2$

$< \sigma a = 140\ N/mm^2$

２．５　Calculation for Cross Beam (Excerpt)

The “Design Tandem-2” which has maximum stress resultants was selected as a calculation case.

１. Decision of Cross Section

(1) Model-3 Sec-6 (at Span)

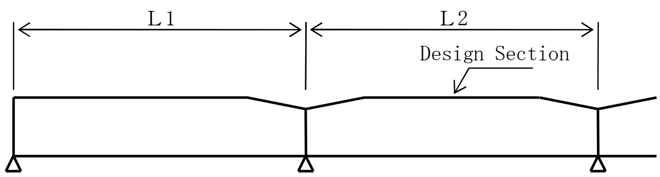
Stress Resultants and Calculation Conditions

Stress Resultants　　M = 195.8 kN·m　　S = 76.5 kN

Shear Force at defect section　Sk= 76.5 kN

Fixed Point Distance　L = 5.000 m

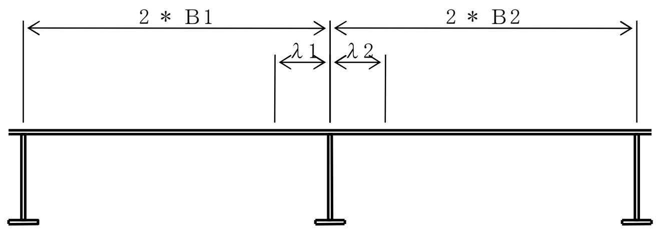
Equivalent Span Length



L2 = 500.0 cm

Li = 0.6 * L2 = 0.6 * 500.0 = 300.0 cm

Effective Width



B1 = 125.0 cm
B2 = 125.0 cm

B1/Li = 125.0 / 300.0 = 0.42

λ1 = 0.15 * Li = 0.15 * 300.0 = 45.0 cm

B2/Li = 125.0 / 300.0 = 0.42

λ2 = 0.15 * Li = 0.15 * 300.0 = 45.0 cm

Effective Width Total　λ = λ1 + λ2 = 45.0 + 45.0 = 90.0 cm

Cross Section Property

			A (cm^2)	Y (cm)	AY (cm^3)	I (cm^4)
1-DECK	PL	900 * 16 (SM400)	144.00	-35.80	-5155	184556
1-WEB	PL	700 * 9 (SM490Y)	63.00	0.00	0	25725
1-LFLG	PL	240 * 10 (SM490Y)	24.00	35.50	852	30246
			231.00		-4303	240527

E = -4303 / 231.00 = -18.63 cm

I = 240527 - 231.00 * -18.63^2 = 160365 cm^4

Yu = -17.97 cm , YL = 54.63 cm

Bending Stress

σu = 195.8×10^6 * -179.7 / (160365×10^4) = -22 N/mm^2 < σca = 140 N/mm^2

σL = 195.8×10^6 * 546.3 / (160365×10^4) = 67 N/mm^2 < σta = 210 N/mm^2

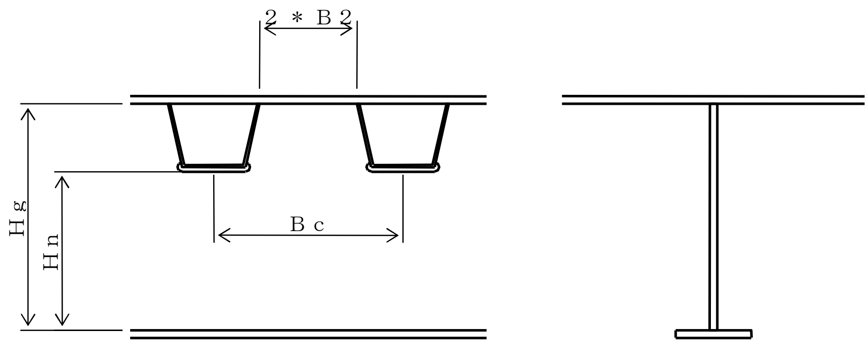
Shear Stress

τ = 76.5×10^3 / 6300 = 12 N/mm^2 < τa = 120 N/mm^2

Composite Stress

κ = (65 / 210 $)^2$ + (12 / 120 $)^2$ = 0.11 < 1.2

Shear Stress of defect section of Longitudinal Rib



τk = 76.5×10^3 / 6300 = 12 N/mm^2 < τa = 120 N/mm^2

τv = τk * Hg / Hn = 12 * 70.0 / 43.8 = 19 N/mm^2 < τa

τh = τk * Bc / (2 * B2) = 12 * 64.0 / (2 * 15.8) = 25 N/mm^2 < τa

Evaluation of Displacement

Disp. By Live load δ = 1.0 mm ≦ δa = L / 500 = 5000 / 500 = 10.0 mm

Calculation for Stiffener

＊Calculation Conditions

Web : SM490Y Web Height(b) : 1300 mm Web Thickness(t) : 9 mm

No. of Vertical Stiffener : 3 Layer of Horizontal Stiffener : 0

Spacing of Vertical Stiffener(a) : 1380 mm

Web edge compressive stress : σc = 22 N/mm^2 Web Shear Stress : τ = 12 N/mm^2

＊Evaluation for Web Thickness

Kh = $\sqrt{(\sigma a/\sigma c)} = \sqrt{(210 / 22)} = 3.09 > 1.2$ Therefore, Kh = 1.20

Minimum Web Thickness t･req = b/(123*Kh) = 1300 / (123*1.20) = 8.8 < 9 mm

Horizontal Stiffener: omitted

＊Evaluation for Vertical Stiffener Spacing

Panel Aspect Ratio K1 = a/b = 138.0 / 130.0 = 1.06 < 1.5

Evaluation K2 = $[b/(100*t)]^4 * [(\sigma/345)^2 + \{\tau/(77+58*(b/a)^2)\}^2]$

$= [130.0/(100*0.9)]^4 * [(22/345)^2 + \{12/(77+58*0.94^2)\}^2] = 0.06 < 1$

＊Cross Section of Vertical Stiffener

Section 1-PL 100 * 9 (SM400)

Iv = $0.9 * 10.0^3 / 3$ = 300 cm^4

Required Rigidity Iv･req = $b*t^3*\gamma v$･req/11 = $130.0*0.9^3*7.10/11$ = 61 < 300 cm^4

γv･req = $8.0*(b/a)^2 = 8.0 * (130.0/138.0)^2 = 7.10$

Required Plate Width B = b/30 + 50 = 1300/30 + 50 = 93.3 < 100 mm

Required Thickness T = 100 / 13 = 7.7 < 9 mm

(5) model-5 Sec-2 (at Span)

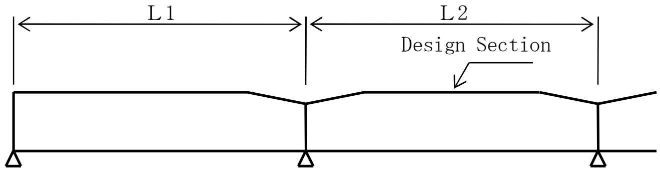
Stress Resultants and Calculation Conditions

Stress Resultants M = 7.5 kN·m S = 6.2 kN

Shear Force at defect section Sk= 6.2 kN

Fixed Point Distance L = 2.500 m

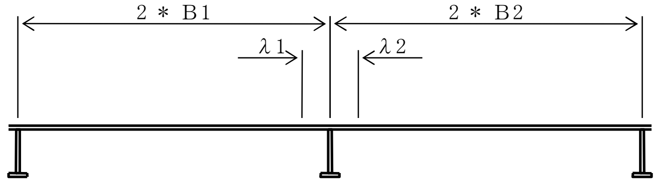
Equivalent Span Length



L2 = 250.0 cm

Li = 0.6 * L2 = 0.6 * 250.0 = 150.0 cm

Effective Width



B1 = 125.0 cm
B2 = 125.0 cm

B1/Li = 125.0 / 150.0 = 0.83

λ1 = 0.15 * Li = 0.15 * 150.0 = 22.5 cm

B2/Li = 125.0 / 150.0 = 0.83

λ2 = 0.15 * Li = 0.15 * 150.0 = 22.5 cm

Effective Width Total λ = λ1 + λ2 = 22.5 + 22.5 = 45.0 cm

Cross Section Property

			$A(cm^2)$	$Y(cm)$	$AY(cm^3)$	$I(cm^4)$
1-DECK	PL	450 * 16(SM400)	72.00	-18.30	-1318	24112
1-WEB	PL	350 * 9(SM400)	31.50	0.00	0	3216
1-LFLG	PL	150 * 10(SM400)	15.00	18.00	270	4860
			118.50		-1048	32188

E = -1048/ 118.50 = -8.84 cm

$I = 32188 - 118.50 * -8.84^2 = 22926\ cm^4$

Yu = -10.26 cm , YL = 27.34 cm

Bending Stress

$\sigma u = 7.5*10^6 * -102.6 / (22926*10^4) = -3\ N/mm^2 < \sigma ca = 140\ N/mm^2$

$\sigma L = 7.5*10^6 * 273.4 / (22926*10^4) = 9\ N/mm^2 < \sigma ta = 140\ N/mm^2$

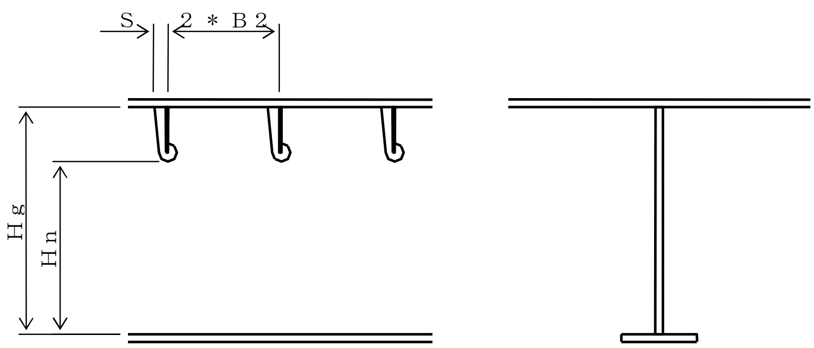
Shear Stress

$\tau = 6.2*10^3 / 3150 = 2\ N/mm^2 < \tau a = 80\ N/mm^2$

Composite Stress

$\kappa = (9 / 140)^2 + (2 / 80)^2 = 0.00 < 1.2$

Shear Stress of defect section of Longitudinal Rib



$\tau k = 6.2*10^3 / 3150 = 2\ N/mm^2 < \tau a = 80\ N/mm^2$

$\tau v = \tau k * Hg / Hn = 2 * 35.0 / 13.0 = 5\ N/mm^2 < \tau a$

$\tau h = \tau k * 2 * B2 / (2 * B2 - S)$

$= 2 * 2 * 25.0 / (2 * 25.0 - 4.0) = 2\ N/mm^2 < \tau a$

Evaluation of Displacement

Disp. By Live load $\delta = 0.0$ mm $\leqq \delta a = L / 500 = 2500 / 500 = 5.0$ mm

Calculation for Stiffener

b = 35.0 : Web Height(cm)

t = 0.9 : Web Thickness(cm)

σ = 3 : Web edge compressive stress (N/mm^2)

τ = 2 : Web Shear Stress (N/mm^2)

Evaluation for Web Thickness

Kh = √(σa / σ) = √(140 / 3) = 7.0 ∴Kh = 1.2

b / (152 * Kh) = 35.0 / (152 * 1.2) = 0.2 cm < t = 0.9 cm

Horizontal Stiffener: omitted

Vertical Stiffener

Kv = √(τa / τ) = √(80 / 2) = 6.4 ∴Kv = 1.2

70 * t * Kv = 70 * 0.9 * 1.2 = 75.6 cm > b = 35.0 cm

Vertical Stiffener: omitted

２. Calculation for Site Joint

(1) Model-3 Sec-6(at Support) LFLG

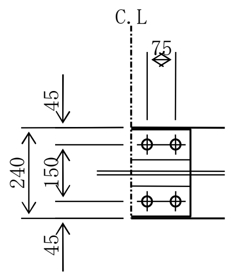
(a) Stress

σ_{tmax} = 71 N/mm^2 　 0.75σ_{ta} = 0.75 * 210 = 158 N/mm^2

(b) Plate all section

1-LFLG PL 240 * 10 　 Ag = 24.0 cm^2 (SM490Y)

(c) Bolt Arrangement



(d) Evaluation for Plate

1- LFLG PL 240 * 10 　 A = 24.0

(24.0 - (2* 2.7)* 1.0) * 1.1 = 20.5 ＜ 24.0 ∴An = 20.5 cm^2

σ_{tn} = σ_{tmax} * Ag / An = 71 * 24.0 / 20.5 = 83 N/mm^2

＜ σ_{ta} = 210 N/mm^2

(e) Design Axial Force

Pt = 0.75σ_{ta} * An / 1.1 = 158 * 2046 / 1.1 = 292950 N

＞ σ_{tn} * An = 83 * 2046 = 169954 N

(f) Required Splice Plate Area

AnR = Pt / σ_a / 2 = 292950 / 210 / 2 = 698 mm^2 = 7.0 cm^2

(g) Required No. of Bolt

n = Pt / (108000 * 1.00) = 292950 / 108000 = 2.7 (use 4 bolts)

(S10T M22 2plane friction force ρ_a = 108000 N inorganic zinc Nmax = 2)

(h) Evaluation for Splice Plate

	(SM490Y)	Ags(cm^2)	Hole deduction		Ans(cm^2)
2-SPL PL	80 * 9	(14.4 -	2*(1*2.7)* 0.9)*1.1=	10.5＜ 14.4	∴ 10.5 ＞ AnR
1-SPL PL	230 * 9	(20.7 -	(2*2.7)* 0.9)*1.1=	17.4＜ 20.7	∴ 17.4 ＞ AnR

(2) Model-3 Sec-6(at suppoer) WEB

(a) Section

1-WEB PL 700 ＊ 9 A = 63.0 cm^2 (SM490Y)

(b) Design Stress

σU = 36 N/mm^2 ＜ σa ＊ 0.75 = 210 ＊ 0.75 = 158 N/mm^2

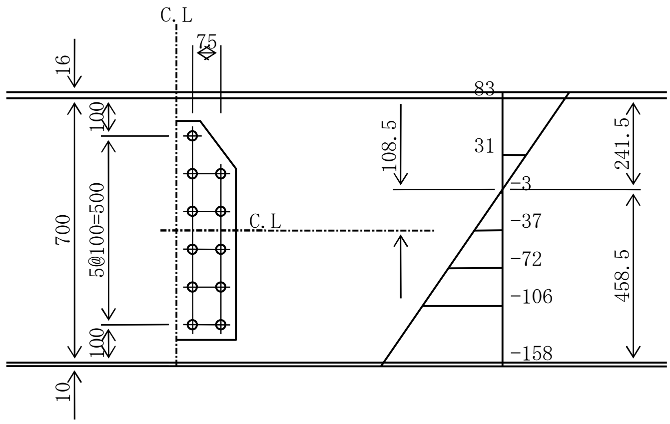
σL = -69 N/mm^2 ＜ σa ＊ 0.75 = 210 ＊ 0.75 = 158 N/mm^2

σUn = 158 ＊ 36 / 69 = 83 N/mm^2

σLn = 158 N/mm^2

τ = 34 N/mm^2

(c) Bolt Arrangement and Stress



(d) Evaluation of Bolt Stress

Evaluation of 6 layer bolt

Sharing Width b1 = 15.0 cm

Total FOrce

P1 = 150 ＊ 9 ＊ (106 + 158) / 2 = 177846 N

Required No. of Bolt (Used Bolt No.)

N1 = 177846 / (108000 ＊ 1.00) = 1.6 (use 2 bolts)

Evaluation of Shear Force

ρs = τ ＊ A / 11 = 34 ＊ 6300 / 11 = 19236 N ＜ ρa = 108000 N

Evaluation for Composite Stress

$\rho c6$ = $\sqrt{((177846 / 2)^2 + 19236^2)}$ = 90980 N ＜ ρa = 108000 N

(S10T M22 2plane friction force ρa = 108000 N inorganic zinc Nmax = 2)

(e) Evaluation of Splice Plate

2-SPL PL 580 ＊ 9 As = 104.4 cm^2 (SM490Y)

Second Moment of Inertia of Splice Plate Is = 41563 cm^4 ＞ Iw

Second Moment of Inertia of Web Iw = 33145 cm^4

Bending Moment at Web

Mw = 158 ＊ 33145＊10^4 / 459 = 114＊10^6 N・mm

Bending Stress of Splice Plate

σsp = 114＊10^6 / (41563＊10^4) ＊ 399 = 109 N/mm^2 ＜ σa = 210 N/mm^2

２．６　Calculation for Bracket　(Excerpt)

The "Design Tandem-1" which has maximum stress resultants was selected as a calculation case.

１．Decision of Cross Section

(1) Model-1 Sec-1 (at Middle)

Stress Resultants and Calculation Conditions

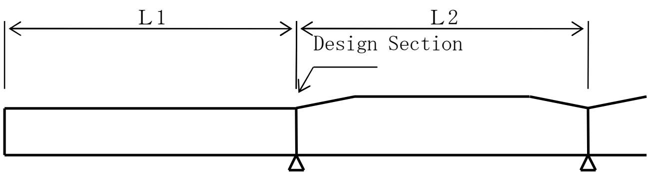
Stress Resultants　　　　　M =　-952.7 kN·m　　S =　 400.5 kN

Stress Resultants at joint　　Mj=　-952.7 kN·m　　Sj=　 400.5 kN

Shear Force at defect section　　Sk=　 400.5 kN

Fixed Point Distance　　L =　 5.200 m

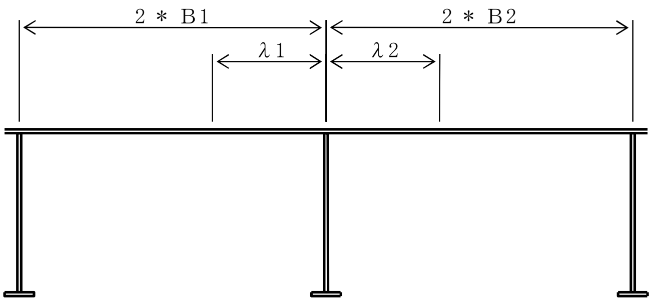
Equivalent Span Length



L1 =　520.0 cm

Li = 2 * L1 = 2 * 520.0 = 1040.0 cm

Effective Width



B1 =　125.0 cm
B2 =　125.0 cm

$B1/Li = 125.0 / 1040.0 = 0.12$

$\lambda 1 = \{ 1.06 - 3.2 * (B1/Li) + 4.5 * (B1/Li)^2 \} * B1$

$= \{ 1.06 - 3.2 * 0.12 + 4.5 * 0.12^2 \} * 125.0$

$= 92.5$ cm

$B2/Li = 125.0 / 1040.0 = 0.12$

$\lambda 2 = \{ 1.06 - 3.2 * (B2/Li) + 4.5 * (B2/Li)^2 \} * B2$

$= \{ 1.06 - 3.2 * 0.12 + 4.5 * 0.12^2 \} * 125.0$

$= 92.5$ cm

Effective Width Total $\lambda = \lambda 1 + \lambda 2 = 92.5 + 92.5 = 185.1$ cm

Cross Section Property

				$A(cm^2)$	$Y(cm)$	$AY(cm^3)$	$I(cm^4)$
1-DECK	PL	1851 * 16	(SM400)	296.16	-65.80	-19487	1282253
1-WEB	PL	1300 * 9	(SM490Y)	117.00	0.00	0	164775
1-LFLG	PL	240 * 15	(SM490Y)	36.00	65.75	2367	155630
				449.16		-17120	1602658

$E = -17120 / 449.16 = -38.12$ cm

$I = 1602658 - 449.16 * -38.12^2 = 950105\ cm^4$

$Yu = -28.48$ cm , $YL = 104.62$ cm

Allowable Bending Stress

・LFLG

Allowable Stress by Lateral Backling

$Aw/Ac = 117.00 / 36.00 = 3.250 > 2$

$K*L/b = \sqrt{(3 + 117.00 / (2 * 36.00))} * 520.0 / 24.0 = 46.596 > 7$

$\sigma ba = 210 - 2.3*(46.596 - 7) = 119\ N/mm^2$

Allowable Stress by Local Backling

$\sigma cal = 210\ N/mm^2$

Allowable Bending Compressive Stress $\sigma ca = 119\ N/mm^2$

Bending Stress

$\sigma u = -952.7*10^6 * -284.8 / (950105*10^4) = 29\ N/mm^2 < \sigma ta = 140\ N/mm^2$

$\sigma L = -952.7*10^6 * 1046.2 / (950105*10^4) = -105\ N/mm^2 < \sigma ca = 119\ N/mm^2$

Shear Stress

$\tau = 400.5*10^3 / 11700 = 34\ N/mm^2 < \tau a = 120\ N/mm^2$

Composite Stress

$\kappa = (-103 / 210)^2 + (34 / 120)^2 = 0.32 < 1.2$

＊At Joint

Allowable Bending Stress

・LFLG

Allowable Stress by Lateral Backling

$Aw/Ac = 117.00 / 36.00 = 3.250 > 2$

$K*L/b = \sqrt{(3 + 117.00 / (2 * 36.00))} * 520.0 / 24.0 = 46.596 > 7$

$\sigma ba = 210 - 2.3*(46.596 - 7) = 119 \ N/mm^2$

Allowable Stress by Local Backling

$\sigma cal = 210 \ N/mm^2$

Allowable Bending Compressive Stress $\sigma ca = 119 \ N/mm^2$

Bending Stress

$\sigma u = -952.7*10^6 * -284.8 / (950105*10^4) = 29 \ N/mm^2 < \sigma ta = 140 \ N/mm^2$

$\sigma L = -952.7*10^6 * 1046.2 / (950105*10^4) = -105 \ N/mm^2 < \sigma ca = 119 \ N/mm^2$

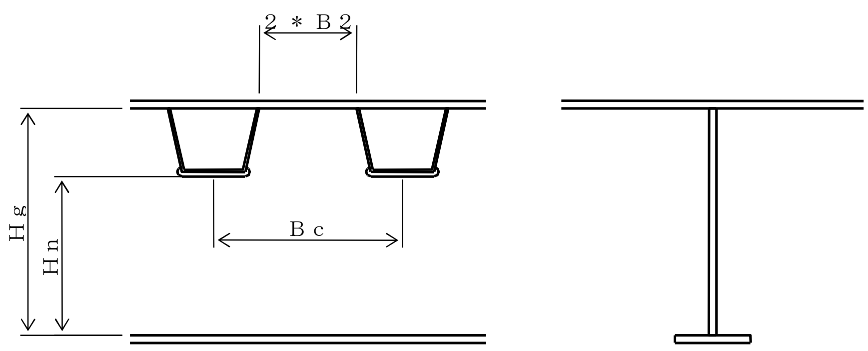
Shear Stress

$\tau = 400.5*10^3 / 11700 = 34 \ N/mm^2 < \tau a = 120 \ N/mm^2$

Composite Stress

$\kappa = (-103 / 210)^2 + (34 / 120)^2 = 0.32 < 1.2$

Shear Stress at Defect Section of Longitudinal Rib



$\tau k = 400.5*10^3 / 11700 = 34 \ N/mm^2 < \tau a = 120 \ N/mm^2$

$\tau v = \tau k * Hg / Hn = 34 * 130.0 / 103.8 = 43 \ N/mm^2 < \tau a$

$\tau h = \tau k * Bc / (2 * B2) = 34 * 64.0 / (2 * 15.8) = 69 \ N/mm^2 < \tau a$

Calculation for Stiffener

＊Calculation Conditions

Web： SM490Y   Web Height (b)： 1300 mm   Web Thickness(t)： 9 mm

No. of Vertical Stiffener： 3   Layer of Horizontal Stiffener： 0

Spacing of Vertical Stiffener(a)： 1300 mm

Web edge compressive stress： σc = 105 N/mm^2 Web Shear Stress： τ = 34 N/mm^2

＊Evaluation for Web Thickness

Kh = $\sqrt{(\sigma a/\sigma c)} = \sqrt{(210 / 105)}$ = 1.41 ＞ 1.2   Therefore, Kh = 1.20

Minimum Web Thickness t・req = b/(123*Kh) = 1300 / (123*1.20) = 8.8 ＜ 9 mm

Horizontal Stiffener: omitted

＊Evaluation for Vertical Stiffener Spacing

Panel Aspect Ratio K1 = a/b = 130.0 / 130.0 = 1.00 ＜ 1.5

Evaluation $K2 = [b/(100*t)]^4 * [(\sigma/345)^2 + \{\tau/(58+77*(b/a)^2)\}^2]$

$= [130.0/(100*0.9)]^4 * [(105/345)^2 + \{34/(58+77*1.00^2)\}^2] = 0.68$ ＜ 1

＊Cross Section of Vertical Stiffener

Section 1-PL   100 * 9 (SM400)

$Iv = 0.9 * 10.0^3 / 3 = 300\ cm^4$

Required Rigidity $Iv{\cdot}req = b*t^3*\gamma v{\cdot}req/11 = 130.0*0.9^3*8.00/11 = 69$ ＜ 300 cm^4

$\gamma v{\cdot}req = 8.0*(b/a)^2 = 8.0 * (130.0/130.0)^2 = 8.00$

Required Plate Width B = b/30 + 50 = 1300/30 + 50 = 93.3 ＜ 100 mm

Required Thickness T = 100 / 13 = 7.7 ＜ 9 mm

２. Calculation for Site Joint

(1) Model－1 Sec-1(at middle) LFLG

(a) Stress

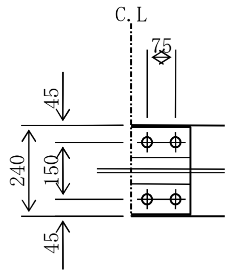
σcmax = -105 N/mm^2 0.75σca = 0.75 * 119 = 89 N/mm^2

∴σc = 105 N/mm^2

(b) Plate All Section

1-LFLG PL 240 * 15 Ag = 36.0 cm^2 (SM490Y)

(c) Bolt Arrangement



(d) Design Axial Force

Pc = σc * Ag = 105 * 3600 = 377662 N

(e) Required Splice Plate Area

AgR = Pc / σa / 2 = 377662 / 210 / 2 = 899 mm^2 = 9.0 cm^2

(f) Required No. of Bolt

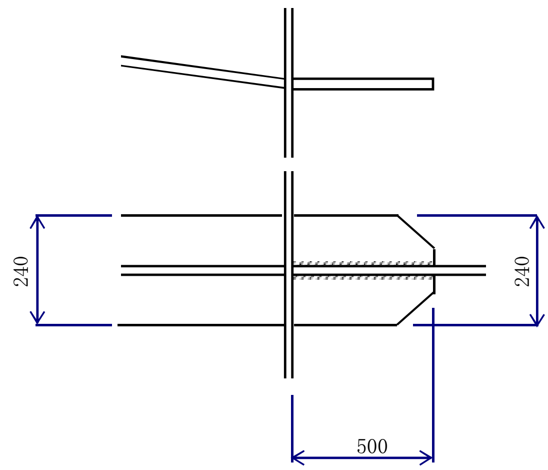
n = Pc / (108000 * 1.00) = 377662 / 108000 = 3.5 (use 4 bolts)

(S10T M22 2plane allowable friction ρa = 108000 N inorganic zinc Nmax = 2)

(g) Evaluation for Splice Plate

	(SM490Y)	Ags(cm^2)		
2-SPL PL	80 * 9	14.4	> AgR =	9.0cm^2
1-SPL PL	230 * 9	20.7	> AgR =	9.0cm^2

3. Evaluation of Stay Plate at Bottom Flange



Bottom Flange Area

$Af = 240 \times 15 = 3600 \ mm^2$

Stress

$\sigma = 105 \ N/mm^2$

Design Axial Force

$P = 3600 \times 105 = 378000 \ N$

Required Throat Thickness

$areq = P / (\tau a \cdot Lreq \cdot 4)$

$= 378000 / (120 \times 500 \times 4)$

$= 1.6 \ mm$

$S = areq \times \sqrt{2}$

$= 1.6 \times \sqrt{2} = 2.3 \rightarrow 6 \ mm$

２．７　Calculation for Stringer (Excerpt)

The “Design Tandem-1” which has maximum stress resultants was selected as a calculation case.

１．Decision of Cross Section

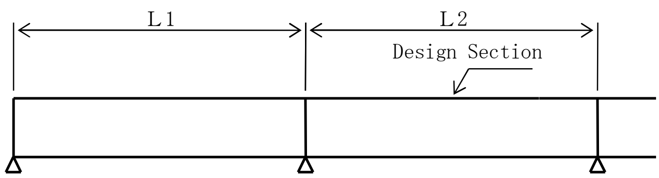
(1) Model-1 Sec-1 (st Span)

Stress Resultants and Calculation Conditions

Stress Resultants　　M = 37.9 kN·m　　S = 4.2 kN

Fixed Point Distance　L = 2.500 m

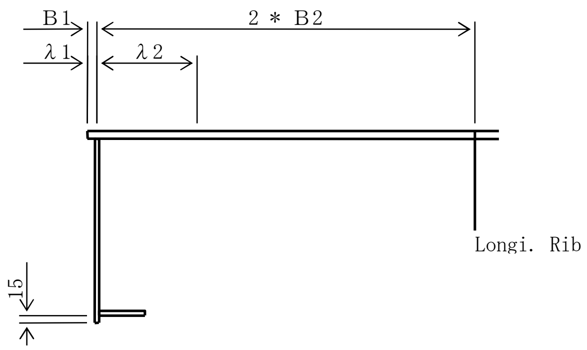
Equivalent Span Length



L1 = 250.0 cm
L2 = 250.0 cm

Li = 0.6 * L2 = 0.6 * 250.0 = 150.0 cm

Effective Width



B1 = 2.0 cm
B2 = 39.4 cm

B1/Li = 2.0 / 150.0 = 0.01

$\lambda 1$ = 2.0 cm

B2/Li = 39.4 / 150.0 = 0.26

$\lambda 2 = \{ 1.06 - 3.2 * (B2/Li) + 4.5 * (B2/Li)^2 \} * B2$

$= \{ 1.06 - 3.2 * 0.26 + 4.5 * 0.26^2 \} * 39.4$

= 20.9 cm

Effective Width Total　$\lambda = \lambda 1 + \lambda 2$ = 2.0 + 20.9 = 22.9 cm

Cross Section Property

			A(cm^2)	Y(cm)	AY(cm^3)	I(cm^4)
1-DECK	PL	229 * 16(SM400)	36.61	-20.00	-732	14643
1-WEB	PL	384 * 9(SM400)	34.56	0.00	0	4247
1-LFLG	PL	100 * 10(SM400)	10.00	17.20	172	2958
			81.17		-560	21848

E = -560/ 81.17 = -6.90 cm

I = 21848 - 81.17 * -6.90^2 = 17982 cm^4

Yu = -13.90 cm , YL = 26.10 cm

Bending Stress

σu = $37.9*10^6$ * -139.0 / ($17982*10^4$) = -29 N/mm^2 < σca = 140 N/mm^2

σL = $37.9*10^6$ * 261.0 / ($17982*10^4$) = 55 N/mm^2 < σta = 140 N/mm^2

Shear Stress

τ = $4.2*10^3$ / 3456 = 1 N/mm^2 < τa = 80 N/mm^2

Composite Stress

κ = (55 / 140 $)^2$ + (1 / 80 $)^2$ = 0.15 < 1.2

Evaluation of Displacement

Displacement due to Live Load δ = 3.3 mm ≦ δa = L / 500 = 2500 / 500 = 5.0 mm

Calculation for Stiffener

b = 38.4 : Web Height(cm)

t = 0.9 : Web Thickness(cm)

σ = 26 : Web edge compressive stress (N/mm^2)

τ = 1 : Web Shear Stress (N/mm^2)

Evaluation for Web Thickness

Kh = √(σa / σ) = √(140 / 26) = 2.3 ∴Kh = 1.2

b / (152 * Kh) = 38.4 / (152 * 1.2) = 0.2 cm < t = 0.9 cm

Horizontal Stiffener: omitted

Vertical Stiffener

Kv = √(τa / τ) = √(80 / 1) = 8.2 ∴Kv = 1.2

70 * t * Kv = 70 * 0.9 * 1.2 = 75.6 cm > b = 38.4 cm

Vertical Stiffener: omitted

2. Calculation for Site Joint

(1) Model-1 Sec-1(at support) LFLG

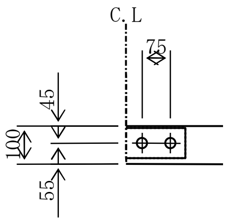
(a) Stress

σtmax = 25 N/mm² 0.75σta = 0.75 * 140 = 105 N/mm²

(b) Plate All Section

1-LFLG PL 100 * 10 Ag = 10.0 cm² (SM400)

(c) Bolt Arrangement



(d) Evaluation of Plate Ares

1- LFLG PL 100 * 10 A = 10.0

(10.0 - (1* 2.7)* 1.0) * 1.1 = 8.0 < 10.0 ∴An = 8.0 cm²

σtn = σtmax * Ag / An = 25 * 10.0 / 8.0 = 31 N/mm²

< σta = 140 N/mm²

(e) Desing Axial Force

Pt = 0.75σta * An / 1.1 = 105 * 803 / 1.1 = 76650 N

> σtn * An = 31 * 803 = 24596 N

(f) Required Splice Plate Area

AnR = Pt / σa / 2 = 76650 / 140 / 2 = 274 mm² = 2.7 cm²

(g) Required No. of Bolt

n = Pt / (108000 * 1.00) = 76650 / 108000 = 0.7 (use 2 bolts)

(S10T M22 2plane allowable friction ρa = 108000 N inorganic zinc Nmax = 2)

(h) Evaluation for Splice Plate

	(SS400)	Ags(cm²)	Hole Deduction		Ans(cm²)
1-SPL PL	80 * 9	(7.2 -	(1*2.7)* 0.9)*1.1=	5.2< 7.2	∴ 5.2 > AnR
1-SPL PL	80 * 9	(7.2 -	(1*2.7)* 0.9)*1.1=	5.2< 7.2	∴ 5.2 > AnR

3. Design Calculation for Main Girder

3. 1. Design Principle

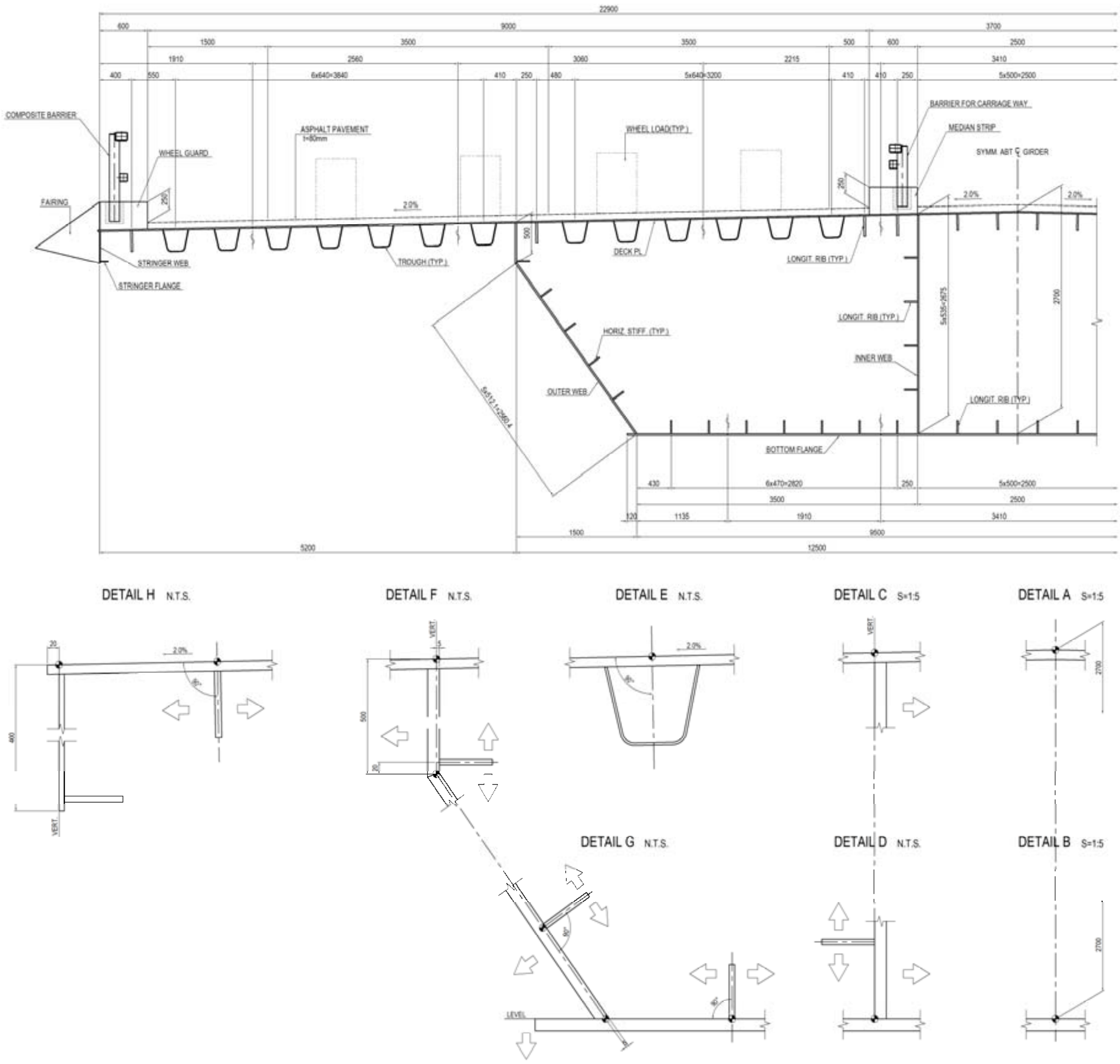
(1) Design Section Force

The section force determined by the static structural analysis for Case 1-6 shall be the design section force. The design force used shall be a factor of the ordinary load conditions.

	Description
Case①	Dead Load
Case②	Live Load
Case③	Temperature Change
Case④	Wind Load
Case⑤	Earthquake
Case⑥	Pre-stress

(2) Design Cross Section

The main girder cross section and plate joint directions are as shown in the figure below.



・Design resistance section: Effective section considering effective width of flange

・Stringer: Effective for section calculation at continuous area in longitudinal direction

(3) Effective Width

The effective width against bending along the horizontal axis for the steel deck and flange is as shown in Section 3.3.

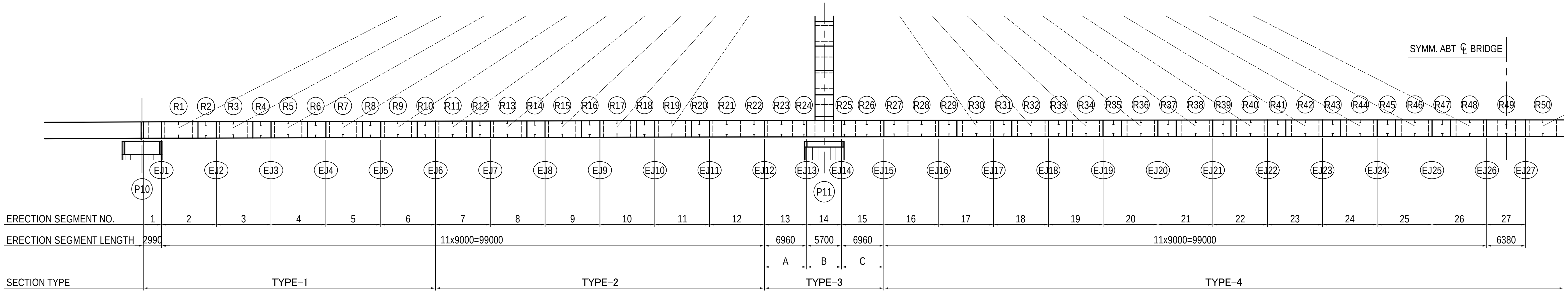
(4) Effective Buckling Length

The main girder shall not be analyzed for overall buckling except in the vicinity of the tower. The effective buckling length in the horizontal and vertical plane for the main girder near the tower is shown in Section3.4.

3．2．Member Dimension of Main Girder

GENERAL VIEW OF MAIN GIRDER (8)

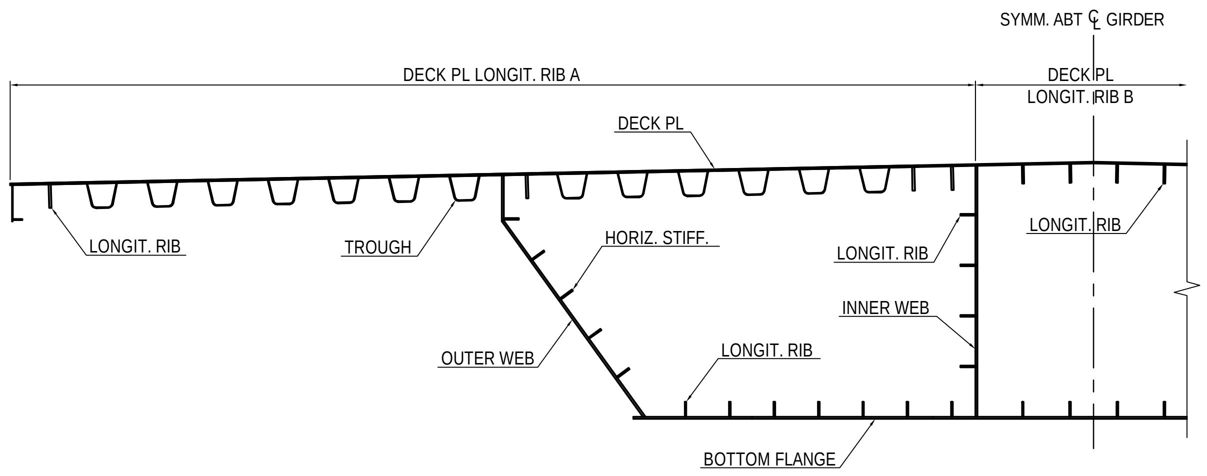
ELEVATION N.T.S.



UNIT : mm

		TYPE-1	TYPE-2	TYPE-3	TYPE-4
DECK PL	THK	16	16	16	16
	STEEL GRADE	SM400	SM400	SM400 / SM490Y / SM400	SM400
	TROUGH	320 x 240 x 8	320 x 240 x 8	320 x 240 x 8	320 x 240 x 8
	LONGIT. RIB A	250 x 24	250 x 24	250 x 24	250 x 24
	LONGIT. RIB B	200 x 20	200 x 20	200x20	200 x 20
OUTER WEB	THK	14	14	17	14
	STEEL GRADE	SM490Y	SM490Y	SM490Y	SM490Y
	HORIZ. STIFF.	160 x 16	160 x 16	200 x 20	160 x 16
INNER WEB	THK	14	14	18 / 35 / 18	14
	STEEL GRADE	SM490Y	SM490Y	SM490Y	SM490Y
	LONGIT. RIB	160 x 16	160 x 16	200 x 20	160 x 16
BOTTOM FLANGE	THK	14	11	15	11
	STEEL GRADE	SM490Y	SM490Y	SM490Y	SM490Y
	LONGIT. RIB	160 x 16	160 x 16	200 x 20	160 x 16

TYPICAL SECTION N.T.S.



PROJECT NAME	FINANCED BY	COUNTERPART	JICA STUDY TEAM
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	REPUBLIC OF THE UNION OF MYANMAR MINISTRY OF CONSTRUCTION DEPARTMENT OF BRIDGE	NIPPON KOEI CO., LTD. ORIENTAL CONSULTANTS GLOBAL CO., LTD. METROPOLITAN EXPRESSWAY COMPANY LIMITED CHODAI CO.,LTD. NIPPON ENGINEERING CONSULTANTS CO.,LTD.

	NAME	SIGNATURE	DATE	DRAWING TITLE	PACKAGE
PREPARED BY	T.TOMODA			GENERAL VIEW OF MAIN GIRDER (8)	1
CHECKED BY	T. HAYAKAWA				DWG No.
APPROVED BY	Y. SANO				P1-CS-1008

3.3. Effective Width of Girder

・Effective Width is calculated based on JSHB II 11.3.5

$$\lambda = \begin{cases} b & (b/L \leqq 0.05) \\ (1.1-2(b/L))b & (0.05 < b/L < 0.30) \\ 0.15L & (0.30 \leqq b/L) \end{cases} \quad \cdots\cdots (11.3.1)$$

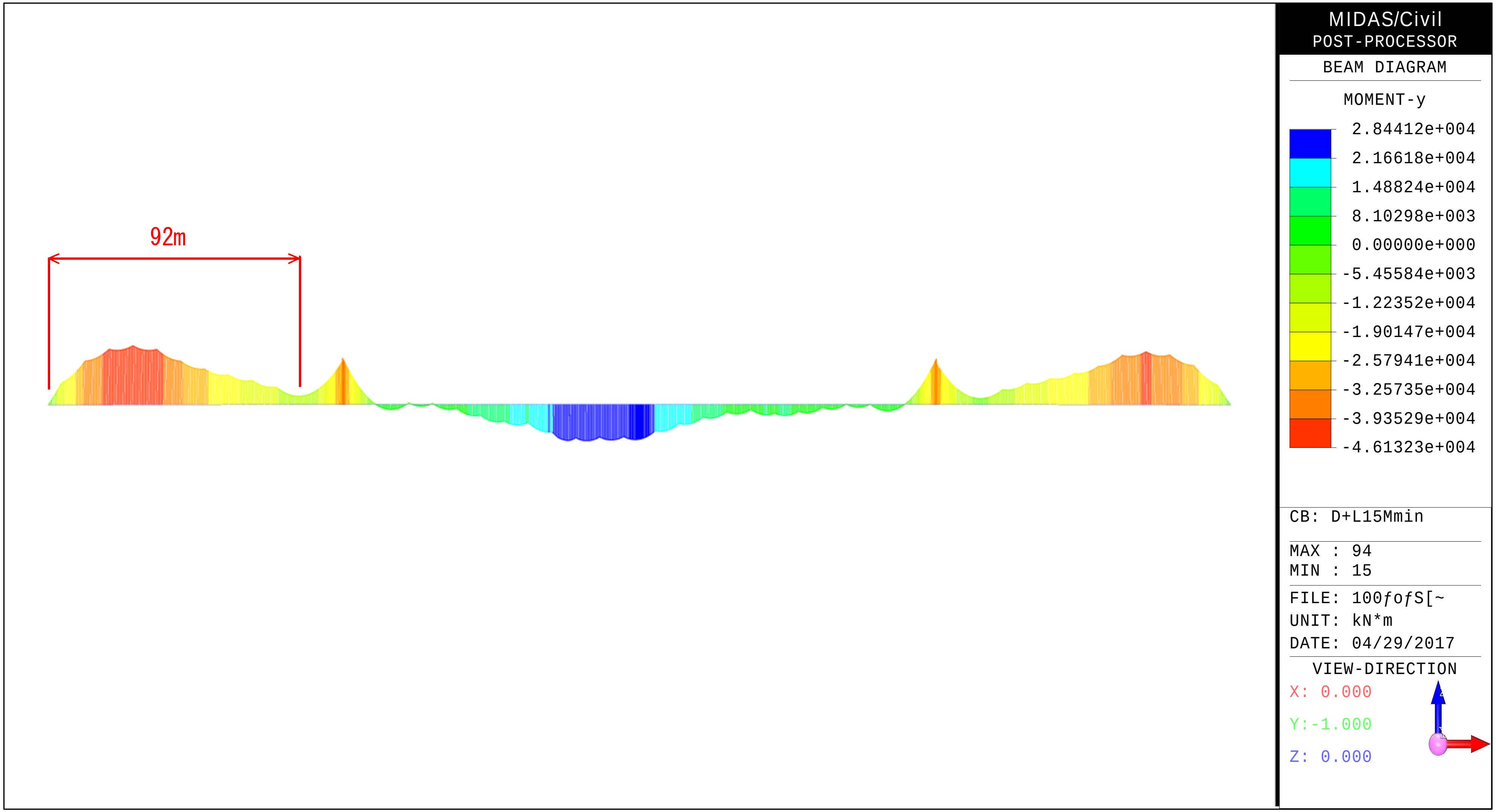
$$\lambda = \begin{cases} b & (b/L \leqq 0.02) \\ (1.06-3.2(b/L)+4.5(b/L)^2)b & (0.02 < b/L < 0.30) \\ 0.15L & (0.30 \leqq b/L) \end{cases} \quad \cdots\cdots (11.3.2)$$

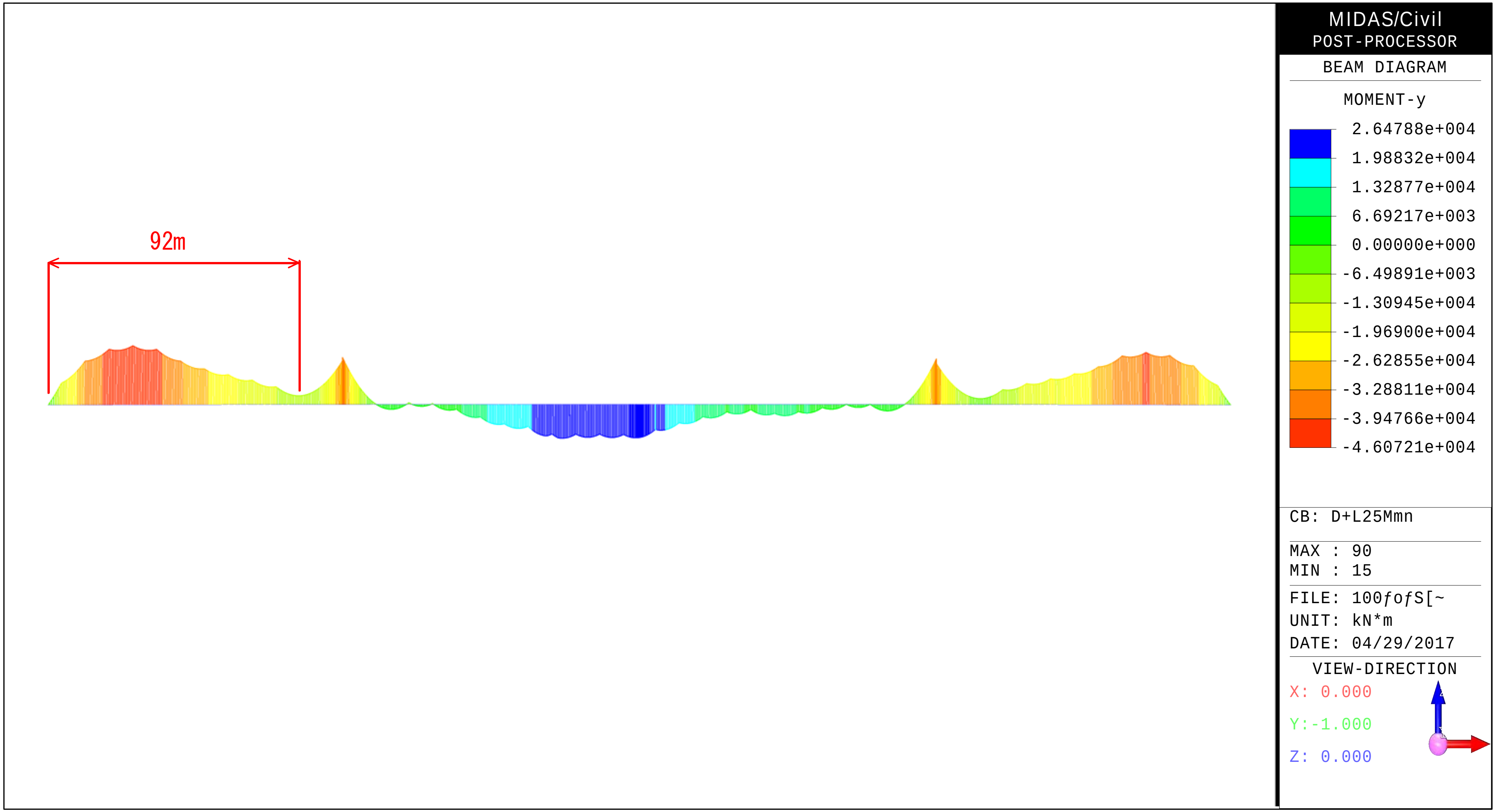
λ : one side effective width of flange(mm)
b : half of web spacing or overhang width of frange(mm)
L : equivalent span length(mm)

・The equivalent span length shall be calculated from max or min bending moment under live load condition.

・Girder Effective Width (mm)

		L	ℓ	Interval	b	b/ℓ	λ	Eq.
Section1	U-Flg1	92000	92000	5200	5200	0.057	5127	(11.3.1)
	U-Flg2	92000	92000	5000	2500	0.027	2500	(11.3.1)
	U-Flg3	92000	92000	2500	1250	0.014	1250	(11.3.1)
	L-Flg	92000	92000	3500	1750	0.019	1750	(11.3.1)
	Web1	46000	46000	2559	1280	0.028	1280	(11.3.1)
	Web2	46000	46000	2659	1330	0.029	1330	(11.3.1)
Section2	U-Flg1	92000	92000	5200	5200	0.057	5127	(11.3.1)
	U-Flg2	92000	92000	5000	2500	0.027	2500	(11.3.1)
	U-Flg3	92000	92000	2500	1250	0.014	1250	(11.3.1)
	L-Flg	92000	92000	3500	1750	0.019	1750	(11.3.1)
	Web1	104000	104000	2559	1280	0.012	1280	(11.3.2)
	Web2	104000	104000	2659	1330	0.013	1330	(11.3.2)
Section3	U-Flg1	32000	32000	5200	5200	0.163	3421	(11.3.2)
	U-Flg2	32000	32000	5000	2500	0.078	2094	(11.3.2)
	U-Flg3	32000	32000	2500	1250	0.039	1178	(11.3.2)
	L-Flg	32000	32000	3500	1750	0.055	1571	(11.3.2)
	Web1	104000	104000	2559	1280	0.012	1280	(11.3.2)
	Web2	104000	104000	2659	1330	0.013	1330	(11.3.2)
Section4	U-Flg1	115000	115000	5200	5200	0.045	5200	(11.3.1)
	U-Flg2	115000	115000	5000	2500	0.022	2500	(11.3.1)
	U-Flg3	115000	115000	2500	1250	0.011	1250	(11.3.1)
	L-Flg	115000	115000	3500	1750	0.015	1750	(11.3.1)
	Web1	146000	146000	2559	1280	0.009	1280	(11.3.1)
	Web2	146000	146000	2659	1330	0.009	1330	(11.3.1)


92m
MIDAS/Civil
POST-PROCESSOR
BEAM DIAGRAM
MOMENT-y
2.84412e+004
2.16618e+004
1.48824e+004
8.10298e+003
0.00000e+000
-5.45584e+003
-1.22352e+004
-1.90147e+004
-2.57941e+004
-3.25735e+004
-3.93529e+004
-4.61323e+004
CB: D+L15Mmin
MAX : 94
MIN : 15
FILE: 100ƒoƒS[~
UNIT: kN*m
DATE: 04/29/2017
VIEW-DIRECTION
X: 0.000
Y:-1.000
Z: 0.000


92m
MIDAS/Civil
POST-PROCESSOR
BEAM DIAGRAM
MOMENT-y
2.64788e+004
1.98832e+004
1.32877e+004
6.69217e+003
0.00000e+000
-6.49891e+003
-1.30945e+004
-1.96900e+004
-2.62855e+004
-3.28811e+004
-3.94766e+004
-4.60721e+004
CB: D+L25Mmn
MAX : 90
MIN : 15
FILE: 100ƒoƒS[~
UNIT: kN*m
DATE: 04/29/2017
VIEW-DIRECTION
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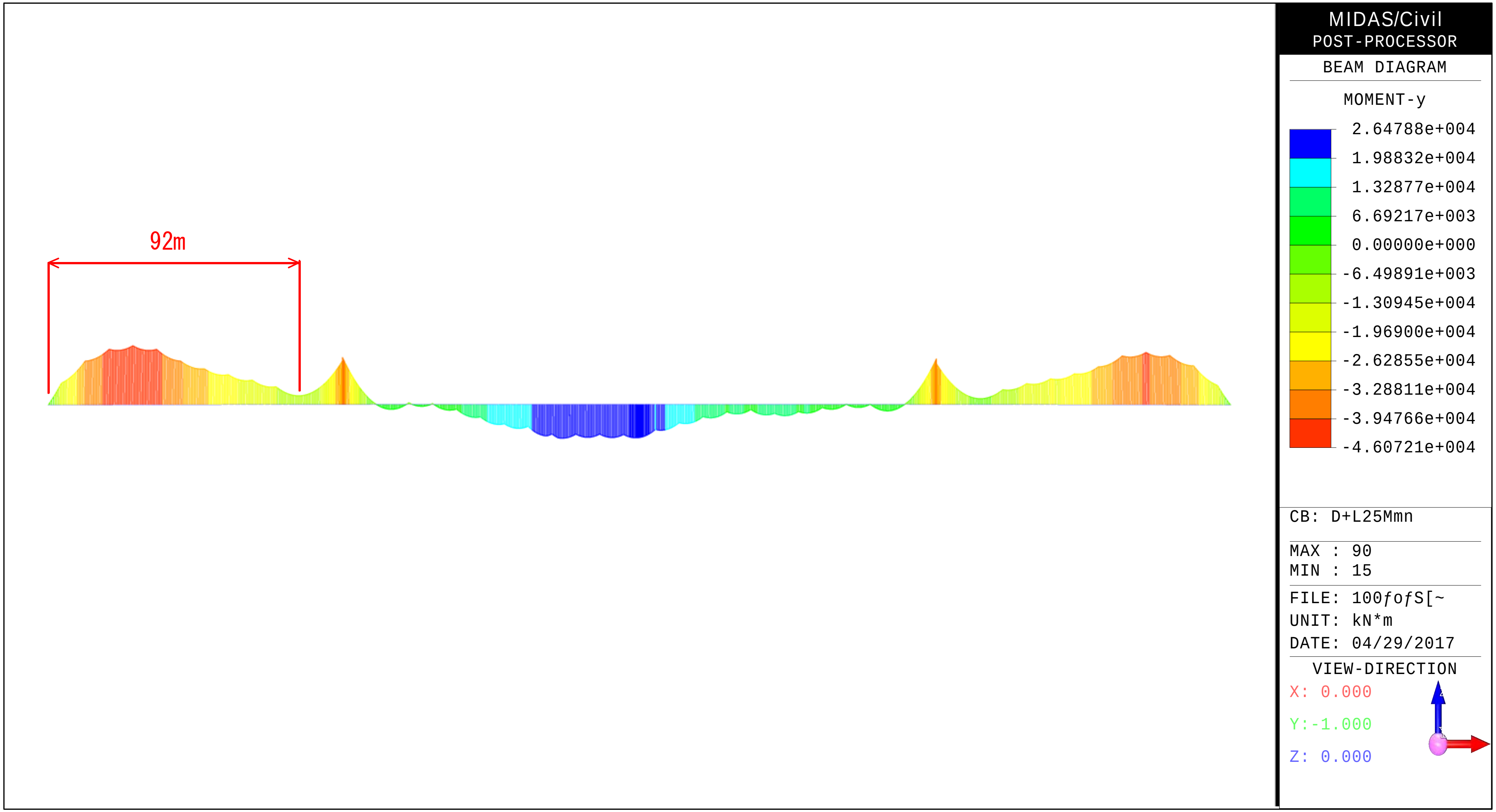
Z: 0.000


92m
MIDAS/Civil
POST-PROCESSOR
BEAM DIAGRAM
MOMENT-y
2.64788e+004
1.98832e+004
1.32877e+004
6.69217e+003
0.00000e+000
-6.49891e+003
-1.30945e+004
-1.96900e+004
-2.62855e+004
-3.28811e+004
-3.94766e+004
-4.60721e+004
CB: D+L25Mmn
MAX : 90
MIN : 15
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UNIT: kN*m
DATE: 04/29/2017
VIEW-DIRECTION
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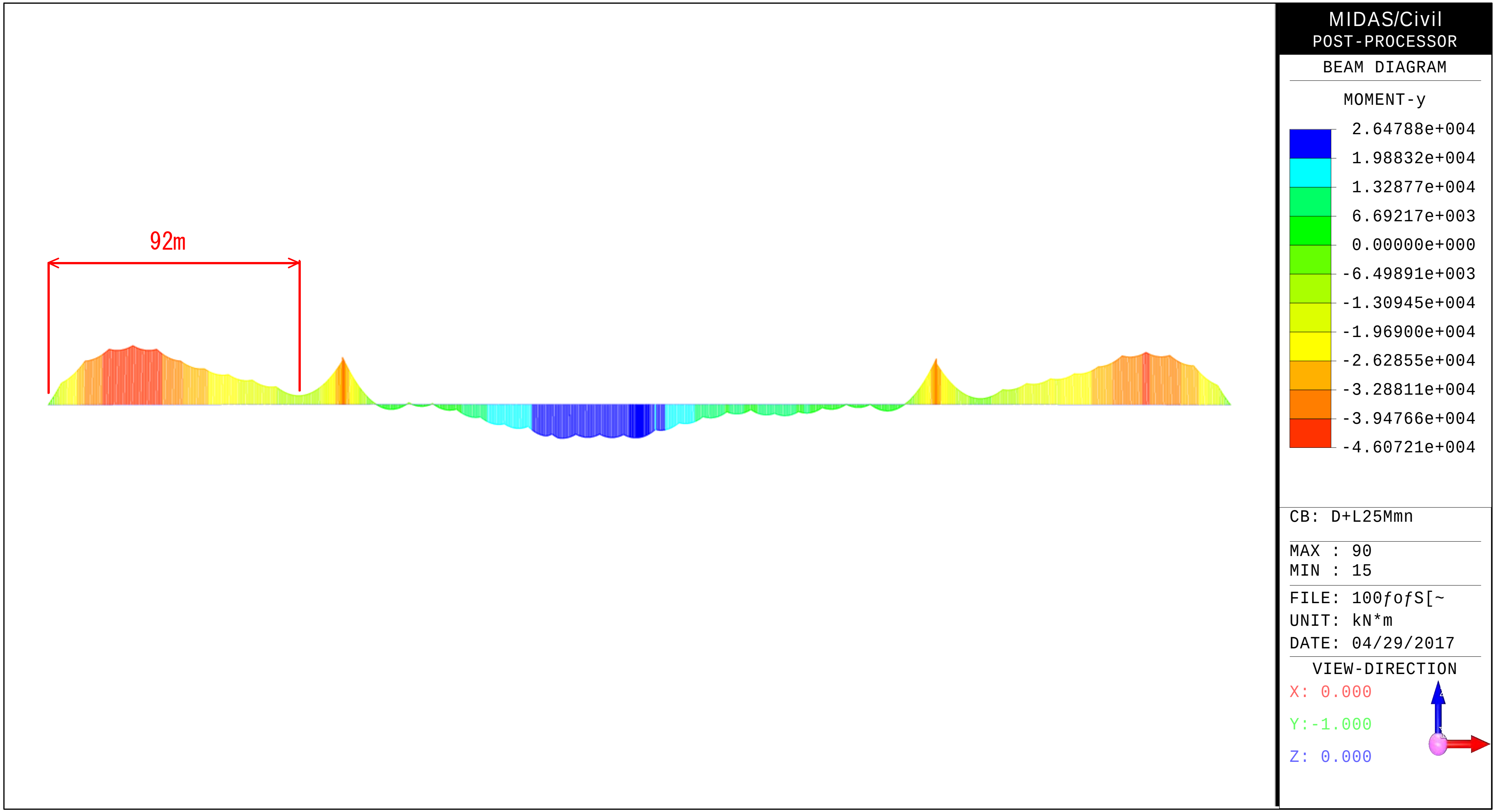
Y:-1.000
Z: 0.000


92m
MIDAS/Civil
POST-PROCESSOR
BEAM DIAGRAM
MOMENT-y
2.64788e+004
1.98832e+004
1.32877e+004
6.69217e+003
0.00000e+000
-6.49891e+003
-1.30945e+004
-1.96900e+004
-2.62855e+004
-3.28811e+004
-3.94766e+004
-4.60721e+004
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MAX : 90
MIN : 15
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DATE: 04/29/2017
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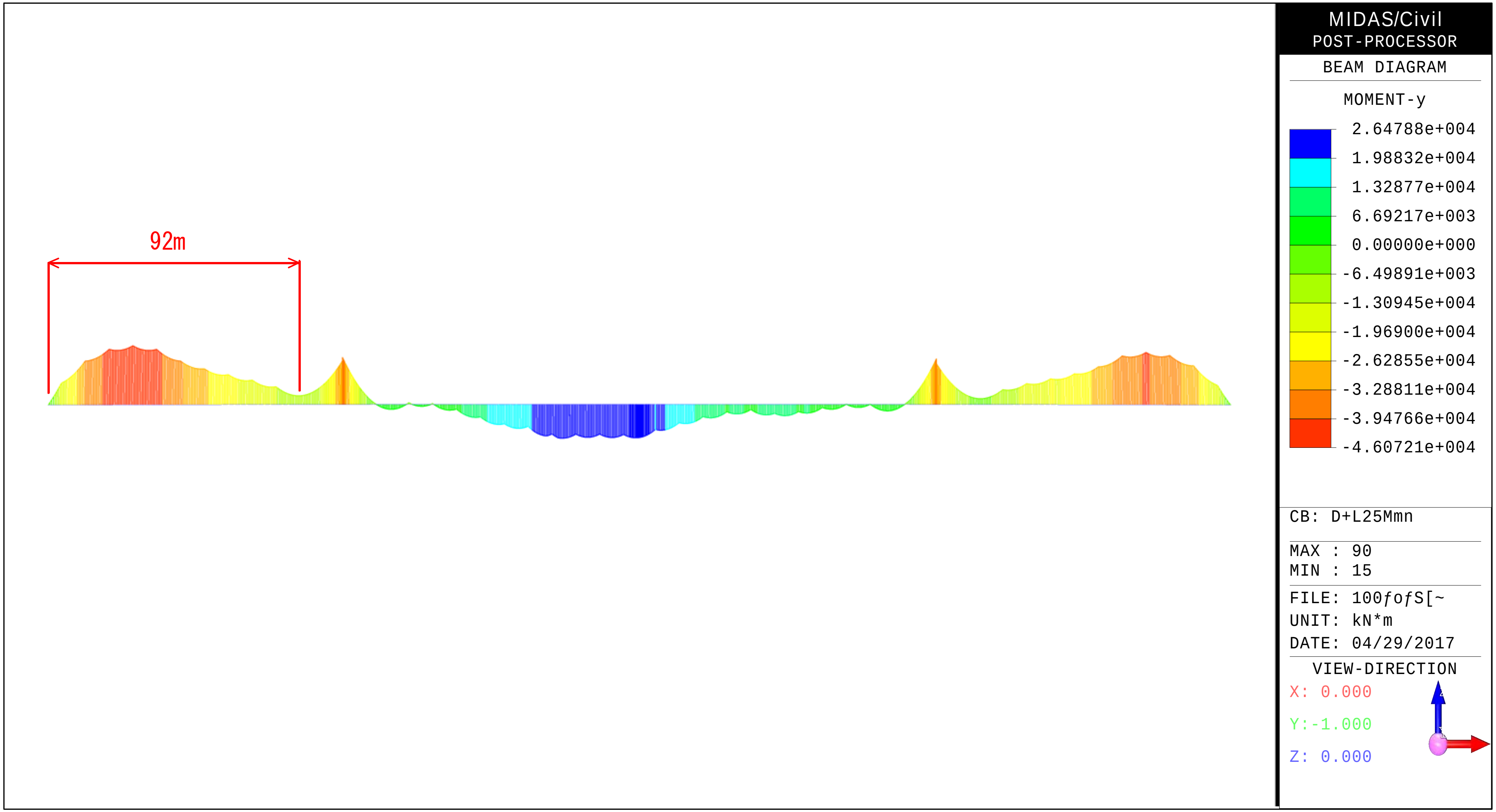
92m
MIDAS/Civil
POST-PROCESSOR
BEAM DIAGRAM
MOMENT-y
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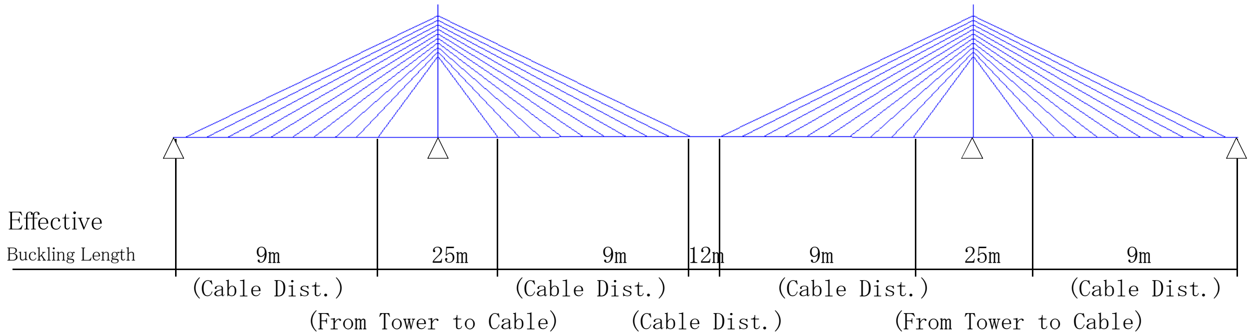
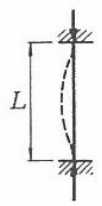
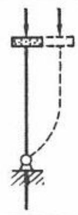
1.98832e+004
1.32877e+004
6.69217e+003
0.00000e+000
-6.49891e+003
-1.30945e+004
-1.96900e+004
-2.62855e+004
-3.28811e+004
-3.94766e+004
-4.60721e+004
CB: D+L25Mmn
MAX : 90
MIN : 15
FILE: 100ƒoƒS[~
UNIT: kN*m
DATE: 04/29/2017
VIEW-DIRECTION
X: 0.000
Y:-1.000
Z: 0.000

3． 4． Effective Buckling Length of Girder



JSHB II p141 Effective Buckling Length

Table-Commentary 3.2.2 L: member Length (mm)

	1	2	3	4	5	6
Buckling Mode						
β (Theoretical)	0. 5	0. 7	1. 0	1. 0	2. 0	2. 0
β (Recommend)	0. 65	0. 8	1. 2	1. 0	2. 1	2. 0

３．５．Cross Section Calculation of Girder　(Excerpt)

（１）Calculation for Method

１）Symbol

Stress Resultants

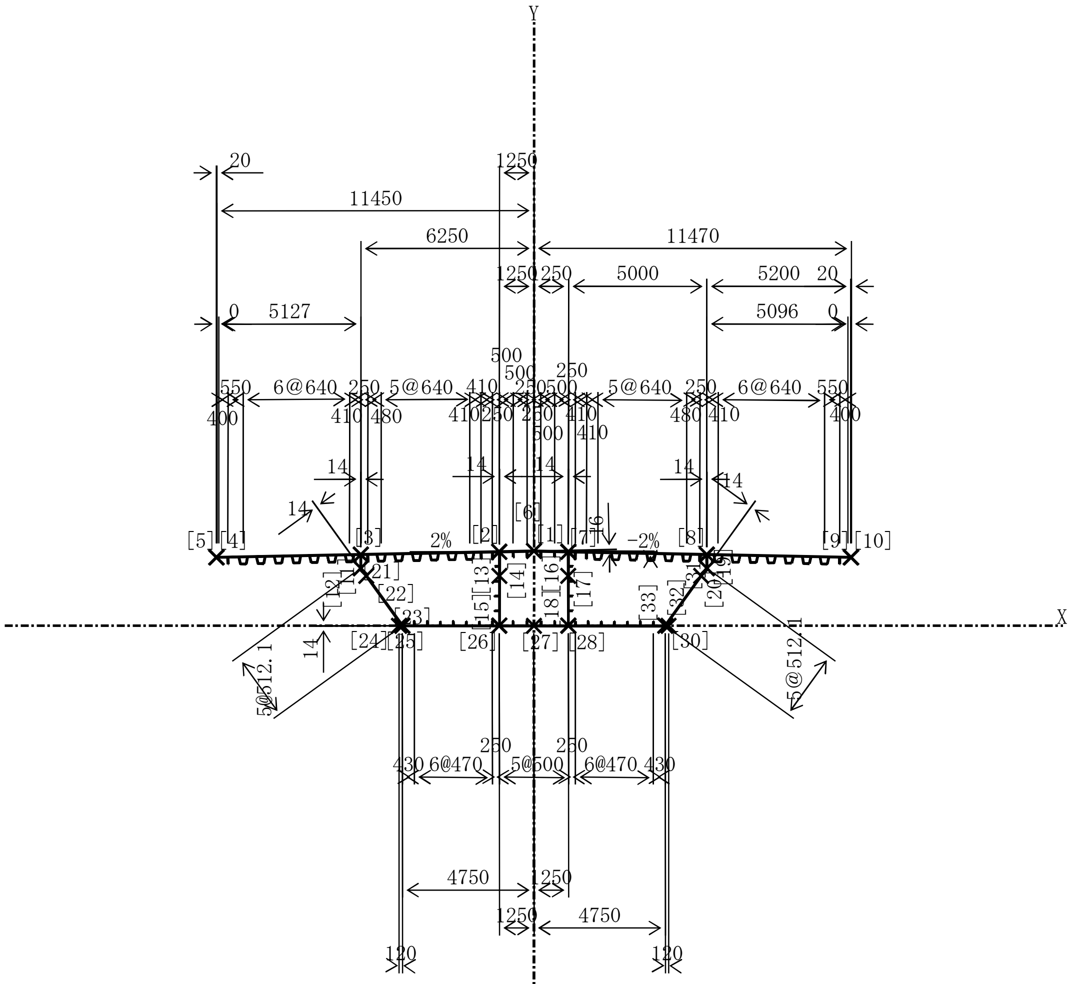
Axial	N
Bending Moment (in-plane)	Mx
Bending Moment (out-plane)	My
Shear Force (in-plane)	Sx
Shear Force (out-plane)	Sy
Torsional Moment	T

Stress

Normal Stress by N	σn
Allowable Axial Direction Compressive Stress	σna
Normal Stress by Mx	σmx
Normal Stress by My	σmy
Normal Stress Total	Σσ
Allowable Normal Stress	σa
Result of JSHBⅡ Eq. 4.3.5	σ435
Result of JSBHⅡ Eq. 4.3.2 or 4.3.4	Cnm
Shear Stress by Sx	τsx
Shear Stress by Sy	τsy
Shear Stress by T	τt
Shear Stress total	Στ
Allowable Shear Stress	τa
Composite Stress	κ

2) Cross Section

Typical Section Section Name : S1 (Girder No. = 1 Section No.= 1)



※Rib at outer web is stiffener ⇒ Not considered in Cross Section Area

（２）Side Span（Ｐ１０～Ｐ１１）

name：Girder　Section Name：S1　（ girder No.=　1　Section No.=　1 ）

Stress Resultants

	N(kN)	Mx(kN·m)	My(kN·m)	Sx(kN)	Sy(kN)	T(kN·m)
D+L:NmaxMmax	8	0	42	15	-3379	15237
D+L:NmaxMmin	8	0	42	15	-3379	15237
D+L:NminMmin	-9	0	-42	-15	-3379	-15237
D+L:NminMmax	-9	0	-42	-15	-3379	-15237
D+L+T'	18151	-16059	-37	13	-3202	13250
D+WgTR'	0	0	-1	148	84	227
D+L+WgTR'	-7	0	-34	106	-2703	12428
D+WgTR+T'	15457	-13679	-1	137	188	210
D+L+WgTR+T'	15462	-13679	-32	98	-2727	11507
D+ELG'	54	0	0	0	400	0
D+ETR'	0	0	-1	962	70	320

Effective Buckling Length　Lx =　9000 mm　Ly =　9000 mm
Curve Radius　R =　0.0 m
Gradient　DECK-L =　2.0 %
　DECK-R =　-2.0 %

Effective Width (mm)

		All	In-plane	Out-plane
DECK-L	Middle	1250	1250	1250
	Middle	5000	5000	5000
	Middle	5200	5127	5200
DECK-R	Middle	1250	1250	1250
	Middle	5000	5000	5000
	Middle	5200	5096	5200
LFLG	Middle	3500	3500	3500
	Middle	2500	2500	2500
	Middle	3500	3500	3500

Cross Section

	Area(cm2)	All	In-plane	Out-plane
1-DECK-L PL 11472 * 16	(SM400)	1835.6	1823.9	1835.6
2-RIB PL 200 * 20	(SM400)	80.0	80.0	80.0
2-RIB PL 250 * 24	(SM400)	120.0	120.0	120.0
6-U.RIB 320 * 240 * 8	(SM400)	323.4	323.4	323.4
1-RIB PL 250 * 24	(SM400)	60.0	60.0	60.0
7-U.RIB 320 * 240 * 8	(SM400)	377.3	377.3	377.3
1-RIB PL 250 * 24	(SM400)	60.0	60.0	60.0
1-DECK-R PL 11472 * 16	(SM400)	1835.6	1818.9	1835.6
2-RIB PL 200 * 20	(SM400)	80.0	80.0	80.0
2-RIB PL 250 * 24	(SM400)	120.0	120.0	120.0
6-U.RIB 320 * 240 * 8	(SM400)	323.4	323.4	323.4
1-RIB PL 250 * 24	(SM400)	60.0	60.0	60.0
7-U.RIB 320 * 240 * 8	(SM400)	377.3	377.3	377.3
1-RIB PL 250 * 24	(SM400)	60.0	60.0	60.0
1-WEB-1 PL 484 * 14	(SM490Y)	67.8	67.8	67.8
1-RIB PL 160 * 16	(SM490Y)	0.0	0.0	0.0
1-WEB-2 PL 2659 * 14	(SM490Y)	372.3	372.3	372.3
4-RIB PL 160 * 16	(SM490Y)	102.4	102.4	102.4
1-WEB-3 PL 2659 * 14	(SM490Y)	372.3	372.3	372.3
4-RIB PL 160 * 16	(SM490Y)	102.4	102.4	102.4
1-WEB-4 PL 484 * 14	(SM490Y)	67.8	67.8	67.8
1-RIB PL 160 * 16	(SM490Y)	0.0	0.0	0.0
1-WEB-L PL 2560 * 14	(SM490Y)	358.5	358.5	358.5
4-RIB PL 160 * 16	(SM490Y)	0.0	0.0	0.0
1-LFLG PL 9740 * 14	(SM490Y)	1363.6	1363.6	1363.6
18-RIB PL 160 * 16	(SM490Y)	460.8	460.8	460.8
1-WEB-R PL 2560 * 14	(SM490Y)	358.5	358.5	358.5
4-RIB PL 160 * 16	(SM490Y)	0.0	0.0	0.0

Property			All	In-plane	Out-plane
Area	A	(cm2)	9338.7	9310.4	9338.7
Center of G	ex	(cm)	-0.0	-0.6	-0.0
	ey	(cm)	179.6	179.4	179.6
2^{nd} moment area	Ix	(cm4)	103169489	103042593	103169489
	Iy	(cm4)	2909665244	2872822244	2909665244
Torsion Factor	J	(cm4)	189108523		
radius of gyration of area	Rx	(cm)	105.1		
	Ry	(cm)	558.2		
Slenderness ratio	Lx/Rx		8.56		
	Ly/Ry		1.61		
Euler Buckling	0.8*σex		21538		
Stress	0.8*σey		607424		

Resistance Bending Moment		(+)	(-)
In-plane	Mxr(上)=	159155.3 kN·m	159155.3 kN·m
	Mxr(下)=	119711.4 kN·m	83749.1 kN·m
Out-plane	Myr(上)=	355146.6 kN·m	355146.6 kN·m
	Myr(下)=	355146.6 kN·m	355146.6 kN·m

Stress (N/mm^2)

D+L:NmaxMmax	[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
DECK-L	[1]	0	140	0	0	0	140	0	-0.00
	[2]	0	140	0	0	0	140	0	-0.00
	[3]	0	140	0	0	0	140	0	0.00
	[4]	0	140	0	0	0	140	0	0.00
	[5]	0	140	0	0	0	140	0	0.00
DECK-R	[6]	0	140	0	0	0	140	0	-0.00
	[7]	0	140	0	0	0	140	0	-0.00
	[8]	0	140	0	0	0	140	0	-0.00
	[9]	0	140	0	0	0	140	0	-0.00
	[10]	0	140	0	0	0	140	0	-0.00
WEB-1	[11]	0	210	0	0	0	159	0	0.00
	[12]	0	210	0	0	0	159	0	0.00
WEB-2	[13]	0	210	0	0	0	210	0	-0.00
	[14]	0	210	0	0	0	210	0	-0.00
	[15]	0	210	0	0	0	210	0	-0.00
WEB-3	[16]	0	210	0	0	0	210	0	-0.00
	[17]	0	210	0	0	0	210	0	-0.00
	[18]	0	210	0	0	0	210	0	-0.00
WEB-4	[19]	0	210	0	0	0	210	0	-0.00
	[20]	0	210	0	0	0	210	0	-0.00
WEB-L	[21]	0	210	0	0	0	180	0	0.00
	[22]	0	210	0	0	0	180	0	0.00
	[23]	0	210	0	0	0	210	0	-0.00
LFLG	[24]	0	210	0	0	0	210	0	-0.00
	[25]	0	210	0	0	0	210	0	-0.00
	[26]	0	210	0	0	0	210	0	-0.00
	[27]	0	210	0	0	0	210	0	-0.00
	[28]	0	210	0	0	0	210	0	-0.00
	[29]	0	210	0	0	0	210	0	-0.00
	[30]	0	210	0	0	0	210	0	-0.00
WEB-R	[31]	0	210	0	0	0	210	0	-0.00
	[32]	0	210	0	0	0	210	0	-0.00
	[33]	0	210	0	0	0	210	0	-0.00

D+L:NmaxMmax	[Point]	τsx	τsy	τt	Στ	τa	κ
DECK-L	[1]	0	0	18	18	80	0.05
	[2]	0	16	18	32	80	0.16
	[3]	0	17	15	20	80	0.06
	[4]	0	0	0	0	80	0.00
	[5]	0	0	0	0	80	0.00

DECK-R	[6]	0	0	18	18	80	0.05
	[7]	0	16	18	32	80	0.16
	[8]	0	17	15	20	80	0.06
	[9]	0	0	0	0	80	0.00
	[10]	0	0	0	0	80	0.00
WEB-1	[11]	0	25	18	42	120	0.13
	[12]	0	26	18	43	120	0.13
WEB-2	[13]	0	24	2	26	120	0.05
	[14]	0	25	2	28	120	0.05
	[15]	0	19	2	21	120	0.03
WEB-3	[16]	0	24	2	26	120	0.05
	[17]	0	25	2	28	120	0.05
	[18]	0	19	2	21	120	0.03
WEB-4	[19]	0	25	18	42	120	0.13
	[20]	0	26	18	43	120	0.13
WEB-L	[21]	0	26	18	43	120	0.13
	[22]	0	26	18	43	120	0.13
	[23]	0	19	18	37	120	0.09
LFLG	[24]	0	0	0	0	120	0.00
	[25]	0	19	18	36	120	0.09
	[26]	0	9	20	30	120	0.06
	[27]	0	0	20	20	120	0.03
	[28]	0	9	20	30	120	0.06
	[29]	0	19	18	36	120	0.09
	[30]	0	0	0	0	120	0.00
WEB-R	[31]	0	26	18	43	120	0.13
	[32]	0	26	18	43	120	0.13
	[33]	0	19	18	37	120	0.09

D+L:NmaxMmin	[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
DECK-L	[1]	0	140	0	0	0	140	0	-0.00
	[2]	0	140	0	0	0	140	0	-0.00
	[3]	0	140	0	0	0	140	0	0.00
	[4]	0	140	0	0	0	140	0	0.00
	[5]	0	140	0	0	0	140	0	0.00
DECK-R	[6]	0	140	0	0	0	140	0	-0.00
	[7]	0	140	0	0	0	140	0	-0.00
	[8]	0	140	0	0	0	140	0	-0.00
	[9]	0	140	0	0	0	140	0	-0.00
	[10]	0	140	0	0	0	140	0	-0.00
WEB-1	[11]	0	210	0	0	0	159	0	0.00
	[12]	0	210	0	0	0	159	0	0.00
WEB-2	[13]	0	210	0	0	0	210	0	-0.00
	[14]	0	210	0	0	0	210	0	-0.00
	[15]	0	210	0	0	0	210	0	-0.00
WEB-3	[16]	0	210	0	0	0	210	0	-0.00
	[17]	0	210	0	0	0	210	0	-0.00
	[18]	0	210	0	0	0	210	0	-0.00
WEB-4	[19]	0	210	0	0	0	210	0	-0.00
	[20]	0	210	0	0	0	210	0	-0.00
WEB-L	[21]	0	210	0	0	0	180	0	0.00
	[22]	0	210	0	0	0	180	0	0.00
	[23]	0	210	0	0	0	210	0	-0.00
LFLG	[24]	0	210	0	0	0	210	0	-0.00
	[25]	0	210	0	0	0	210	0	-0.00
	[26]	0	210	0	0	0	210	0	-0.00
	[27]	0	210	0	0	0	210	0	-0.00
	[28]	0	210	0	0	0	210	0	-0.00
	[29]	0	210	0	0	0	210	0	-0.00
	[30]	0	210	0	0	0	210	0	-0.00
WEB-R	[31]	0	210	0	0	0	210	0	-0.00
	[32]	0	210	0	0	0	210	0	-0.00
	[33]	0	210	0	0	0	210	0	-0.00

D+L:NmaxMmin	[Point]	τ sx	τ sy	τ t	Σ τ	τ a	κ
DECK-L	[1]	0	0	18	18	80	0.05
	[2]	0	16	18	32	80	0.16
	[3]	0	17	15	20	80	0.06
	[4]	0	0	0	0	80	0.00
	[5]	0	0	0	0	80	0.00
DECK-R	[6]	0	0	18	18	80	0.05
	[7]	0	16	18	32	80	0.16
	[8]	0	17	15	20	80	0.06
	[9]	0	0	0	0	80	0.00
	[10]	0	0	0	0	80	0.00
WEB-1	[11]	0	25	18	42	120	0.13
	[12]	0	26	18	43	120	0.13
WEB-2	[13]	0	24	2	26	120	0.05
	[14]	0	25	2	28	120	0.05
	[15]	0	19	2	21	120	0.03
WEB-3	[16]	0	24	2	26	120	0.05
	[17]	0	25	2	28	120	0.05
	[18]	0	19	2	21	120	0.03
WEB-4	[19]	0	25	18	42	120	0.13
	[20]	0	26	18	43	120	0.13
WEB-L	[21]	0	26	18	43	120	0.13
	[22]	0	26	18	43	120	0.13
	[23]	0	19	18	37	120	0.09
LFLG	[24]	0	0	0	0	120	0.00
	[25]	0	19	18	36	120	0.09
	[26]	0	9	20	30	120	0.06
	[27]	0	0	20	20	120	0.03
	[28]	0	9	20	30	120	0.06
	[29]	0	19	18	36	120	0.09
	[30]	0	0	0	0	120	0.00
WEB-R	[31]	0	26	18	43	120	0.13
	[32]	0	26	18	43	120	0.13
	[33]	0	19	18	37	120	0.09

D+L:NminMmin	[Point]	σ n	σ na	σ mx	σ my	Σ σ	σ a	σ 435	Cnm
DECK-L	[1]	0	140	0	0	0	140	0	0.00
	[2]	0	140	0	0	0	140	0	0.00
	[3]	0	140	0	0	0	140	0	0.00
	[4]	0	140	0	0	0	140	0	-0.00
	[5]	0	140	0	0	0	140	0	-0.00
DECK-R	[6]	0	140	0	0	0	140	0	0.00
	[7]	0	140	0	0	0	140	0	0.00
	[8]	0	140	0	0	0	140	0	0.00
	[9]	0	140	0	0	0	140	0	0.00
	[10]	0	140	0	0	0	140	0	0.00
WEB-1	[11]	0	159	0	0	0	159	0	0.00
	[12]	0	159	0	0	0	159	0	0.00
WEB-2	[13]	0	136	0	0	0	136	0	0.00
	[14]	0	136	0	0	0	136	0	0.00
	[15]	0	136	0	0	0	136	0	0.00
WEB-3	[16]	0	136	0	0	0	136	0	0.00
	[17]	0	136	0	0	0	136	0	0.00
	[18]	0	136	0	0	0	136	0	0.00
WEB-4	[19]	0	159	0	0	0	159	0	0.00
	[20]	0	159	0	0	0	159	0	0.00
WEB-L	[21]	0	148	0	0	0	148	0	0.00
	[22]	0	148	0	0	0	148	0	0.00
	[23]	0	148	0	0	0	148	0	0.00

LFLG	[24]	0	210	0	0	0	210	0	0.00
	[25]	0	159	0	0	0	159	0	0.00
	[26]	0	149	0	0	0	149	0	0.00
	[27]	0	149	0	0	0	149	0	0.00
	[28]	0	149	0	0	0	149	0	0.00
	[29]	0	158	0	0	0	158	0	0.00
	[30]	0	210	0	0	0	210	0	0.00
WEB-R	[31]	0	143	0	0	0	143	0	0.00
	[32]	0	143	0	0	0	143	0	0.00
	[33]	0	143	0	0	0	143	0	0.00

D+L:NminMmin	[Point]	τsx	τsy	τt	Στ	τa	κ
DECK-L	[1]	0	0	18	18	80	0.05
	[2]	0	16	18	32	80	0.16
	[3]	0	17	15	20	80	0.06
	[4]	0	0	0	0	80	0.00
	[5]	0	0	0	0	80	0.00
DECK-R	[6]	0	0	18	18	80	0.05
	[7]	0	16	18	32	80	0.16
	[8]	0	17	15	20	80	0.06
	[9]	0	0	0	0	80	0.00
	[10]	0	0	0	0	80	0.00
WEB-1	[11]	0	25	18	42	120	0.13
	[12]	0	26	18	43	120	0.13
WEB-2	[13]	0	24	2	26	120	0.05
	[14]	0	25	2	28	120	0.05
	[15]	0	19	2	21	120	0.03
WEB-3	[16]	0	24	2	26	120	0.05
	[17]	0	25	2	28	120	0.05
	[18]	0	19	2	21	120	0.03
WEB-4	[19]	0	25	18	42	120	0.13
	[20]	0	26	18	43	120	0.13
WEB-L	[21]	0	26	18	43	120	0.13
	[22]	0	26	18	43	120	0.13
	[23]	0	19	18	37	120	0.09
LFLG	[24]	0	0	0	0	120	0.00
	[25]	0	19	18	36	120	0.09
	[26]	0	9	20	30	120	0.06
	[27]	0	0	20	20	120	0.03
	[28]	0	9	20	30	120	0.06
	[29]	0	19	18	36	120	0.09
	[30]	0	0	0	0	120	0.00
WEB-R	[31]	0	26	18	43	120	0.13
	[32]	0	26	18	43	120	0.13
	[33]	0	19	18	37	120	0.09

D+L:NminMmax	[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
DECK-L	[1]	0	140	0	0	0	140	0	0.00
	[2]	0	140	0	0	0	140	0	0.00
	[3]	0	140	0	0	0	140	0	0.00
	[4]	0	140	0	0	0	140	0	-0.00
	[5]	0	140	0	0	0	140	0	-0.00
DECK-R	[6]	0	140	0	0	0	140	0	0.00
	[7]	0	140	0	0	0	140	0	0.00
	[8]	0	140	0	0	0	140	0	0.00
	[9]	0	140	0	0	0	140	0	0.00
	[10]	0	140	0	0	0	140	0	0.00
WEB-1	[11]	0	159	0	0	0	159	0	0.00
	[12]	0	159	0	0	0	159	0	0.00
WEB-2	[13]	0	136	0	0	0	136	0	0.00
	[14]	0	136	0	0	0	136	0	0.00
	[15]	0	136	0	0	0	136	0	0.00

WEB-3	[16]	0	136	0	0	0	136	0	0.00
	[17]	0	136	0	0	0	136	0	0.00
	[18]	0	136	0	0	0	136	0	0.00
WEB-4	[19]	0	159	0	0	0	159	0	0.00
	[20]	0	159	0	0	0	159	0	0.00
WEB-L	[21]	0	148	0	0	0	148	0	0.00
	[22]	0	148	0	0	0	148	0	0.00
	[23]	0	148	0	0	0	148	0	0.00
LFLG	[24]	0	210	0	0	0	210	0	0.00
	[25]	0	159	0	0	0	159	0	0.00
	[26]	0	149	0	0	0	149	0	0.00
	[27]	0	149	0	0	0	149	0	0.00
	[28]	0	149	0	0	0	149	0	0.00
	[29]	0	158	0	0	0	158	0	0.00
	[30]	0	210	0	0	0	210	0	0.00
WEB-R	[31]	0	143	0	0	0	143	0	0.00
	[32]	0	143	0	0	0	143	0	0.00
	[33]	0	143	0	0	0	143	0	0.00

D+L:NminMmax	[Point]	τ sx	τ sy	τ t	Σ τ	τ a	κ
DECK-L	[1]	0	0	18	18	80	0.05
	[2]	0	16	18	32	80	0.16
	[3]	0	17	15	20	80	0.06
	[4]	0	0	0	0	80	0.00
	[5]	0	0	0	0	80	0.00
DECK-R	[6]	0	0	18	18	80	0.05
	[7]	0	16	18	32	80	0.16
	[8]	0	17	15	20	80	0.06
	[9]	0	0	0	0	80	0.00
	[10]	0	0	0	0	80	0.00
WEB-1	[11]	0	25	18	42	120	0.13
	[12]	0	26	18	43	120	0.13
WEB-2	[13]	0	24	2	26	120	0.05
	[14]	0	25	2	28	120	0.05
	[15]	0	19	2	21	120	0.03
WEB-3	[16]	0	24	2	26	120	0.05
	[17]	0	25	2	28	120	0.05
	[18]	0	19	2	21	120	0.03
WEB-4	[19]	0	25	18	42	120	0.13
	[20]	0	26	18	43	120	0.13
WEB-L	[21]	0	26	18	43	120	0.13
	[22]	0	26	18	43	120	0.13
	[23]	0	19	18	37	120	0.09
LFLG	[24]	0	0	0	0	120	0.00
	[25]	0	19	18	36	120	0.09
	[26]	0	9	20	30	120	0.06
	[27]	0	0	20	20	120	0.03
	[28]	0	9	20	30	120	0.06
	[29]	0	19	18	36	120	0.09
	[30]	0	0	0	0	120	0.00
WEB-R	[31]	0	26	18	43	120	0.13
	[32]	0	26	18	43	120	0.13
	[33]	0	19	18	37	120	0.09

D+L+T’	[Point]	σ n	σ na	σ mx	σ my	Σ σ	σ a	σ 435	Cnm
DECK-L	[1]	19	140	14	0	34	140	0	-0.24
	[2]	19	140	14	0	33	140	0	-0.24
	[3]	19	140	12	0	32	140	0	-0.22
	[4]	19	140	11	0	30	140	0	-0.21
	[5]	19	140	11	0	30	140	0	-0.21

DECK-R	[6]	19	140	14	0	34	140	0	-0.24
	[7]	19	140	14	0	33	140	0	-0.24
	[8]	19	140	12	0	32	140	0	-0.22
	[9]	19	140	11	0	30	140	0	-0.21
	[10]	19	140	11	0	30	140	0	-0.21
WEB-1	[11]	19	210	12	0	31	210	0	-0.15
	[12]	19	210	4	0	24	210	0	-0.11
WEB-2	[13]	19	210	13	0	33	210	0	-0.16
	[14]	19	210	0	0	19	210	0	-0.09
	[15]	19	210	-28	0	-9	210	0	0.04
WEB-3	[16]	19	210	13	0	33	210	0	-0.16
	[17]	19	210	0	0	19	210	0	-0.09
	[18]	19	210	-28	0	-9	210	0	0.04
WEB-4	[19]	19	210	12	0	31	210	0	-0.15
	[20]	19	210	4	0	24	210	0	-0.11
WEB-L	[21]	19	210	4	0	24	210	0	-0.11
	[22]	19	210	0	0	20	210	0	-0.09
	[23]	19	210	-28	0	-9	197	0	0.04
LFLG	[24]	19	210	-28	0	-9	210	0	0.04
	[25]	19	210	-28	0	-9	157	0	0.04
	[26]	19	210	-28	0	-9	147	0	0.04
	[27]	19	210	-28	0	-9	147	0	0.04
	[28]	19	210	-28	0	-9	147	0	0.04
	[29]	19	210	-28	0	-9	157	0	0.04
	[30]	19	210	-28	0	-9	210	0	0.04
WEB-R	[31]	19	210	4	0	24	210	0	-0.11
	[32]	19	210	0	0	20	210	0	-0.09
	[33]	19	210	-28	0	-9	196	0	0.04

D+L+T'

	[Point]	τsx	τsy	τt	Στ	τa	κ
DECK-L	[1]	0	0	15	15	80	0.09
	[2]	0	15	15	29	80	0.18
	[3]	0	16	13	18	80	0.10
	[4]	0	0	0	0	80	0.05
	[5]	0	0	0	0	80	0.05
DECK-R	[6]	0	0	15	15	80	0.09
	[7]	0	15	15	29	80	0.18
	[8]	0	16	13	18	80	0.10
	[9]	0	0	0	0	80	0.05
	[10]	0	0	0	0	80	0.05
WEB-1	[11]	0	23	15	39	120	0.13
	[12]	0	24	15	40	120	0.12
WEB-2	[13]	0	23	2	25	120	0.07
	[14]	0	24	2	26	120	0.06
	[15]	0	18	2	20	120	0.03
WEB-3	[16]	0	23	2	25	120	0.07
	[17]	0	24	2	26	120	0.06
	[18]	0	18	2	20	120	0.03
WEB-4	[19]	0	23	15	39	120	0.13
	[20]	0	24	15	40	120	0.12
WEB-L	[21]	0	24	15	40	120	0.12
	[22]	0	24	15	40	120	0.12
	[23]	0	18	15	34	120	0.08
LFLG	[24]	0	0	0	0	120	0.00
	[25]	0	18	15	33	120	0.08
	[26]	0	9	18	26	120	0.05
	[27]	0	0	18	18	120	0.02
	[28]	0	9	18	26	120	0.05
	[29]	0	18	15	33	120	0.08
	[30]	0	0	0	0	120	0.00
WEB-R	[31]	0	24	15	40	120	0.12
	[32]	0	24	15	40	120	0.12
	[33]	0	18	15	34	120	0.08

D+WgTR’		[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	DECK-L	[1]	0	140	0	0	0	140	0	-0.00
		[2]	0	140	0	0	0	140	0	-0.00
		[3]	0	140	0	0	0	140	0	-0.00
		[4]	0	140	0	0	0	140	0	-0.00
		[5]	0	140	0	0	0	140	0	-0.00
	DECK-R	[6]	0	140	0	0	0	140	0	-0.00
		[7]	0	140	0	0	0	140	0	-0.00
		[8]	0	140	0	0	0	140	0	-0.00
		[9]	0	140	0	0	0	140	0	0.00
		[10]	0	140	0	0	0	140	0	0.00
	WEB-1	[11]	0	210	0	0	0	210	0	-0.00
		[12]	0	210	0	0	0	210	0	-0.00
	WEB-2	[13]	0	210	0	0	0	210	0	-0.00
		[14]	0	210	0	0	0	210	0	-0.00
		[15]	0	210	0	0	0	210	0	-0.00
	WEB-3	[16]	0	210	0	0	0	210	0	-0.00
		[17]	0	210	0	0	0	210	0	-0.00
		[18]	0	210	0	0	0	210	0	-0.00
	WEB-4	[19]	0	210	0	0	0	210	0	-0.00
		[20]	0	210	0	0	0	210	0	-0.00
	WEB-L	[21]	0	210	0	0	0	210	0	-0.00
		[22]	0	210	0	0	0	210	0	-0.00
		[23]	0	210	0	0	0	210	0	-0.00
	LFLG	[24]	0	210	0	0	0	210	0	-0.00
		[25]	0	210	0	0	0	210	0	-0.00
		[26]	0	210	0	0	0	210	0	-0.00
		[27]	0	210	0	0	0	210	0	-0.00
		[28]	0	210	0	0	0	210	0	-0.00
		[29]	0	210	0	0	0	210	0	-0.00
		[30]	0	210	0	0	0	210	0	-0.00
	WEB-R	[31]	0	210	0	0	0	210	0	-0.00
		[32]	0	210	0	0	0	210	0	-0.00
		[33]	0	210	0	0	0	210	0	-0.00

D+WgTR’		[Point]	τsx	τsy	τt	Στ	τa	κ
	DECK-L	[1]	0	0	0	1	80	0.00
		[2]	0	0	0	1	80	0.00
		[3]	0	0	0	1	80	0.00
		[4]	0	0	0	0	80	0.00
		[5]	0	0	0	0	80	0.00
	DECK-R	[6]	0	0	0	1	80	0.00
		[7]	0	0	0	1	80	0.00
		[8]	0	0	0	1	80	0.00
		[9]	0	0	0	0	80	0.00
		[10]	0	0	0	0	80	0.00
	WEB-1	[11]	0	1	0	1	120	0.00
		[12]	0	1	0	1	120	0.00
	WEB-2	[13]	0	1	0	1	120	0.00
		[14]	0	1	0	1	120	0.00
		[15]	0	0	0	1	120	0.00
	WEB-3	[16]	0	1	0	1	120	0.00
		[17]	0	1	0	1	120	0.00
		[18]	0	0	0	1	120	0.00
	WEB-4	[19]	0	1	0	1	120	0.00
		[20]	0	1	0	1	120	0.00
	WEB-L	[21]	0	1	0	1	120	0.00
		[22]	0	1	0	1	120	0.00
		[23]	0	0	0	1	120	0.00

LFLG	[24]	0	0	0	0	120	0.00
	[25]	0	0	0	1	120	0.00
	[26]	0	0	0	1	120	0.00
	[27]	0	0	0	1	120	0.00
	[28]	0	0	0	1	120	0.00
	[29]	0	0	0	1	120	0.00
	[30]	0	0	0	0	120	0.00
WEB-R	[31]	0	1	0	1	120	0.00
	[32]	0	1	0	1	120	0.00
	[33]	0	0	0	1	120	0.00

D+L+WgTR'		[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	DECK-L	[1]	0	140	0	0	0	140	0	0.00
		[2]	0	140	0	0	0	140	0	0.00
		[3]	0	140	0	0	0	140	0	0.00
		[4]	0	140	0	0	0	140	0	-0.00
		[5]	0	140	0	0	0	140	0	-0.00
	DECK-R	[6]	0	140	0	0	0	140	0	0.00
		[7]	0	140	0	0	0	140	0	0.00
		[8]	0	140	0	0	0	140	0	0.00
		[9]	0	140	0	0	0	140	0	0.00
		[10]	0	140	0	0	0	140	0	0.00
	WEB-1	[11]	0	159	0	0	0	159	0	0.00
		[12]	0	159	0	0	0	159	0	0.00
	WEB-2	[13]	0	136	0	0	0	136	0	0.00
		[14]	0	136	0	0	0	136	0	0.00
		[15]	0	136	0	0	0	136	0	0.00
	WEB-3	[16]	0	136	0	0	0	136	0	0.00
		[17]	0	136	0	0	0	136	0	0.00
		[18]	0	136	0	0	0	136	0	0.00
	WEB-4	[19]	0	159	0	0	0	159	0	0.00
		[20]	0	159	0	0	0	159	0	0.00
	WEB-L	[21]	0	148	0	0	0	148	0	0.00
		[22]	0	148	0	0	0	148	0	0.00
		[23]	0	148	0	0	0	148	0	0.00
	LFLG	[24]	0	210	0	0	0	210	0	0.00
		[25]	0	159	0	0	0	159	0	0.00
		[26]	0	149	0	0	0	149	0	0.00
		[27]	0	149	0	0	0	149	0	0.00
		[28]	0	149	0	0	0	149	0	0.00
		[29]	0	158	0	0	0	158	0	0.00
		[30]	0	210	0	0	0	210	0	0.00
	WEB-R	[31]	0	143	0	0	0	143	0	0.00
		[32]	0	143	0	0	0	143	0	0.00
		[33]	0	143	0	0	0	143	0	0.00

D+L+WgTR'		[Point]	τsx	τsy	τt	Στ	τa	κ
	DECK-L	[1]	0	0	14	15	80	0.03
		[2]	0	13	14	26	80	0.10
		[3]	0	14	13	16	80	0.04
		[4]	0	0	0	0	80	0.00
		[5]	0	0	0	0	80	0.00
	DECK-R	[6]	0	0	14	15	80	0.03
		[7]	0	13	14	26	80	0.10
		[8]	0	14	13	16	80	0.04
		[9]	0	0	0	0	80	0.00
		[10]	0	0	0	0	80	0.00
	WEB-1	[11]	0	20	14	34	120	0.08
		[12]	0	20	14	35	120	0.09
	WEB-2	[13]	0	19	2	21	120	0.03
		[14]	0	20	2	22	120	0.03
		[15]	0	15	2	17	120	0.02

WEB-3	[16]	0	19	2	21	120	0.03
	[17]	0	20	2	22	120	0.03
	[18]	0	15	2	17	120	0.02
WEB-4	[19]	0	20	14	34	120	0.08
	[20]	0	20	14	35	120	0.09
WEB-L	[21]	0	20	14	35	120	0.09
	[22]	0	21	14	35	120	0.09
	[23]	0	15	14	30	120	0.06
LFLG	[24]	0	0	0	0	120	0.00
	[25]	0	15	14	29	120	0.06
	[26]	0	8	16	24	120	0.04
	[27]	0	0	16	17	120	0.02
	[28]	0	8	16	24	120	0.04
	[29]	0	15	14	29	120	0.06
	[30]	0	0	0	0	120	0.00
WEB-R	[31]	0	20	14	35	120	0.09
	[32]	0	21	14	35	120	0.09
	[33]	0	15	14	30	120	0.06

D+WgTR+T'		[Point]	σ n	σ na	σ mx	σ my	Σ σ	σ a	σ 435	Cnm
	DECK-L	[1]	17	140	12	0	29	140	0	-0.20
		[2]	17	140	12	0	28	140	0	-0.20
		[3]	17	140	10	0	27	140	0	-0.19
		[4]	17	140	9	0	26	140	0	-0.18
		[5]	17	140	9	0	26	140	0	-0.18
	DECK-R	[6]	17	140	12	0	29	140	0	-0.20
		[7]	17	140	12	0	28	140	0	-0.20
		[8]	17	140	10	0	27	140	0	-0.19
		[9]	17	140	9	0	26	140	0	-0.18
		[10]	17	140	9	0	26	140	0	-0.18
	WEB-1	[11]	17	210	10	0	27	210	0	-0.13
		[12]	17	210	4	0	20	210	0	-0.10
	WEB-2	[13]	17	210	11	0	28	210	0	-0.13
		[14]	17	210	0	0	17	210	0	-0.08
		[15]	17	210	-24	0	-7	210	0	0.03
	WEB-3	[16]	17	210	11	0	28	210	0	-0.13
		[17]	17	210	0	0	17	210	0	-0.08
		[18]	17	210	-24	0	-7	210	0	0.03
	WEB-4	[19]	17	210	10	0	27	210	0	-0.13
		[20]	17	210	4	0	20	210	0	-0.10
	WEB-L	[21]	17	210	4	0	20	210	0	-0.10
		[22]	17	210	0	0	17	210	0	-0.08
		[23]	17	210	-24	0	-7	197	0	0.03
	LFLG	[24]	17	210	-24	0	-7	210	0	0.04
		[25]	17	210	-24	0	-7	157	0	0.04
		[26]	17	210	-24	0	-7	147	0	0.04
		[27]	17	210	-24	0	-7	147	0	0.04
		[28]	17	210	-24	0	-7	147	0	0.04
		[29]	17	210	-24	0	-7	157	0	0.04
		[30]	17	210	-24	0	-7	210	0	0.04
	WEB-R	[31]	17	210	4	0	20	210	0	-0.10
		[32]	17	210	0	0	17	210	0	-0.08
		[33]	17	210	-24	0	-7	196	0	0.03

D+WgTR+T'		[Point]	τ sx	τ sy	τ t	Σ τ	τ a	κ
	DECK-L	[1]	0	0	0	1	80	0.04
		[2]	0	1	0	1	80	0.04
		[3]	0	1	0	1	80	0.04
		[4]	0	0	0	0	80	0.03
		[5]	0	0	0	0	80	0.03

DECK-R	[6]	0	0	0	1	80	0.04
	[7]	0	1	0	1	80	0.04
	[8]	0	1	0	1	80	0.04
	[9]	0	0	0	0	80	0.03
	[10]	0	0	0	0	80	0.03
WEB-1	[11]	0	1	0	2	120	0.02
	[12]	0	1	0	2	120	0.01
WEB-2	[13]	0	1	0	1	120	0.02
	[14]	0	1	0	1	120	0.01
	[15]	0	1	0	1	120	0.00
WEB-3	[16]	0	1	0	1	120	0.02
	[17]	0	1	0	1	120	0.01
	[18]	0	1	0	1	120	0.00
WEB-4	[19]	0	1	0	2	120	0.02
	[20]	0	1	0	2	120	0.01
WEB-L	[21]	0	1	0	2	120	0.01
	[22]	0	1	0	2	120	0.01
	[23]	0	1	0	2	120	0.00
LFLG	[24]	0	0	0	0	120	0.00
	[25]	0	1	0	1	120	0.00
	[26]	0	1	0	1	120	0.00
	[27]	0	0	0	1	120	0.00
	[28]	0	1	0	1	120	0.00
	[29]	0	1	0	1	120	0.00
	[30]	0	0	0	0	120	0.00
WEB-R	[31]	0	1	0	2	120	0.01
	[32]	0	1	0	2	120	0.01
	[33]	0	1	0	2	120	0.00

D+L+WgTR+T'	[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
DECK-L	[1]	17	140	12	0	29	140	0	-0.20
	[2]	17	140	12	0	28	140	0	-0.20
	[3]	17	140	10	0	27	140	0	-0.19
	[4]	17	140	9	0	26	140	0	-0.18
	[5]	17	140	9	0	26	140	0	-0.18
DECK-R	[6]	17	140	12	0	29	140	0	-0.20
	[7]	17	140	12	0	28	140	0	-0.20
	[8]	17	140	10	0	27	140	0	-0.19
	[9]	17	140	9	0	26	140	0	-0.18
	[10]	17	140	9	0	26	140	0	-0.18
WEB-1	[11]	17	210	10	0	27	210	0	-0.13
	[12]	17	210	4	0	20	210	0	-0.10
WEB-2	[13]	17	210	11	0	28	210	0	-0.13
	[14]	17	210	0	0	17	210	0	-0.08
	[15]	17	210	-24	0	-7	210	0	0.03
WEB-3	[16]	17	210	11	0	28	210	0	-0.13
	[17]	17	210	0	0	17	210	0	-0.08
	[18]	17	210	-24	0	-7	210	0	0.03
WEB-4	[19]	17	210	10	0	27	210	0	-0.13
	[20]	17	210	4	0	20	210	0	-0.10
WEB-L	[21]	17	210	4	0	20	210	0	-0.10
	[22]	17	210	0	0	17	210	0	-0.08
	[23]	17	210	-24	0	-7	197	0	0.03
LFLG	[24]	17	210	-24	0	-7	210	0	0.04
	[25]	17	210	-24	0	-7	157	0	0.04
	[26]	17	210	-24	0	-7	147	0	0.04
	[27]	17	210	-24	0	-7	147	0	0.04
	[28]	17	210	-24	0	-7	147	0	0.04
	[29]	17	210	-24	0	-7	157	0	0.04
	[30]	17	210	-24	0	-7	210	0	0.04
WEB-R	[31]	17	210	4	0	20	210	0	-0.10
	[32]	17	210	0	0	17	210	0	-0.08
	[33]	17	210	-24	0	-7	196	0	0.03

D+L+WgTR+T’		[Point]	τsx	τsy	τt	Στ	τa	κ
	DECK-L	[1]	0	0	13	14	80	0.07
		[2]	0	13	13	25	80	0.14
		[3]	0	14	12	15	80	0.07
		[4]	0	0	0	0	80	0.03
		[5]	0	0	0	0	80	0.03
	DECK-R	[6]	0	0	13	14	80	0.07
		[7]	0	13	13	25	80	0.14
		[8]	0	14	12	15	80	0.07
		[9]	0	0	0	0	80	0.03
		[10]	0	0	0	0	80	0.03
	WEB-1	[11]	0	20	13	33	120	0.09
		[12]	0	21	13	34	120	0.09
	WEB-2	[13]	0	19	2	21	120	0.05
		[14]	0	20	2	22	120	0.04
		[15]	0	15	2	17	120	0.02
	WEB-3	[16]	0	19	2	21	120	0.05
		[17]	0	20	2	22	120	0.04
		[18]	0	15	2	17	120	0.02
	WEB-4	[19]	0	20	13	33	120	0.09
		[20]	0	21	13	34	120	0.09
	WEB-L	[21]	0	21	13	34	120	0.09
		[22]	0	21	13	34	120	0.09
		[23]	0	16	13	29	120	0.06
	LFLG	[24]	0	0	0	0	120	0.00
		[25]	0	15	13	28	120	0.06
		[26]	0	8	15	23	120	0.04
		[27]	0	0	15	15	120	0.02
		[28]	0	8	15	23	120	0.04
		[29]	0	15	13	28	120	0.06
		[30]	0	0	0	0	120	0.00
	WEB-R	[31]	0	21	13	34	120	0.09
		[32]	0	21	13	34	120	0.09
		[33]	0	16	13	29	120	0.06

D+ELG’		[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	DECK-L	[1]	0	140	0	0	0	140	0	-0.00
		[2]	0	140	0	0	0	140	0	-0.00
		[3]	0	140	0	0	0	140	0	-0.00
		[4]	0	140	0	0	0	140	0	-0.00
		[5]	0	140	0	0	0	140	0	-0.00
	DECK-R	[6]	0	140	0	0	0	140	0	-0.00
		[7]	0	140	0	0	0	140	0	-0.00
		[8]	0	140	0	0	0	140	0	-0.00
		[9]	0	140	0	0	0	140	0	-0.00
		[10]	0	140	0	0	0	140	0	-0.00
	WEB-1	[11]	0	210	0	0	0	210	0	-0.00
		[12]	0	210	0	0	0	210	0	-0.00
	WEB-2	[13]	0	210	0	0	0	210	0	-0.00
		[14]	0	210	0	0	0	210	0	-0.00
		[15]	0	210	0	0	0	210	0	-0.00
	WEB-3	[16]	0	210	0	0	0	210	0	-0.00
		[17]	0	210	0	0	0	210	0	-0.00
		[18]	0	210	0	0	0	210	0	-0.00
	WEB-4	[19]	0	210	0	0	0	210	0	-0.00
		[20]	0	210	0	0	0	210	0	-0.00
	WEB-L	[21]	0	210	0	0	0	210	0	-0.00
		[22]	0	210	0	0	0	210	0	-0.00
		[23]	0	210	0	0	0	210	0	-0.00

	LFLG	[24]	0	210	0	0	0	210	0 -0.00
		[25]	0	210	0	0	0	210	0 -0.00
		[26]	0	210	0	0	0	210	0 -0.00
		[27]	0	210	0	0	0	210	0 -0.00
		[28]	0	210	0	0	0	210	0 -0.00
		[29]	0	210	0	0	0	210	0 -0.00
		[30]	0	210	0	0	0	210	0 -0.00
	WEB-R	[31]	0	210	0	0	0	210	0 -0.00
		[32]	0	210	0	0	0	210	0 -0.00
		[33]	0	210	0	0	0	210	0 -0.00

D+ELG’		[Point]	τsx	τsy	τt	Στ	τa	κ
	DECK-L	[1]	0	0	0	0	80	0.00
		[2]	0	2	0	2	80	0.00
		[3]	0	2	0	2	80	0.00
		[4]	0	0	0	0	80	0.00
		[5]	0	0	0	0	80	0.00
	DECK-R	[6]	0	0	0	0	80	0.00
		[7]	0	2	0	2	80	0.00
		[8]	0	2	0	2	80	0.00
		[9]	0	0	0	0	80	0.00
		[10]	0	0	0	0	80	0.00
	WEB-1	[11]	0	3	0	3	120	0.00
		[12]	0	3	0	3	120	0.00
	WEB-2	[13]	0	3	0	3	120	0.00
		[14]	0	3	0	3	120	0.00
		[15]	0	2	0	2	120	0.00
	WEB-3	[16]	0	3	0	3	120	0.00
		[17]	0	3	0	3	120	0.00
		[18]	0	2	0	2	120	0.00
	WEB-4	[19]	0	3	0	3	120	0.00
		[20]	0	3	0	3	120	0.00
	WEB-L	[21]	0	3	0	3	120	0.00
		[22]	0	3	0	3	120	0.00
		[23]	0	2	0	2	120	0.00
	LFLG	[24]	0	0	0	0	120	0.00
		[25]	0	2	0	2	120	0.00
		[26]	0	1	0	1	120	0.00
		[27]	0	0	0	0	120	0.00
		[28]	0	1	0	1	120	0.00
		[29]	0	2	0	2	120	0.00
		[30]	0	0	0	0	120	0.00
	WEB-R	[31]	0	3	0	3	120	0.00
		[32]	0	3	0	3	120	0.00
		[33]	0	2	0	2	120	0.00

D+ETR’		[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	DECK-L	[1]	0	140	0	0	0	140	0	-0.00
		[2]	0	140	0	0	0	140	0	-0.00
		[3]	0	140	0	0	0	140	0	-0.00
		[4]	0	140	0	0	0	140	0	-0.00
		[5]	0	140	0	0	0	140	0	-0.00
	DECK-R	[6]	0	140	0	0	0	140	0	-0.00
		[7]	0	140	0	0	0	140	0	-0.00
		[8]	0	140	0	0	0	140	0	-0.00
		[9]	0	140	0	0	0	140	0	0.00
		[10]	0	140	0	0	0	140	0	0.00
	WEB-1	[11]	0	210	0	0	0	210	0	-0.00
		[12]	0	210	0	0	0	210	0	-0.00
	WEB-2	[13]	0	210	0	0	0	210	0	-0.00
		[14]	0	210	0	0	0	210	0	-0.00
		[15]	0	210	0	0	0	210	0	-0.00

WEB-3	[16]	0	210	0	0	0	210	0	-0.00
	[17]	0	210	0	0	0	210	0	-0.00
	[18]	0	210	0	0	0	210	0	-0.00
WEB-4	[19]	0	210	0	0	0	210	0	-0.00
	[20]	0	210	0	0	0	210	0	-0.00
WEB-L	[21]	0	210	0	0	0	210	0	-0.00
	[22]	0	210	0	0	0	210	0	-0.00
	[23]	0	210	0	0	0	210	0	-0.00
LFLG	[24]	0	210	0	0	0	210	0	-0.00
	[25]	0	210	0	0	0	210	0	-0.00
	[26]	0	210	0	0	0	210	0	-0.00
	[27]	0	210	0	0	0	210	0	-0.00
	[28]	0	210	0	0	0	210	0	-0.00
	[29]	0	210	0	0	0	210	0	-0.00
	[30]	0	210	0	0	0	210	0	-0.00
WEB-R	[31]	0	210	0	0	0	210	0	-0.00
	[32]	0	210	0	0	0	210	0	-0.00
	[33]	0	210	0	0	0	210	0	-0.00

D+ETR'		[Point]	τ sx	τ sy	τ t	Σ τ	τ a	κ
	DECK-L	[1]	2	0	0	3	80	0.00
		[2]	2	0	0	3	80	0.00
		[3]	2	0	0	3	80	0.00
		[4]	0	0	0	0	80	0.00
		[5]	0	0	0	0	80	0.00
	DECK-R	[6]	2	0	0	3	80	0.00
		[7]	2	0	0	3	80	0.00
		[8]	2	0	0	3	80	0.00
		[9]	0	0	0	0	80	0.00
		[10]	0	0	0	0	80	0.00
	WEB-1	[11]	1	1	0	2	120	0.00
		[12]	1	1	0	2	120	0.00
	WEB-2	[13]	0	0	0	1	120	0.00
		[14]	0	1	0	1	120	0.00
		[15]	0	0	0	1	120	0.00
	WEB-3	[16]	0	0	0	1	120	0.00
		[17]	0	1	0	1	120	0.00
		[18]	0	0	0	1	120	0.00
	WEB-4	[19]	1	1	0	2	120	0.00
		[20]	1	1	0	2	120	0.00
	WEB-L	[21]	1	1	0	2	120	0.00
		[22]	1	1	0	2	120	0.00
		[23]	2	0	0	2	120	0.00
	LFLG	[24]	0	0	0	0	120	0.00
		[25]	2	0	0	2	120	0.00
		[26]	2	0	0	3	120	0.00
		[27]	2	0	0	3	120	0.00
		[28]	2	0	0	3	120	0.00
		[29]	2	0	0	2	120	0.00
		[30]	0	0	0	0	120	0.00
	WEB-R	[31]	1	1	0	2	120	0.00
		[32]	1	1	0	2	120	0.00
		[33]	2	0	0	2	120	0.00

3. 6. Combination Stress of Girder Systam and Slab System

1) Slab System Stress (refer Longi. Rib calculation)

Bending Stress Max

σ u = 20 N/mm^2 σ L = 105 N/mm^2

Bending Stress Min

σ u = −41 N/mm^2 σ L = −51 N/mm^2

2) Evaluation for Combination

Rib bottom at girder system stress: Calculated from proportion of stress at deck top and bottom flange bottom.

(Unit : N/mm^2)

Section		Material	Girder System		Slab System		Total		Allowable		Material
			Deck-top	Rib-bot	Deck-top	Rib-bot	Deck-top	Rib-bot	Stress		UP
Side Span	S1	SS400	34	30	20	105	50	135	≦	195	
	EJ1	SS400	38	33	20	105	53	138	≦	195	
	R1	SS400	45	38	20	105	58	143	≦	195	
	R2	SS400	46	38	20	105	58	143	≦	195	
	EJ2	SS400	48	40	20	105	60	145	≦	195	
	R3	SS400	53	43	20	105	63	148	≦	195	
	R4	SS400	51	41	20	105	61	146	≦	195	
	EJ3	SS400	52	42	20	105	62	147	≦	195	
	R5	SS400	−54	−44	−41	−51	−85	−95	≦	195	
	R6	SS400	−58	−47	−41	−51	−88	−98	≦	195	
	EJ4	SS400	−58	−47	−41	−51	−88	−98	≦	195	
	R7	SS400	−61	−50	−41	−51	−91	−101	≦	195	
	R8	SS400	−63	−51	−41	−51	−92	−102	≦	195	
	EJ5	SS400	−62	−51	−41	−51	−92	−102	≦	195	
	R9	SS400	−64	−53	−41	−51	−94	−104	≦	195	
	R10	SS400	−66	−55	−41	−51	−96	−106	≦	195	
	EJ6	SS400	−68	−56	−41	−51	−97	−107	≦	195	
	R11	SS400	−68	−56	−41	−51	−97	−107	≦	195	
	R12	SS400	−67	−56	−41	−51	−97	−107	≦	195	
	EJ7	SS400	−66	−55	−41	−51	−96	−106	≦	195	
	R13	SS400	−64	−55	−41	−51	−96	−106	≦	195	
	R14	SS400	−62	−53	−41	−51	−94	−104	≦	195	
	EJ8	SS400	−60	−52	−41	−51	−93	−103	≦	195	
	R15	SS400	−58	−51	−41	−51	−92	−102	≦	195	
	R16	SS400	−57	−50	−41	−51	−91	−101	≦	195	
	EJ9	SS400	−55	−49	−41	−51	−90	−100	≦	195	
	R17	SS400	−53	−48	−41	−51	−89	−99	≦	195	
	R18	SS400	−53	−48	−41	−51	−89	−99	≦	195	
	EJ10	SS400	−52	−47	−41	−51	−88	−98	≦	195	
	R19	SS400	−51	−46	−41	−51	−87	−97	≦	195	
	EJ11	SS400	−58	−50	−41	−51	−91	−101	≦	195	
	EJ12	SS400	−67	−57	−41	−51	−98	−108	≦	195	
	EJ13	SS400	−72	−60	−41	−51	−101	−111	≦	195	
	P11L	SM490Y	−72	−60	−41	−51	−101	−111	≦	295	
	P11	SM490Y	−74	−62	−41	−51	−103	−113	≦	295	

(Unit : N/mm^2)

Section		Material	Girder System		Slab System		Total		Allowable Stress	Material UP
			Deck-top	Rib-bot	Deck-top	Rib-bot	Deck-top	Rib-bot		
Center Span	P11	SM490Y	-75	-62	-41	-51	-103	-113	≦ 295	
	P11R	SM490Y	-72	-60	-41	-51	-101	-111	≦ 295	
	EJ14	SS400	-71	-59	-41	-51	-100	-110	≦ 195	
	EJ15	SS400	-64	-54	-41	-51	-95	-105	≦ 195	
	EJ16	SS400	-56	-50	-41	-51	-91	-101	≦ 195	
	R30	SS400	-53	-47	-41	-51	-88	-98	≦ 195	
	EJ17	SS400	-54	-48	-41	-51	-89	-99	≦ 195	
	R31	SS400	-55	-49	-41	-51	-90	-100	≦ 195	
	R32	SS400	-54	-48	-41	-51	-89	-99	≦ 195	
	EJ18	SS400	-55	-50	-41	-51	-91	-101	≦ 195	
	R33	SS400	-56	-51	-41	-51	-92	-102	≦ 195	
	R34	SS400	-56	-51	-41	-51	-92	-102	≦ 195	
	EJ19	SS400	-57	-51	-41	-51	-92	-102	≦ 195	
	R35	SS400	-59	-52	-41	-51	-93	-103	≦ 195	
	R36	SS400	-59	-52	-41	-51	-93	-103	≦ 195	
	EJ20	SS400	-59	-51	-41	-51	-92	-102	≦ 195	
	R37	SS400	-60	-52	-41	-51	-93	-103	≦ 195	
	R38	SS400	-60	-52	-41	-51	-93	-103	≦ 195	
	EJ21	SS400	-58	-50	-41	-51	-91	-101	≦ 195	
	R39	SS400	-59	-50	-41	-51	-91	-101	≦ 195	
	R40	SS400	-56	-48	-41	-51	-89	-99	≦ 195	
	EJ22	SS400	-53	-45	-41	-51	-86	-96	≦ 195	
	R41	SS400	-54	-45	-41	-51	-86	-96	≦ 195	
	R42	SS400	-53	-44	-41	-51	-85	-95	≦ 195	
	EJ23	SS400	-51	-42	-41	-51	-83	-93	≦ 195	
	R43	SS400	-51	-42	-41	-51	-83	-93	≦ 195	
	R44	SS400	-50	-41	-41	-51	-82	-92	≦ 195	
	EJ24	SS400	-49	-42	-41	-51	-83	-93	≦ 195	
	R45	SS400	-49	-43	-41	-51	-84	-94	≦ 195	
	R46	SS400	-50	-44	-41	-51	-85	-95	≦ 195	
	EJ25	SS400	-49	-43	-41	-51	-84	-94	≦ 195	
	R47	SS400	-50	-44	-41	-51	-85	-95	≦ 195	
	R48	SS400	-50	-44	-41	-51	-85	-95	≦ 195	
	EJ26	SS400	-48	-43	-41	-51	-84	-94	≦ 195	
	R49	SS400	-49	-44	-41	-51	-85	-95	≦ 195	

3. 7. Calculation for Site Joint of Girder (Excerpt)

3. 7. 1. Design Principle

・Stress Evaluation method for tensile flange and longi. Rib (after hole deduction)

Evaluation Equation : $\sigma tn = \sigma tmax * Ag/An \leqq \sigma ta$

where

- σtn : stress after hole deduction
- $\sigma tmax$: stress
- Ag : Total cross section area (flange + longi. rib)
- An : Net cross section area (flange with hole deduction + longi. Rib with hole deduction)
- σta : Allowable tensile stress

・Calculation method for required number of bolt

$\sigma tn = \sigma tmax * Ag/An$

in case $\sigma tn \geqq 0.75 \sigma ta$: $\sigma t = \sigma tn$

in case $\sigma tn < 0.75 \sigma ta$: $\sigma t = 0.75 \sigma ta$

required number: $\sigma t * AnS / \rho a$

where

- $0.75 \sigma ta$: 75% of allowable stress
- σt : tensile stress for bolt design
- AnS : Net cross section area of flange or rib

３．７．２. Side Span Joint（Ｐ１０～Ｐ１１）

(1) Girder EJ1 WEB-1

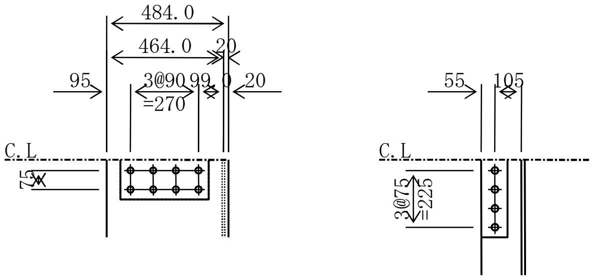
(a) Stress

σ tmax = 35 N/mm^2 0.75σ ta = 0.75 ＊ 210 = 158 N/mm^2
σ cmax = -5 N/mm^2 0.75σ ca = 0.75 ＊ 173 = 130 N/mm^2
∴σ c = 130 N/mm^2
τ max = 41 N/mm^2

(b) Base metal total cross section area

1-WEB-1 PL 484 ＊ 14 Ag = 67.8 cm^2 (SM490Y)
1-RIB PL 160 ＊ 16 Agr = 25.6 cm^2 (SM490Y)
ΣAg = Ag + Agr = 67.8 + 25.6 = 93.4 cm^2

(c) Bolt Arrangement



(d) Evaluation for Base Metal

1-WEB-1 PL 484 ＊ 14 A = 67.8
(67.8 - (4＊ 2.5)＊ 1.4) ＊ 1.1 = 59.1 ＜ 67.8 ∴An = 59.1 cm^2
1-RIB PL 160 ＊ 16 Ar = 25.6
(25.6 - (1＊ 2.7)＊ 1.6) ＊ 1.1 = 23.4 ＜ 25.6 ∴Anr = 23.4 cm^2
ΣAn = An + Anr = 59.1 + 23.4 = 82.5 cm^2
σ tn = σ tmax ＊ ΣAg / ΣAn = 35 ＊ 93.4 / 82.5 = 40 N/mm^2
＜ σ ta = 210 N/mm^2

(e) Design Axial Force

・Base Metal Pt = 0.75σ ta ＊ An / 1.1 = 158 ＊ 5914 / 1.1 = 846713 N
＞ σ tn ＊ An = 40 ＊ 5914 = 234389 N
Pc = σ c ＊ Ag = 130 ＊ 6776 = 879999 N
・Rib Ptr = 0.75σ ta ＊ Anr / 1.1 = 158 ＊ 2341 / 1.1 = 335160 N
＞ σ tn ＊ Anr = 40 ＊ 2341 = 92780 N
Pcr = σ c ＊ Agr = 130 ＊ 2560 = 332469 N

(f) Required Cross Section Area for Splice Plate

・Base Metal (one side) AnR = An / 2 = 59.1 / 2 = 29.6 cm^2
AgR = Ag / 2 = 67.8 / 2 = 33.9 cm^2
・Rib AnrR = Anr = 23.4 cm^2
AgrR = Agr = 25.6 cm^2

(g) Required Number of bolt

・Base Metal n = Pc / (108000 ＊ 1.00) = 879999 / 108000 = 8.1 nos.
・Rib nr = Ptr / (108000 ＊ 1.00) = 335160 / 108000 = 3.11 nos.
(S10T M22 2 plane allowable friction ρa = 108000 N inorganic zinc Nmax = 2,4 nos.)

(h) stress per 1 bolt

ρp = Pc / 8 = 879999 / 8 = 110000 N
ρs = τ ＊ Ag / 8 = 41 ＊ 6776 / 8 = 35060 N

(i) Evaluation for Splice Plate

	(SM490Y)	Ags(cm^2)	Hole deduction			Ans(cm^2)
1-SPL PL	350 * 9	(31.5 -	(4*2.5)* 0.9)*1.1=	24.8<	31.5	∴ 24.8
1-SPL PL	350 * 10	(35.0 -	(4*2.5)* 1.0)*1.1=	27.5<	35.0	∴ 27.5
2-SPL PL	100 * 15	(30.0 -	2*(1*2.7)* 1.5)*1.1=	24.1<	30.0	∴ 24.1

３．７．３. Main Span Joint（Ｐ１１～ＣＬ(EJ26)）

(1) Girder　EJ14　WEB-1

(a) Stress

σ tmax = 22 N/mm^2　　0.75 σ ta = 0.75 ＊ 210 = 158 N/mm^2

σ cmax = −30 N/mm^2　　0.75 σ ca = 0.75 ＊ 189 = 142 N/mm^2

∴ σ c = 142 N/mm^2

τ max = 56 N/mm^2

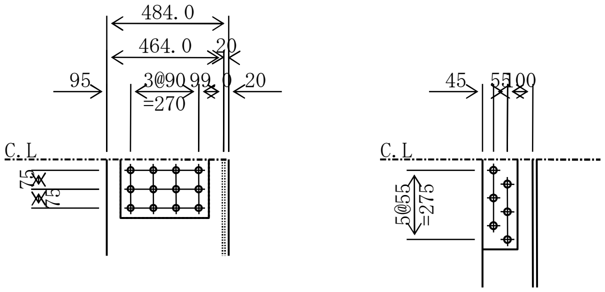
(b) Base metal total cross section area

1-WEB-1　PL　484 ＊ 17　　Ag = 82.3 cm^2　(SM490Y)

1-RIB　PL　200 ＊ 20　　Agr = 40.0 cm^2　(SM490Y)

ΣAg = Ag + Agr = 82.3 + 40.0 = 122.3 cm^2

(c) Bolt Arrangement



(d) Evaluation for Base Metal

1-WEB-1　PL　484 ＊ 17　　A = 82.3

(82.3 − (4＊ 2.5)＊ 1.7) ＊ 1.1 = 71.8 ＜ 82.3　∴An = 71.8 cm^2

1-RIB　PL　200 ＊ 20　　Ar = 40.0

(40.0 − (1＊ 2.7+ 1＊1.325)＊ 2.0) ＊ 1.1 = 35.1 ＜ 40.0　∴Anr = 35.1 cm^2

ΣAn = An + Anr = 71.8 + 35.1 = 107.0 cm^2

σ tn = σ tmax ＊ ΣAg / ΣAn = 22 ＊ 122.3 / 107.0 = 25 N/mm^2

＜ σ ta = 210 N/mm^2

(e) Design Axial Force

・Base Metal　Pt = 0.75 σ ta ＊ An / 1.1 = 158 ＊ 7181 / 1.1 = 1028152 N

＞ σ tn ＊ An = 25 ＊ 7181 = 180205 N

Pc = σ c ＊ Ag = 142 ＊ 8228 = 1166756 N

・Rib　Ptr = 0.75 σ ta ＊ Anr / 1.1 = 158 ＊ 3515 / 1.1 = 503213 N

＞ σ tn ＊ Anr = 25 ＊ 3515 = 88198 N

Pcr = σ c ＊ Agr = 142 ＊ 4000 = 567216 N

(f) Required Cross Section Area for Splice Plate

・Base Metal (one side)　AnR = An / 2 = 71.8 / 2 = 35.9 cm^2

AgR = Ag / 2 = 82.3 / 2 = 41.1 cm^2

・Rib　AnrR = Anr = 35.1 cm^2

AgrR = Agr = 40.0 cm^2

(g) Required Number of bolt

・Base Metal　n = Pc / (108000 ＊ 1.00) = 1166756 / 108000 = 10.8 nos.

・Rib　nr = Pcr / (108000 ＊ 1.00) = 567216 / 108000 = 5.3 nos.

(S10T M22 2 plane allowable friction ρ a = 108000 Ninorganic zinc Nmax = 3,6 nos.)

(h) stress per 1 bolt

ρ p = Pc / 12 = 1166756 / 12 = 97230 N

ρ s = τ ＊ Ag / 12 = 56 ＊ 8228 / 12 = 38156 N

(i) Evaluation for Splice Plate

	(SM490Y)	Ags(cm^2)	Hole deduction			Ans(cm^2)
1-SPL PL	350 * 10	(35.0 -	(4*2.5)* 1.0)*1.1=	27.5<	35.0	∴ 27.5
1-SPL PL	350 * 12	(42.0 -	(4*2.5)* 1.2)*1.1=	33.0<	42.0	∴ 33.0
2-SPL PL	135 * 15	(40.5 -	2*(1*2.7+ 1*1.325)* 1.5)*1.1=	31.3<	40.5	∴ 31.3

3. 7. 4. Splice Plate Thickness and Bolt No. at Outer Web

<Splice Plate Thickness and Bolt No. at Outer Web>

	Name	Required No. of Bolt			Used	Used	Required Area			Splice Thickness		Used Section	
		WEB-1	WEB-L	WEB-1L	Bolt	Bolt	WEB-1	WEB-L	WEB-1L	Out	In	Out	In
		n1	n2	n	Row	No.	Ar1	Ar2	Ar	spl-1	spl-2	As-1	As-2
	EJ1	8.1	39.5	47.6	2	58	29.6	149.0	178.6	9	10	199.3	181.0
	EJ2	7.8	39.5	47.3	2	58	29.6	149.0	178.6	9	10	199.3	181.0
	EJ3	7.8	39.5	47.3	2	58	29.6	149.0	178.6	9	10	199.3	181.0
	EJ4	7.8	39.5	47.3	2	58	29.6	149.0	178.6	9	10	199.3	181.0
	EJ5	7.8	39.5	47.3	2	58	29.6	149.0	178.6	9	10	199.3	181.0
	EJ6	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ7	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ8	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ9	7.5	35.6	43.1	2	58	33.9	179.2	213.1	9	10	246.4	237.0
	EJ10	7.5	35.6	43.1	2	58	33.9	179.2	213.1	9	10	246.4	237.0
	EJ11	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ12	7.8	39.5	47.3	2	58	29.6	149.0	178.6	9	10	199.3	181.0
WEB-1 + WEB-L	EJ13	10.7	52.8	63.5	3	87	35.9	181.0	216.9	10	12	221.4	217.1
	EJ14	10.8	53.1	63.9	3	87	35.9	217.6	253.5	10	12	266.3	275.4
	EJ15	7.8	35.8	43.6	2	58	29.6	179.2	208.8	9	10	239.7	229.5
	EJ16	7.5	35.6	43.1	2	58	33.9	179.2	213.1	9	10	246.4	237.0
	EJ17	7.5	35.7	43.2	2	58	33.9	179.2	213.1	9	10	246.4	237.0
	EJ18	7.5	35.7	43.2	2	58	33.9	179.2	213.1	9	10	246.4	237.0
	EJ19	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ20	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ21	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ22	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ23	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ24	7.5	39.5	47.0	2	58	33.9	149.0	182.9	9	10	206.0	188.5
	EJ25	7.8	39.5	47.3	2	58	29.6	149.0	178.6	9	10	199.3	181.0
	EJ26	7.8	39.5	47.3	2	58	29.6	149.0	178.6	9	10	199.3	181.0

	Name	Required No. of Bolt			Used	Used	Required Area			Splice Thickness		Used Section	
		WEB-4	WEB-R	WEB-4R	Bolt	Bolt	WEB-4	WEB-R	WEB-4R	Out	In	Out	In
		n1	n2	n	Row	No.	Ar1	Ar2	Ar	spl-1	spl-2	As-1	As-2
	EJ1	8.1	39.5	47.6	2	58	29.6	149.0	178.6	10	9	181.0	199.3
	EJ2	7.8	39.5	47.3	2	58	29.6	149.0	178.6	10	9	181.0	199.3
	EJ3	7.8	39.5	47.3	2	58	29.6	149.0	178.6	10	9	181.0	199.3
	EJ4	7.8	39.5	47.3	2	58	29.6	149.0	178.6	10	9	181.0	199.3
	EJ5	7.8	39.5	47.3	2	58	29.6	149.0	178.6	10	9	181.0	199.3
	EJ6	7.5	39.5	47.0	2	58	33.9	149.0	182.9	10	9	188.5	206.0
	EJ7	7.5	39.5	47.0	2	58	33.9	149.0	182.9	10	9	188.5	206.0
	EJ8	7.5	39.5	47.0	2	58	33.9	149.0	182.9	10	9	188.5	206.0
	EJ9	7.5	35.6	43.1	2	58	33.9	179.2	213.1	10	9	237.0	246.4
	EJ10	7.5	35.6	43.1	2	58	33.9	179.2	213.1	10	9	237.0	246.4
	EJ11	7.5	36.0	43.5	2	58	33.9	179.2	213.1	10	9	237.0	246.4
	EJ12	7.5	35.6	43.1	2	58	33.9	179.2	213.1	10	9	237.0	246.4
WEB-4 + WEB-R	EJ13	10.7	52.5	63.2	3	87	35.9	217.6	253.5	12	10	275.4	266.3
	EJ14	10.7	52.6	63.3	3	87	35.9	217.6	253.5	12	10	275.4	266.3
	EJ15	7.5	35.6	43.1	2	58	33.9	179.2	213.1	10	9	237.0	246.4
	EJ16	7.5	35.8	43.3	2	58	33.9	179.2	213.1	10	9	237.0	246.4
	EJ17	7.5	35.6	43.1	2	58	33.9	179.2	213.1	10	9	237.0	246.4
	EJ18	7.5	35.7	43.2	2	58	33.9	179.2	213.1	10	9	237.0	246.4
	EJ19	7.5	39.5	47.0	2	58	33.9	149.0	182.9	10	9	188.5	206.0
	EJ20	7.5	39.5	47.0	2	58	33.9	149.0	182.9	10	9	188.5	206.0
	EJ21	7.5	39.5	47.0	2	58	33.9	149.0	182.9	10	9	188.5	206.0
	EJ22	7.8	39.5	47.3	2	58	29.6	149.0	178.6	10	9	181.0	199.3
	EJ23	7.8	39.5	47.3	2	58	29.6	149.0	178.6	10	9	181.0	199.3
	EJ24	7.8	39.5	47.3	2	58	29.6	149.0	178.6	10	9	181.0	199.3
	EJ25	7.8	39.5	47.3	2	58	29.6	149.0	178.6	10	9	181.0	199.3
	EJ26	7.8	39.5	47.3	2	58	29.6	149.0	178.6	10	9	181.0	199.3

＜Stress Evaluation of 1 bolt at outer web＞ (HT Bolt S10T M22 2 plane allowable friction ρa = 108000 N inorganic zinc)

	Name	ρp(Pt)				ρp(Pc)				ρs			Σρs	
		WEB-1	WEB-L	WEB-1L	ρp(Pt)	WEB-1	WEB-L	WEB-1L	ρp(Pc)	WEB-1	WEB-L	WEB-1L	ρs(Pt)	ρs(Pc)
		Pt-1	Pt-2	Pt	(N)	Pc-1	Pc-2	Pc	(N)	(N)	(N)	(N)	(N)	(N)
	EJ1	846713	4267548	5114261	88177	880583	4118115	4998698	86184	35060	26601	61661	107598	105971
	EJ2	846713	4267548	5114261	88177	826308	3935222	4761530	82095	23869	22779	46648	99756	94423
	EJ3	846713	4267548	5114261	88177	817201	3910865	4728066	81518	19176	18430	37606	95861	89774
	EJ4	846713	4267548	5114261	88177	813791	3897235	4711026	81225	18995	16129	35124	94915	88494
	EJ5	846713	4267548	5114261	88177	810457	3879733	4690190	80865	18016	15302	33318	94262	87460
	EJ6	0	4267548	4267548	73578	806249	3847311	4653560	80234	16699	14167	30866	79790	85966
	EJ7	0	4267548	4267548	73578	807708	3861372	4669080	80501	20623	17502	38125	82869	89073
	EJ8	0	4267548	4267548	73578	806310	3847419	4653729	80237	22350	18969	41319	84386	90251
	EJ9	-	-	-	-	806244	3849354	4655598	80269	22233	18869	41102	-	90180
	EJ10	-	-	-	-	805970	3842418	4648388	80145	21414	18169	39583	-	89387
	EJ11	0	4267548	4267548	73578	810655	3898472	4709127	81192	20132	4240	24372	77510	84771
	EJ12	846713	4267548	5114261	88177	805970	3849516	4655486	80267	9430	8325	17755	89947	82207
WEB-1 + WEB-L	EJ13	1028152	5182023	6210175	71381	1155655	5701164	6856819	78814	33143	28276	61419	94168	99920
	EJ14	1028152	0	1028152	11818	1166756	5729957	6896713	79273	38156	28891	67047	68081	103824
	EJ15	846713	0	846713	14599	807565	3862528	4670093	80519	10448	34036	44484	46818	91990
	EJ16	-	-	-	-	807936	3844354	4652290	80212	25747	24021	49768	-	94397
	EJ17	-	-	-	-	806951	3855108	4662059	80380	29392	24917	54309	-	97008
	EJ18	-	-	-	-	806920	3853683	4660603	80355	29726	25207	54933	-	97338
	EJ19	0	4267548	4267548	73578	806569	3843574	4650143	80175	28691	24331	53022	90692	96122
	EJ20	0	4267548	4267548	73578	807738	3879922	4687660	80822	25938	21997	47935	87815	93968
	EJ21	0	4267548	4267548	73578	807372	3879841	4687213	80814	21226	17995	39221	83379	89829
	EJ22	0	4267548	4267548	73578	806117	3857796	4663913	80412	22689	19244	41933	84689	90689
	EJ23	0	4267548	4267548	73578	806468	3874061	4680529	80699	20634	19825	40459	83969	90273
	EJ24	0	4267548	4267548	73578	807291	3890729	4698020	81000	21159	20385	41544	84497	91033
	EJ25	846713	4267548	5114261	88177	808384	3911295	4719679	81374	2773	18526	21299	90713	84115
	EJ26	846713	4267548	5114261	88177	810106	3895084	4705190	81124	19696	19598	39294	96536	90139

	Name	ρp(Pt)				ρp(Pc)				ρs			Σρs	
		WEB-4	WEB-R	WEB-4R	ρp(Pt)	WEB-4	WEB-R	WEB-4R	ρp(Pc)	WEB-4	WEB-R	WEB-4R	ρs(Pt)	ρs(Pc)
		Pt-1	Pt-2	Pt	(N)	Pc-1	Pc-2	Pc	(N)	(N)	(N)	(N)	(N)	(N)
	EJ1	846713	4267548	5114261	88177	878871	3983688	4862559	83837	35060	26601	61661	107598	104071
	EJ2	846713	4267548	5114261	88177	814695	3891858	4706553	81147	23869	22779	46648	99756	93600
	EJ3	846713	4267548	5114261	88177	812251	3881938	4694189	80934	19176	18430	37606	95861	89244
	EJ4	846713	4267548	5114261	88177	811301	3878739	4690040	80863	18995	16129	35124	94915	88162
	EJ5	846713	4267548	5114261	88177	809715	3871749	4681464	80715	18016	15302	33318	94262	87321
	EJ6	0	4267548	4267548	73578	806234	3848010	4654244	80246	16699	14167	30866	79790	85977
	EJ7	0	4267548	4267548	73578	807342	3864302	4671644	80546	20623	17502	38125	82869	89113
	EJ8	0	4267548	4267548	73578	806117	3849274	4655391	80265	22350	18969	41319	84386	90276
	EJ9	-	-	-	-	806010	3845349	4651359	80196	22233	18869	41102	-	90115
	EJ10	-	-	-	-	805822	3846800	4652622	80218	21414	18169	39583	-	89452
	EJ11	-	-	-	-	807870	3886374	4694244	80935	20132	17073	37205	-	89077
	EJ12	-	-	-	-	805777	3843117	4648894	80153	9430	31434	40864	-	89969
WEB-4 + WEB-R	EJ13	1028152	0	1028152	11818	1151606	5668715	6820321	78394	10630	28276	38906	40661	87518
	EJ14	1028152	0	1028152	11818	1154173	5681512	6835685	78571	11385	28891	40276	41974	88293
	EJ15	-	-	-	-	807372	3842553	4649925	80171	10448	34036	44484	-	91686
	EJ16	-	-	-	-	806849	3865888	4672737	80564	28344	24021	52365	-	96087
	EJ17	-	-	-	-	806519	3841988	4648507	80147	29392	24917	54309	-	96814
	EJ18	-	-	-	-	806818	3850618	4657436	80301	29726	25207	54933	-	97292
	EJ19	0	4267548	4267548	73578	806351	3851882	4658233	80314	28691	24331	53022	90692	96238
	EJ20	0	4267548	4267548	73578	809405	3882449	4691854	80894	25938	21997	47935	87815	94030
	EJ21	0	4267548	4267548	73578	809715	3884035	4693750	80927	21226	17995	39221	83379	89930
	EJ22	846713	4267548	5114261	88177	807144	3849543	4656687	80288	3155	19244	22399	90977	83354
	EJ23	846713	4267548	5114261	88177	809634	3872018	4681652	80718	3259	19825	23084	91148	83954
	EJ24	846713	4267548	5114261	88177	819818	3970656	4790474	82594	3009	20385	23394	91227	85844
	EJ25	846713	4267548	5114261	88177	830699	3959015	4789714	82581	2821	18526	21347	90724	85296
	EJ26	846713	4267548	5114261	88177	813013	3892315	4705328	81126	2906	19598	22504	91003	84190

＜Splice Plate Thickness and Bolt No. of Horizontal Stiffener at Outer Web＞

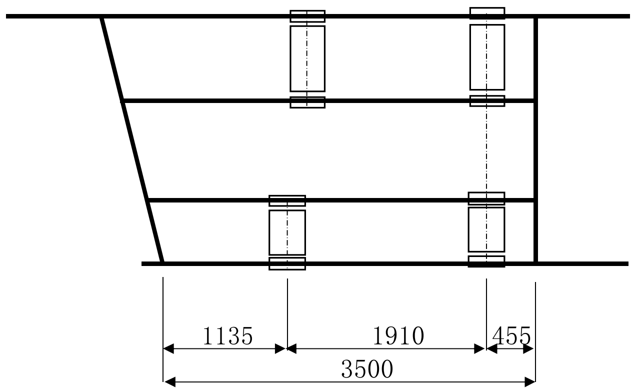
	Name	Required No. of Bolt			Used Bolt	Used Bolt	Required Area			Splice Thickness	Used Area
		WEB-1	WEB-L	WEB-1L			WEB-1	WEB-L	WEB-1L		
		n1	n2	n	Row	No.	Ar1	Ar2	Ar	spl	As
	EJ1	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ2	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ3	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ4	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ5	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ6	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ7	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ8	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ9	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ10	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ11	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ12	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
WEB-1 + WEB-L	EJ13	5.2	19.4	24.6	6	30	23.4	93.6	117.0	15	120.5
	EJ14	5.3	19.5	24.8	6	30	23.4	102.4	125.8	15	144.1
	EJ15	3.1	10.2	13.3	4	20	23.4	102.4	125.8	15	144.1
	EJ16	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ17	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ18	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ19	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ20	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ21	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ22	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ23	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ24	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ25	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ26	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5

	Name	Required No. of Bolt			Used Bolt	Used Bolt	Required Area			Splice Thickness	Used Area
		WEB-4	WEB-R	WEB-4R			WEB-4	WEB-R	WEB-4R		
		n1	n2	n	Row	No.	Ar1	Ar2	Ar	spl	As
	EJ1	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ2	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ3	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ4	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ5	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ6	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ7	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ8	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ9	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ10	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ11	2.8	10.3	13.1	4	20	25.6	102.4	128.0	15	150.0
	EJ12	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
WEB-4 + WEB-R	EJ13	5.2	19.3	24.5	6	30	23.4	102.4	125.8	15	144.1
	EJ14	5.2	19.3	24.5	6	30	23.4	102.4	125.8	15	144.1
	EJ15	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ16	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ17	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ18	2.8	10.2	13.0	4	20	25.6	102.4	128.0	15	150.0
	EJ19	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ20	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ21	2.8	12.4	15.2	4	20	25.6	93.6	119.2	15	126.4
	EJ22	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ23	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ24	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ25	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5
	EJ26	3.1	12.4	15.5	4	20	23.4	93.6	117.0	15	120.5

3．7．5．Calculation for flange longitudinal joint

Because of the transport limit, longitudinal joints were prepared at the following area.
Bolt number at flange longitudinal joint shall be calculated by shear flow which is calculated from shear stress at web section

Detail calculation　　S1



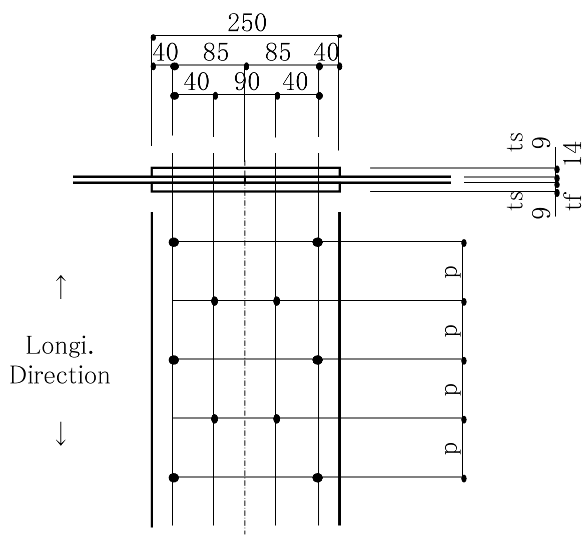
FLG material　　　　SM490Y
FLG thickness　　tf =　14　mm

Shear Stress above girder at flange　　τF = 36.0 N/mm^2
Shear Flow　　q = $\tau F \cdot tf$ = 504.0 N/mm

Required bolt pitch　　pr = $\rho a \cdot$ 1 row / q = 214 mm
where ρa = 108000 N/no. (M22 S10T 2 plane friction)
Max botl pitch　　Pr' = 12・ts = 108 mm
Design bolt pitch　　p = (pr or less than pr) = 108 mm (MAX 150mm)

Splice Thickness　　ts = (td/2 以上) = 9 mm (SM490Y)

Bolt shall be agganged by following figure at whole section.



Cross Section Number	FLG thickness	FLG Material	Shear Stress above girder	Shear Flow	Required Bolt Pitch	Max Bolt Pitch	Design Bolt Pitch	Splice Thickness
	tf (mm)		τ F (N/mm2)	q (N/mm)	pr (mm)	pr' (mm)	p (mm)	ts (mm)
S1	14	SM490Y	36	504	214	108	108	9
EJ1	14	SM490Y	35	490	220	108	108	9
R1	14	SM490Y	37	518	208	108	108	9
R2	14	SM490Y	28	392	276	108	108	9
EJ2	14	SM490Y	27	378	286	108	108	9
R3	14	SM490Y	30	420	257	108	108	9
R4	14	SM490Y	22	308	351	108	108	9
EJ3	14	SM490Y	22	308	351	108	108	9
R5	14	SM490Y	26	364	297	108	108	9
R6	14	SM490Y	17	238	454	108	108	9
EJ4	14	SM490Y	19	266	406	108	108	9
R7	14	SM490Y	23	322	335	108	108	9
R8	14	SM490Y	16	224	482	108	108	9
EJ5	14	SM490Y	18	252	429	108	108	9
R9	14	SM490Y	25	350	309	108	108	9
R10	14	SM490Y	18	252	429	108	108	9
EJ6	11	SM490Y	21	231	468	108	108	9
R11	11	SM490Y	27	297	364	108	108	9
R12	11	SM490Y	22	242	446	108	108	9
EJ7	11	SM490Y	25	275	393	108	108	9
R13	11	SM490Y	30	330	327	108	108	9
R14	11	SM490Y	24	264	409	108	108	9
EJ8	11	SM490Y	27	297	364	108	108	9
R15	11	SM490Y	32	352	307	108	108	9
R16	11	SM490Y	24	264	409	108	108	9
EJ9	11	SM490Y	27	297	364	108	108	9
R17	11	SM490Y	32	352	307	108	108	9
R18	11	SM490Y	23	253	427	108	108	9
EJ10	11	SM490Y	26	286	378	108	108	9
R19	11	SM490Y	32	352	307	108	108	9
EJ11	11	SM490Y	26	286	378	108	108	9
EJ12	11	SM490Y	44	484	223	108	108	9
EJ13	15	SM490Y	44	660	164	108	108	9

Cross Section Number	FLG thickness	FLG Material	Shear Stress above girder	Shear Flow	Required Bolt Pitch	Max Bolt Pitch	Design Bolt Pitch	Splice Thickness
	tf (mm)		τF (N/mm2)	q (N/mm)	pr (mm)	pr' (mm)	p (mm)	ts (mm)
EJ14	15	SM490Y	53	795	136	108	108	9
EJ15	11	SM490Y	56	616	175	108	108	9
EJ16	11	SM490Y	39	429	252	108	108	9
R30	11	SM490Y	45	495	218	108	108	9
EJ17	11	SM490Y	39	429	252	108	108	9
R31	11	SM490Y	36	396	273	108	108	9
R32	11	SM490Y	44	484	223	108	108	9
EJ18	11	SM490Y	39	429	252	108	108	9
R33	11	SM490Y	36	396	273	108	108	9
R34	11	SM490Y	42	462	234	108	108	9
EJ19	11	SM490Y	37	407	265	108	108	9
R35	11	SM490Y	34	374	289	108	108	9
R36	11	SM490Y	39	429	252	108	108	9
EJ20	11	SM490Y	33	363	298	108	108	9
R37	11	SM490Y	30	330	327	108	108	9
R38	11	SM490Y	33	363	298	108	108	9
EJ21	11	SM490Y	28	308	351	108	108	9
R39	11	SM490Y	28	308	351	108	108	9
R40	11	SM490Y	35	385	281	108	108	9
EJ22	11	SM490Y	29	319	339	108	108	9
R41	11	SM490Y	26	286	378	108	108	9
R42	11	SM490Y	34	374	289	108	108	9
EJ23	11	SM490Y	29	319	339	108	108	9
R43	11	SM490Y	27	297	364	108	108	9
R44	11	SM490Y	35	385	281	108	108	9
EJ24	11	SM490Y	30	330	327	108	108	9
R45	11	SM490Y	27	297	364	108	108	9
R46	11	SM490Y	35	385	281	108	108	9
EJ25	11	SM490Y	31	341	317	108	108	9
R47	11	SM490Y	28	308	351	108	108	9
R48	11	SM490Y	37	407	265	108	108	9
EJ26	11	SM490Y	32	352	307	108	108	9
R49	11	SM490Y	28	308	351	108	108	9

３．７．６． Calculation for Horizontal Joint at Block under Main Tower

1) Design Principle

・Because of the transport limit, horizontal joint shall be prepared at following part.
Area : SJ4 ～ SJ5 、 Block: EJ13 ～ EJ14
・Material of splice plate shall be decided based on the base metal material.

2) Calculation for Required Bolt No. and Splice Plate Thickness

・Calculated by full strength

(a) Girder Web WEB-2,WEB- (SM490Y)

required No. (S10T M22 2 plane allowable friction ρa = 108000 N)

nreq = $\sigma a * Ag / \rho a$
= 210 × 3000 × 35 / 108000
= 204.2 or more < 216 nos. OK

splice thickness (SM490Y)

ts = tw / 2 = 35 / 2 = 17.5 mm → 18 mm

(b) Girder diaphragm P11L, P: (SM490Y)

required no. (S10T M22 2 plane allowable friction ρa = 108000 N)

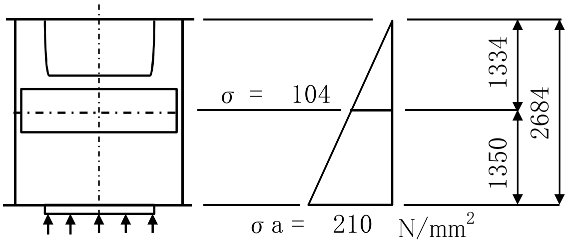
nreq = $\sigma a * Ag / \rho a$
= 210 × 2500 × 35 / 108000
= 170.1 or more < 174 nos. OK

splice thickness (SM490Y)

ts = tw / 2 = 35 / 2 = 17.5 mm → 18 mm

(c) Transverse Rib at Pivot Be (SM490Y)

・Calculated as the LFLG have full strength



Design Stress σ = 104 N/mm^2 < 0.75 σ a = 158 N/mm^2

required no. (longi.) (S10T M22 2 plane allowable friction ρ a = 108000 N)

nreq = σ * Ag / ρ a

= 158 ×(2 × 3000)× 45 / 2 / 108000

= 196.9 or more < 198 nos. OK

shear evaluation q = τ w * tw = 59 × 45 = 2655 N/mm

n* ρ a / pitch = 6 × 108000 / 66

= 9818 > q = 2655 N/mm OK

required no. (trans.) (S10T M22 2 plane allowable friction ρ a = 108000 N)

nreq = σ * Ag / ρ a

= 158 ×(2 × 2500)× 45 / 2 / 108000

= 164.1 or more < 168 nos. OK

shear evaluation q = τ w * tw = 117 × 45 = 5265 N/mm

n* ρ a / pitch = 6 × 108000 / 66

= 9818 > q = 5265 N/mm OK

splice thickness (SM490Y)

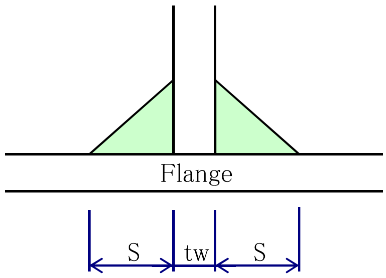
ts = tw / 2 = 45 / 2 = 22.5 mm → 23 mm

3．8． Calculation for Welding of Girder

(1) Evaluation for Fillet Weld Size

1) Design Principle

The welding of the main girder flange and the web shall use the largest weld size determined through the comparison of weld size based on shear stress, composite stress, and plate thickness.



2) Weld Size Based on Shear Stress (JSHB II 6.2.7)

$$S1 = \tau \cdot tw / (\tau a \cdot 0.707 \cdot 2)$$

Where,
- τ : Shear Stress of Upper and Lower Component of Web (N/mm^2)
- τa : Allowable Shear Stress (N/mm^2)
- tw : Main Girder Web Thickness (mm)
- tu : Main Girder Upper Flange Thickness (mm)
- tl : Main Girder Bottom Flange Thickness (mm)

3) Weld Size Based on Composite Stress

$$S2 = \tau \cdot tw / (\tau a \cdot 0.707 \cdot 2 \cdot \sqrt{(1.2-(\sigma / \sigma a)^2)})$$

Where,
- σ : Vertical Stress due to Bending Moment from Upper and Lower Component of Web (N/mm^2)
- σa : Allowable Vertical Stress (N/mm^2)

4) Weld Size Based on Plate Thickness (JSHB II 6.2.5)

$$t1 > St \geqq \sqrt{(2 \cdot t2)}$$

Where,
- t1 : Thickness of thinner base metal (mm)
- t2 : Thickness of thicker base metal (mm)

5) Required Size of Fillet Weld

$$Sreq = Max\{S1, S2, St\}$$

Where, $6 \leqq S \leqq 12$

(2) Calculation Results for Welds

1) OUTER WEB

Section	tu	tw	Stress		Allowable Value		Fillet Welding Size				
	tl	tw	τ	σ	τ a	σ a	S1	S2	Sreq	√(2·t)	S
	(mm)	(mm)	(N/mm²)	(N/mm²)	(N/mm²)	(N/mm²)	(mm)	(mm)	(mm)	(mm)	(mm)
S1	16	14	42.5	0.0	120	210	3.51	3.20	3.51	5.66	6
	14	14	36.9	0.0	120	210	3.04	2.78	3.04	5.29	6
EJ1	16	14	40.6	-4.7	120	210	3.35	3.06	3.35	5.66	6
	14	14	35.4	-10.8	120	210	2.92	2.67	2.92	5.29	6
R1	16	14	44.2	-16.1	120	210	3.65	3.34	3.65	5.66	6
	14	14	38.0	-34.9	120	210	3.13	2.89	3.13	5.29	6
R2	16	14	32.8	-25.5	120	210	2.71	2.49	2.71	5.66	6
	14	14	28.9	-45.6	120	210	2.38	2.22	2.38	5.29	6
EJ2	16	14	31.1	-27.7	120	210	2.57	2.36	2.57	5.66	6
	14	14	27.5	-51.5	120	210	2.27	2.12	2.27	5.29	6
R3	16	14	34.9	-35.9	120	210	2.88	2.66	2.88	5.66	6
	14	14	30.3	-69.0	120	210	2.50	2.39	2.50	5.29	6
R4	16	14	25.2	-41.8	120	210	2.08	1.93	2.08	5.66	6
	14	14	22.5	-73.1	120	210	1.86	1.79	1.86	5.29	6
EJ3	16	14	25.2	-42.8	120	210	2.08	1.93	2.08	5.66	6
	14	14	22.5	-76.4	120	210	1.86	1.80	1.86	5.29	6
R5	16	14	30.2	-48.1	120	210	2.49	2.33	2.49	5.66	6
	14	14	26.2	-94.9	120	210	2.16	2.17	2.17	5.29	6
R6	16	14	19.5	-51.3	120	210	1.61	1.51	1.61	5.66	6
	14	14	17.7	-91.4	120	210	1.46	1.45	1.46	5.29	6
EJ4	16	14	22.1	-51.2	120	210	1.82	1.71	1.82	5.66	6
	14	14	19.6	-91.8	120	210	1.62	1.61	1.62	5.29	6
R7	16	14	26.8	-54.5	120	210	2.21	2.08	2.21	5.66	6
	14	14	23.2	-98.2	120	210	1.91	1.93	1.93	5.29	6
R8	16	14	18.1	-56.0	120	210	1.49	1.41	1.49	5.66	6
	14	14	16.2	-91.8	120	210	1.34	1.33	1.34	5.29	6
EJ5	16	14	20.9	-55.5	120	210	1.72	1.62	1.72	5.66	6
	14	14	18.4	-91.4	120	210	1.52	1.51	1.52	5.29	6
R9	16	14	29.6	-57.6	120	210	2.44	2.30	2.44	5.66	6
	14	14	25.1	-97.1	120	210	2.07	2.08	2.08	5.29	6
R10	16	14	21.4	-59.4	120	210	1.77	1.67	1.77	5.66	6
	14	14	18.7	-85.6	120	210	1.54	1.52	1.54	5.29	6
EJ6	16	14	19.4	-60.5	120	210	1.60	1.51	1.60	5.66	6
	11	14	16.6	-92.2	120	210	1.37	1.36	1.37	5.29	6
R11	16	14	25.9	-61.1	120	210	2.14	2.02	2.14	5.66	6
	11	14	21.4	-92.5	120	210	1.77	1.76	1.77	5.29	6
R12	16	14	21.0	-60.5	120	210	1.73	1.64	1.73	5.66	6
	11	14	17.8	-82.4	120	210	1.47	1.44	1.47	5.29	6
EJ7	16	14	23.9	-59.2	120	210	1.97	1.86	1.97	5.66	6
	11	14	19.9	-80.7	120	210	1.64	1.60	1.64	5.29	6
R13	16	14	29.3	-58.4	120	210	2.42	2.28	2.42	5.66	6
	11	14	23.8	-83.0	120	210	1.96	1.92	1.96	5.29	6
R14	16	14	22.9	-56.9	120	210	1.89	1.78	1.89	5.66	6
	11	14	19.2	-74.4	120	210	1.58	1.53	1.58	5.29	6
EJ8	16	14	25.8	-55.2	120	210	2.13	2.00	2.13	5.66	6
	11	14	21.3	-73.3	120	210	1.76	1.69	1.76	5.29	6

	tu	tw	Stress		Allowable Value		Fillet Welding Size				
Section	tl	tw	τ	σ	τa	σa	S1	S2	Sreq	$\sqrt{(2 \cdot t)}$	S
	(mm)	(mm)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(mm)	(mm)	(mm)	(mm)	(mm)
R15	16	14	31.4	-53.8	120	210	2.59	2.43	2.59	5.66	6
	11	14	25.4	-76.5	120	210	2.10	2.03	2.10	5.29	6
R16	16	14	22.7	-52.5	120	210	1.87	1.76	1.87	5.66	6
	11	14	19.1	-68.1	120	210	1.58	1.51	1.58	5.29	6
EJ9	16	14	25.7	-50.9	120	210	2.12	1.98	2.12	5.66	6
	11	14	21.3	-67.1	120	210	1.76	1.68	1.76	5.29	6
R17	16	14	31.4	-49.5	120	210	2.59	2.42	2.59	5.66	6
	11	14	25.5	-70.6	120	210	2.10	2.02	2.10	5.29	6
R18	16	14	21.5	-49.8	120	210	1.77	1.66	1.77	5.66	6
	11	14	18.6	-62.5	120	210	1.53	1.46	1.53	5.29	6
EJ10	16	14	24.8	-48.9	120	210	2.05	1.91	2.05	5.66	6
	11	14	21.1	-62.0	120	210	1.74	1.65	1.74	5.29	6
R19	16	14	31.0	-48.4	120	210	2.56	2.39	2.56	5.66	6
	11	14	25.7	-66.3	120	210	2.12	2.02	2.12	5.29	6
EJ11	16	14	23.4	-50.9	120	210	1.93	1.81	1.93	5.66	6
	11	14	20.6	-57.6	120	210	1.70	1.60	1.70	5.29	6
EJ12	16	14	42.8	-43.8	120	210	3.53	3.28	3.53	5.66	6
	11	14	35.3	-80.5	120	210	2.91	2.84	2.91	5.29	6
EJ13	16	17	46.9	-24.1	120	210	4.70	4.31	4.70	5.83	6
	15	17	40.1	-103.7	120	210	4.02	4.11	4.11	5.83	6
P11L	16	17	45.2	-18.3	120	210	4.53	4.15	4.53	5.83	9
	15	17	38.8	-108.9	120	210	3.89	4.03	4.03	5.83	6
P11	16	17	55.0	31.9	120	210	5.51	5.08	5.51	5.83	9
	15	17	48.3	-125.6	120	210	4.84	5.27	5.27	5.83	6
P11R	16	17	52.5	-15.1	120	210	5.26	4.81	5.26	5.83	9
	15	17	46.3	-114.0	120	210	4.64	4.87	4.87	5.83	6
EJ14	16	17	54.3	-21.6	120	210	5.44	4.99	5.44	5.83	6
	15	17	47.7	-110.9	120	210	4.78	4.98	4.98	5.83	6
EJ15	16	14	52.1	-44.1	120	210	4.30	4.00	4.30	5.66	6
	11	14	44.9	-91.6	120	210	3.70	3.69	3.70	5.29	6
EJ16	16	14	33.2	-53.2	120	210	2.74	2.57	2.74	5.66	6
	11	14	30.6	-67.1	120	210	2.52	2.41	2.52	5.29	6
R30	16	14	40.3	-51.2	120	210	3.32	3.11	3.32	5.66	6
	11	14	35.5	-75.2	120	210	2.93	2.83	2.93	5.29	6
EJ17	16	14	34.3	-51.5	120	210	2.83	2.65	2.83	5.66	6
	11	14	30.9	-68.7	120	210	2.55	2.44	2.55	5.29	6
R31	16	14	31.0	-52.2	120	210	2.56	2.40	2.56	5.66	6
	11	14	28.5	-68.8	120	210	2.35	2.25	2.35	5.29	6
R32	16	14	40.5	-51.4	120	210	3.34	3.13	3.34	5.66	6
	11	14	35.2	-73.3	120	210	2.90	2.80	2.90	5.29	6
EJ18	16	14	34.6	-51.8	120	210	2.85	2.67	2.85	5.66	6
	11	14	30.7	-65.3	120	210	2.53	2.41	2.53	5.29	6
R33	16	14	31.4	-52.9	120	210	2.59	2.43	2.59	5.66	6
	11	14	28.2	-64.1	120	210	2.33	2.21	2.33	5.29	6
R34	16	14	39.2	-53.0	120	210	3.23	3.03	3.23	5.66	6
	11	14	33.7	-67.0	120	210	2.78	2.65	2.78	5.29	6
EJ19	16	14	33.4	-53.3	120	210	2.75	2.59	2.75	5.66	6
	11	14	29.3	-59.6	120	210	2.42	2.28	2.42	5.29	6
R35	16	14	30.1	-54.5	120	210	2.48	2.33	2.48	5.66	6
	11	14	26.9	-58.5	120	210	2.22	2.09	2.22	5.29	6

Section	tu	tw	Stress		Allowable Value		Fillet Welding Size				
	tl	tw	τ	σ	τa	σa	S1	S2	Sreq	√(2・t)	S
	(mm)	(mm)	(N/mm²)	(N/mm²)	(N/mm²)	(N/mm²)	(mm)	(mm)	(mm)	(mm)	(mm)
R36	16	14	36.0	-54.8	120	210	2.97	2.79	2.97	5.66	6
	11	14	30.9	-61.3	120	210	2.55	2.41	2.55	5.29	6
EJ20	16	14	30.2	-54.5	120	210	2.49	2.34	2.49	5.66	6
	11	14	26.6	-55.0	120	210	2.19	2.06	2.19	5.29	6
R37	16	14	27.0	-55.3	120	210	2.23	2.09	2.23	5.66	6
	11	14	24.2	-54.5	120	210	2.00	1.88	2.00	5.29	6
R38	16	14	30.5	-54.8	120	210	2.52	2.36	2.52	5.66	6
	11	14	26.5	-58.9	120	210	2.19	2.06	2.19	5.29	6
EJ21	16	14	24.8	-53.3	120	210	2.05	1.92	2.05	5.66	6
	11	14	22.2	-55.0	120	210	1.83	1.72	1.83	5.29	6
R39	16	14	25.2	-53.5	120	210	2.08	1.95	2.08	5.66	6
	11	14	22.5	-55.9	120	210	1.86	1.75	1.86	5.29	6
R40	16	14	32.5	-50.9	120	210	2.68	2.51	2.68	5.66	6
	11	14	27.6	-64.0	120	210	2.28	2.16	2.28	5.29	6
EJ22	16	14	26.4	-48.3	120	210	2.18	2.03	2.18	5.66	6
	11	14	23.0	-55.4	120	210	1.90	1.78	1.90	5.29	6
R41	16	14	23.3	-48.9	120	210	1.92	1.80	1.92	5.66	6
	11	14	20.7	-54.7	120	210	1.71	1.60	1.71	5.29	6
R42	16	14	32.5	-47.4	120	210	2.68	2.50	2.68	5.66	6
	11	14	27.4	-58.6	120	210	2.26	2.13	2.26	5.29	6
EJ23	16	14	27.1	-45.4	120	210	2.24	2.08	2.24	5.66	6
	11	14	23.4	-48.7	120	210	1.93	1.80	1.93	5.29	6
R43	16	14	24.2	-46.0	120	210	2.00	1.86	2.00	5.66	6
	11	14	21.3	-47.2	120	210	1.76	1.64	1.76	5.29	6
R44	16	14	33.2	-45.2	120	210	2.74	2.55	2.74	5.66	6
	11	14	27.8	-48.9	120	210	2.29	2.14	2.29	5.29	6
EJ24	16	14	27.9	-42.9	120	210	2.30	2.14	2.30	5.66	6
	11	14	23.9	-37.9	120	210	1.97	1.82	1.97	5.29	6
R45	16	14	25.0	-43.1	120	210	2.06	1.92	2.06	5.66	6
	11	14	21.8	-35.7	120	210	1.80	1.66	1.80	5.29	6
R46	16	14	34.1	-42.2	120	210	2.81	2.61	2.81	5.66	6
	11	14	28.4	-35.7	120	210	2.34	2.16	2.34	5.29	6
EJ25	16	14	28.9	-29.6	120	210	2.38	2.19	2.38	5.66	6
	11	14	24.6	-23.3	120	210	2.03	1.86	2.03	5.29	6
R47	16	14	26.1	-30.1	120	210	2.15	1.98	2.15	5.66	6
	11	14	22.5	85.0	120	210	1.86	1.82	1.86	5.29	6
R48	16	14	35.6	-29.8	120	210	2.94	2.70	2.94	5.66	6
	11	14	29.4	85.3	120	210	2.43	2.38	2.43	5.29	6
EJ26	16	14	30.8	-28.4	120	210	2.54	2.34	2.54	5.66	6
	11	14	25.9	89.7	120	210	2.14	2.12	2.14	5.29	6
R49	16	14	25.3	-28.9	120	210	2.09	1.92	2.09	5.66	6
	11	14	21.9	91.1	120	210	1.81	1.80	1.81	5.29	6

2) INNER WEB

Section	tu	tw	Stress		Additional		Composite		Allowable		Fillet Welding Size				
	tl	tw	$\tau 1$	$\sigma 1$	$\tau 2$	$\sigma 2$	$\Sigma \tau$	$\Sigma \sigma$	τa	σa	S1	S2	Sreq	$\sqrt{(2 \cdot t)}$	S
	(mm)	(mm)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(mm)	(mm)	(mm)	(mm)	(mm)
S1	16	14	26.4	0.0	-	-	26.4	0.0	120	210	2.18	1.99	2.18	5.66	6
	14	14	21.2	0.0	-	-	21.2	0.0	120	210	1.75	1.60	1.75	5.29	6
EJ1	16	14	25.1	37.1	-	-	25.1	37.1	120	210	2.07	1.92	2.07	5.66	6
	14	14	20.2	-10.8	-	-	20.2	-10.8	120	210	1.67	1.52	1.67	5.29	6
R1	16	14	29.2	-1.3	26.6	18.9	55.8	17.6	120	210	4.60	4.21	4.60	5.66	6
	14	14	23.4	-34.8	4.7	6.4	28.1	-28.4	120	210	2.32	2.13	2.32	5.29	6
R2	16	14	19.0	-2.4	-	-	19.0	-2.4	120	210	1.57	1.43	1.57	5.66	6
	14	14	15.4	-45.5	-	-	15.4	-45.5	120	210	1.27	1.18	1.27	5.29	6
EJ2	16	14	17.8	-30.6	-	-	17.8	-30.6	120	210	1.47	1.35	1.47	5.66	6
	14	14	14.4	-51.4	-	-	14.4	-51.4	120	210	1.19	1.11	1.19	5.29	6
R3	16	14	21.9	-39.2	26.6	18.9	48.5	-20.3	120	210	4.00	3.67	4.00	5.66	6
	14	14	17.6	-68.9	4.7	6.4	22.3	-62.5	120	210	1.84	1.74	1.84	5.29	6
R4	16	14	13.8	-45.8	-	-	13.8	-45.8	120	210	1.14	1.06	1.14	5.66	6
	14	14	11.2	-72.9	-	-	11.2	-72.9	120	210	0.92	0.89	0.92	5.29	6
EJ3	16	14	13.7	-46.9	-	-	13.7	-46.9	120	210	1.13	1.05	1.13	5.66	6
	14	14	11.2	-76.3	-	-	11.2	-76.3	120	210	0.92	0.89	0.92	5.29	6
R5	16	14	19.1	-52.4	26.6	18.9	45.7	-33.5	120	210	3.77	3.48	3.77	5.66	6
	14	14	15.3	-94.7	4.7	6.4	20.0	-88.3	120	210	1.65	1.63	1.65	5.29	6
R6	16	14	10.2	-55.9	-	-	10.2	-55.9	120	210	0.84	0.79	0.84	5.66	6
	14	14	8.3	-91.3	-	-	8.3	-91.3	120	210	0.68	0.68	0.68	5.29	6
EJ4	16	14	12.3	-55.9	-	-	12.3	-55.9	120	210	1.01	0.95	1.01	5.66	6
	14	14	10.0	-91.6	-	-	10.0	-91.6	120	210	0.82	0.82	0.82	5.29	6
R7	16	14	17.3	-59.0	21.9	14.9	39.2	-44.1	120	210	3.23	3.01	3.23	5.66	6
	14	14	13.9	-97.8	2.4	4.5	16.3	-93.3	120	210	1.34	1.34	1.34	5.29	6
R8	16	14	9.8	-60.7	-	-	9.8	-60.7	120	210	0.81	0.77	0.81	5.66	6
	14	14	8.0	-91.7	-	-	8.0	-91.7	120	210	0.66	0.66	0.66	5.29	6
EJ5	16	14	12.3	-60.1	-	-	12.3	-60.1	120	210	1.01	0.96	1.01	5.66	6
	14	14	9.9	-91.3	-	-	9.9	-91.3	120	210	0.82	0.81	0.82	5.29	6
R9	16	14	20.7	-62.0	21.9	14.9	42.6	-47.1	120	210	3.51	3.28	3.51	5.66	6
	14	14	16.5	-97.0	2.4	4.5	18.9	-92.5	120	210	1.56	1.55	1.56	5.29	6
R10	16	14	13.0	-64.1	-	-	13.0	-64.1	120	210	1.07	1.02	1.07	5.66	6
	14	14	10.5	-85.5	-	-	10.5	-85.5	120	210	0.87	0.85	0.87	5.29	6
EJ6	16	14	11.1	-65.6	-	-	11.1	-65.6	120	210	0.92	0.87	0.92	5.66	6
	11	14	8.5	-92.1	-	-	8.5	-92.1	120	210	0.70	0.70	0.70	5.29	6
R11	16	14	17.6	-65.9	13.2	8.6	30.8	-57.3	120	210	2.54	2.39	2.54	5.66	6
	11	14	13.3	-92.4	1.0	2.5	14.3	-89.9	120	210	1.18	1.17	1.18	5.29	6
R12	16	14	12.7	-65.3	-	-	12.7	-65.3	120	210	1.05	1.00	1.05	5.66	6
	11	14	9.7	-82.4	-	-	9.7	-82.4	120	210	0.80	0.78	0.80	5.29	6
EJ7	16	14	15.7	-63.8	-	-	15.7	-63.8	120	210	1.29	1.23	1.29	5.66	6
	11	14	11.9	-80.7	-	-	11.9	-80.7	120	210	0.98	0.96	0.98	5.29	6
R13	16	14	21.0	-62.5	13.2	8.6	34.2	-53.9	120	210	2.82	2.65	2.82	5.66	6
	11	14	15.8	-83.0	1.0	2.5	16.8	-80.5	120	210	1.39	1.35	1.39	5.29	6
R14	16	14	14.6	-60.8	-	-	14.6	-60.8	120	210	1.20	1.14	1.20	5.66	6
	11	14	11.1	-74.4	-	-	11.1	-74.4	120	210	0.92	0.88	0.92	5.29	6
EJ8	16	14	17.6	-58.8	-	-	17.6	-58.8	120	210	1.45	1.37	1.45	5.66	6
	11	14	13.3	-73.3	-	-	13.3	-73.3	120	210	1.10	1.06	1.10	5.29	6

Section	tu	tw	Stress		Additional		Composite		Allowable		Fillet Welding Size				
	tl	tw	$\tau 1$	$\sigma 1$	$\tau 2$	$\sigma 2$	$\Sigma \tau$	$\Sigma \sigma$	τa	σa	S1	S2	Sreq	$\sqrt{(2 \cdot t)}$	S
	(mm)	(mm)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(mm)	(mm)	(mm)	(mm)	(mm)
R15	16	14	22.9	-56.9	13.2	8.6	36.1	-48.3	120	210	2.98	2.78	2.98	5.66	6
	11	14	17.2	-76.5	1.0	2.5	18.2	-74.0	120	210	1.50	1.45	1.50	5.29	6
R16	16	14	14.2	-55.4	-	-	14.2	-55.4	120	210	1.17	1.10	1.17	5.66	6
	11	14	10.8	-68.1	-	-	10.8	-68.1	120	210	0.89	0.85	0.89	5.29	6
EJ9	16	14	17.1	-53.6	-	-	17.1	-53.6	120	210	1.41	1.32	1.41	5.66	6
	11	14	13.0	-67.1	-	-	13.0	-67.1	120	210	1.07	1.02	1.07	5.29	6
R17	16	14	22.5	-51.7	16.1	9.4	38.6	-42.3	120	210	3.18	2.96	3.18	5.66	6
	11	14	16.9	-70.6	0.8	1.8	17.7	-68.8	120	210	1.46	1.40	1.46	5.29	6
R18	16	14	12.0	-52.1	-	-	12.0	-52.1	120	210	0.99	0.93	0.99	5.66	6
	11	14	9.2	-62.5	-	-	9.2	-62.5	120	210	0.76	0.72	0.76	5.29	6
EJ10	16	14	15.0	-51.1	-	-	15.0	-51.1	120	210	1.24	1.16	1.24	5.66	6
	11	14	11.4	-62.0	-	-	11.4	-62.0	120	210	0.94	0.89	0.94	5.29	6
R19	16	14	20.5	-50.3	16.1	9.4	36.6	-40.9	120	210	3.02	2.80	3.02	5.66	6
	11	14	15.5	-66.4	0.8	1.8	16.3	-64.6	120	210	1.34	1.28	1.34	5.29	6
EJ11	16	14	11.9	-53.1	-	-	11.9	-53.1	120	210	0.98	0.92	0.98	5.66	6
	11	14	9.2	-57.7	-	-	9.2	-57.7	120	210	0.76	0.72	0.76	5.29	6
EJ12	16	14	29.1	-44.9	-	-	29.1	-44.9	120	210	2.40	2.23	2.40	5.66	6
	11	14	22.0	-80.6	-	-	22.0	-80.6	120	210	1.81	1.77	1.81	5.29	6
EJ13	16	18	31.9	-23.4	-	-	31.9	-23.4	120	210	3.38	3.10	3.38	6.00	6
	15	18	25.5	-103.6	-	-	25.5	-103.6	120	210	2.70	2.76	2.76	6.00	6
P11L	16	35	19.1	27.8	-	-	19.1	27.8	120	210	3.94	3.62	3.94	8.37	9
	15	35	13.9	-108.8	-	-	13.9	-108.8	120	210	2.87	2.97	2.97	8.37	9
P11	16	35	20.6	37.9	-	-	20.6	37.9	120	210	4.25	3.93	4.25	8.37	9
	15	35	15.2	-125.4	-	-	15.2	-125.4	120	210	3.13	3.41	3.41	8.37	9
P11R	16	35	19.3	30.3	-	-	19.3	30.3	120	210	3.98	3.66	3.98	8.37	9
	15	35	14.3	-113.9	-	-	14.3	-113.9	120	210	2.95	3.10	3.10	8.37	9
EJ14	16	18	32.1	-20.2	-	-	32.1	-20.2	120	210	3.40	3.12	3.40	6.00	6
	15	18	25.9	-110.4	-	-	25.9	-110.4	120	210	2.75	2.86	2.86	6.00	6
EJ15	16	14	29.3	-44.6	-	-	29.3	-44.6	120	210	2.42	2.25	2.42	5.66	6
	11	14	22.5	-91.6	-	-	22.5	-91.6	120	210	1.86	1.85	1.86	5.29	6
EJ16	16	14	12.2	-55.1	-	-	12.2	-55.1	120	210	1.01	0.95	1.01	5.66	6
	11	14	9.8	-67.2	-	-	9.8	-67.2	120	210	0.81	0.77	0.81	5.29	6
R30	16	14	20.3	-52.8	15.3	8.4	35.6	-44.4	120	210	2.94	2.73	2.94	5.66	6
	11	14	15.7	-75.3	1.9	1.3	17.6	-74.0	120	210	1.45	1.40	1.45	5.29	6
EJ17	16	14	14.9	-53.4	-	-	14.9	-53.4	120	210	1.23	1.15	1.23	5.66	6
	11	14	11.7	-68.7	-	-	11.7	-68.7	120	210	0.97	0.92	0.97	5.29	6
R31	16	14	11.9	-54.3	-	-	11.9	-54.3	120	210	0.98	0.92	0.98	5.66	6
	11	14	9.5	-68.9	-	-	9.5	-68.9	120	210	0.78	0.75	0.78	5.29	6
R32	16	14	22.1	-53.3	15.3	8.4	37.4	-44.9	120	210	3.08	2.87	3.08	5.66	6
	11	14	17.0	-73.4	1.9	1.3	18.9	-72.1	120	210	1.56	1.50	1.56	5.29	6
EJ18	16	14	16.7	-54.1	-	-	16.7	-54.1	120	210	1.38	1.29	1.38	5.66	6
	11	14	13.0	-65.3	-	-	13.0	-65.3	120	210	1.07	1.02	1.07	5.29	6
R33	16	14	13.8	-55.3	-	-	13.8	-55.3	120	210	1.14	1.07	1.14	5.66	6
	11	14	10.8	-64.2	-	-	10.8	-64.2	120	210	0.89	0.85	0.89	5.29	6
R34	16	14	22.3	-55.5	13.5	8.8	35.8	-46.7	120	210	2.95	2.75	2.95	5.66	6
	11	14	17.1	-67.0	1.0	2.4	18.1	-64.6	120	210	1.49	1.42	1.49	5.29	6
EJ19	16	14	17.0	-56.1	-	-	17.0	-56.1	120	210	1.40	1.32	1.40	5.66	6
	11	14	13.1	-59.7	-	-	13.1	-59.7	120	210	1.08	1.02	1.08	5.29	6
R35	16	14	14.0	-57.5	-	-	14.0	-57.5	120	210	1.15	1.09	1.15	5.66	6
	11	14	10.9	-58.5	-	-	10.9	-58.5	120	210	0.90	0.85	0.90	5.29	6

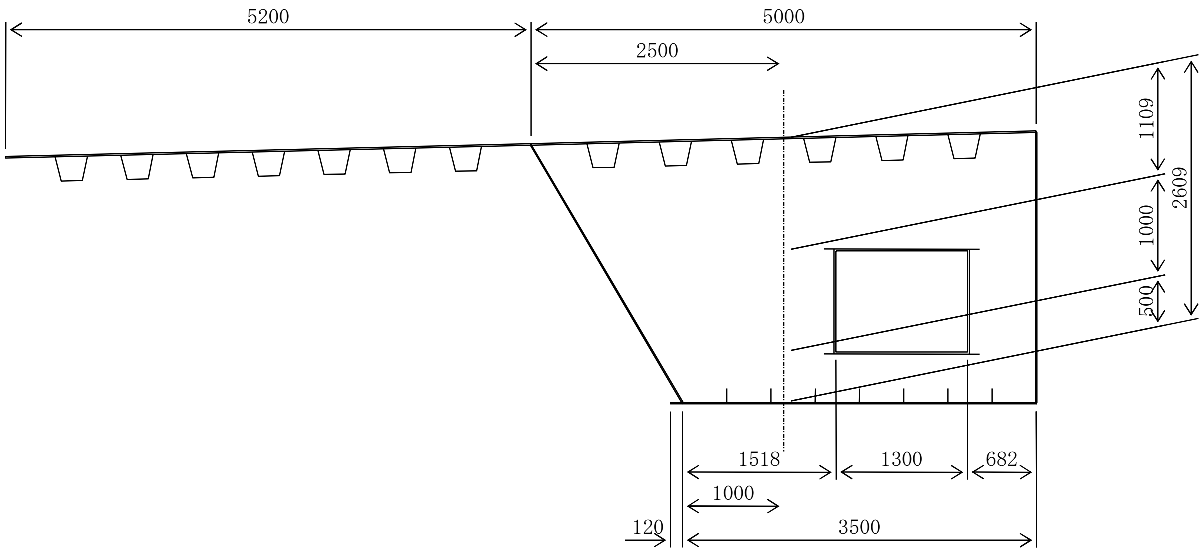
Section	tu	tw	Stress		Additional		Composite		Allowable		Fillet Welding Size				
	tl	tw	τ1	σ1	τ2	σ2	Στ	Σσ	τa	σa	S1	S2	Sreq	√(2·t)	S
	(mm)	(mm)	(N/mm²)	(N/mm²)	(N/mm²)	(N/mm²)	(N/mm²)	(N/mm²)	(N/mm²)	(N/mm²)	(mm)	(mm)	(mm)	(mm)	(mm)
R36	16	14	20.5	-57.8	13.5	8.8	34.0	-49.0	120	210	2.80	2.62	2.80	5.66	6
	11	14	15.7	-61.3	1.0	2.4	16.7	-58.9	120	210	1.38	1.30	1.38	5.29	6
EJ20	16	14	15.2	-57.9	-	-	15.2	-57.9	120	210	1.25	1.18	1.25	5.66	6
	11	14	11.8	-55.0	-	-	11.8	-55.0	120	210	0.97	0.92	0.97	5.29	6
R37	16	14	12.2	-58.9	-	-	12.2	-58.9	120	210	1.01	0.95	1.01	5.66	6
	11	14	9.6	-54.5	-	-	9.6	-54.5	120	210	0.79	0.74	0.79	5.29	6
R38	16	14	16.4	-58.2	13.5	8.8	29.9	-49.4	120	210	2.47	2.31	2.47	5.66	6
	11	14	12.6	-58.9	1.0	2.4	13.6	-56.5	120	210	1.12	1.06	1.12	5.29	6
EJ21	16	14	11.1	-57.0	-	-	11.1	-57.0	120	210	0.92	0.86	0.92	5.66	6
	11	14	8.7	-55.0	-	-	8.7	-55.0	120	210	0.72	0.67	0.72	5.29	6
R39	16	14	11.8	-57.1	-	-	11.8	-57.1	120	210	0.97	0.92	0.97	5.66	6
	11	14	9.2	-55.9	-	-	9.2	-55.9	120	210	0.76	0.71	0.76	5.29	6
R40	16	14	19.6	-54.2	22.7	15.4	42.3	-38.8	120	210	3.49	3.23	3.49	5.66	6
	11	14	15.0	-64.0	2.5	4.6	17.5	-59.4	120	210	1.44	1.36	1.44	5.29	6
EJ22	16	14	14.0	-50.7	-	-	14.0	-50.7	120	210	1.15	1.08	1.15	5.66	6
	11	14	10.8	-55.4	-	-	10.8	-55.4	120	210	0.89	0.84	0.89	5.29	6
R41	16	14	11.1	-51.4	-	-	11.1	-51.4	120	210	0.92	0.86	0.92	5.66	6
	11	14	8.7	-54.6	-	-	8.7	-54.6	120	210	0.72	0.67	0.72	5.29	6
R42	16	14	20.4	-50.4	22.7	15.4	43.1	-35.0	120	210	3.56	3.28	3.56	5.66	6
	11	14	15.5	-58.6	2.5	4.6	18.0	-54.0	120	210	1.48	1.39	1.48	5.29	6
EJ23	16	14	15.2	-48.7	-	-	15.2	-48.7	120	210	1.25	1.17	1.25	5.66	6
	11	14	11.7	-48.7	-	-	11.7	-48.7	120	210	0.97	0.90	0.97	5.29	6
R43	16	14	12.3	-49.4	-	-	12.3	-49.4	120	210	1.01	0.95	1.01	5.66	6
	11	14	9.5	-47.2	-	-	9.5	-47.2	120	210	0.78	0.73	0.78	5.29	6
R44	16	14	21.3	-48.5	22.6	16.1	43.9	-32.4	120	210	3.62	3.34	3.62	5.66	6
	11	14	16.2	-48.9	4.0	5.4	20.2	-43.5	120	210	1.67	1.55	1.67	5.29	6
EJ24	16	14	16.2	-46.4	-	-	16.2	-46.4	120	210	1.34	1.25	1.34	5.66	6
	11	14	12.4	-37.9	-	-	12.4	-37.9	120	210	1.02	0.95	1.02	5.29	6
R45	16	14	13.4	-46.9	-	-	13.4	-46.9	120	210	1.11	1.03	1.11	5.66	6
	11	14	10.3	-35.7	-	-	10.3	-35.7	120	210	0.85	0.79	0.85	5.29	6
R46	16	14	22.4	-45.6	22.6	16.1	45.0	-29.5	120	210	3.71	3.42	3.71	5.66	6
	11	14	17.0	-35.7	4.0	5.4	21.0	-30.3	120	210	1.73	1.60	1.73	5.29	6
EJ25	16	14	17.4	-41.6	-	-	17.4	-41.6	120	210	1.44	1.33	1.44	5.66	6
	11	14	13.3	-23.4	-	-	13.3	-23.4	120	210	1.10	1.01	1.10	5.29	6
R47	16	14	14.6	-41.9	-	-	14.6	-41.9	120	210	1.20	1.12	1.20	5.66	6
	11	14	11.2	-20.5	-	-	11.2	-20.5	120	210	0.92	0.85	0.92	5.29	6
R48	16	14	24.0	-40.1	22.6	16.1	46.6	-24.0	120	210	3.84	3.53	3.84	5.66	6
	11	14	18.2	-19.7	4.0	5.4	22.2	-14.3	120	210	1.83	1.67	1.83	5.29	6
EJ26	16	14	19.3	-4.2	-	-	19.3	-4.2	120	210	1.59	1.45	1.59	5.66	6
	11	14	14.6	89.4	-	-	14.6	89.4	120	210	1.20	1.19	1.20	5.29	6
R49	16	14	13.9	-5.7	-	-	13.9	-5.7	120	210	1.15	1.05	1.15	5.66	6
	11	14	10.7	91.0	-	-	10.7	91.0	120	210	0.88	0.88	0.88	5.29	6

３．９． Calculation for Intermediate Diaphragm (Excerpt)

３．９．１． Cross Section Calculation of Intermediate Diaohragm

（１）Left/Right ＣＥＬＬ Diaphragm Ｄ１～Ｄ１０

１）Design Principle



(a) Diaphragm

Equivalent Span Length	Lu	=	92.000 m
Diaphragm Spacing	Ld	=	4.500 m
Diaphragm Thickness	Td	=	9 mm (SM400)
Open Area Width	b	=	1300 mm
Open Area Height	h	=	1000 mm

(b) Girder Cross Section

Upper Flange

Web Spacing	Bu = 5000 mm ,	Tu = 16 mm ,	Au = 800.16 cm^2	
Left Overhang	BuL = 5200 mm ,	TuL = 16 mm ,	AuL = 832.17 cm^2	
Right Overhang	BuR = 0 mm ,	TuR = 9 mm ,	AuR = 0.00 cm^2	
Gradient	= 2.00 %			
Rib (left)	7-U-320*240*8	A = 377.30 cm^2	Iy = 7195 cm^4	
Rib (Right)	6-U-320*240*8	A = 323.40 cm^2	Iy = 7195 cm^4	
Upper Flange Area Total	Fu = 2333.0 cm^2			

Bottom Flange

Web Spacing BL = 3500 mm , TL = 14 mm , AL = 490.00 cm^2

Left Overhang BLL = 120 mm , TLL = 14 mm , ALL = 16.80 cm^2

Right Overhang BLR = 0 mm , TLR = 14 mm , ALR = 0.00 cm^2

Rib 7-PL 160* 16 A = 179.20 cm^2

Bottom Flange Area Total FL = 686.0 cm^2

Web

Height Hw = 2609 mm

Thickness Tw = 14 mm

Web Area Total Fh = 393.8 cm^2

2) Evaluation for Diaphragm Spacing

Diaphragm Spacing Limit

Lu = 92.000 > 50.000 m therefore,

Ldreq = 0.14 * Lu - 1.0 = 0.14 * 92.000 - 1.0 = 11.880 m > Ld = 4.500 m

3) Calculatuion of Open Area Ratio ρ

$\rho = \sqrt{\ } \{ (b * h) / ((Bu+BL) * Hw / 2) \}$

$= \sqrt{\ } \{ (1300 * 1000) / ((5000+3500) * 2609 / 2) \} = 0.34 < 0.40$

Therefore, calculated as filled plate method.

4) Calculation of Required Rigidity for Diaphragm

(a) Warp Constant Idw

e = IL / BL + ((Bu + 2 * BL) / 12) * Fh

= 6906425 / 350.0 + ((500.0 + 2 * 350.0) / 12) * 393.8 = 59109 cm^3

f = Iu / Bu + ((2 * Bu + BL) / 12) * Fh

= 361300262 / 500.0 + ((2 * 500.0 + 350.0) / 12) * 393.8 = 766899 cm^3

$\alpha 1$ = e / (e + f) * (Bu + BL) / 4 * Hw

= 59109 / (59109 + 766899) * (500.0 + 350.0) / 4 * 260.9 = 3967 cm^2

$\alpha 2$ = f / (e + f) * (Bu + BL) / 4 * Hw

= 766899 / (59109 + 766899) * (500.0 + 350.0) / 4 * 260.9 = 51474 cm^2

$Idw = 1/3 \{ \alpha 1^2 * Fu * (1 + (bu1 + bu2) / Bu)^2$

$+ \alpha 2^2 * FL * (1 + (bL1 + bL2) / BL)^2$

$+ 2 * (\alpha 1^2 - \alpha 1 * \alpha 2 + \alpha 2^2) * Fh \}$

$= 1/3 \{ 3967^2 * 2333.0 * (1 + (520.0 + 0.0) / 500.0)^2$

$+ 51474^2 * 686.0 * (1 + (12.0 + 0.0) / 350.0)^2$

$+ 2 * (3967^2 - 3967 * 51474 + 51474^2) * 393.8 \}$

$= 1.345*10^{12}\ cm^6 = 1.345*10^{18}\ mm^6$

Iu : Second Moment of Inertia around Vertical Axis at Upper Flange with Rib

= 361300262 cm^4

IL : Second Moment of Inertia around Vertical Axis at Bottom Flange with Rib

= 6906425 cm^4

Fu : Total Area of Upper Flange with Rib = 2333.0 cm^2

FL : Total Area of Bottom Flange with Rib = 686.0 cm^2

Fh : Area per web = 393.8 cm^2

Hw : Height of Web = 260.9 cm

(b) Required Rigidity Kreq

Kreq = 20 * Es * Idw / Ld^3

= 20 * 2.0*10^5 * 1.345*10^{18} / 11880.0^3 = 3.209*10^{12} N·mm

Es : Young's Modulus of Steel = 2.0*10^5 N/mm^2

Idw : Wrap Constant

Ldreq : Diaphragm Spacing Limit

5) Calculation of Actual Rigidity of Diaphragm

K = 4 * Gs * A * td

= 4 * 7.7*10^4 * 260.9 * (500.0+350.0) * 10^3 / 2 * 0.9 = 3.074*10^{13} N·mm

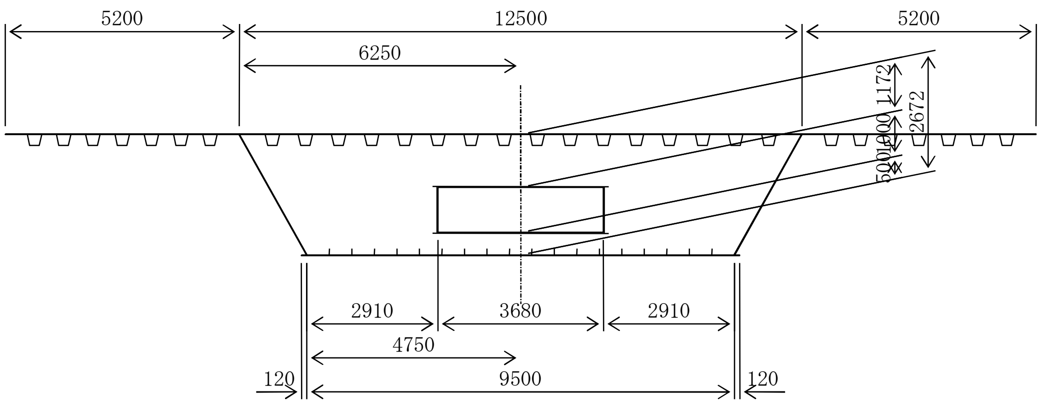
> Kreq = 3.209*10^{12} N·mm

Gs : Elastic Shear Modulud of Steel = 7.7*10^4 N/mm^2

A : Area of Girder

(2) Evaluation as a 1-box girder (Diaphragm Ｄ１～Ｄ１０)

1）Design Principle



(a) Diaphragm

Equivalent Span Length Lu = 92.000 m

Diaphragm Spacing Ld = 4.500 m

Diaphragm Thickness Td = 9 mm (SM400)

Open Area Width b = 3680 mm

Open Area Height h = 1000 mm

(b) Girder Cross Section

Upper Flange

Web Spacing Bu = 12500 mm , Tu = 16 mm , Au = 2000.00 cm^2

Left Overhang BuL = 5200 mm , TuL = 16 mm , AuL = 832.00 cm^2

Right Overhang BuR = 5200 mm , TuR = 16 mm , AuR = 832.00 cm^2

Rib 30-U-320*240*8 A = 1617.00 cm^2 Iy = 7195 cm^4

Upper Flange Area Total Fu = 5281.0 cm^2

Bottom Flange

Web Spacing BL = 9500 mm , TL = 14 mm , AL = 1330.00 cm^2

Left Overhang BLL = 120 mm , TLL = 14 mm , ALL = 16.80 cm^2

Right Overhang BLR = 120 mm , TLR = 14 mm , ALR = 16.80 cm^2

Rib 18-PL 160* 16 A = 460.80 cm^2

Bottom Flange Area Total FL = 1824.4 cm^2

Web

Height	Hw	=	2672 mm
Thickness	Tw	=	14 mm
Web Area Total	Fh	=	429.0 cm^2

2）Evaluation for Diaphragm Spacing

Diaphragm Spacing Limit

Lu = 92.000 > 50.000 m therefore,

Ldreq = 0.14 * Lu - 1.0 = 0.14 * 92.000 - 1.0 = 11.880 m > Ld = 4.500 m

3）Calculatuion of Open Area Ratio ρ

$\rho = \sqrt{\ } \{ (b * h) / ((Bu+BL) * Hw / 2) \}$

$= \sqrt{\ } \{ (3680 * 1000) / ((12500+9500) * 2672 / 2) \} = 0.35 < 0.40$

Therefore, calculated as filled plate method.

4）Calculation of Required Rigidity for Diaphragm

(a) Warp Constant Idw

$e = IL / BL + ((Bu + 2 * BL) / 12) * Fh$

$= 138809216 / 950.0 + ((1250.0 + 2 * 950.0) / 12) * 429.0 = 258726\ cm^3$

$f = Iu / Bu + ((2 * Bu + BL) / 12) * Fh$

$= -1990697705 / 1250.0 + ((2 * 1250.0 + 950.0) / 12) * 429.0 = 1966751\ cm^3$

$\alpha 1 = e / (e + f) * (Bu + BL) / 4 * Hw$

$= 258726 / (258726 + 1966751) * (1250.0 + 950.0) / 4 * 267.2 = 17085\ cm^2$

$\alpha 2 = f / (e + f) * (Bu + BL) / 4 * Hw$

$= 1966751 / (258726 + 1966751) * (1250.0 + 950.0) / 4 * 267.2 = 129875\ cm^2$

$Idw = 1/3 \{ \alpha 1^2 * Fu * (1 + (bu1 + bu2) / Bu)^2$

$+ \alpha 2^2 * FL * (1 + (bL1 + bL2) / BL)^2$

$+ 2 * (\alpha 1^2 - \alpha 1 * \alpha 2 + \alpha 2^2) * Fh \}$

$= 1/3 \{ 17085^2 * 5281.0 * (1 + (520.0 + 520.0) / 1250.0)^2$

$+ 129875^2 * 1824.4 * (1 + (12.0 + 12.0) / 950.0)^2$

$+ 2 * (17085^2 - 17085 * 129875 + 129875^2) * 429.0 \}$

$= 1.678*10^{13}\ cm^6 = 1.678*10^{19}\ mm^6$

Iu : Second Moment of Inertia around Vertical Axis at Upper Flange with Rib

= -1990697705 cm^4

IL : Second Moment of Inertia around Vertical Axis at Bottom Flange with Rib

= 138809216 cm^4

Fu : Total Area of Upper Flange with Rib = 5281.0 cm^2

FL : Total Area of Bottom Flange with Rib = 1824.4 cm^2

Fh : Area per web = 429.0 cm^2

Hw : Height of Web = 267.2 cm

(b) Required Rigidity Kreq

Kreq = 20 * Es * Idw / Ld^3

= 20 * 2.0*10^5 * 1.678*10^{19} / 11880.0^3 = 4.003*10^{13} N・mm

Es : Young's Modulus of Steel = 2.0*10^5 N/mm^2

Idw : Wrap Constant

Ldreq : Diaphragm Spacing Limit

5) Calculation of Actual Rigidity of Diaphragm

(a) Actual Rigidity

K = 4 * Gs * A * td

= 4 * 7.7*10^4 * 267.2 * (1250.0+950.0) * 10^3 / 2 * 0.9 = 8.147*10^{13} N・mm

> Kreq = 4.003*10^{13} N・mm

Gs : Elastic Shear Modulud of Steel = 7.7*10^4 N/mm^2

A : Area of Girder

3．9．2　Calculation for Diaphragm Longitudinal Joint

Calculated by 75% of full strength.

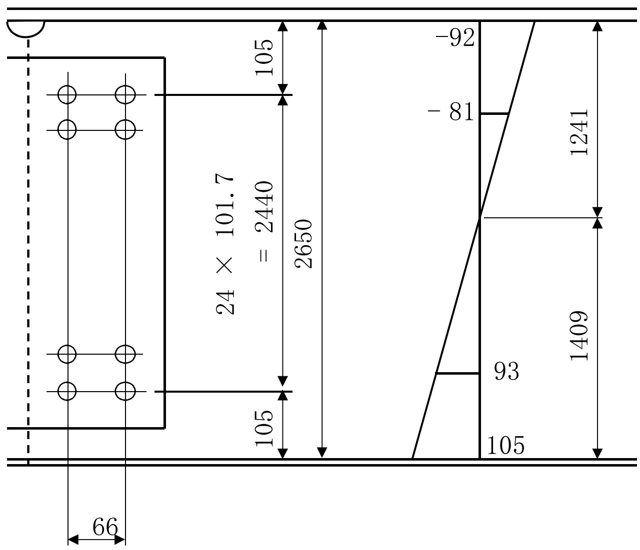
< SJ3～SJ6 >　　Web Section　　2650 × 9　　(SM400)

Spacing of Fixd Points L = 1500 mm

Deck Effective Width λ = 2 x 0.15L = 450 mm

				$A (cm^2)$	y (cm)	$Ay (cm^3)$	$Ay^2 (cm^4)$	
Deck	450	x	16	72	-133.3	-9597.6	1279360	*Girder DECK Min
Web	2650	x	9	238.5			1395722	
Flange	450	x	11	49.5	133.05	6585.975	876264	*Girder LFLG Min
				360		-3011.625	3551346	
							-25402	
			δ =	-8.4 cm		Is =	3525944	

Yu = 1241 mm　　Yl = 1409 mm



Sharing Width of edge bolt due to Bending Moment

b1 = 105 + 102 / 2 = 156 mm (upper edge)

b2 = 105 + 102 / 2 = 156 mm (lower edge)

Total of sharing force

P1 = 156 × 9 × (-92 + -81)/ 2 = -121560 N

P2 = 156 × 9 × (105 + 93)/ 2 = 139119 N

Required Bolt No.

n1 = -121560 / 108000 = -1.1 → 2 nos.

n2 = 139119 / 108000 = 1.3 → 2 nos.

Splice (SS400)

2 - SPL PL 2520 × 9 = 45360 mm^2

Is = 9 × 2520^3/ 12 × 2 + 45360 × -84^2 = 24324572160 mm^4 > Iw

Iw = 9 × 2650^3/ 12 + 23850 × -84^2 = 14125504350 mm^4

Mw = 105 × 14125504350 / 1409 = 1052645817 N/mm^2

σs = 1052645817 / 24324572160 × 1354

= 59 N/mm^2 < σta = 140 N/mm^2

３．９．３． Calculation for Stiffener od Diaphragm

(１) Left/Right ＣＥＬＬ Diaphragm

＊Calculation Conditions

Web Material： SM400　　Web Hwight(b)： 2659 mm　　Web Thickness(t)： 9 mm

Horizontal Stiffener： 1 layer

Vertical Stiffener Spacing (a)： 5000 mm

＊Cross Section of Horizontal Stiffener

Section　1-PL　　140 ＊ 11 (SM400)

$Ih = 1.1 * 14.0^3 / 3 = 1006\ cm^4$

Required Rigidity　$Ih{\cdot}req = b*t^3*\gamma h{\cdot}req/11 = 265.9*0.9^3*56.41/11 = 994 < 1006\ cm^4$

$\gamma h{\cdot}req = 30*(a/b) = 30 * (500.0/265.9) = 56.41$

3.9.4 Welding Calculation for Girder and Diaphragm

Calculate welding of girder flange and diaphragm.

Max Cable Tension 6617 kN (C1)

Cable Angle θ = 26° 67'31" = 27.12528 °

$P = 6617 / 2 = 3309$ kN

$P1 = P \sin\theta = 1508$ kN

Shear Stress due to the cable

DIA Cross Section

$\tau = 1508 \times 1000 / (2700 \times 9) = 62$ kN/mm^2

Welding for Girder Flange and Diaphragm

$S1 = \tau \cdot tw / (\tau a \cdot 0.707 \cdot 2)$

$= 62 \times 9 / (80 \times 0.707 \times 2) = 4.9$ mm

$S2 = \sqrt{2t} = \sqrt{(2 \cdot 9)} = 4.2$ mm

∴ Fillet Weld S = 6 mm

３．１０． Calculation for Rib (Excerpt)

３．１０．１ Explanation of Equations

Required Cross Section Area of Longitudinal Rib

$AL\cdot req = b * t / (10*n)$

Required Rigidity of Longitudinal Rib

$IL\cdot req = b * t^3 / 11 * \gamma L\cdot req$

Rigidity Ratio of Longi. Rib and Required Rigidity of Trans. Rib

1) $\alpha \leqq \alpha 0$ and in case rigidity of trans. rib satisfy "Ic・req"

$\gamma L\cdot req = 4\alpha^2 n*(t0/t)^2 *(1+n*\delta L) - (\alpha^2+1)^2/n$ (t≧t0)

$= 4\alpha^2 n*(1+n*\delta L) - (\alpha^2+1)^2/n$ (t＜t0) ･････ (4.2.5)

Where, required rigidity of trans. rib is:

$Ic\cdot req = (b*t^3/11)*\{ (1+ n*\gamma L\cdot req)/(4*\alpha^3) \}$ ･･････････････････････ (4.2.6)

2) other than 1)

$\gamma L\cdot req = [\{2n^2*(t0/t)^2*(1+n*\delta L) - 1\}^2 -1] / n$ (t≧t0)

$= [\{2n^2*(1+n*\delta L) - 1\}^2 -1] / n$ (t＜t0) ･･････ (4.2.7)

Where,

t	: Thickness of stiffened plate	b	: Total width of stiffened plate
a	: Trans. rib spacing	n	: No. of panels devided by trans. rib
α	: Aspect ratio of stiffened plate		$\alpha = a / b$
$\alpha 0$	: Limit aspect ratio		$\alpha 0 = \sqrt[4]{(1+n*\gamma L)}$
δL	: Section area ratio of 1-longi. rib		$\delta L = AL / (b*t)$
γL	: Rigidity ratio of longi. rib		$\gamma L = IL / (b*t^3/11)$
t0	: Thickness at「JSHB・Table-4.2.6」		t0 = b / (k*f*n)

SM400:k=28 SM490:k=24 SM490Y:k=22 SM570:k=22

f : Coefficient decided by strass gradient (=1) 「JSHBⅡ 4.2.4」

AL : Section area of 1-longi. rib

IL : 2nd moment of inertia of 1-longi. rib

Ic : 2nd moment of inertia of 1-trans. rib

３．１０．２． Calculation for Longitudinal Rib

(１) Girder Left/Right CELL　Name：LFLG

Section No.：Sec- 1　(2nd panel)

panel length： 4500 mm　　no. of Trans. rib ： 1　　trans. rib spacing(a)： 2250 mm

plate material：　SM490Y　　width(b)： 3500 mm　　thickness(t)　：　14 mm

no. of longi. rib： 7　longi. Rib height ： 160 mm　　longi. Rib thickness：　16 mm

$AL = 16.0 * 1.6 = 25.60\ cm^2$　　　$IL = 16.0^3 * 1.6 / 3 = 2185\ cm^4$

$\delta L = 25.60 / (350.0*1.4) = 0.052$　　　$\gamma L = 2185 / (350.0*1.4^3/11) = 25.02$

$\alpha = 225.00 / 350.0 = 0.643$　　　$\alpha 0 = \sqrt[4]{(1+8*25.02)} = 3.766$

$t0 = 350.0 / (22*1.000*8) = 1.99\ cm$　　　$t = 1.4\ cm$

$\alpha \leqq \alpha 0$、$Ic{\cdot}req \leqq Ic$、$t < t0$、therefore, fromn「JSHBⅡ・Eq(4.2.5)」

$\gamma L{\cdot}req = 4 * 0.643^2 * 8 * (1+8*0.052) - (0.643^2+1)^2 / 8 = 18.502$

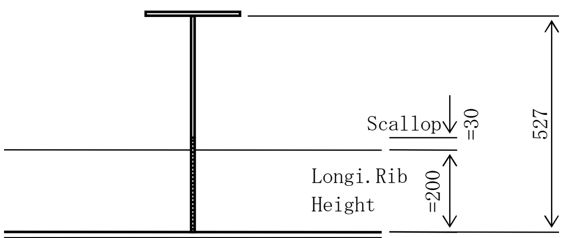
$AL{\cdot}req = 350.0 * 1.4 / (10*8) = 6.13\ cm^2 < AL = 25.60\ cm^2$

$IL{\cdot}req = 350.0 * 1.4^3 * 18.502 / 11 = 1615\ cm^4 < IL = 2185\ cm^4$

$Ic{\cdot}req = 350.0 * 1.4^3 * (1+8*18.502) / (11*4*0.643^3) = 12243\ cm^4 < Ic = 106947\ cm^4$

３．１０．３． Calculation for Transverse Rib

Trans. rib section　R1～R22,R27～R49



				Ag(cm²)	I(cm⁴)
1-WEB	PL	527* 9	(SM400　) =	47.43	43909
1-FLG	PL	230*10	(SM400　) =	23.00	65096

$\Sigma Ag = 70.43\ cm^2 \quad 109004\ cm^4$

$Ic = 109004 - 0.9 * (20.0 + 3.0)^3 / 3 = 105354\ cm^4 \geqq Ic{\cdot}req = 17106\ cm^4$

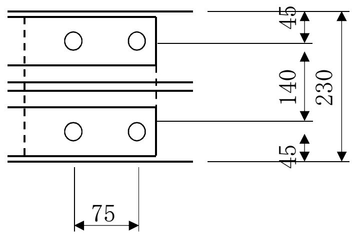
3．10．4．Calculation for Trans. Rib Longi. Joint

Calculate by 75% of full strength.

Flange Section 230 × 10 (SM400)

Basde Metal Total Area Ag = 23.0 cm^2

Bolt Arrangement



Required No. of Bolt $= \frac{105 \times 2300}{108000} = 2.2 < 4$ nos.

Required Area of Splice

AgR = 23.0 cm^2

Use TCB M22 S10T

Splice (SS400)

1 - SPL PL	220 ×	9	=	19.8	cm^2
2 - SPL PL	80 ×	9	=	14.4	cm^2
				34.2	cm^2 > AgR

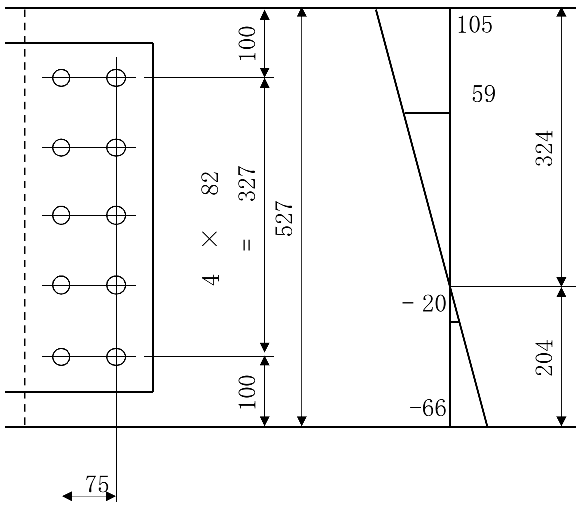
Web Section 527 × 9 (SM400) : R1～R22,R27～R49

Spacing of Fixed Points L = 1500 mm (Min)
Deck Effective Width λ = 2 x 0.15L
= 450 mm

				$A(cm^2)$	y(cm)	$Ay(cm^3)$	$Ay^2(cm^4)$	
Flange	230	x	10	23	-26.9	-617.55	16581	
Web	527	x	9	47.43			10977.23873	
Flange	450	x	11	49.5	26.9	1331.55	35819	*Girder FLG Min
				119.93		714	63377.23873	
							-4317	

δ = 6.0 cm Is = 59060

Yu = 324 mm Yl = 204 mm



Sharing width of edge bolt due to bending moment
b1 = 100 + 82 / 2 = 141 mm (upper edge)
b2 = 100 + 82 / 2 = 141 mm (lower edgr)

Total od sharing force
P1 = 141 × 9 × (105 + 59)/ 2 = 104140 N
P2 = 141 × 9 × (-66 + -20)/ 2 = 54758 N

Required Bolt No.
n1 = 104140 / 108000 = 0.96 → 2 nos.
n2 = 54758 / 108000 = 0.5 → 2 nos.

Splice (SS400)
2 - SPL PL 407 × 9 = 7326 mm^2
Is = 9 × 407^3/ 12 × 2 + 7326 × 60^2 = 127502315 mm^4 > Iw
Iw = 9 × 527^3/ 12 + 4743 × 60^2 = 126847187 mm^4
Mw = 105 × 126847187 / 324 = 41171421 N/mm^2
σs = 41171421 / 127502315 × 264
= 85 N/mm^2 < σta = 140 N/mm^2

３．１１． Calculation for Intermediate Stiffener (Excerpt)

３．１１．１. Explanation of Equations

Evaluation of vertical stiffener spacing

Followings K1,K2 shall be satisfied.

$K1 = a/b \leqq 1.5$

1) In case without horizontal stiffener

$K2 = [b/(100*t)]^4 * [(\sigma/345)^2 + \{\tau/(77+58*(b/a)^2)\}^2] \leqq 1 : (a/b > 1)$

$K2 = [b/(100*t)]^4 * [(\sigma/345)^2 + \{\tau/(58+77*(b/a)^2)\}^2] \leqq 1 : (a/b \leqq 1)$

2) In case with 1-layer horizontal stiffener

$K2 = [b/(100*t)]^4 * [(\sigma/900)^2 + \{\tau/(120+58*(b/a)^2)\}^2] \leqq 1 : (a/b > 0.80)$

$K2 = [b/(100*t)]^4 * [(\sigma/900)^2 + \{\tau/(90+77*(b/a)^2)\}^2] \leqq 1 : (a/b \leqq 0.80)$

3) In case with 2-layers horizontal stiffener

$K2 = [b/(100*t)]^4 * [(\sigma/3000)^2 + \{\tau/(187+58*(b/a)^2)\}^2] \leqq 1 : (a/b > 0.64)$

$K2 = [b/(100*t)]^4 * [(\sigma/3000)^2 + \{\tau/(140+77*(b/a)^2)\}^2] \leqq 1 : (a/b \leqq 0.64)$

Required rigidity of vertical stiffener

$Iv \cdot req = b * t^3 / 11 * \gamma v \cdot req$ $\quad\quad$ $\gamma v \cdot req = 8.0 * (b/a)^2$

Min plate width : b/30 + 50 (mm)

Min plate thickness : 1/13 of width of stifener

Required rigidity of horizontal stiffener

$Ih \cdot req = b * t^3 / 11 * \gamma h \cdot req$ $\quad\quad$ $\gamma h \cdot req = 30 * (a/b)$

Where,

a : Spacing of Vertical Stiffener

b : Width of Web

t : Thickness of Web

σ : Edge compressive stress of web

τ : Shear stress of web

３．１１．２． Cross Section of Stiffener

＊Section of Vertical Stiffener

Secton No.：VStfNo = 1
1-PL 140 * 11
$Iv = 1.1 * 14.0^3 / 3 = 1006\ cm^4 \geqq 741\ cm^4$

Section No.：VStfNo = 2
1-PL 170 * 14
$Iv = 1.4 * 17.0^3 / 3 = 2293\ cm^4 \geqq 1913\ cm^4$

Section No.：VStfNo = 3
1-PL 190 * 15
$Iv = 1.5 * 19.0^3 / 3 = 3429\ cm^4 \geqq 2998\ cm^4$

＊Section of Horizontal Stiffener

Section No.：HStfNo = 1
1-PL 160 * 16
$Ih = 1.6 * 16.0^3 / 3 = 2185\ cm^4 \geqq 1684\ cm^4$

Section No.：HStfNo = 2
1-PL 200 * 20
$Ih = 2.0 * 20.0^3 / 3 = 5333\ cm^4 \geqq 3579\ cm^4$

３．１１．３． Calculation for Required Rigidity and Spacing Evaluation

(１) Girder　Web Name：WEB-1+L , WEB-4+R

(ａ) Section Dimension and Evaluation of Web Thickness

No.	Section No.	Spacing (mm)	Stiff. No.	Stiff. Spacing (mm)	Stiff. layer	Stress σc (N/mm²)	τ	Web Material	Web Height (mm)	Web Thick. (mm)	Req. Thick. (mm)
2	1	4500	1	2250	2	-35	45	SM490Y	3044	14	10.4
3	1	4500	1	2250	2	-46	34	SM490Y	3044	14	10.4
4	1	4500	1	2250	2	-69	36	SM490Y	3044	14	10.4
5	1	4500	1	2250	2	-73	26	SM490Y	3044	14	10.4
6	1	4500	1	2250	2	-95	31	SM490Y	3044	14	10.4
7	1	4500	1	2250	2	-92	20	SM490Y	3044	14	10.4
8	1	4500	1	2250	2	-98	28	SM490Y	3044	14	10.4
9	1	4500	1	2250	2	-92	18	SM490Y	3044	14	10.4
10	1	4500	1	2250	2	-97	30	SM490Y	3044	14	10.4
11	1	4500	1	2250	2	-86	22	SM490Y	3044	14	10.4
11	2	4500	1	2250	2	-92	20	SM490Y	3044	14	10.4
12	2	4500	1	2250	2	-93	27	SM490Y	3044	14	10.4
13	2	4500	1	2250	2	-83	21	SM490Y	3044	14	10.4
14	2	4500	1	2250	2	-83	30	SM490Y	3044	14	10.4
15	2	4500	1	2250	2	-75	23	SM490Y	3044	14	10.4
16	2	4500	1	2250	2	-77	32	SM490Y	3044	14	10.4
17	2	4500	1	2250	2	-69	23	SM490Y	3044	14	10.4
18	2	4500	1	2250	2	-71	32	SM490Y	3044	14	10.4
19	2	4500	1	2250	2	-63	22	SM490Y	3044	14	10.4
20	2	4500	1	2250	2	-67	32	SM490Y	3044	14	10.4
21	2	4500	1	2250	2	-58	24	SM490Y	3044	14	10.4
22	2	4500	1	2250	2	-81	44	SM490Y	3044	14	10.4
23	2	4500	1	2250	2	-81	44	SM490Y	3044	14	10.4
23	3	4500	1	2250	2	-104	49	SM490Y	3044	17	10.4
24	3	4083	1	2042	2	-104	49	SM490Y	3044	17	10.4
25	3	3667	1	1833	2	-104	49	SM490Y	3044	17	10.4

No.	Section No.	Section Spacing (mm)	Stiff. No.	Stiff. Spacing (mm)	Stiff. layer	Stress σc (N/mm²)	Stress τ (N/mm²)	Web Material	Web Height (mm)	Web Thick. (mm)	Req. Thick. (mm)
28	3	3667	1	1833	2	−110	56	SM490Y	3044	17	10.4
29	3	4083	1	2042	2	−110	56	SM490Y	3044	17	10.4
30	3	4500	1	2250	2	−110	56	SM490Y	3044	17	10.4
30	4	4500	1	2250	2	−92	53	SM490Y	3044	14	10.4
31	4	4500	1	2250	2	−92	53	SM490Y	3044	14	10.4
32	4	4500	1	2250	2	−68	34	SM490Y	3044	14	10.4
33	4	4500	1	2250	2	−76	41	SM490Y	3044	14	10.4
34	4	4500	1	2250	2	−69	31	SM490Y	3044	14	10.4
35	4	4500	1	2250	2	−74	41	SM490Y	3044	14	10.4
36	4	4500	1	2250	2	−65	32	SM490Y	3044	14	10.4
37	4	4500	1	2250	2	−67	40	SM490Y	3044	14	10.4
38	4	4500	1	2250	2	−59	31	SM490Y	3044	14	10.4
39	4	4500	1	2250	2	−62	37	SM490Y	3044	14	10.4
40	4	4500	1	2250	2	−56	27	SM490Y	3044	14	10.4
41	4	4500	1	2250	2	−59	31	SM490Y	3044	14	10.4
42	5	4500	1	2250	2	−56	26	SM490Y	3044	14	10.4
43	5	4500	1	2250	2	−64	33	SM490Y	3044	14	10.4
44	5	4500	1	2250	2	−55	24	SM490Y	3044	14	10.4
45	5	4500	1	2250	2	−59	33	SM490Y	3044	14	10.4
46	5	4500	1	2250	2	−47	25	SM490Y	3044	14	10.4
47	5	4500	1	2250	2	−49	34	SM490Y	3044	14	10.4
48	5	4500	1	2250	2	−43	25	SM490Y	3044	14	10.4
49	5	4500	1	2250	2	−42	35	SM490Y	3044	14	10.4
50	5	4500	1	2250	2	−38	27	SM490Y	3044	14	10.4
51	5	4500	1	2250	2	−37	37	SM490Y	3044	14	10.4
53	5	3000	1	1500	2	−34	26	SM490Y	3044	14	10.4

(b) Spacing Evaluation and Required Rigidity

No.	Section No.	a/b	Spacing Evalu.	γv·req	Iv·req (cm^4)	Iv	VStf No	γh·req	Ih·req (cm^4)	Ih	HStf No
2	1	0.74	0.54	14.64	1112	2293	2	22.17	1684	2185	1
3	1	0.74	0.30	14.64	1112	2293	2	22.17	1684	2185	1
4	1	0.74	0.34	14.64	1112	2293	2	22.17	1684	2185	1
5	1	0.74	0.18	14.64	1112	2293	2	22.17	1684	2185	1
6	1	0.74	0.27	14.64	1112	2293	2	22.17	1684	2185	1
7	1	0.74	0.12	14.64	1112	2293	2	22.17	1684	2185	1
8	1	0.74	0.22	14.64	1112	2293	2	22.17	1684	2185	1
9	1	0.74	0.11	14.64	1112	2293	2	22.17	1684	2185	1
10	1	0.74	0.26	14.64	1112	2293	2	22.17	1684	2185	1
11	1	0.74	0.14	14.64	1112	2293	2	22.17	1684	2185	1
11	2	0.74	0.12	14.64	1112	2293	2	22.17	1684	2185	1
12	2	0.74	0.20	14.64	1112	2293	2	22.17	1684	2185	1
13	2	0.74	0.14	14.64	1112	2293	2	22.17	1684	2185	1
14	2	0.74	0.25	14.64	1112	2293	2	22.17	1684	2185	1
15	2	0.74	0.16	14.64	1112	2293	2	22.17	1684	2185	1
16	2	0.74	0.28	14.64	1112	2293	2	22.17	1684	2185	1
17	2	0.74	0.15	14.64	1112	2293	2	22.17	1684	2185	1
18	2	0.74	0.28	14.64	1112	2293	2	22.17	1684	2185	1
19	2	0.74	0.13	14.64	1112	2293	2	22.17	1684	2185	1
20	2	0.74	0.27	14.64	1112	2293	2	22.17	1684	2185	1
21	2	0.74	0.16	14.64	1112	2293	2	22.17	1684	2185	1
22	2	0.74	0.52	14.64	1112	2293	2	22.17	1684	2185	1
23	2	0.74	0.52	14.64	1112	3429	3	22.17	1684	2185	1
23	3	0.74	0.30	14.64	1991	3429	3	22.17	3015	5333	2
24	3	0.67	0.26	17.78	2418	3429	3	20.12	2736	5333	2
25	3	0.60	0.21	22.05	2998	3429	3	18.07	2457	5333	2
28	3	0.60	0.27	22.05	2998	3429	3	18.07	2457	5333	2
29	3	0.67	0.34	17.78	2418	3429	3	20.12	2736	5333	2

No.	Section No.	a/b	Spacing Evalu.	γv·req	Iv·req (cm^4)	Iv	VStf No	γh·req	Ih·req (cm^4)	Ih	HStf No
30	3	0.74	0.39	14.64	1991	3429	3	22.17	3015	5333	2
30	4	0.74	0.75	14.64	1112	3429	3	22.17	1684	2185	1
31	4	0.74	0.75	14.64	1112	2293	2	22.17	1684	2185	1
32	4	0.74	0.30	14.64	1112	2293	2	22.17	1684	2185	1
33	4	0.74	0.45	14.64	1112	2293	2	22.17	1684	2185	1
34	4	0.74	0.27	14.64	1112	2293	2	22.17	1684	2185	1
35	4	0.74	0.46	14.64	1112	2293	2	22.17	1684	2185	1
36	4	0.74	0.27	14.64	1112	2293	2	22.17	1684	2185	1
37	4	0.74	0.43	14.64	1112	2293	2	22.17	1684	2185	1
38	4	0.74	0.25	14.64	1112	2293	2	22.17	1684	2185	1
39	4	0.74	0.36	14.64	1112	2293	2	22.17	1684	2185	1
40	4	0.74	0.20	14.64	1112	2293	2	22.17	1684	2185	1
41	4	0.74	0.26	14.64	1112	2293	2	22.17	1684	2185	1
42	5	0.74	0.18	14.64	1112	2293	2	22.17	1684	2185	1
43	5	0.74	0.30	14.64	1112	2293	2	22.17	1684	2185	1
44	5	0.74	0.15	14.64	1112	2293	2	22.17	1684	2185	1
45	5	0.74	0.30	14.64	1112	2293	2	22.17	1684	2185	1
46	5	0.74	0.16	14.64	1112	2293	2	22.17	1684	2185	1
47	5	0.74	0.30	14.64	1112	2293	2	22.17	1684	2185	1
48	5	0.74	0.17	14.64	1112	2293	2	22.17	1684	2185	1
49	5	0.74	0.32	14.64	1112	2293	2	22.17	1684	2185	1
50	5	0.74	0.19	14.64	1112	2293	2	22.17	1684	2185	1
51	5	0.74	0.35	14.64	1112	2293	2	22.17	1684	2185	1
53	5	0.49	0.07	32.95	2502	2293	2	14.78	1123	2185	1

(c) Rigidity Evaluation for Vertical Stiffener by Max Spacng

No.	Section No.	a/b	Spacing Evalu.	Max Space	γv·req	Iv·req (cm^4)	Iv	VStf No	
53	5	0.49	0.07	4566	3.56	270	2293	2	[OK]

３．１１．４． Stress Evaluation for Horizontal Stiffener

（１）Girder　Web name：WEB-1+L , WEB-4+R

No.	Section No.	Web Material	Web Height (mm)	Edge Stress σc (N/mm²)	σt	Nutral Axis (mm)	Stiff. Layer	Stiff. Position (mm)	Stiff. Stress (N/mm²)	Stiff. Material
8	1	SM490Y	3044	-98	0	3044	2	426	-84	SM490Y
								1096	-63	SM490Y
12	2	SM490Y	3044	-93	0	3044	2	426	-80	SM490Y
								1096	-59	SM490Y
28	3	SM490Y	3044	-110	0	3044	2	426	-95	SM490Y
								1096	-71	SM490Y
30	4	SM490Y	3044	-92	0	3044	2	426	-79	SM490Y
								1096	-59	SM490Y
43	5	SM490Y	3044	-64	0	3044	2	426	-55	SM490Y
								1096	-41	SM490Y

（２）Girder　Web Name：WEB-2 , WEB-3

No.	Section No.	Web Material	Web Height (mm)	Edge Stress σc (N/mm²)	σt	Nutral Axis (mm)	Stiff. Layer	Stiff. Position (mm)	Stiff. Stress (N/mm²)	Stiff. Material
8	1	SM490Y	2659	-98	0	2659	2	372	-84	SM490Y
								957	-63	SM490Y
12	2	SM490Y	2659	-93	0	2659	2	372	-80	SM490Y
								957	-59	SM490Y
28	3	SM490Y	2659	-110	0	2659	2	372	-95	SM490Y
								957	-71	SM490Y
30	4	SM490Y	2659	-92	0	2659	2	372	-79	SM490Y
								957	-59	SM490Y
43	5	SM490Y	2659	-64	0	2659	2	372	-55	SM490Y
								957	-41	SM490Y

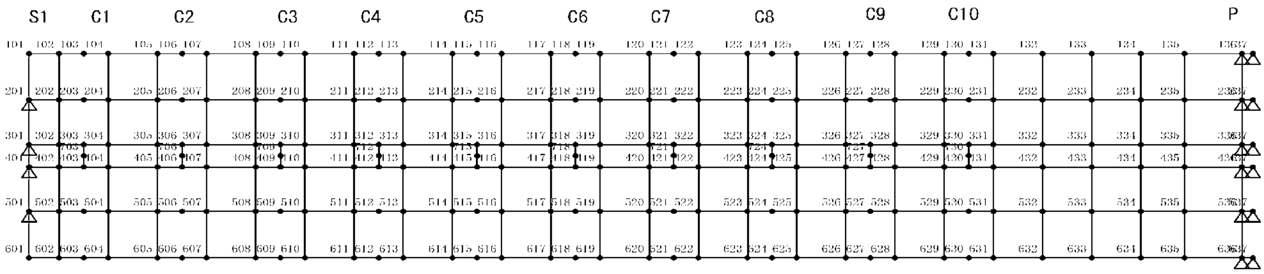
4. Evaluation of Girder Considering Girder Width

As the main girder is suspended by cable at the center of the cross section, arching upwards along the transverse direction, the top and bottom flange undergoes 2-axial stress in longitudinal and transverse.
Especially in the bottom flange, buckling is more likely to occur in this state than under uniaxial stress conditions and therefore, another evaluation is required.
Furthermore, an additional stress is occurred at girder because of the arrangement of cable anchor and transverse members, therefore evaluation of girder considering girder width was performed.

4．1　Analysis along the Transverse Direction　　　**(Excerpt)**

By considering the main girder to be a lattice structure comprised of the vertical girder, the web, the diaphragms and the brackets, stress in the transverse direction is determined through the lattice analysis.
The analysis shall be performed for dead and live load conditions. The effect of the cable shall be considered by applying the vertical component of the tension in the cable as load.

(1) Side Span Model



(2) Stress at Bottom Flange

	σY (N/mm^2)
C2 (C1)	32.3
C5 (C3,C4)	30.4
C9 (C6～C8,C10)	36.4
C12 (C11,C13～C15)	36.5
C16 (C17～C20)	37.2

(3) Bending Moment at Girder Center

The load is transferred from diaphragm to cable through girder center if a model has the cable anchor at diaphragm. Therefore, local stress will be occurred at the girder center similar to the stringer.
Here, the local stress was calculated.

(4) Stress Increment at Girder Center

Stress at Girder Center (N/mm^2)

	Section		Dead Load		Dead Load + Live Load	
			at anchor	at span	at anchor	at span
C4	Sec-1	σu	4.8	-2.4	6.4	-3.2
		σl	-5.6	2.8	-7.4	3.7
C5	Sec-1	σu	5.5	-2.7	7.1	-3.6
		σl	-6.3	3.2	-8.3	4.1
C6	Sec-2	σu	3.6	-1.8	4.6	-2.3
		σl	-4.6	2.3	-5.9	3.0
C8	Sec-2	σu	575.0	-2.4	6.3	-3.2
		σl	-6.2	3.1	-8.1	4.0
C11	Sec-2	σu	5.8	-2.9	7.5	-3.7
		σl	-7.4	3.7	-9.6	4.8
C16	Sec-2	σu	5.6	-2.8	7.6	-3.8
		σl	-7.1	3.6	-9.7	4.8

4．2　Buckling Evaluation for Bi-axial Compressive Stress State

(Excerpt)

The bottom flange buckling evaluation under the biaxial compressive stress condition was performed through the evaluation of stress in the transverse direction and allowable stress in the longitudinal direction.

In the bottom flange, there are two values of allowable compressive stress in the longitudinal direction, i.e., in the inner cell section and in the outer cell section. The allowable compressive stress in the inner cell is smaller than that in the outer cell; therefore, the evaluation was performed for the inner cell section.

Bi-axial buckling evaluation for trans. compressive stress and longi. allowable stress

Thickness t mm	Width B mm	Trans. Rib Distance L mm	Longi. Rib Distance b mm	Longi. Rib Section br * tr	Trans. σy N/mm2	Longi. Allowable σcal	ν>=1.7 for $\sigma x=\sigma cal$
14 (C1～C5)	2500	2250	500	160*16	32.3	147	1.76
	3500		470			157	
11 (C6～C10)	2500	2250	500	160*16	36.4	102	2.43
	3500		470			115	
11 (C11～C15)	2500	2250	500	160*16	36.5	102	2.42
	3500		470			115	
11 (C16～C20)	2500	2250	500	160*16	37.2	102	2.41
	3500		470			115	

Buckling Safty Ratio νmin = 1.76　>= 1.70

The calculation result shows that the buckling safety ratio ν is bigger than 1.7, and the safety for biaxial buckling is ensured.

4．3 Evaluation for Composite Stress with Additional Stress

Composite Stress of girder stress and additional stress was evaluated.

In the additional stress, uneven stress at anchor and stress caused by anchor fixing between diaphragm were included.

Evaluation for Composite Stress σ：Compressive +

		σM	σD	σs1	σs2	Σσ	σcal	Σσ<=σcal
C5	U.Flg	63.8	3.6	14.9	-5.8	82.3	131.6	OK
	Web	25.1	-	51.5	51.5	76.6	157.0	OK
	L.Flg	97.6	8.3	4.5	1.0	106.9	146.9	OK
C6	U.Flg	67.9	2.3	8.6	-3.9	78.8	131.6	OK
	Web	28.3	-	51.7	51.7	80.0	158.0	OK
	L.Flg	92.8	5.9	2.5	0.8	99.5	102.1	OK
C9	U.Flg	52.6	3.2	9.4	-5.5	65.2	131.6	OK
	Web	35.5	-	41.2	41.2	76.7	146.0	OK
	L.Flg	70.9	8.1	1.8	1.9	80.9	102.1	OK
C11	U.Flg	53.4	3.7	8.4	-5.7	65.5	131.6	OK
	Web	41.9	-	27.2	27.2	69.1	141.0	OK
	L.Flg	75.6	9.6	1.3	2.3	87.5	102.1	OK
C16	U.Flg	55.5	3.8	15.4	-5.9	74.7	131.6	OK
	Web	29.0	-	53.0	53.0	82.0	153.0	OK
	L.Flg	64.2	9.7	4.6	1.1	75.0	102.1	OK

σM : Girder system compressive stress. (Web: stress caused by axial force)

σD : Additional stress caused by anchor fixing between diaphragm

σs1:Max uneven stress at anchor, σs2: Uneven stress of trans. rib point

from the results, all of the section were within the allowable value.

5. Calculation for Bearing Support

5. 1. Design Principle

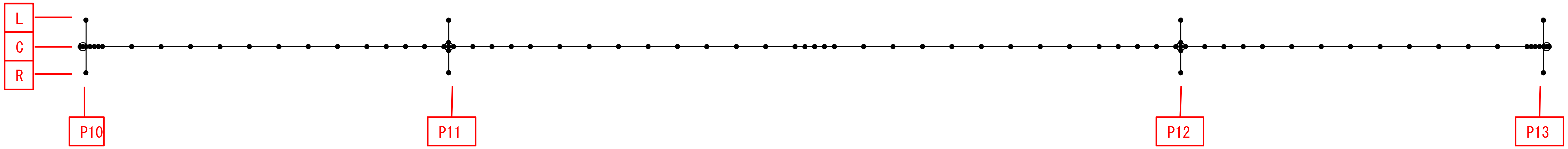
(1) Common

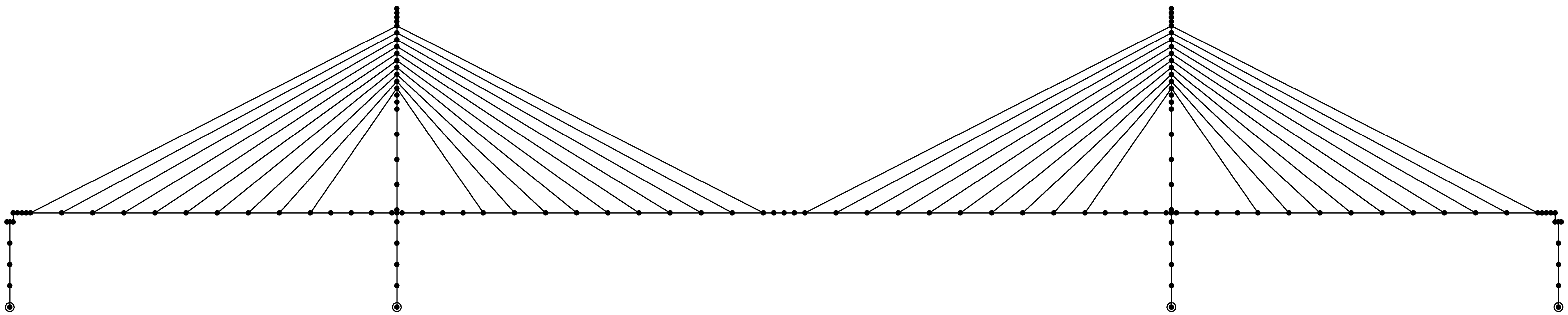
1) The maximum reaction force ae each load case shall be used as design force.

2) Considering maximum bearing movement at each load case.

3) Support Conditions

	End Pier : P10・P13				Intermediate Pier(Tower) : P11・P12			
	Type	Conditions			Type	Conditions		
		Longi.	Trans.	Vert.		Longi.	Trans.	Vert.
L	Rocking	Move	Move	Fix	Pin-roller	Move	Move	Fix
C	Horizontal	Move	Fix	Mo	Pivot	Fix	Fix	Fix
R	Rocking	Move	Move	Fix	Pin-roller	Move	Move	Fix

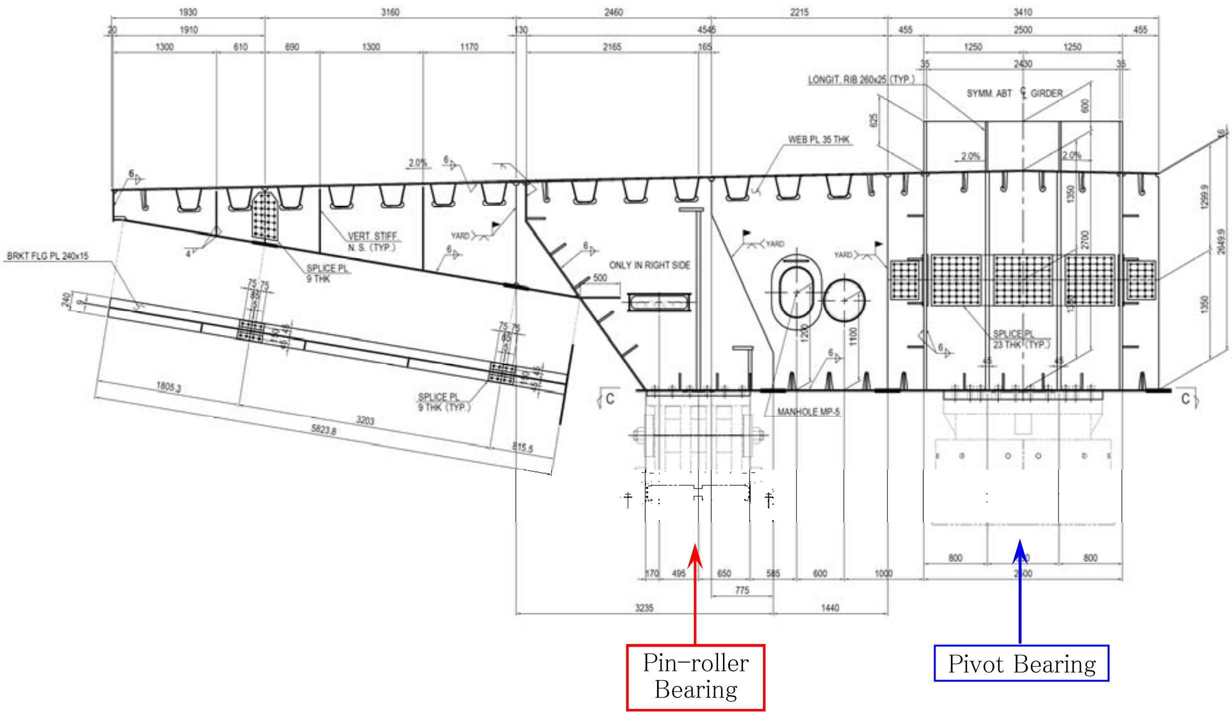




（2） Structure of Bearing

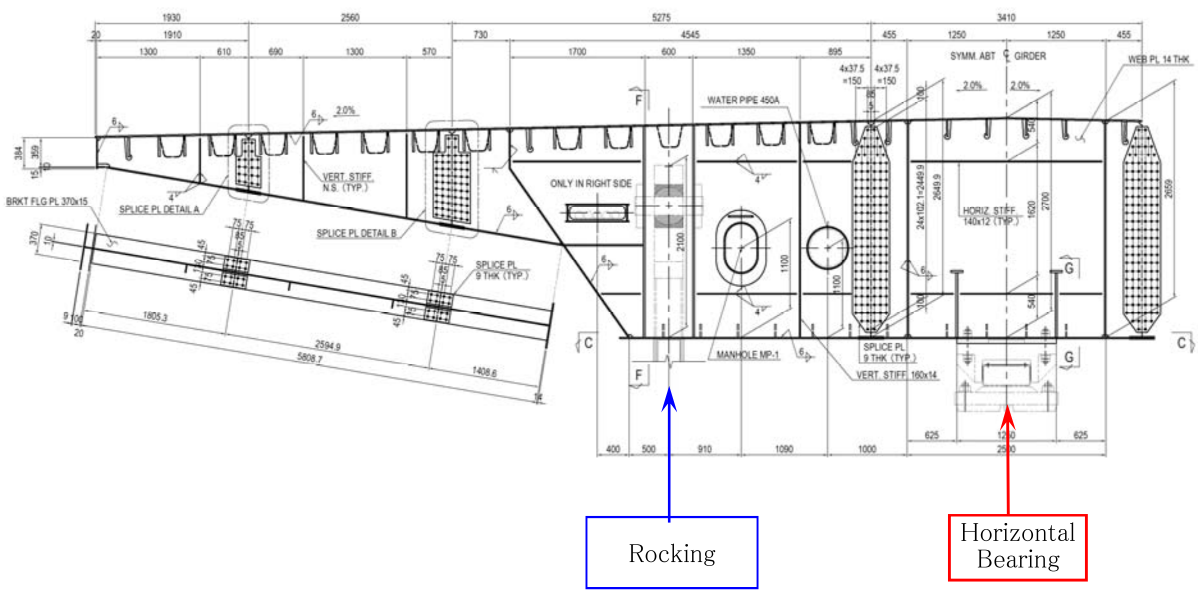
The structure of the support section at each position is shown below.

1） Support Section Underneath Main Tower



Pivot Bearing	:	Resist in vertical direction (±direction) Resist in longitudinal horizontal force (±direction) Resist in transverse horizontal force (only comp.)
Pin-roller Bearing	:	Resist in transverse horizontal force (only comp.)

2） Bearing at Ends



Rocking Bearing	:	Resist in vertical reaction force (±direction)
Horizontal Bearing	:	Resist in transverse reaction force (only comp.)

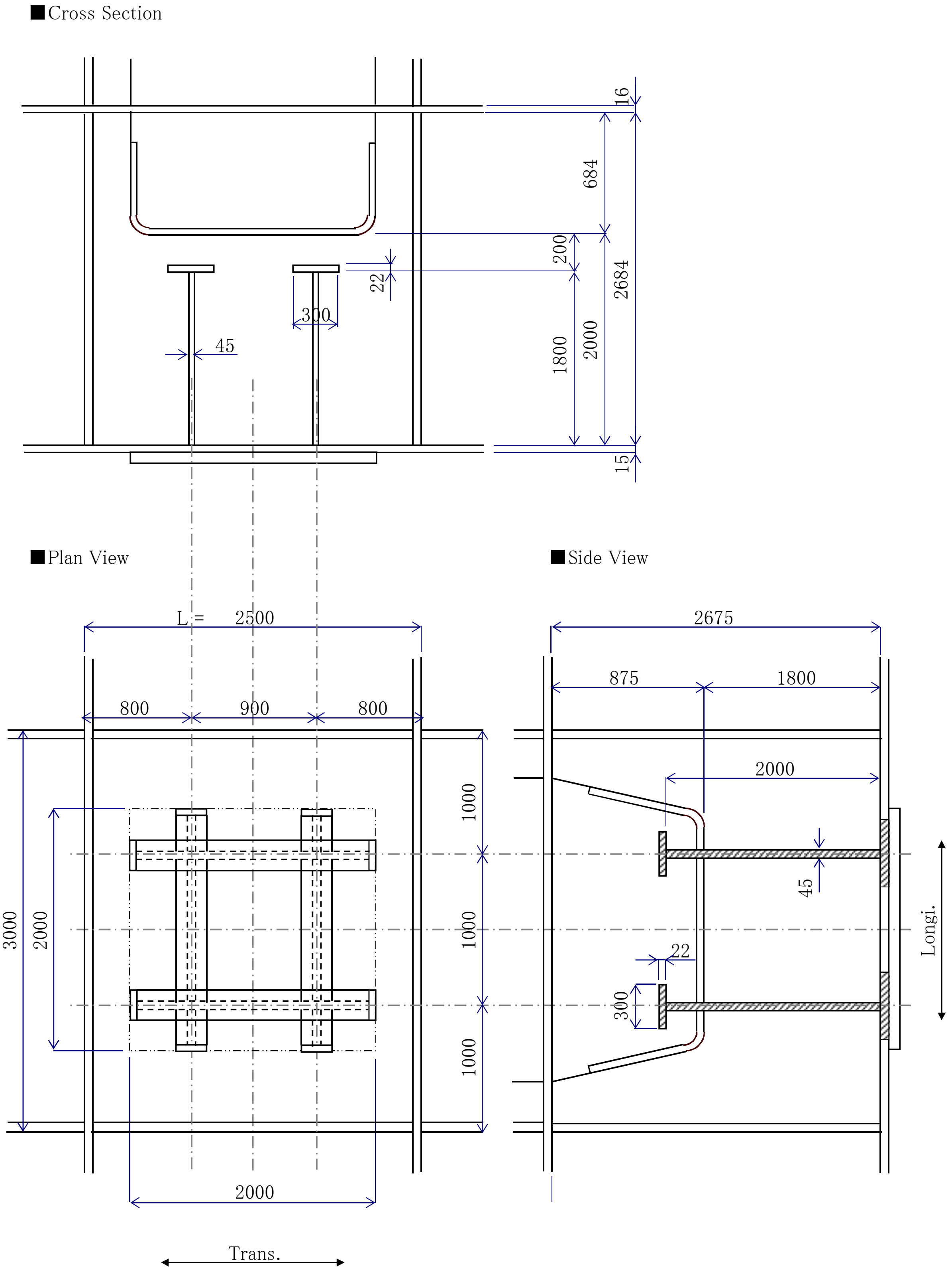
5. 2. Design Reaction Force

Design Conditions

				Cable Stayed Bridge						Remarks
				End(P10·P13)			Intermediate(P11·P12)			
				Rocking		Horizontal	Pin-roller		Pivot	
				L	R	C	L	R	C	
Span(m)				111.000		111.000	224.000		224.000	
Girder Height(m)				2.700		2.700	2.700		2.700	
Design Strength of Beam (N/mm2)				30		30	30		30	
Bearing Restriction Condition	Longi.			Mobable		Mobable	Mobable		Fixed	
	Trans.			Mobable		Fixed	Mobable		Fixed	
	Vert.			Fixed		Mobable	Fixed		Fixed	
Dead Load Reaction Force	Longi.		kN	—	—	—	—	—	1000	Per Bearing
	Trans.		kN	—	—	0	0	0	0	100 KN round up
	Vert.		kN	100	100	—	12400	12400	46200	
Regular Scenario Reaction Force	Longi.	|max|	kN	—	—	—	—	—	4800	Per Bearing
	Trans.	|max|	kN	—	—	100	0	0	100	100 KN round up
	Vert.	max	kN	3100	3100	—	20800	20800	57700	
		min	kN	-1800	-1800	—	7300	7300	44900	
Regular Scenario Reaction Force	Longi.	|max|	kN	—	—	—	—	—	9200	Per Bearing
	Trans.	|max|	kN	—	—	100	0	0	100	100 KN round up
	Vert.	max	kN	3200	3200	—	20900	20900	58000	
		min	kN	-1900	-1900	—	7100	7100	44200	
Wind Scenario Reaction Force (Trans.)	Longi.	|max|	kN	—	—	—	—	—	4800	Per Bearing
	Trans.	|max|	kN	—	—	200	0	0	2100	100 KN round up
	Vert.	max	kN	3100	3100	—	22300	22300	57700	
		min	kN	-1900	-1900	—	5800	5800	44900	
Wind + Temperature (Trans.)	Longi.	|max|	kN	—	—	—	—	—	9200	Per Bearing
	Trans.	|max|	kN	—	—	200	0	0	2100	100 KN round up
	Vert.	max	kN	3300	3300	—	22400	22400	58000	
		min	kN	-1900	-1900	—	5600	5600	44200	
Seismic Performance1 (Longi.)	Longi.	|max|	kN	—	—	—	3800	3800	17600	Per Bearing
	Trans.	|max|	kN	—	—	0	0	0	0	100 KN round up
	Vert.	max	kN	400	400	—	12500	12500	46300	kh=0.30
		min	kN	-200	-200	—	12400	12400	46100	
Seismic Performance1 (Trans.)	Longi.	|max|	kN	—	—	—	—	—	1000	Per Bearing
	Trans.	|max|	kN	—	—	1600	3800	3800	13700	100 KN round up
	Vert.	max	kN	700	700	—	17500	17500	46200	kh=0.30
		min	kN	-500	-500	—	7400	7400	46200	
Seismic Performance2 (Longi.)	Longi.	|max|	kN	—	—	—	5600	5600	25900	Per Bearing
	Trans.	|max|	kN	—	—	0	0	0	0	100 KN round up
	Vert.	max	kN	500	500	—	12500	12500	46400	kh=0.45
		min	kN	-300	-300	—	12400	12400	46000	
Seismic Performance2 (Trans.)	Longi.	|max|	kN	—	—	—	—	—	1000	Per Bearing
	Trans.	|max|	kN	—	—	6700	5600	5600	20500	100 KN round up
	Vert.	max	kN	1000	1000	—	20000	20000	46200	kh=0.45
		min	kN	-800	-800	—	4900	4900	46200	
Movement	Temperature		mm	68.0	68.0	68.0	—	—	—	25℃相当
	Wind (Longi.)		mm	—	—	—	—	—	—	
	Seismic performance1 (Longi.)		mm	55.8	55.8	55.8	—	—	—	
	Seismic performance2 (Longi.)		mm	83.8	83.8	83.8	—	—	—	
Girder Rotation			rad	1/140	1/140	—	1/230	1/230	1/230	1/10round down
Negative Evaluation	Dead	Rd	kN	100	100	—	12400	12400	46200	Per Bearing
	Live	Rl(min)	kN	-1900	-1900	—	-5100	-5100	-1300	100 KN round up
	Negative	Rd+2×Rl	kN	-3700	-3700	—	2200	2200	43600	
	Judge		—	Necessary	Necessary	—	OK	OK	OK	

5. 3. Calculation for Bearing Support Section (Excerpt: Pivot Bearing Section)

(1) Design Condition



Bearing Support Section Rtiffeners

(2) Calculation for Transverse Rib at Support Section

(a) Effective Width

[Trans] Deck and Bottom Flange

$b_1 = \frac{1000}{2} = 500$ mm l = 2500 mm $\frac{b}{l} = \frac{500}{2500} = 0.20$

$\frac{\lambda_{RL1}}{2} = \{1.1 - 2(b/l)\}b = 350$ mm

$b_2 = \frac{1000}{2} = 500$ mm l = 2500 mm $\frac{b}{l} = \frac{500}{2500} = 0.200$

$\frac{\lambda_{RL2}}{2} = \{1.1 - 2(b/l)\}b = 350$ mm $\therefore \lambda_{RL} = \lambda_{RL1} + \lambda_{RL2} = 700$ mm

[Longi] Deck and Bottom Flange

$b_1 = \frac{900}{2} = 450$ mm l = 3000 mm $\frac{b}{l} = \frac{450}{3000} = 0.15$

$\frac{\lambda_{RL1}}{2} = \{1.1 - 2(b/l)\}b = 360$ mm

$b_2 = \frac{800}{2} = 400$ mm l = 3000 mm $\frac{b}{l} = \frac{400}{3000} = 0.133$

$\frac{\lambda_{RL2}}{2} = \{1.1 - 2(b/l)\}b = 334$ mm $\therefore \lambda_{RL} = \lambda_{RL1} + \lambda_{RL2} = 694$ mm

(b) Rigidity

[Trans] Rigidity of Trans Rib at Support

	b(mm)		t(mm)	A(mm^2)	y(mm)	Ay(mm^3)	$Ay^2 + I$ (mm^4)
1 - U.Flg	300	×	22	6600	-1011.0	-6672600	674600 $\times 10^4$
1 - Web	2000	×	45	90000	-	-	3000000 $\times 10^4$
1 - L.Flg	700	×	15	10500	1007.5	10578750	1065809 $\times 10^4$
			A =	107100		3906150	4740409 $\times 10^4$
						$-\Sigma A \cdot \delta^2 =$	-14268 $\times 10^4$
$\delta = \Sigma(A \cdot y) / \Sigma A =$				36.5	mm		4726141 $\times 10^4$

[Longi] Rigidity of Trans Rib at Support

	b(mm)		t(mm)	A(mm^2)	y(mm)	Ay(mm^3)	$Ay^2 + I$ (mm^4)
1 - U.Flg	300	×	22	6600	-911.0	-6012600	547748 $\times 10^4$
1 - Web	1800	×	45	81000	-	-	2187000 $\times 10^4$
1 - L.Flg	694	×	15	10410	907.5	9447075	857322 $\times 10^4$
			A =	98010		3434475	3592070 $\times 10^4$
						$-\Sigma A \cdot \delta^2 =$	-12006 $\times 10^4$
$\delta = \Sigma(A \cdot y) / \Sigma A =$				35.0	mm		3580064 $\times 10^4$

[Trans] Rigidity at Girder WEB side section

	b(mm)		t(mm)	A(mm²)	y(mm)	Ay(mm³)	Ay² + I (mm⁴)
1 - Deck	700	×	16	11200	-1350.0	-15120000	2041200 ×10^4
1 - Web	2684	×	45	120780	-	-	7250681 ×10^4
1 - L.Flg	700	×	15	10500	1349.5	14169750	1912208 ×10^4
			A =	142480		-950250	11204089 ×10^4
						$-\Sigma A \cdot \delta^2$ =	-640 ×10^4
							11203449 ×10^4

$\delta = \Sigma(A \cdot y) / \Sigma A =$ -6.7 mm

[Longi] Rigidity at Girder WEB side section

	b(mm)		t(mm)	A(mm²)	y(mm)	Ay(mm³)	Ay² + I (mm⁴)
1 - Deck	694	×	16	11104	-1345.5	-14940432	2010235 ×10^4
1 - Web	2675	×	45	120375	-	-	7177986 ×10^4
1 - L.Flg	694	×	15	10410	1345.0	14001450	1883195 ×10^4
			A =	141889		-938982	11071416 ×10^4
						$-\Sigma A \cdot \delta^2$ =	-618 ×10^4
							11070798 ×10^4

$\delta = \Sigma(A \cdot y) / \Sigma A =$ -6.6 mm

(c) Design Strass Resultants

a.Calculation of design force from vertical reaction force

Vertical Reaction Rv = 57700 kN (Reguler)

Load q = Rv / A = 7212.5 kN/m

ここに、 A ; Loading area length =(2.000 (Trans.) + 2.000 (Longi.))× 2 = 8.000 m

Analysis Results

[Trans] Max Stress Resultants M = 7283.0 kN•m
S = 10474.4 kN

[Longi] Max Stress Resultants M = 3445.6 kN•m
S = 4750.6 kN

b.Calculation of design force from seismic force (longi)

Vertical Reaction Rv = 46200 kN (Dead Load)

Load q = Rv / A = 5775.0 kN/m

ここに、 A ; Loading area length =(2.000 (Trans.) + 2.000 (Longi.))× 2 = 8.000 m

Longi. Horiz. Force Rhe = 25900 kN (Seismic)

Distance from 1/2 of bearing ～web bottom h = 0.740 m

Bending Moment by seismic horiz. force M = Rhe ∗ h = 19153.1 kNm

Couple by seismic horiz. Force F = M / a = 19153.1 kN

Load q = F / A = 12950.0 kN/m

ここに、 A ; Loading area length = 2.000 (Trans.) m

Analysis Results

[Trans] Max Stress Resultants	M =	3652.8	kN・m	(Dead+Seismic)
	S =	6648.5	kN	(〃)
[Longi] Max Stress Resultants	M =	3573.5	kN・m	(Dead+Seismic)
	S =	5616.6	kN	(〃)

c.Calculation of design force from seismic force (trans)

Trans. Horiz. Force Rhe = 20500 kN (Seismic)

Distance from 1/2 of bearing ～web bottom h = 0.740 m

Bending Moment by seismic horiz. force M = Rhe ∗ h = 15159.8 kNm

Couple by seismic horiz. Force F = M / b = 16844.2 kN

Load q = F / A = 10250.0 kN/m

ここに、 A ; Loading area length = 2.000 (Longi.) m

Analysis Results

[Trans] Max Stress Resultants	M =	5104.1	kN・m	(Dead+Seismic)
	S =	7022.4	kN	(〃)
[Longi] Max Stress Resultants	M =	1941.0	kN・m	(Dead+Seismic)
	S =	4713.2	kN	(〃)

d.Design Stress Resultants

[Trans] Max Stress Resultants	M =	7283.0	kN・m	(Stress Resultants by Vertical Reaction Force)
	S =	10474.4	kN	(〃)
[Longi] Max Stress Resultants	M =	3573.5	kN・m	(Stress Resultants by Seismic(longi.))
	S =	5616.6	kN	(〃)

(d) [Trans.] Stress Evaluation of Trans. Rib

Material: SM490Y

	b(mm)		t(mm)	A(mm²)	y(mm)	Ay(mm³)	Ay² + I (mm⁴)
1 − U.Flg	300	×	22	6600	−1011.0	−6672600	674600 ×10⁴
1 − Web	2000	×	45	90000	−	−	3000000 ×10⁴
1 − L.Flg	700	×	15	10500	1007.5	10578750	1065809 ×10⁴
			A =	107100		3906150	4740409 ×10⁴
						−ΣA・δ² =	−14268 ×10⁴
							4726141 ×10⁴

$\delta = \Sigma(A\cdot y)/\Sigma A = 37$ mm

Yu = −1059 mm ∴ Zu = −44649419 mm^3

Yl = 979 mm ∴ Zl = 48299857 mm^3

$$\sigma u = \frac{M}{Zu} = \frac{7283.0 \times 10^6}{-44649419} = -163\ N/mm^2 < 166\ N/mm^2$$

$$\sigma l = \frac{M}{Zl} = \frac{7283.0 \times 10^6}{48299857} = 151\ N/mm^2 < 210\ N/mm^2$$

(下フランジ:SM490Y)

$$\tau = \frac{S}{Aw} = \frac{10474.4 \times 10^3}{90000} = 116\ N/mm^2 < 120\ N/mm^2$$

L/b = 2500 / 300 = 8.3 > 7/k = 2.234 k = 3.133

Aw/Ac = 13.64 > 2.0 b/t = 5.8 < 10.5

∴ $\sigma ca = 210 - 2.3(K\cdot L/b - 7) = 166\ N/mm^2$

Welding for Trans. rib and Girder Web

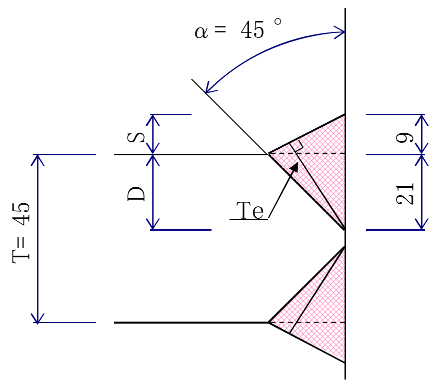
scallop 35mm

Sreg1 = S / (Hw・τa・2・0.707)

$$= \frac{10474.4 \times 10^3}{(2659 - 35) \times 120 \times 2 \times 0.707} = 23.5\ mm$$

Sreg2 = $\sqrt{2t} = \sqrt{(2 \cdot 45)} = 9.5$ mm

∴ Welding: partial penetration weld, deduction: 3mm of incomplete penetration



$D \geqq 2\cdot\sqrt{T} = 13.42$ mm

$\alpha = 45° \sim 70° = 45°$

$S \geqq D(\sec\alpha - 1) = 8.70$ mm

$Te = (D\cdot\sec\alpha\cdot\cos\frac{\alpha}{2}) - 3 = 24.44$ mm

$$\tau = \frac{10474.4 \times 10^3}{2624 \times 24.44 \times 2 \times 0.707} = 116\ N/mm^2 < \tau a = 120\ N/mm^2$$

(e) [Longi.] Stress Evaluation of Trans. Rib

Material: SM490Y

	b(mm)		t(mm)	$A(mm^2)$	y(mm)	$Ay(mm^3)$	$Ay^2 + I\ (mm^4)$
1 − U.Flg	300	×	22	6600	−911.0	−6012600	547748×10^4
1 − Web	1800	×	45	81000	−	−	2187000 ×105
1 − L.Flg	694	×	15	10410	907.5	9447075	857322×10^4
			A =	98010		3434475	3592070×10^4
						$-\Sigma A \cdot \delta^2 =$	-12006×10^4
							3580064×10^4

$\delta = \Sigma(A \cdot y) / \Sigma A =$ 35 mm

Yu = −957 mm ∴ Zu = $-37409237\ mm^3$

Yl = 880 mm ∴ Zl = $40682545\ mm^3$

$$\sigma u = \frac{M}{Zu} = \frac{3573.5 \times 10^6}{-37409237} = -96\ N/mm^2 < 157\ N/mm^2$$

$$\sigma l = \frac{M}{Zl} = \frac{3573.5 \times 10^6}{40682545} = 88\ N/mm^2 < 210\ N/mm^2$$ (bottom flange:SM490Y)

$$\tau = \frac{S}{Aw} = \frac{5616.6 \times 10^3}{81000} = 69\ N/mm^2 < 120\ N/mm^2$$

L/b = 3000 / 300 = 10.0 > 7/k = 2.316 k = 3.023

Aw/Ac = 12.27 > 2.0 b/t = 5.8 < 10.5

∴ $\sigma ca = 210 - 2.3(K \cdot L/b - 7) = 157\ N/mm^2$

Welding for Trans. Rib and Cross Beam

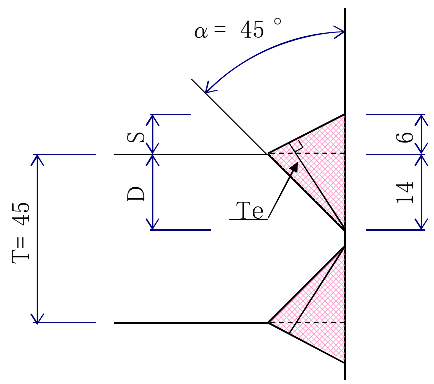
scallop: 35mm

Sreg1 = S / (Hw・ τa・2・0.707)

$$= \frac{5616.6 \times 10^3}{(2675 - 35) \times 120 \times 2 \times 0.707} = 12.5\ mm$$

Sreg2 = $\sqrt{2t} = \sqrt{(2 \cdot 45)} =$ 9.5 mm

∴ Welding: partial penetration weld, deduction: 3mm of incomplete penetration



$D \geqq 2 \cdot \sqrt{T}$ = 13.42 mm

$\alpha = 45° \sim 70°$ = 45 °

$S \geqq D(\sec\alpha - 1)$ = 5.80 mm

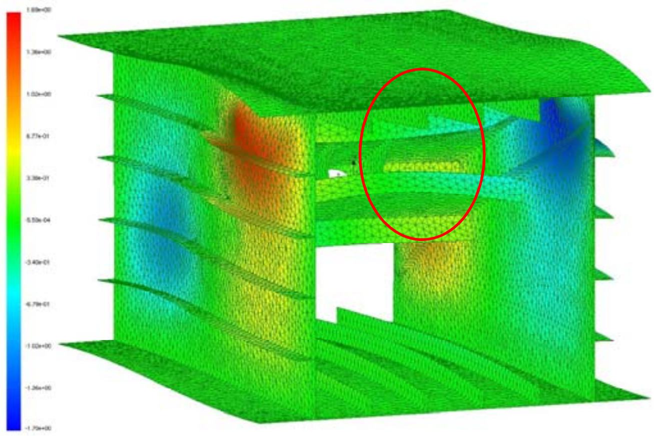
$Te = (D \cdot \sec\alpha \cdot \cos\frac{\alpha}{2}) - 3$ = 15.29 mm

$$\tau = \frac{5616.6 \times 10^3}{2640 \times 15.29 \times 2 \times 0.707} = 98\ N/mm^2 < \tau a = 120\ N/mm^2$$

6. Calculation for Cable Anchor

6. 1. Girder Anchor for Cable

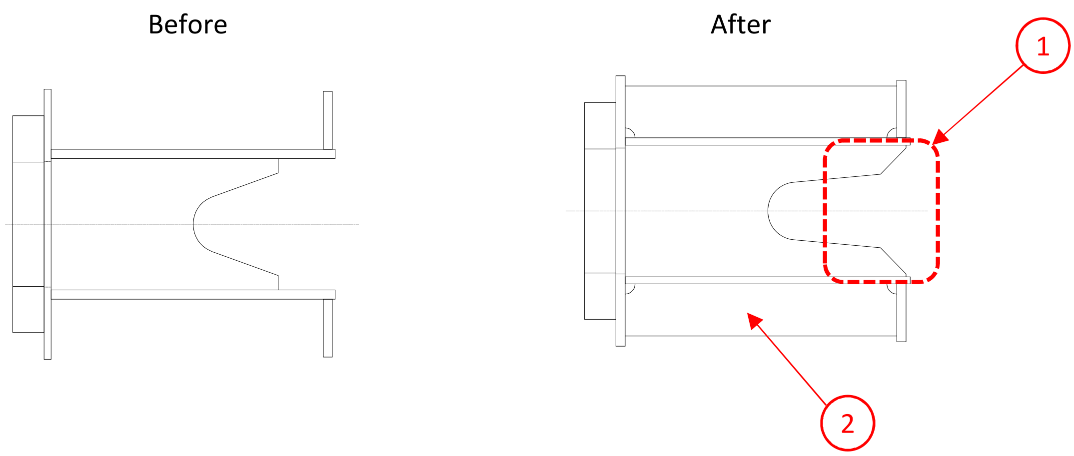
I-section cable anchor girder at middle web has out-plane torsion deformation caused by the cable tension.



Therefore, in order to increase a resistance for torsion, following items were studied.

① Extend the diaphragm at cable anchor section until edge of flange.

② Add ribs at otuside of diaphragm



６．２．Calculation for Cable Anchor Structure (Tower side, Girder side)　**(Excerpt)**

（１） Design Principle

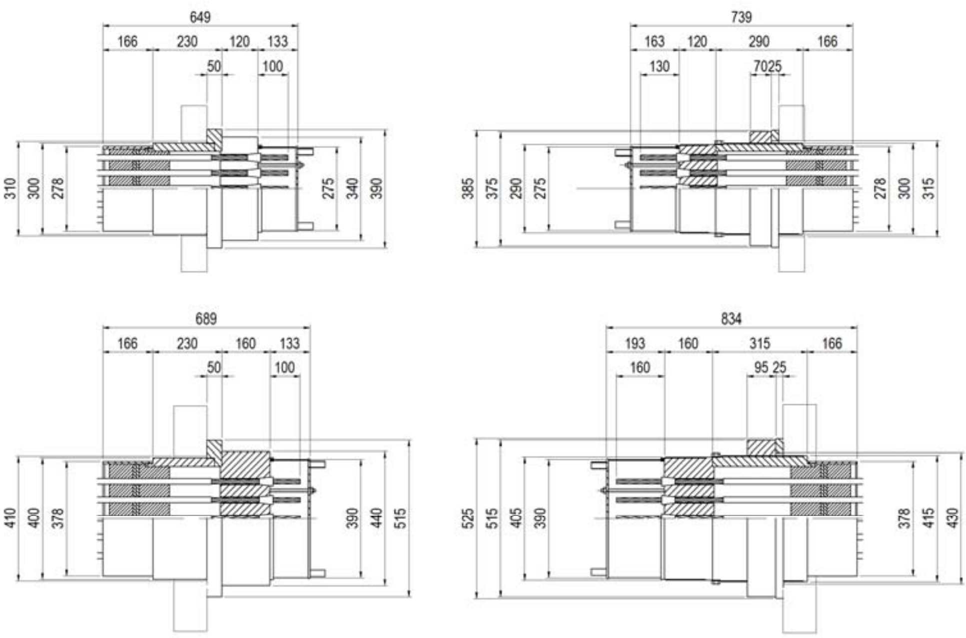
Anchors on girder and tower were studied.
Tower cross section and the middle cell of the girder are as follows:
 Tower cross section : Trans. width: 2.5 m x Longi. width: 3.0 m
 Girder middle cell　: Space between web: 2.5 m,　Height of girder: 2.7 m
Cable was selected as Parallel Strand Cables which is assembled by PC strand at the site.

Cables are fixed to the tower. The tower and girder sockets are shown below.

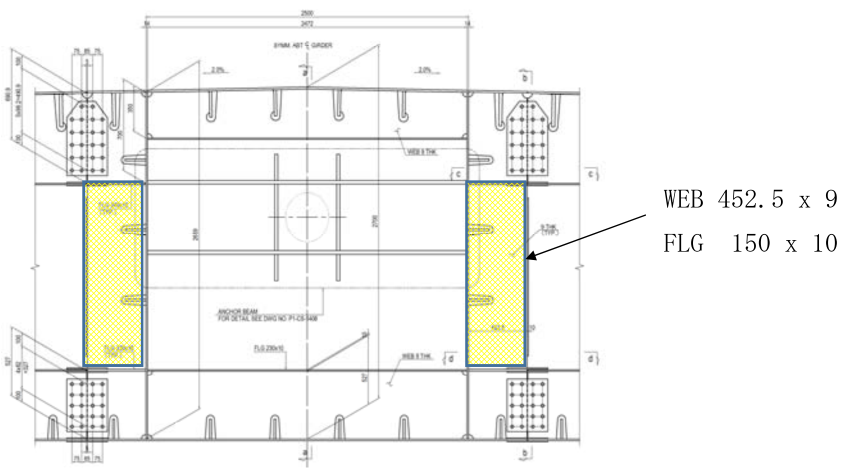
Tower(Fix)　　　　　　　　　　Girder(Movable)

37H

70H



in order to increase a rigidity, trans. rib vertical member (T shape member) shall be installed at outside.



（２） Calculation for Cable Anchor

[Cable TYPE : 70H (upper)]

Tower Side Anchor Girder

T = 6700 kN (Max(C1) 10kN round up)

Stress Resultants at Anchor Girder
Width b = 0.740 m distributed. Span L= 0.900 m
(Bearing Plate width)

p = T / b = 9054 kN/m

M = p*b(L-b/2)/4 = 888 kNm
S = T / 2 = 3350 kN

Section			A (mm^2)	y (mm)	Ay (mm^3)	Ay^2 (mm^4)	I (mm^4)
2 - Flg	SM490Y	200 × 25	10000	-262.5	-2625000	689062500	520833
2 - Web	SM490Y	500 × 36	36000	0	0	0	750000000
2 - Flg	SM490Y	150 × 25	7500	222.5	1668750	371296875	390625
			53500		-956250		1811270833
e = -17.9 mm						−	17088188
						I =	1794182645

yu = -257 mm ∴ Zu = I / yu = -6981255 mm^3
yl = 293 mm ∴ Zl = I / yl = 6123490 mm^3
Aw = 36000 mm^2

Allowable compressive bending stress
L = 0.90 m
Aw/Ac = 36000 / 10000 = 3.6 > 2
L / b = 900 / 200 = 4.5
K = √(3 + 36000 / 20000) = 2.19
σ_{ca} = 203 N/mm^2

Bending stress
σ_U = 887.8 × 10^6 / -6981255 = -127.2 N/mm^2 < 203.4 N/mm^2
σ_L = 887.8 × 10^6 / 6123490 = 145.0 N/mm^3 < 210.0 N/mm^2

Shear Stress
τ = 3350.0 × 10^3 / 36000 = 93.1 N/mm^2 < 120.0 N/mm^2

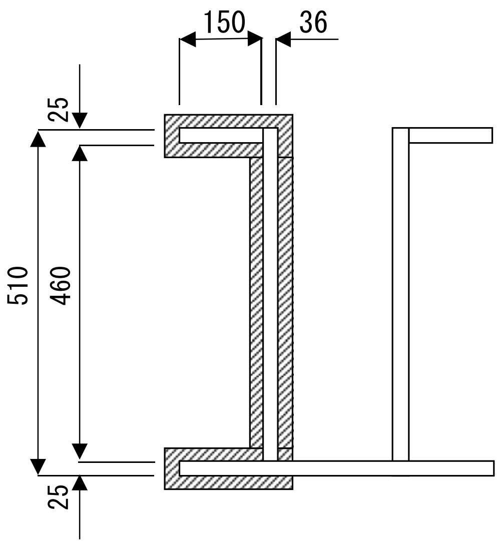
Composite stress $\kappa = \left(\frac{145}{210}\right)^2 + \left(\frac{93}{120}\right)^2 = 1.08 < 1.20$

Welding Evaluation with Vertical Member

Both side fixed model

M = 222 kNm

S = 1675 kN



Fillet weld size is bigger than 12mm, therefore groove weld is applied.

α = 60 °

D = 9 mm S1 = 9 mm Te = 15.59 mm

2nd moment of inertia at welding section

(SM490Y)				A (mm^2)	y (mm)	Ay (mm^3)	Ay^2 (mm^4)	I (mm^4)
2 - Flg	150	×	15.59	4677	-242.5	-1134060	275009615	94700
2 - Web	460	×	15.59	14341	0	0	0	252886346
2 - Flg	150	×	15.59	4677	242.5	1134060	275009615	94700
				23694		0		803094975
e = 0 mm							-	0
							I =	803094975

Stress at Welding Caused by Bending

τ = 221937500 / 803094975 × 242.5

= 67.0 N/mm^2 < τa = 120 N/mm^2

Stress at Welding Caused by Shear Force

τ = (1× 1675000) / (15.59 × 1520)

= 70.7 N/mm^2 < τa = 120 N/mm^2

Composite Stress

$$\kappa = \left(\frac{67}{120}\right)^2 + \left(\frac{71}{120}\right)^2 = 0.66 < 1.20$$

Diaphragm

Diaphragm receive half of the force.

width b = 0.435 m distributed. Span L= 0.435 m

p = T/2 / b = 7701 kN/m

M = p*b(L-b/2)/4 = 182 kNm

S = T/2 / 2 = 1675 kN

effective width

λ = 0.15*b = 65 mm

Section

			A (mm^2)	y (mm)	Ay (mm^3)	Ay^2 (mm^4)	I (mm^4)
2 - Flg	SM490Y	65 × 25	3250	-137.5	-446875	61445312.5	169271
2 - Web	SM490Y	250 × 36	18000	0	0	0	93750000
			21250		-446875		155364584
e = -21 mm						-	9397781
						I =	145966803

yu = -129 mm ∴ Zu = I / yu = -1131526 mm^3

yl = 146 mm ∴ Zl = I / yl = 999773 mm^3

Aw = 2 × 485 × 36 = 34920 mm^2 (Shear MAX:Anchor Girder WEB)

σu = -161.0 N/mm^2 < σca = 210.0 N/mm^2

σl = 182.2 N/mm^2 < σta = 210.0 N/mm^2

τ = 48.0 N/mm^2 < τa = 120.0 N/mm^2

α = 0.91 < 1.20

Welding Evaluation

Fillet Weld S = 12 mm (throat a = 8.49 mm)

Sreq = √ (2 × 36) = 8.5 mm

τ = 1 × 1675000 / (4 × 8.49 × (485 - 1 × 35))

= 109.7 N/mm2 < 120 N/mm2

Girder Side Anchor Girder

T = 6700 kN

Stress Resultants at Anchor Girder

width b = 0.750 m distributed. Span L= 2.500 m

p = T / b = 8933 kN/m

M = p*b(L-b/2)/4 = 3559 kNm

S = T / 2 = 3350 kN

Section			A (mm^2)	y (mm)	Ay (mm^3)	Ay^2 (mm^4)	I (mm^4)
2 - Flg	SM490Y	250 × 32	16000	-516.0	-8256000	4260096000	1365333
2 - Web	SM490Y	1000 × 25	50000	0	0	0	4166666667
2 - Flg	SM490Y	200 × 32	12800	469.0	6003200	2815500800	1092267
			78800		-2252800		1.1245E+10
e = -28.6 mm						-	64407552
						I =	1.118E+10

yu = -503 mm ∴ Zu = I / yu = -22227263 mm^3

yl = 561 mm ∴ Zl = I / yl = 19929258 mm^3

Aw = 50000 mm^2

Allowable compressive bending stress

L = 2.50 m

Aw/Ac = 50000 / 16000 = 3.1 > 2

L / b = 2500 / 250 = 10.0

K = √(3 + 50000 / 32000) = 2.14

σ_{ca1} = 177 N/mm^2

bf/tf = 6.8 ≦ 10.5

σ_{ca2} = 210 N/mm^2

Bending Stress

σ_U = 3559.4 × 10^6 / -22227263 = -160.1 N/mm^2 < 177.0 N/mm^2

σ_L = 3559.4 × 10^6 / 19929258 = 178.6 N/mm^3 < 210.0 N/mm^2

Shear Stress

τ = 3350.0 × 10^3 / 50000 = 67.0 N/mm^2 < 120.0 N/mm^2

Composite Stress

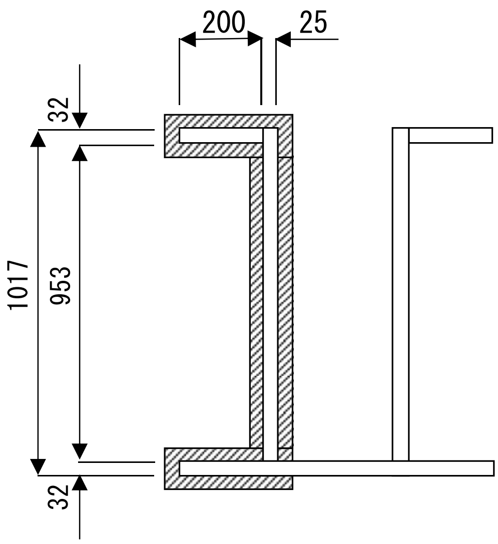
$$\kappa = \left(\frac{179}{210}\right)^2 + \left(\frac{67}{120}\right)^2 = 1.04 < 1.20$$

Welding Evaluation with Middle Web

Both side fixed model

M = 890 kNm

S = 1675 kN



Fillet weld size is bigger than 12mm, therefore groove weld is applied.

α = 45 °

D = 11 mm S1 = 5 mm Te = 11.37 mm

2nd moment of inertia at welding section

(SM490Y)				A (mm²)	y (mm)	Ay (mm³)	Ay² (mm⁴)	I (mm⁴)
2 - Flg	200	×	11.37	4549	-492.5	-2240322	1103358558	49024
2 - Web	953	×	11.37	21675	0	0	0	1640482713
2 - Flg	200	×	11.37	4549	492.5	2240322	1103358558	49024
				30773		0		3847297877
e = 0 mm							−	0
							I =	3847297877

Stress at Welding Caused by Bending

τ = 889843750 / 3847297877 × 492.5

= 113.9 N/mm² < τa = 120 N/mm²

Stress at Welding Caused by Shear Force

τ = (1× 1675000) / (11.37 × 2706)

= 54.4 N/mm² < τa = 120 N/mm²

Composite Stress

$$\kappa = \left(\frac{114}{120}\right)^2 + \left(\frac{54}{120}\right)^2 = 1.11 < 1.20$$

Diaphragm

Diaphragm receive half of the force.

width b = 0.455 m distributed. Span L= 0.455 m

p = T / b = 14725 kN/m

M = p*b(L-b/2)/4 = 381 kNm

S = T / 2 = 3350 kN

effective width

λ = 0.15*b = 68 mm

Section

				A (mm^2)	y (mm)	Ay (mm^3)	Ay^2 (mm^4)	I (mm^4)
2 - Flg	SM490Y	68 × 32		4352	-266.0	-1157632	307930112	371371
2 - Web	SM490Y	500 × 25		25000	0	0	0	520833333
				29352		-1157632		829134816
e = -39.4 mm							-	45657006
							I =	783477810

yu = -243 mm ∴ Zu = I / yu = -3224189 mm^3

yl = 289 mm ∴ Zl = I / yl = 2710996 mm^3

Aw = 2 × 985 × 25 = 49250 mm^2 (shear MAX:Anchor girder WEB)

Bending Stress

σu = -118.2 N/mm^2 < σca = 210.0 N/mm^2

σl = 140.6 N/mm^2 < σta = 210.0 N/mm^2

Shear Stress

τ = 68.0 N/mm^2 < τa = 120.0 N/mm^2

Composite Stress

$$\kappa = \left(\frac{141}{210}\right)^2 + \left(\frac{68}{120}\right)^2 = 0.77 < 1.20$$

Welding Evaluation

Fillet Weld S = 11 mm (throat a = 7.78 mm)

Sreq = √ (2 × 25) = 7.1 mm

τ = 1 × 3350000 / (4 × 7.78 × (985 - 1 × 35))

= 113.3 N/mm2 < 120 N/mm2

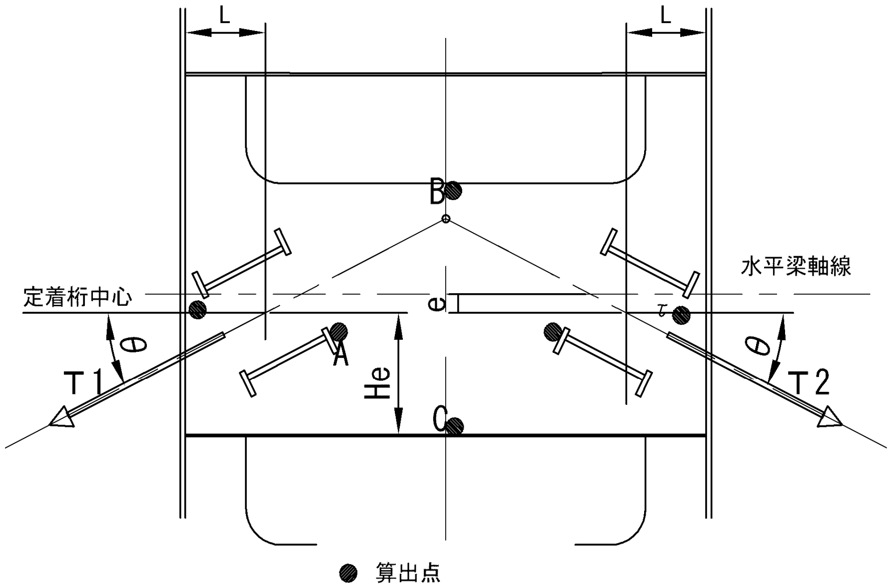
６．３　Diaphragm and Vertical Plate at Tower Cable Anchor

Followings force were considered for vertical plate design.

１）Tensile force caused by horizontal component of cable tension

２）Bending and shear caused by vertical component of cable tension

３）Horizontal Force and eccentric bending caused by difference of left and right cable tension



Stress is calculated by following equations;

１）Tensile stress at anchor girder attached section

$\sigma tA = Th / A + \sigma x$

２）Tensile stress at middle of vertical plate

$\sigma tB = Th / A - Th * e / Wu - Tv * L / Wu$

$\sigma tC = Th / A + Th * e / Wl + Tv * L / Wl$

Th: large value of Th1 or Th2

３）Shear Stress of Diaphragm

$\tau d = \Delta Th / 2 / Ad$

４）Shear force of vertical plate attached section

$\tau = (Tv + \Delta Th * He / Lt) / Aw$ 、Lt=3.0

５）Composite stress of tower stress and vertical plate stress

$\sigma cT = \sigma c + \sigma z$　　　σc ：Stress of Tower

$\sigma c = \sigma n$(Axial σ) $+ 0.9 * \sigma bc$(bending σ, inside)

Th、⊿Th : Horizontal component of cable tension, difference of the force

Tv : Vertical component of cable tension

A、Aw : Vertical plate beam area, web area (per 2 vertical plate)

Wu : vertical plate section factor(upper side) (per 2 vertical plate)

Wl : vertical plate section factor(lower side) (per 2 vertical plate)

σx, σz : uneven stress front/back of anchor girder

e : eccentric amount of anchor girder(lower side:+)

L: distance between anchor girder center and tower wall

He : distance between diaphragm and anchor girder

Lt : tower wall distance 3.0m

Horizontal Beam section

Diaphragm effective width

Equivalent span length L0 = 3.0 m (tower wall distance)

b1 = (900 - 550) /2 = 175

b1 / L0 = 175 / 3000 = 0.058

λ1 = (1.06 - 3.2 * (b/L0) + 4.5 * (b/L0)^2) * b = 156

b2 = (outside, upper flange) : 100

b2 / L0 = 100 / 3000 = 0.033

λ2 = (1.06 - 3.2 * (b/L0) + 4.5 * (b/L0)^2) * b = 96

SM490Y				A	y	A*y	Ay^2
2-Flg	192	*	12	46.08	74.4	3428.4	255069
2-Web	1476	*	30	885.6	-	-	1607789
2-Flg	252	*	12	60.48	-74.4	-4499.7	334779
				992.16		-1071.3	2197637
				e0 =	-1.1	-A*e0^2=	-1201
							2196436

yu=	76.1	Wu=	28862
yl=	-73.9	Wl=	29722

Allowable compressive bending stress σba

k = √(1+442.8/23.0) = 4.5

7/K = 1.55 < L/b = 300.0/19.2 = 15.6 <=27

σba = 210 - 2.3 * (K*L/b - 7) = 64.4

Diaphragm cross section area Ad

width Bd = 300.0 - 2*4.0 - 50.0(man hole) - 5*7.0(scallop)

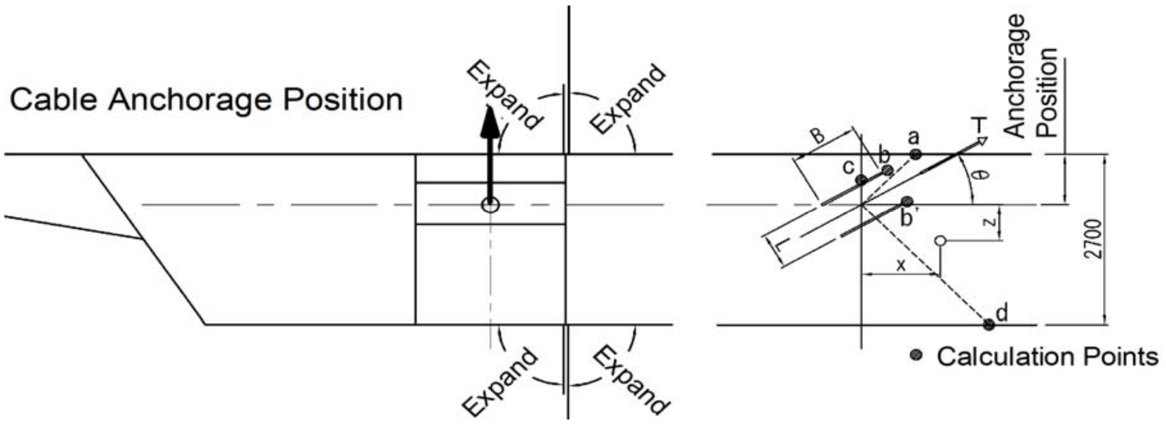
Ad = Bd * 1.2 = 248.4 (per one side)

	C1, C20	C5, C16	C6, C15	C10, C11
T1(kN)	6617	5292	3144	3628
T2(kN)	5623	5488	3227	3608
θ(°)	27.0	33.3	35.8	55.2
Th(kN)	5895.8	4586.9	2617.3	2070.5
Tv(kN)	3004.1	3013.0	1887.7	2979.1
⊿Th(kN)	885.7	163.8	67.3	11.4
L(m)	0.50	0.55	0.50	0.70
He(m)	0.90	0.80	0.70	0.75
e(m)	-0.161	-0.061	0.039	-0.011
A(cm2)	992.16	992.16	992.16	992.16
Aw(cm2)	885.6	885.6	885.6	885.6
Wu(cm3)	28862	28862	28862	28862
Wl(cm3)	29722	29722	29722	29722
Ad(cm2)	248.4	248.4	248.4	248.4
σx	34.0	23.2	14.7	4.3
σA	93.4	69.4	41.1	25.2
σtB	40.3	-1.5	-9.9	-50.6
σtC	78	92.6	61.6	90.3
σba	64.4	64.4	64.4	64.4
σta	210	210	210	210
σ<=σa	OK	OK	OK	OK
τ	37.0	34.5	21.5	33.7
τ(anchor)	42.7	38.5	24.0	27.0
τd	17.8	3.3	1.4	0.2
τa	120	120	120	120
τ<=τa	OK	OK	OK	OK
α	0.48	0.53	0.34	0.51
α<= 1.2	OK	OK	OK	OK
tower σc	26.4	104.0	119.2	148.2
σz	5.7	16.0	12.9	30.6
total σcT	32.1	120.0	132.1	178.8
σcal	210	210	210	210
σcT<=σcal	OK	OK	OK	OK

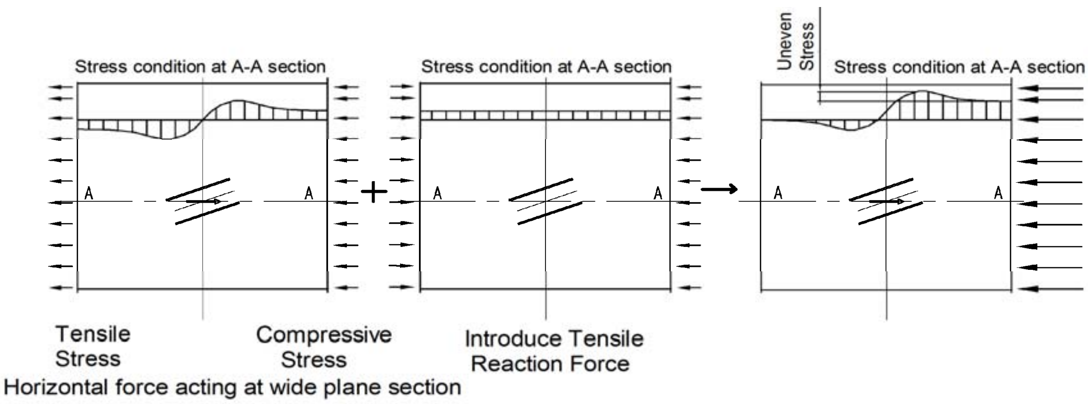
C6～C10 girder height:1.5m (for calculation)

６．４．Additional Stress at Cable Anchor (Excerpt)

While the cable propagates energy through the cable anchorage girder to the main girder web, it propagates through the cable anchorage location on the web, a comparatively localized point, causing an uneven distribution of stress in the main girder web. Therefore, the uneven distribution of stress at the cable anchorage location is verified with a calculation model which considers the application of reaction force from the cable anchorage girder on the surface which consists of expanded top and bottom flange at the cable anchorage position on the web.



In the horizontal direction, an adjustment to stress as shown below is necessary because the main girder has not been constrained at the opposite of the cable extending direction.



Tensile Compressive Inrtoduce Tensile Force
Horizontal force acting at wide plane section

Stress at Anchor
Girder Side

	C1-C5	C6-C10	C11-C15	C16-C20
Design TensionT (kN)	6620	3760	3740	5630
Mid. Web Thickness t (mm)	14	14	14	14
Anchor position(cm)	100	100	100	100
Anchor Girder Height B (cm)	100	80	80	100
Anchor Girder Spacing L (cm)	48	36	36	48

σ :Comp: positive

		T (kN)	ν	B (cm)	L (cm)	θ (°)	X σ (cm)	X τ (cm)	Z (cm)	per 10mm plate thickness		
										σ x (N/mm2)	σ z (N/mm2)	τ xz(N/mm2)
C1 (N70)	Web up a	6620	0.3	100	48	27.1	140	70	-100	31.0	8.6	-37.2
	Web b						36	-	-45.5	116.8	35.5	-97.8
	Web c						0	-	-29	-59.8	87.7	-72.5
	Web bottom d						250	140	170	13.5	-2.7	6.6
C5 (N70)	Web up a	5300	0.3	100	48	33.4	140	70	-100	24.2	7.9	-30.7
	Web b						31	-	-49.2	75.4	44.9	-82
	Web c						0	-	-30.7	-53.5	81.6	-48.3
	Web bottom d						250	140	170	9.7	-2.8	3.3
C6 (N37)	Web up a	3150	0.3	80	36	35.9	130	60	-100	14.0	5.9	-18.5
	Web b’						45	-	-10.6	74.3	14	-52.6
	Web c						0	-	-24.2	-43.6	66.4	-32.1
	Web bottom d						250	130	170	5.5	-1.8	1.4
C9 (N37)	Web up a	3760	0.3	80	36	48.2	130	60	-100	15.1	8.3	-22.6
	Web b’						42	-	-20.1	59.6	43.3	-70.4
	Web c						0	-	-29	-53.0	95.7	-17.9
	Web bottom d						250	130	170	4.5	-2.9	-1.1
C11 (N37)	Web up a	3610	0.3	80	36	55.2	130	60	-100	13.3	8.5	-21.4
	Web b’						39	-	-25	39.6	60.8	-67.9
	Web c						0	-	-33.5	-52.5	105.9	-9.9
	Web bottom d						250	130	170	3.3	-3.1	-2.7
C15 (N37)	Web up a	3230	0.3	80	36	35.8	130	60	-100	14.4	6.1	-18.9
	Web b’						45	-	-10.6	75.7	14.7	-53.8
	Web c						0	-	-24.2	-44.5	67.8	-33.1
	Web bottom d						250	130	170	5.5	-1.9	1.4
C16 (N70)	Web up a	5490	0.3	100	48	33.3	140	70	-100	25.0	8.2	-31.8
	Web b						31	-	-49.2	77.7	47.3	-85.5
	Web c						0	-	-30.7	-55.4	84.3	-50.5
	Web bottom d						250	140	170	10.0	-2.9	3.5
C20 (N70)	Web up a	5630	0.3	100	48	27.0	140	70	-100	26.4	7.3	-31.6
	Web b						36	-	-45.4	100.4	30	-83.7
	Web c						0	-	-28.9	-50.5	74	-61.9
	Web bottom d						250	140	170	11.5	-2.3	5.6

Web b,b’ is 3cm distant from top of anchor girder web

Uneven stress at Anchor Girder

		stress per 10mm		t (mm)	σ x1= σ x0*10/t	Girder Area Ag (m2)	even stress	stress at anchor σ x	even stress σ n	uneven stress (additional)	
		σ x0	τ xz0							σ x'	τ xz
C1 (N70)	Web up a	31.0	-37.2	14	22.1	0.93	3.2	25.3	6.4	18.9	26.6
	Web b,c	116.8	-97.8	14	83.4			86.6		80.2	69.9
	Web bottom d	13.5	6.6	14	9.6			12.8		6.4	4.7
C5 (N70)	Web up a	24.2	-30.7	14	17.3	0.93	2.4	19.7	4.8	14.9	21.9
	Web b,c	75.4	-82	14	53.9			56.3		51.5	58.6
	Web bottom d	9.7	3.3	14	6.9			9.3		4.5	2.4
C6 (N37)	Web up a	14.0	-18.5	14	10.0	0.90	1.4	11.4	2.8	8.6	13.2
	Web b',c	74.3	-52.6	14	53.1			54.5		51.7	37.6
	Web bottom d	5.5	1.4	14	3.9			5.3		2.5	1.0
C9 (N37)	Web up a	15.1	-22.6	14	10.8	0.90	1.4	12.2	2.8	9.4	16.1
	Web b',c	59.6	-70.4	14	42.6			44.0		41.2	50.3
	Web bottom d	4.5	-1.1	14	3.2			4.6		1.8	0.8
C11 (N37)	Web up a	13.3	-21.4	14	9.5	0.90	1.1	10.6	2.2	8.4	15.3
	Web b',c	39.6	-67.9	14	28.3			29.4		27.2	48.5
	Web bottom d	3.3	-2.7	14	2.4			3.5		1.3	1.9
C15 (N37)	Web up a	14.4	-18.9	14	10.3	0.90	1.5	11.8	3.0	8.8	13.5
	Web b',c	75.7	-53.8	14	54.1			55.6		52.6	38.4
	Web bottom d	5.5	1.4	14	3.9			5.4		2.4	1.0
C16 (N70)	Web up a	25.0	-31.8	14	17.9	0.90	2.5	20.4	5.0	15.4	22.7
	Web b,c	77.7	-85.5	14	55.5			58.0		53.0	61.1
	Web bottom d	10.0	3.5	14	7.1			9.6		4.6	2.5
C20 (N70)	Web up a	26.4	-31.6	14	18.9	0.90	2.8	21.7	5.6	16.1	22.6
	Web b,c	100.4	-83.7	14	71.7			74.5		68.9	59.8
	Web bottom d	11.5	5.6	14	8.2			11.0		5.4	4.0

Stress at Anchor (around anchor section)

Girder Side

	C1-C5	C6-C10	C11-C15	C16-C20
Design TensionT (kN)	6620	3760	3740	5630
Mid. Web Thickness t (mm)	14	14	14	14
Anchor position(cm)	100	100	100	100
Anchor Girder Height B (cm)	100	80	80	100
Anchor Girder Spacing L (cm)	48	36	36	48

σ :Comp: positive

		T (kN)	ν	B (cm)	L (cm)	θ (°)	X σ (cm)	X τ (cm)	Z (cm)	per 10mm plate thickness		
										σ x (N/mm2)	σ z (N/mm2)	τ xz(N/mm2)
C1 (N70)	Web up a	6620	0.3	100	48	27.1	10	70	-100	-4.1	38.9	-37.2
	Web b						36	-	-45.5	116.8	35.5	-97.8
	Web c						0	-	-29	-59.8	87.7	-72.5
	Web bottom d						10	140	170	5.1	-21	6.6
C5 (N70)	Web up a	5300	0.3	100	48	33.4	10	70	-100	-4.7	37.7	-30.7
	Web b						31	-	-49.2	75.4	44.9	-82
	Web c						0	-	-30.7	-53.5	81.6	-48.3
	Web bottom d						10	140	170	4.8	-20.6	3.3
C6 (N37)	Web up a	3150	0.3	80	36	35.9	10	60	-100	-3.5	24.4	-18.5
	Web b’						45	-	-10.6	74.3	14	-52.6
	Web c						0	-	-24.2	-43.6	66.4	-32.1
	Web bottom d						10	130	170	3.1	-13.3	1.4
C9 (N37)	Web up a	3760	0.3	80	36	48.2	10	60	-100	-5.8	37.1	-22.6
	Web b’						42	-	-20.1	59.6	43.3	-70.4
	Web c						0	-	-29	-53.0	95.7	-17.9
	Web bottom d						10	130	170	4.6	-20.6	-1.1
C11 (N37)	Web up a	3610	0.3	80	36	55.2	10	60	-100	-6.4	39	-21.4
	Web b’						39	-	-25	39.6	60.8	-67.9
	Web c						0	-	-33.5	-52.5	105.9	-9.9
	Web bottom d						10	130	170	4.8	-21.9	-2.7
C15 (N37)	Web up a	3230	0.3	80	36	35.8	10	60	-100	-3.6	25.1	-18.9
	Web b’						45	-	-10.6	75.7	14.7	-53.8
	Web c						0	-	-24.2	-44.5	67.8	-33.1
	Web bottom d						10	130	170	3.1	-13.6	1.4
C16 (N70)	Web up a	5490	0.3	100	48	33.3	10	70	-100	-4.8	39	-31.8
	Web b						31	-	-49.2	77.7	47.3	-85.5
	Web c						0	-	-30.7	-55.4	84.3	-50.5
	Web bottom d						10	140	170	5.1	-21.4	3.5
C20 (N70)	Web up a	5630	0.3	100	48	27.0	10	70	-100	-3.4	32.9	-31.6
	Web b						36	-	-45.4	100.4	30	-83.7
	Web c						0	-	-28.9	-50.5	74	-61.9
	Web bottom d						10	140	170	4.4	-17.8	5.6

Web b,b’ is 3cm distant from top of anchor girder web

Uneven stress at Anchor Girder

		stress per 10mm		t (mm)	σ x1= σ x0*10/t	Girder Area Ag (m2)	even stress	stress at anchor σ x	even stress σ n	uneven stress (additional)	
		σ x0	τ xz0							σ x'	τ xz
C1 (N70)	Web up a	-4.1	-37.2	14	-2.9			0.3		-6.1	26.6
	Web b,c	116.8	-97.8	14	83.4	0.93	3.2	86.6	6.4	80.2	69.9
	Web bottom d	5.1	6.6	14	3.6			6.8		0.4	4.7
C5 (N70)	Web up a	-4.7	-30.7	14	-3.4			-1.0		-5.8	21.9
	Web b,c	75.4	-82	14	53.9	0.93	2.4	56.3	4.8	51.5	58.6
	Web bottom d	4.8	3.3	14	3.4			5.8		1.0	2.4
C6 (N37)	Web up a	-3.5	-18.5	14	-2.5			-1.1		-3.9	13.2
	Web b',c	74.3	-52.6	14	53.1	0.90	1.4	54.5	2.8	51.7	37.6
	Web bottom d	3.1	1.4	14	2.2			3.6		0.8	1.0
C9 (N37)	Web up a	-5.8	-22.6	14	-4.1			-2.7		-5.5	16.1
	Web b',c	59.6	-70.4	14	42.6	0.90	1.4	44.0	2.8	41.2	50.3
	Web bottom d	4.6	-1.1	14	3.3			4.7		1.9	0.8
C11 (N37)	Web up a	-6.4	-21.4	14	-4.6			-3.5		-5.7	15.3
	Web b',c	39.6	-67.9	14	28.3	0.90	1.1	29.4	2.2	27.2	48.5
	Web bottom d	4.8	-2.7	14	3.4			4.5		2.3	1.9
C15 (N37)	Web up a	-3.6	-18.9	14	-2.6			-1.1		-4.1	13.5
	Web b',c	75.7	-53.8	14	54.1	0.90	1.5	55.6	3.0	52.6	38.4
	Web bottom d	3.1	1.4	14	2.2			3.7		0.7	1.0
C16 (N70)	Web up a	-4.8	-31.8	14	-3.4			-0.9		-5.9	22.7
	Web b,c	77.7	-85.5	14	55.5	0.90	2.5	58.0	5.0	53.0	61.1
	Web bottom d	5.1	3.5	14	3.6			6.1		1.1	2.5
C20 (N70)	Web up a	-3.4	-31.6	14	-2.4			0.4		-5.2	22.6
	Web b,c	100.4	-83.7	14	71.7	0.90	2.8	74.5	5.6	68.9	59.8
	Web bottom d	4.4	5.6	14	3.1			5.9		0.3	4.0

Stress as Tower side Anchor

	C1,5,16,20	C6−15
Design TensionT (kN)	6620	3760
Mid. Web Thickness t (mm)	30	30
Anchor position(cm)	50～55	50～70
Anchor Girder Height B (cm)	50	50
Anchor Girder Spacing L (cm)	47	36

σ :Comp: positive

		T (kN)	ν	B (cm)	L (cm)	θ (°)	X σ (cm)	X τ (cm)	Z (cm)	per 10mm plate thickness		
										σ x (N/mm2)	σ z (N/mm2)	τ xz(N/mm2)
C1,20 (N70)	a	6620	0.3	50	47	27.0	−36.5	−36.5	−7.8	−207.4	0.5	97.4
	b						−10.7	−	−21.9	−141.9	143.6	−108.2
	c						15.2	−	−34.1	164.0	42.3	−128.1
C5,16 (N70)	a	5490	0.3	50	47	33.3	−37.1	−37.1	−3.7	−151.6	−20.1	98.1
	b						−12.9	−	−20.6	−133.2	136.5	−59.5
	c						11.3	−	−35.6	110.9	60.6	−115.5
C6,15 (N37)	a	3230	0.3	50	36	35.8	−34.1	−34.1	2.4	−90.8	−15.2	61.3
	b						−10.5	−	−15.6	−85.2	88.3	−28.5
	c						13	−	−31.6	59.3	46.8	−72
C10,11 (N37)	a	3630	0.3	50	36	55.2	−31.3	−31.3	13.5	−49.7	−70.4	81
	b						−14.8	−	−11.3	−97.0	104.9	40.6
	c						1.8	−	−34.1	14.9	104.5	−67.6

Uneven Stress at anchor girder

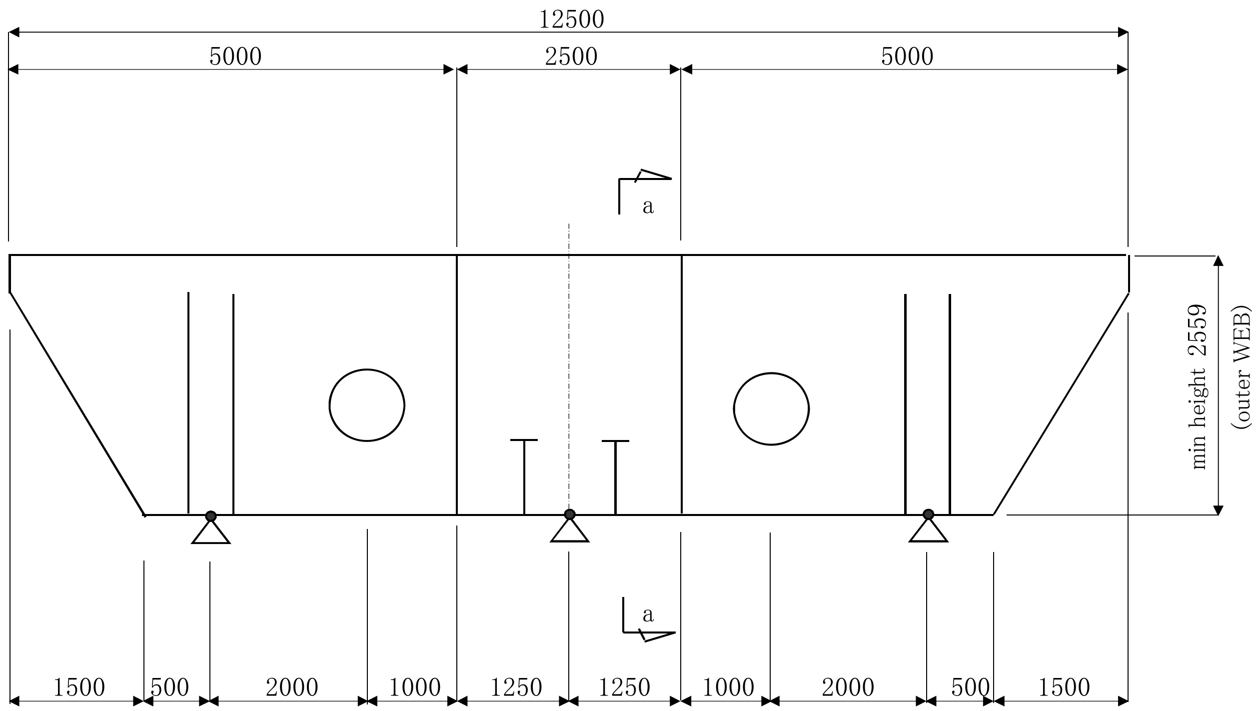
		stress per 10mm		t (mm)	σ x1,z1= σ x0,z0*10/t	Girder Area Ag (m2)	even stress	stress at anchor σ x	even stress σ n	uneven stress(additional)		
		σ x0, σ z0	τ xz0							σ x'	σ z'	τ xz
C1,20 (N70)	a	−207.4	97.4	30	−69.1	0.08	−35.1	−104.2	−70.2	−34.0	−	32.5
	b	−141.9	−108.2	30	−47.3			−82.4		−12.2	−	36.1
	c	42.3	−128.1	30	14.1	0.53	2.8	16.9	5.6	−	5.7	42.7
C5,16 (N70)	a	−151.6	98.1	30	−50.5	0.08	−27.3	−77.8	−54.6	−23.2	−	32.7
	b	−133.2	−59.5	30	−44.4			−71.7		−17.1	−	19.8
	c	60.6	−115.5	30	20.2	0.53	1.4	21.6	2.8	−	16.0	38.5
C6 (N37)	a	−90.8	61.3	30	−30.3	0.08	−15.6	−45.9	−31.2	−14.7	−	20.4
	b	−85.2	−28.5	30	−28.4			−44.0		−12.8	−	9.5
	c	46.8	−72	30	15.6	0.53	0.9	16.5	1.8	−	12.9	24.0
C9 (N37)	a	−49.7	81	30	−16.6	0.08	−12.3	−28.9	−24.6	−4.3	−	27.0
	b	−97.0	40.6	30	−32.3			−44.6		−20.0	−	13.5
	c	104.5	−67.6	30	34.8	0.53	1.4	36.2	2.8	−	30.6	22.5

7. Calculation for Cross Beam on Support

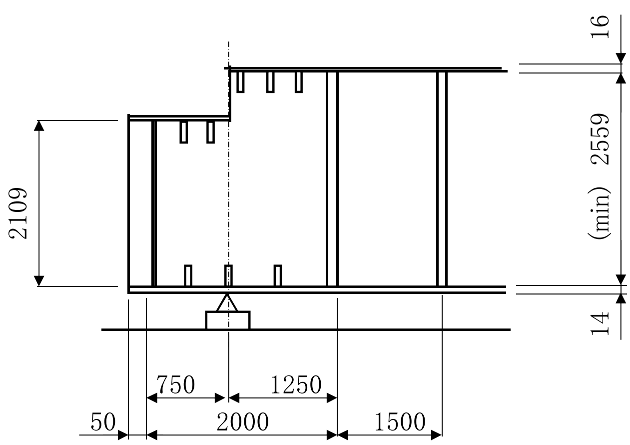
7. 1. Calculation for Cross Beam on P10 (Excerpt)

(1) Cross Section Calculation of Cross Beam on P10

1) Structure Outline



a－a Section



2) Design Stress Resultants

From static structure analysis results;

CL	(3101-J)	Mmax =	11985.7	kN・m	: D+L(max)
		Mmin =	-7590.3	kN・m	: D+L(min)
		S =	-2820.2	kN	: D+L(min)
SJ4	(3101-3/4)	Mmax =	8989.3	kN・m	: D+L(max)
		Mmin =	-5692.7	kN・m	: D+L(min)
		S =	-2820.2	kN	: D+L(min)

3) Effective width JSHB Ⅱ 11.3.5

$b_1 = \frac{2000}{2} = 1000$ mm $l = 5000$ mm $\frac{b}{l} = \frac{1000}{5000} = 0.200$

$\frac{\lambda_{RL1}}{2} = \{1.06 - 3.2\,(b\,/\,l) + 4.5\,(b\,/\,l)^2\}\,b = 600$ mm

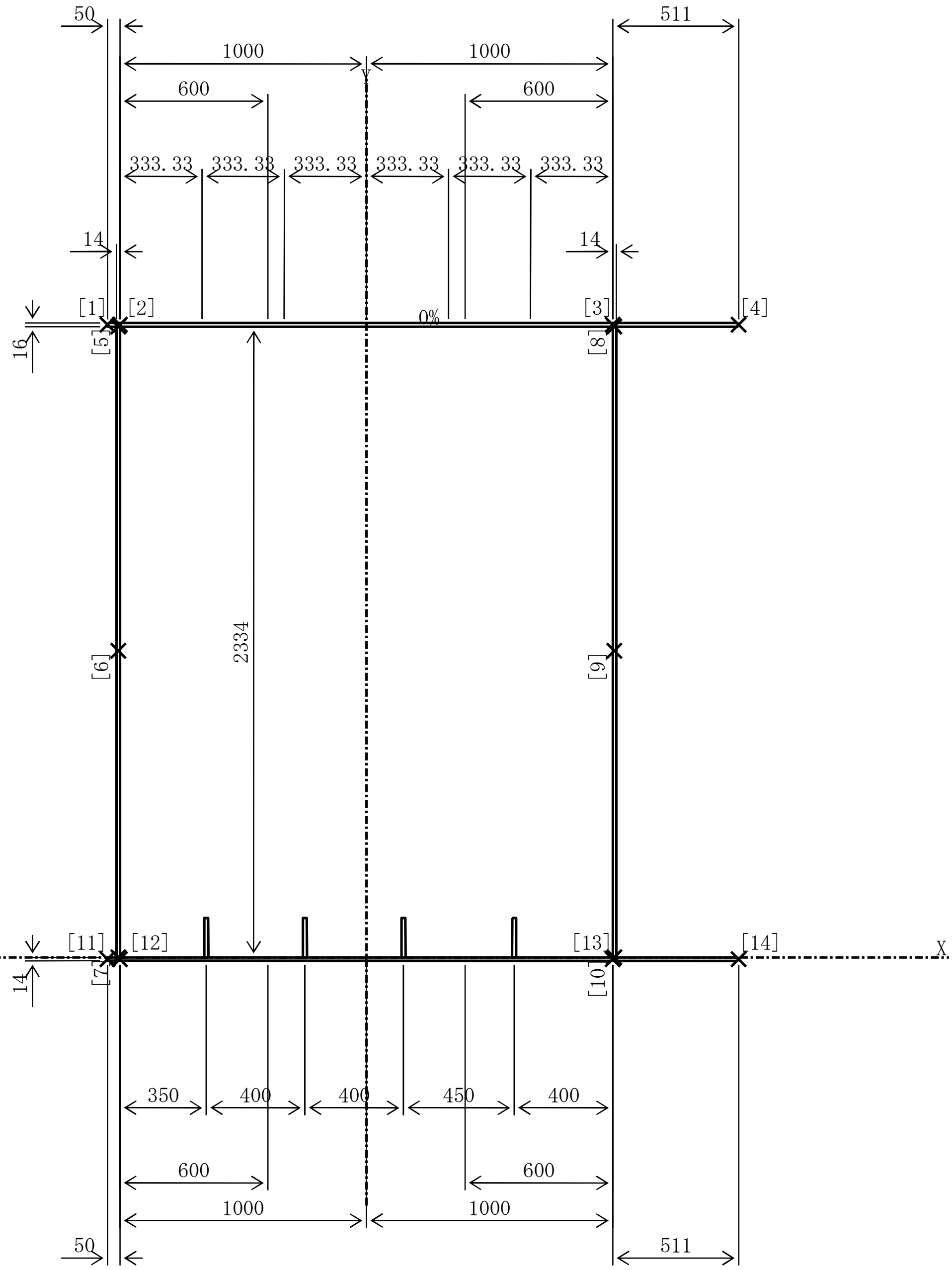
$b_2 = \frac{1500}{2} = 750$ mm $l = 5000$ mm $\frac{b}{l} = \frac{750}{5000} = 0.150$

$\frac{\lambda_{RL2}}{2} = \{1.06 - 3.2\,(b\,/\,l) + 4.5\,(b\,/\,l)^2\}\,b = 511$ mm

$\therefore\ \lambda_{RL} = \lambda_{RL1} + \lambda_{RL2} = 1111$ mm

4) Calculation for Ｐ１０ Cross Beam

Girder Name : P10 Section : SJ4 (Girder No.= 1 Section No. = 1)



Girder Name：P10　Section：SJ4　（Girder No.＝　1　Section No.＝　1）

Stress Resultants

Mmax	Mx = 8989 kN･m	Sy = -2820 kN	T = 0 kN･m
Mmin	Mx = -5693 kN･m	Sy = -2820 kN	T = 0 kN･m

Effective buckling length　Lx = 3500 mm　Ly = 3500 mm
Curvature radius　R = 0.0 m
Gradient　UFLG = 0.0 %

Effective Width (mm)

		Full Width	In-plane
UFLG	Middle	2000	1200
	Overhang	511	511
LFLG	Middle	2000	1200
	Overhang	511	511

Section

	Area(cm2)	Whole	In-plane	
1-UFLG	PL 2561 * 16 (SM400)	409.8	281.8	
5-RIB	PL 260 * 22 (SM400)	0.0	0.0	※not include upper longi. rib
1-LWEB	PL 2334 * 14 (SM490Y)	326.8	326.8	※height: average (left,right)
1-RWEB	PL 2334 * 14 (SM490Y)	326.8	326.8	※　〃
1-LFLG	PL 2561 * 14 (SM490Y)	358.5	246.5	
4-RIB	PL 170 * 17 (SM400)	115.6	57.8	

Section Property

			Whole	In-plane
Area	A	(cm2)	1537.4	1239.6
Center of G	ex	(cm)	11.2	14.2
	ey	(cm)	112.5	115.0
2^{nd} Moment	Ix	(cm4)	14894855	10929434
	Iy	(cm4)	11291150	11083812
Torsion factor	J	(cm4)	14888417	

Resist Bending Moment

		(+)	(−)
In-plane	Mxr(上)=	12752.4 kN･m	12752.4 kN･m
	Mxr(下)=	19715.8 kN･m	19715.8 kN･m

Stress (N/mm^2)

Mmax	[Point]	σmx	σa	τsy	τt	Στ	τa	κ
UFLG	[1]	-99	140	0	0	0	80	0.50
	[2]	-99	140	26	0	26	80	0.60
	[3]	-99	140	20	0	20	80	0.56
	[4]	-99	140	0	0	0	80	0.50
LWEB	[5]	-97	210	31	0	31	120	0.28
	[6]	2	210	45	0	45	120	0.14
	[7]	95	210	33	0	33	120	0.28
RWEB	[8]	-97	210	36	0	36	120	0.31
	[9]	2	210	50	0	50	120	0.17
	[10]	95	210	38	0	38	120	0.30
LFLG	[11]	96	210	0	0	0	120	0.21
	[12]	96	210	32	0	32	120	0.28
	[13]	96	210	27	0	27	120	0.26
	[14]	96	210	0	0	0	120	0.21

Mmin	[point]	σmx	σa	τsy	τt	Στ	τa	κ
UFLG	[1]	62	140	0	0	0	80	0.20
	[2]	62	140	26	0	26	80	0.31
	[3]	62	140	20	0	20	80	0.26
	[4]	62	140	0	0	0	80	0.20

LWEB	[5]	62	210	31	0	31	120	0.15
	[6]	-1	210	45	0	45	120	0.14
	[7]	-60	210	33	0	33	120	0.16
RWEB	[8]	62	210	36	0	36	120	0.18
	[9]	-1	210	50	0	50	120	0.17
	[10]	-60	210	38	0	38	120	0.18
LFLG	[11]	-61	210	0	0	0	120	0.08
	[12]	-61	210	32	0	32	120	0.16
	[13]	-61	210	27	0	27	120	0.13
	[14]	-61	210	0	0	0	120	0.08

5) Evaluation for 2-axial stress

・2-axial stress (girder system and cross beam system) shall be checked.

Eq. $k2 = (\sigma 1/\sigma a)^2 - (\sigma 1/\sigma a)(\sigma 2/\sigma a) + (\sigma 2/\sigma a)^2 + (\tau_1/\tau a)^2 \leqq 1.2$

[DECK]

$$k2 = \left(\frac{0}{140}\right)^2 - \frac{0}{140} \times \frac{-132}{140} + \left(\frac{-132}{140}\right)^2 + \left(\frac{32}{80}\right)^2$$

$$= 1.05 \leqq 1.2$$

[LFLG]

$$k2 = \left(\frac{0}{140}\right)^2 - \frac{0}{140} \times \frac{-81}{140} + \left(\frac{-81}{140}\right)^2 + \left(\frac{36}{80}\right)^2$$

$$= 0.54 \leqq 1.2$$

※σ1 :D+L stress (same condition with cross beam stress resultants)

（２） Calculation for Longi. Rib of Cross Beam at Ｐ１０

Stiff. Name：UFLG

Panel Length : 5000 mm No. of Trans. Rib : 0 Trans. Rib Spacing(a) : 5000 mm

Stiff. Material : SM400 Stiff. width(b) : 2000 mm Stiff. thickness(t) : 16 mm

No. of Longi. rib : 5 Longi. Rib height : 260 mm Longi. Rib thickness : 22 mm

$AL = 26.0 * 2.2 = 57.20\ cm^2$ $IL = 26.0^3 * 2.2 / 3 = 12889\ cm^4$

$\delta L = 57.20 / (200.0*1.6) = 0.179$ $\gamma L = 12889 / (200.0*1.6^3/11) = 173.07$

$\alpha = 500.00 / 200.0 = 2.500$ $\alpha 0 = \sqrt[4]{(1+6*173.07)} = 5.678$

$t0 = 200.0 / (28*1.000*6) = 1.19\ cm$ $t = 1.6\ cm$

$\alpha \leqq \alpha 0$、$t \geqq t0$, therefore from 「JSHBⅡ・Eq(4.2.5)」

$\gamma L\cdot req = 4 * 2.500^2 * 6 * (1.2/1.6)^2 * (1+6*0.179) - (2.500^2+1)^2 / 6 = 163.342$

$AL\cdot req = 200.0 * 1.6 / (10*6) = 5.33\ cm^2 < AL = 57.20\ cm^2$

$IL\cdot req = 200.0 * 1.6^3 * 163.342 / 11 = 12165\ cm^4 < IL = 12889\ cm^4$

Stiff. Name：LFLG

Panel Length : 2678 mm No. of Trans. Rib : 0 Trans. Rib Spacing(a) : 2678 mm

Stiff. Material : SM490Y Stiff. width(b) : 2000 mm Stiff. thickness(t) : 14 mm

No. of Longi. rib : 4 Longi. Rib height : 170 mm Longi. Rib thickness : 17 mm

$AL = 17.0 * 1.7 = 28.90\ cm^2$ $IL = 17.0^3 * 1.7 / 3 = 2784\ cm^4$

$\delta L = 28.90 / (200.0*1.4) = 0.103$ $\gamma L = 2784 / (200.0*1.4^3/11) = 55.80$

$\alpha = 267.80 / 200.0 = 1.339$ $\alpha 0 = \sqrt[4]{(1+5*55.80)} = 4.091$

$t0 = 200.0 / (22*1.000*5) = 1.82\ cm$ $t = 1.4\ cm$

$\alpha \leqq \alpha 0$、$t < t0$, therefore from「JSHB Ⅱ・eq(4.2.5)」

$\gamma L\cdot req = 4 * 1.339^2 * 5 * (1+5*0.103) - (1.339^2+1)^2 / 5 = 52.804$

$AL\cdot req = 200.0 * 1.4 / (10*5) = 5.60\ cm^2 < AL = 28.90\ cm^2$

$IL\cdot req = 200.0 * 1.4^3 * 52.804 / 11 = 2634\ cm^4 < IL = 2784\ cm^4$

（３） Calculation for Cross Beam Site Joint

1) P10 - UFLG

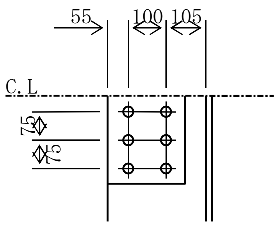
(a) Stress

σ tmax = 62 N/mm^2 0.75σ ta = 0.75 ＊ 140 = 105 N/mm^2
σ cmax = -99 N/mm^2 0.75σ ca = 0.75 ＊ 140 = 105 N/mm^2
∴σ c = 105 N/mm^2
τ max = 26 N/mm^2

(b) Base Metal Total Section

1-UFLG PL 2561 ＊ 16 Ag = 409.8 cm^2 (SM400)
5-RIB PL 260 ＊ 22 Agr = 286.0 cm^2 (SM400)
ΣAg = Ag + Agr = 409.8 + 286.0 = 695.8 cm^2

(c) Bolt Arrangement



(d) Evaluation for Base Metal

1- UFLG PL 2561 ＊ 16 An = 409.8 cm^2
5-RIB PL 260 ＊ 22 Ar = 286.0
(286.0 - 5＊(2＊ 2.7)＊ 2.2) ＊ 1.1 = 249.3 ＜ 286.0 ∴Anr = 249.3 cm^2
ΣAn = An + Anr = 409.8 + 249.3 = 659.0 cm^2
σ tn = σ tmax ＊ ΣAg / ΣAn = 62 ＊ 695.8 / 659.0 = 66 N/mm^2
＜ σ ta = 140 N/mm^2

(e) Design Axial Force

・Rib Ptr = 0.75σ ta ＊ Anr / 1.1 = 105 ＊ 24926 / 1.1 = 2379300 N
＞ σ tn ＊ Anr = 66 ＊ 24926 = 1644620 N
Pcr = σ c ＊ Agr = 105 ＊ 28600 = 3003000 N

(f) Required area of Splice

・Rib AnrR = Anr = 249.3 cm^2
AgrR = Agr = 286.0 cm^2

(g) Required No. of Bolt

・Rib nr = Pcr / (108000 ＊ 1.00) = 3003000 / 108000 = 27.8本 (5 @ 6 = 30 nos.)
(S10T M22 2 plane allowable friction ρa = 108000 N inorganic zinc Nmax = 2,3)

(i) Evaluation for Splice

	(SS400)	Ags(cm^2)	Hole deduction	Ans(cm^2)
10-SPL PL	200 ＊ 16	(320.0	- 10＊(2＊2.7)＊ 1.6)＊1.1= 257.0＜ 320.0	∴257.0
		＞ AgrR		＞AnrR

(4) Calculation for Stiffener

Web Height	b =	2559 mm
Web Thickness	tw =	14 mm
Web Comp. Stress	σw =	130 N/mm^2
Web Shear Stress	τ =	50 N/mm^2
Web Material		SM490Y

(a) Evaluation of Web Thickness

$k = \sqrt{(\sigma a / \sigma)} = \sqrt{(210 / 130)} = 1.27 > 1.2$

$b / 123 = 2559 / (123 \times 1.20) = 17.3 > tw = 14$ mm

therefore, horizontal stiffener shall be used.

(b) Evaluation of Vertical Stiffener

Necessity of vertical stiff.

$k = \sqrt{(\tau a / \tau)} = \sqrt{(120 / 50)} = 1.55 > 1.2$

$b = 2559 \geqq 1.20 \times 57 \times tw = 1.2 \times 57 \times 14 = 958$ mm

therefore, vertical stiffener shall be used.

spacing: a = 1350 mm (ペンデル支承位置～INNER WEB間の中央設置)

min width: b/30 + 50 (mm) = 2559 / 30 + 50 = 135.3 mm → 160 mm

min thickness : 1/13 of stiff. width 160 / 13 = 12.3 → 14 mm

Evaluation for vertical stiff. Spacing JSHB Ⅱ 11.4.3

a/b = 1350 / 2559 = 0.53 < 1.0

$$\left(\frac{2559}{100 \times 14}\right)^4 \times \left[\left(\frac{130}{900}\right)^2 + \left\{\frac{50}{90 + 77 \times (2559 / 1350)^2}\right\}^2\right]$$

= 0.44 ≦ 1.0 OK

Required Rigidity JSHB Ⅱ 11.4.4

$$Ivreq = \frac{b \cdot t^3}{11} \cdot 8.0\left(\frac{b}{a}\right)^2 = 18{,}349{,}521 \text{ mm4}$$

Section 1 − PL 160 x 14 (SM400)

Iv = 160 ^3x 14 / 3 = 19,114,667 mm4 ≧ Iv・req = 18,349,521 mm4

(c) Evaluation for Horizontal Stiff. JSHB Ⅱ 8.6.2

Required Rigidity

$$Ihreq = \frac{b \cdot t^3}{11} \cdot 30\left(\frac{a}{b}\right) = 10102909 \text{ mm4}$$

Section 1 − PL 140 x 12 (SM400)

Iv = 140 ^3x 12 / 3 = 10,976,000 mm4 ≧ Ih・req = 10,102,909 mm4

8. Calculation for Tower

8. 1. Design Principle

(1) Design Section force

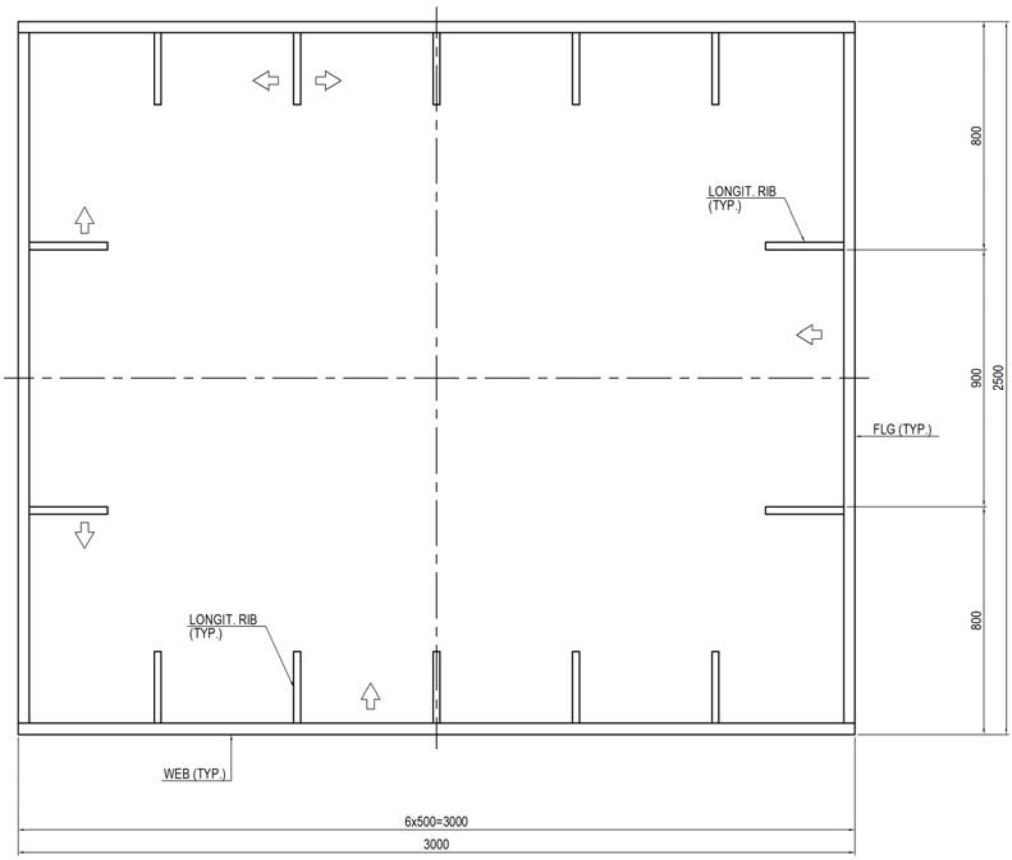
The section force determined by the static structural analysis for Case 1-6 shall be the design section force. The design force used shall be a factor of the ordinary load conditions.

	Description
Case①	Dead Load
Case②	Love Load
Case③	Temperature Change
Case④	Wind Load
Case⑤	Seismic
Case⑥	Pre-stress

(2) Design Section

・The main tower cross section and plate joint directions are shown in the figure below.

TYPICAL SECTION



・Design Section: effective cross section including effective width of flange

・Longitudinal Rib: effective

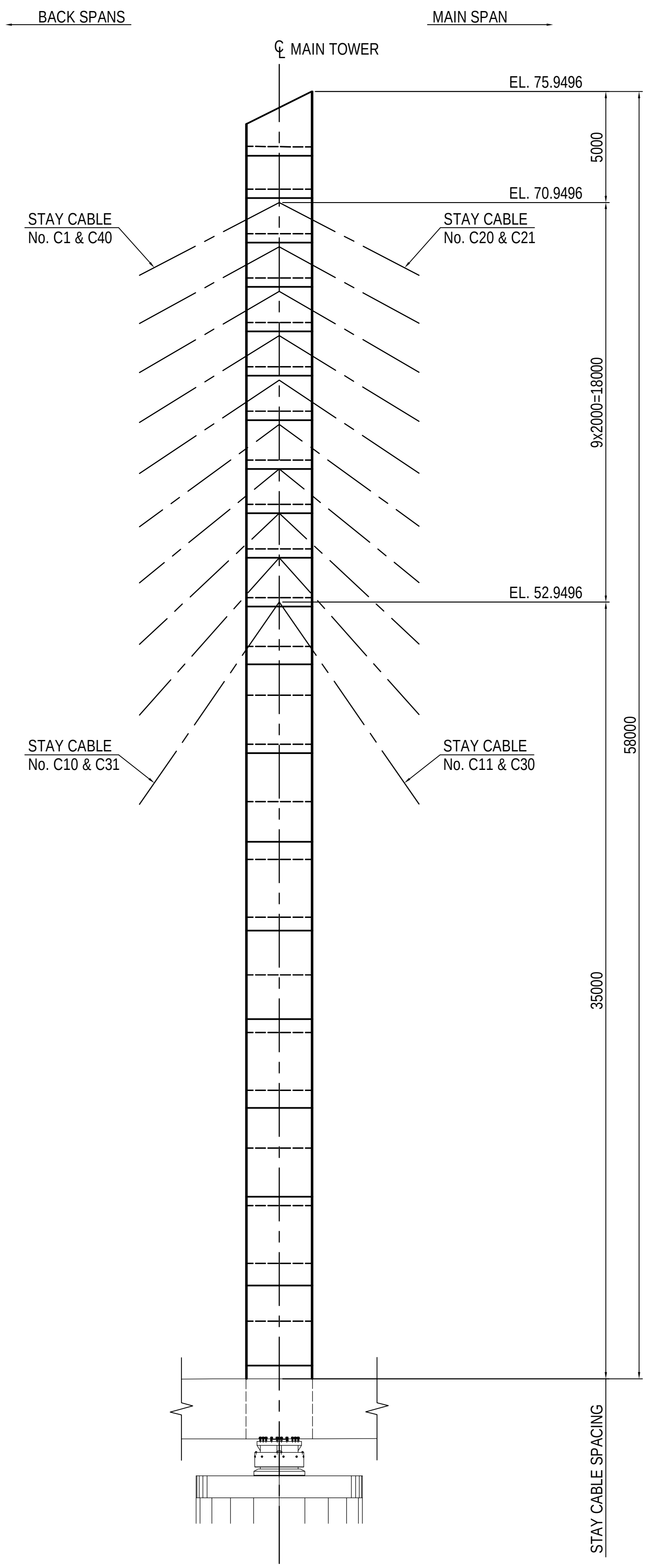
(3) Effective Width ・・・Shown in section 8.3

(4) Effective Buckling Length ・・・ Shown in Section 8.4

８．２．Structure Detail of Tower

GENERAL VIEW OF MAIN TOWER S=1:300

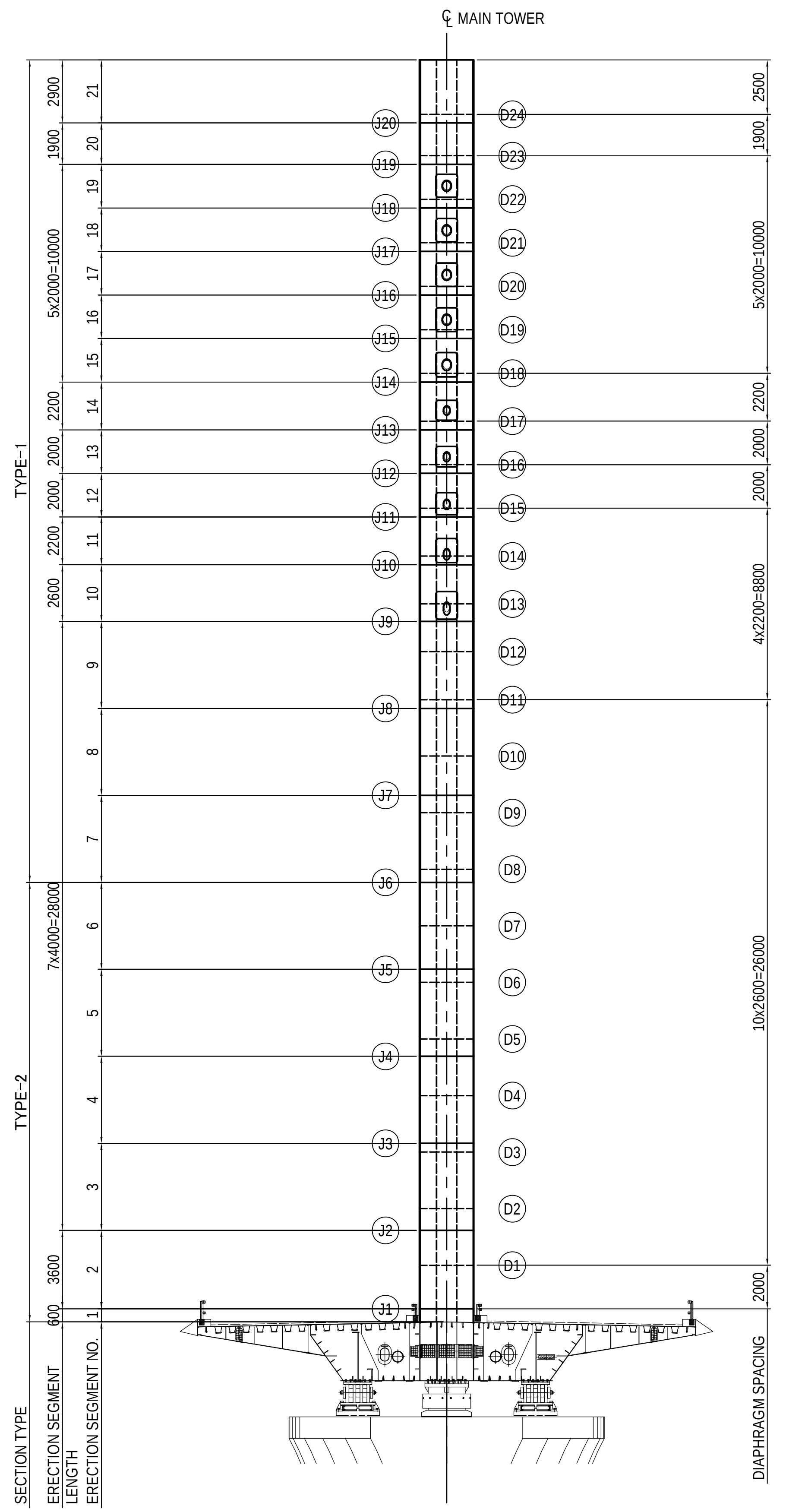
SIDE ELEVATION



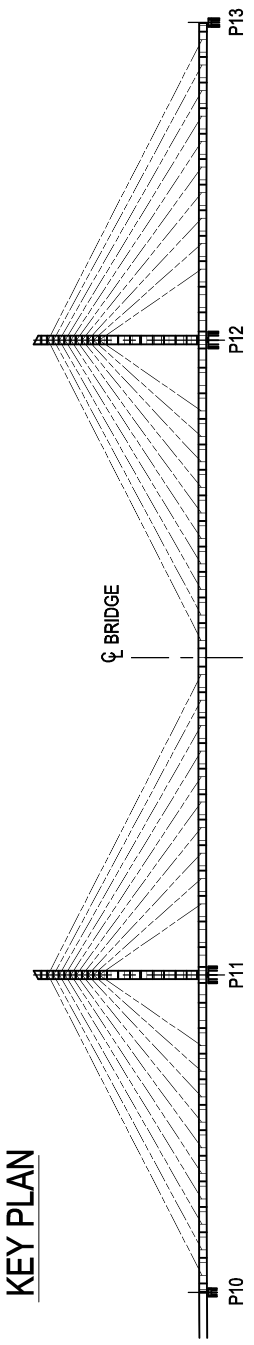
UNIT : mm

		TYPE-1	TYPE-2
FLANGE	STEEL GRADE	SM490Y	SM490Y
	THK	2420x40	2430x35
	VERT. RIB	2-280x27	2-260x25
WEB	STEEL GRADE	SM490Y	SM490Y
	THK	3000x40	3000x35
	VERT. RIB	5-250x25	5-250x25

FRONT ELEVATION



KEY PLAN



NOTES:

1 - MAIN TOWER P11 IS SHOWN, MAIN TOWER P12 IS SIMILAR AND LOCATED AT OPPOSITE HAND.

PROJECT NAME	FINANCED BY	COUNTERPART	JICA STUDY TEAM		NAME	SIGNATURE	DATE	DRAWING TITLE	PACKAGE
DETAILED DESIGN ON BAGO RIVER BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	REPUBLIC OF THE UNION OF MYANMAR MINISTRY OF CONSTRUCTION DEPARTMENT OF BRIDGE	NIPPON KOEI CO., LTD. ORIENTAL CONSULTANTS GLOBAL CO., LTD. METROPOLITAN EXPRESSWAY COMPANY LIMITED CHODAI CO.,LTD. NIPPON ENGINEERING CONSULTANTS CO.,LTD.	PREPARED BY	T.TOMODA			GENERAL VIEW OF MAIN TOWER	1
				CHECKED BY	T. HAYAKAWA				DWG No.
				APPROVED BY	Y. SANO				P1-CS-1201

8．3．Calculation for Effective Width

・Calculated from JSHB Ⅱ11.3.5

$$\lambda = \begin{cases} b & (b/L \leqq 0.05) \\ (1.1-2(b/L))b & (0.05 < b/L < 0.30) \\ 0.15L & (0.30 \leqq b/L) \end{cases} \quad \cdots\cdots\cdots (11.3.1)$$

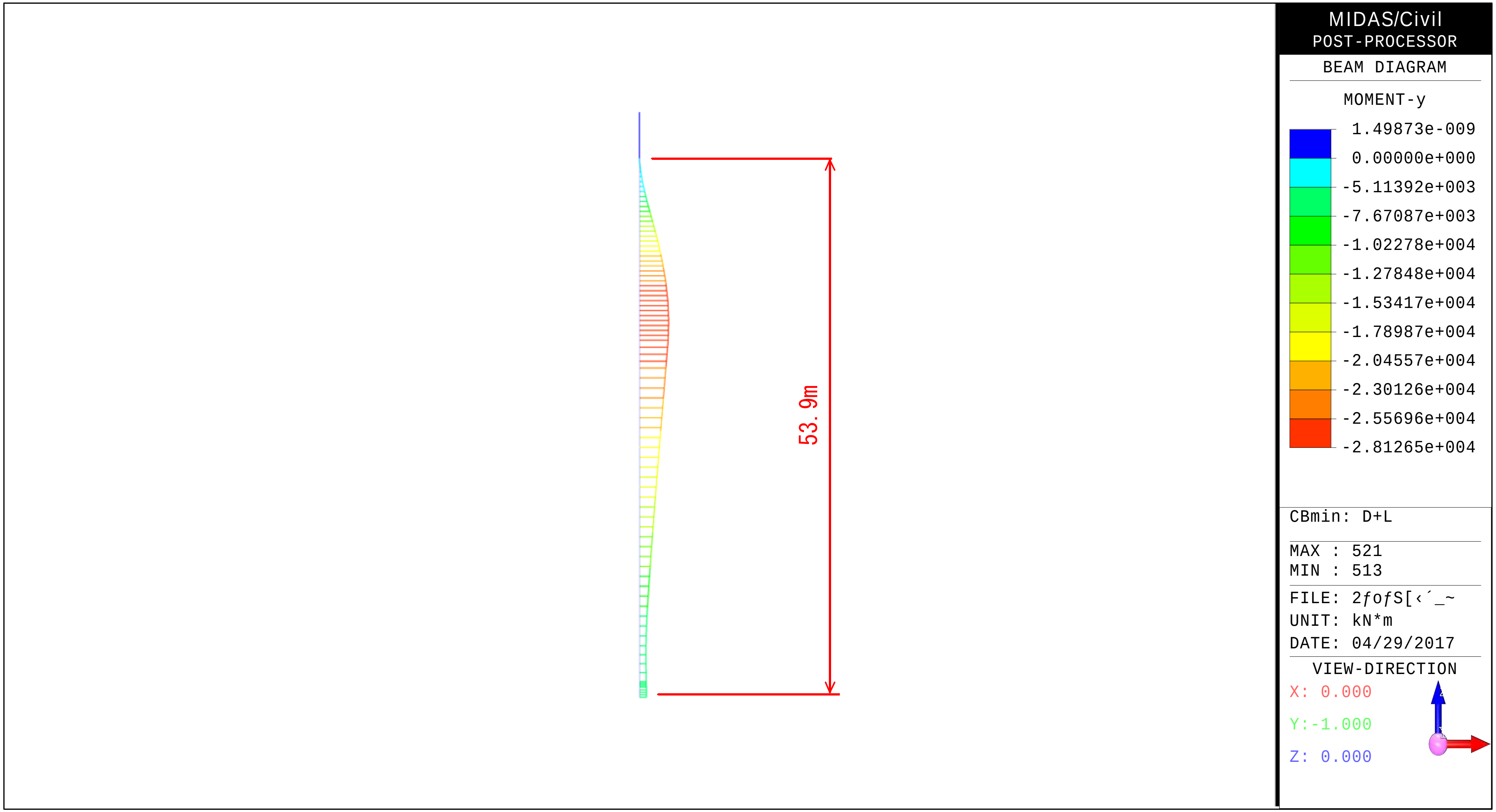
$$\lambda = \begin{cases} b & (b/L \leqq 0.02) \\ (1.06-3.2(b/L)+4.5(b/L)^2)b & (0.02 < b/L < 0.30) \\ 0.15L & (0.30 \leqq b/L) \end{cases} \quad \cdots\cdots\cdots (11.3.2)$$

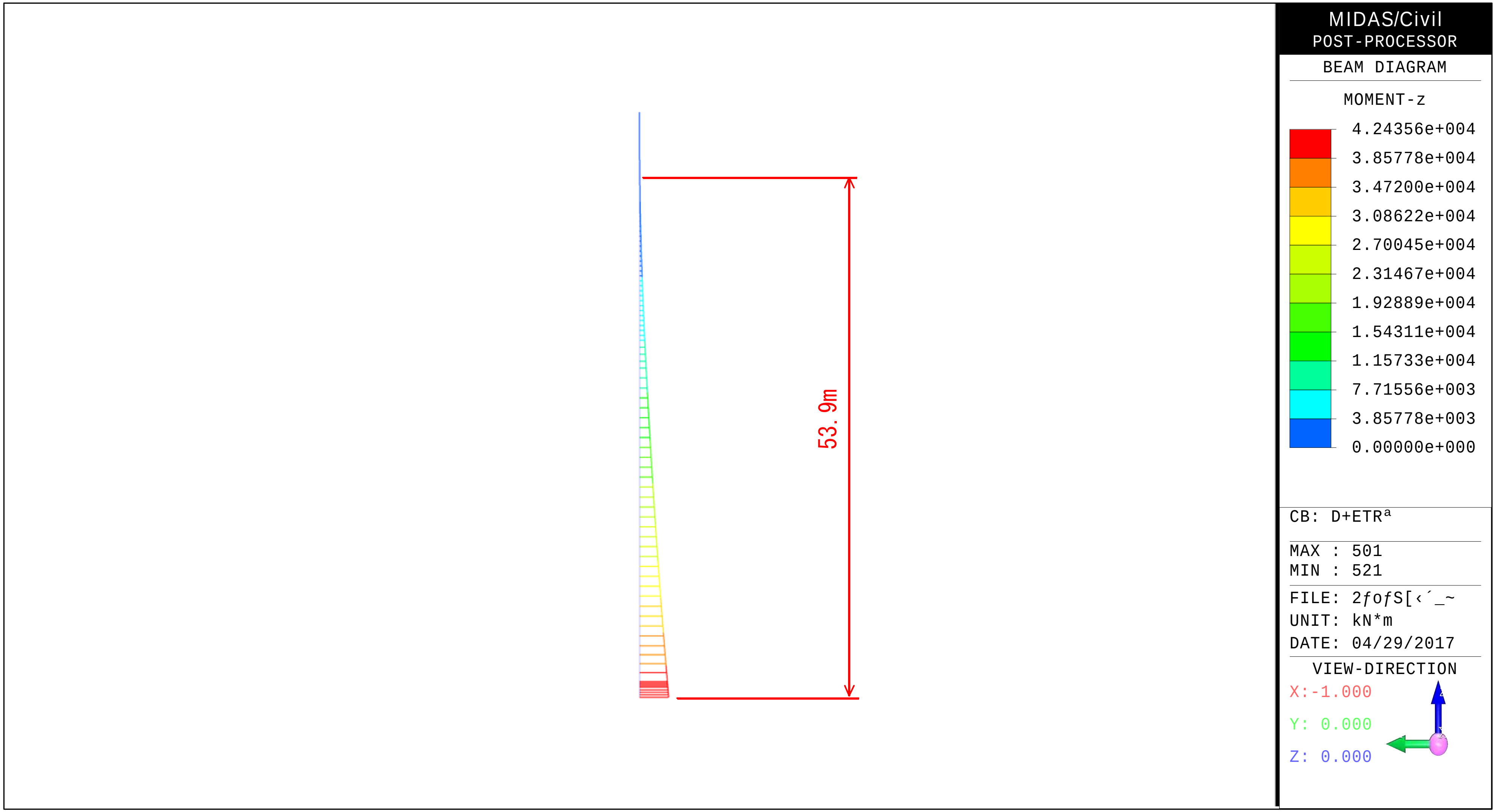
λ : on side effective width of flange(mm)
b : 1/2 of web spacing or overhang width of flange(mm)
L : equivalent span length(mm)

・Effective span length is calculated from Moment diagram

・Effective Width of Tower (mm)

		L	ℓ	Dist.	b	b/ℓ	λ	Eq
Tower	Flg	53900	53900	2500	1250	0.023	1250	(10.3.1)
	Web	53900	107800	3000	1500	0.014	1500	(10.3.2)


53.9m
MIDAS/Civil
POST-PROCESSOR
BEAM DIAGRAM
MOMENT-y
1.49873e-009
0.00000e+000
-5.11392e+003
-7.67087e+003
-1.02278e+004
-1.27848e+004
-1.53417e+004
-1.78987e+004
-2.04557e+004
-2.30126e+004
-2.55696e+004
-2.81265e+004
CBmin: D+L
MAX : 521
MIN : 513
FILE: 2ƒoƒS[‹´_~
UNIT: kN*m
DATE: 04/29/2017
VIEW-DIRECTION
X: 0.000
Y:-1.000
Z: 0.000


53.9m
MIDAS/Civil
POST-PROCESSOR
BEAM DIAGRAM
MOMENT-z
4.24356e+004
3.85778e+004
3.47200e+004
3.08622e+004
2.70045e+004
2.31467e+004
1.92889e+004
1.54311e+004
1.15733e+004
7.71556e+003
3.85778e+003
0.00000e+000
CB: D+ETRª
MAX : 501
MIN : 521
FILE: 2ƒoƒS[‹´_~
UNIT: kN*m
DATE: 04/29/2017
VIEW-DIRECTION
X:-1.000
Y: 0.000
Z: 0.000

8．4． Effective Buckling Length of Tower

・Effective Buckling Length

In-plane : 0.7h
Out-plane : 1.0h

where, h : Height from base of tower to top cable

	Length h (m)	Factor	Effec. Length (m)
In-plane	53.900	0.700	37.730
Out-plane	53.900	1.000	53.900

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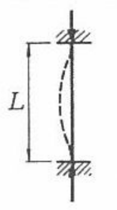
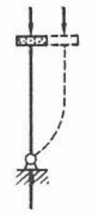
Table-Commentary 3.2.2

L: member Length (mm)

	1	2	3	4	5	6
Buckling Mode						
β (Theoretical)	0.5	0.7	1.0	1.0	2.0	2.0
β (Recommend)	0.65	0.8	1.2	1.0	2.1	2.0

８．５．Cross Section Calculation for Tower **(Excerpt)**

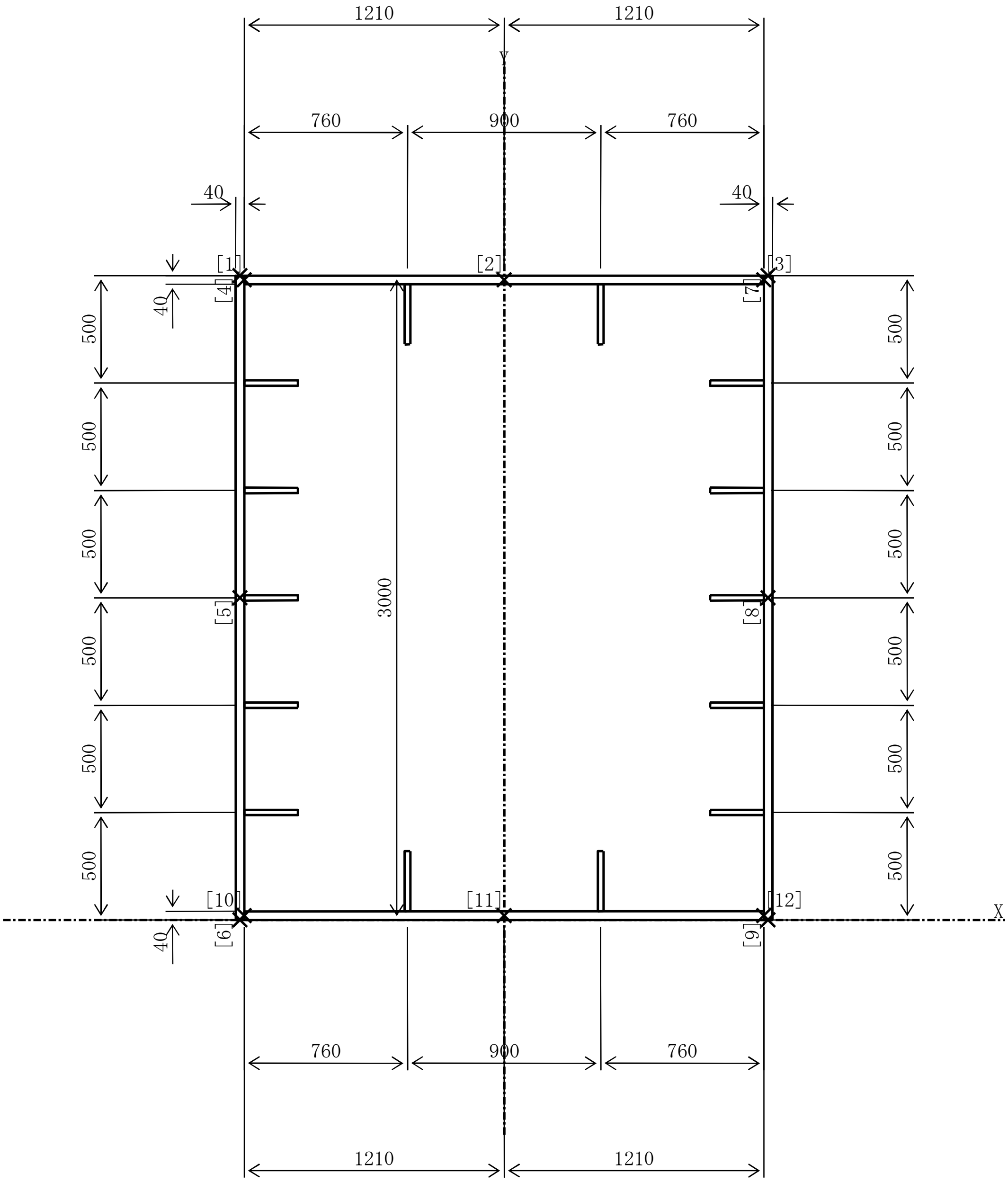
（１）Symbol

Stress Resultants	
Axial	N
Bending Moment (in-plane)	Mx
Bending Moment (out-plane)	My
Shear Force (in-plane)	Sx
Shear Force (out-plane)	Sy
Torsional Moment	T

Stress	
Normal Stress by N	σn
Allowable Axial Direction Compressive Stress	σna
Normal Stress by Mx	σmx
Normal Stress by My	σmy
Normal Stress Total	Σσ
Allowable Normal Stress	σa
Result of JSHBⅡ Eq. 4.3.5	σ435
Result of JSBHⅡ Eq. 4.3.2 or 4.3.4	Cnm
Shear Stress by Sx	τsx
Shear Stress by Sy	τsy
Shear Stress by T	τt
Shear Stress total	Στ
Allowable Shear Stress	τa
Composite Stress	κ

（２）Cross Section

name：Tower　Section：J20　（Girder No.＝　1　Section No.＝　1）



Name : Tower　Section : J20　(Girder No. = 1　Section No. = 1)

Stress Resultants

	N(kN)	Mx(kN·m)	My(kN·m)	Sx(kN)	Sy(kN)	T(kN·m)
D+L	-107	0	0	0	0	0
D+L+T'	-93	0	0	0	0	0
D+WtTR'	-86	0	19	15	0	0
D+L+WtTR'	-86	0	10	8	0	0
D+WtTR+T'	-80	0	18	14	0	0
D+L+WtTR+T'	-80	0	9	7	0	0
D+ELG'	-72	-27	0	0	-22	0
D+ETR'	-72	0	27	22	0	0

Effective Buckling Length　Lx = 37700 mm　Ly = 53900 mm

Cross Section	Area(cm2)	All	In-plane	Out-plane
1-Top	PL 2420 * 40 (SM490Y)	968.0	968.0	968.0
2-RIB	PL 280 * 27 (SM490Y)	151.2	151.2	151.2
1-LWeb	PL 3000 * 40 (SM490Y)	1200.0	1200.0	1200.0
5-RIB	PL 250 * 25 (SM490Y)	312.5	312.5	312.5
1-Rweb	PL 3000 * 40 (SM490Y)	1200.0	1200.0	1200.0
5-RIB	PL 250 * 25 (SM490Y)	312.5	312.5	312.5
1-Bott	PL 2420 * 40 (SM490Y)	968.0	968.0	968.0
2-RIB	PL 280 * 27 (SM490Y)	151.2	151.2	151.2

Property			All	In-plane	Out-plane
Area	A	(cm2)	5263.4	5263.4	5263.4
Center of G	ex	(cm)	0.0	0.0	0.0
	ey	(cm)	150.0	150.0	150.0
2^{nd} moment area	Ix	(cm4)	68822825	68822825	68822825
	Iy	(cm4)	53763877	53763877	53763877
Torsion Factor	J	(cm4)	78278007		
radius of gyration of area	Rx	(cm)	114.3		
	Ry	(cm)	101.1		
Slenderness ratio		Lx/Rx	32.97		
		Ly/Ry	53.33		
Euler Buckling		0.8*σex	1453		
Stress		0.8*σey	555		

Resistance Bending Moment

		(+)	(-)
In-plane	Mxr(up) =	96352.0 kN·m	96352.0 kN·m
	Mxr(bottom)=	96352.0 kN·m	96352.0 kN·m
Out-plane	Myr(up) =	90323.3 kN·m	90323.3 kN·m
	Myr(bottom)=	90323.3 kN·m	90323.3 kN·m

Stress (N/mm^2)

D+L	[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
Top	[1]	0	163	0	0	0	210	0	0.00
	[2]	0	163	0	0	0	210	0	0.00
	[3]	0	163	0	0	0	210	0	0.00
LWeb	[4]	0	163	0	0	0	210	0	0.00
	[5]	0	163	0	0	0	210	0	0.00
	[6]	0	163	0	0	0	210	0	0.00
Rweb	[7]	0	163	0	0	0	210	0	0.00
	[8]	0	163	0	0	0	210	0	0.00
	[9]	0	163	0	0	0	210	0	0.00
Bott	[10]	0	163	0	0	0	210	0	0.00
	[11]	0	163	0	0	0	210	0	0.00
	[12]	0	163	0	0	0	210	0	0.00

D+L		[Point]	τ sx	τ sy	τ t	Σ τ	τ a	κ
	Top	[1]	0	0	0	0	120	0.00
		[2]	0	0	0	0	120	0.00
		[3]	0	0	0	0	120	0.00
	LWeb	[4]	0	0	0	0	120	0.00
		[5]	0	0	0	0	120	0.00
		[6]	0	0	0	0	120	0.00
	Rweb	[7]	0	0	0	0	120	0.00
		[8]	0	0	0	0	120	0.00
		[9]	0	0	0	0	120	0.00
	Bott	[10]	0	0	0	0	120	0.00
		[11]	0	0	0	0	120	0.00
		[12]	0	0	0	0	120	0.00

D+L+T’		[Point]	σ n	σ na	σ mx	σ my	Σ σ	σ a	σ 435	Cnm
	Top	[1]	0	163	0	0	0	210	0	0.00
		[2]	0	163	0	0	0	210	0	0.00
		[3]	0	163	0	0	0	210	0	0.00
	LWeb	[4]	0	163	0	0	0	210	0	0.00
		[5]	0	163	0	0	0	210	0	0.00
		[6]	0	163	0	0	0	210	0	0.00
	Rweb	[7]	0	163	0	0	0	210	0	0.00
		[8]	0	163	0	0	0	210	0	0.00
		[9]	0	163	0	0	0	210	0	0.00
	Bott	[10]	0	163	0	0	0	210	0	0.00
		[11]	0	163	0	0	0	210	0	0.00
		[12]	0	163	0	0	0	210	0	0.00

D+L+T’		[Point]	τ sx	τ sy	τ t	Σ τ	τ a	κ
	Top	[1]	0	0	0	0	120	0.00
		[2]	0	0	0	0	120	0.00
		[3]	0	0	0	0	120	0.00
	LWeb	[4]	0	0	0	0	120	0.00
		[5]	0	0	0	0	120	0.00
		[6]	0	0	0	0	120	0.00
	Rweb	[7]	0	0	0	0	120	0.00
		[8]	0	0	0	0	120	0.00
		[9]	0	0	0	0	120	0.00
	Bott	[10]	0	0	0	0	120	0.00
		[11]	0	0	0	0	120	0.00
		[12]	0	0	0	0	120	0.00

D+WtTR’		[Point]	σ n	σ na	σ mx	σ my	Σ σ	σ a	σ 435	Cnm
	Top	[1]	0	163	0	0	0	210	0	0.00
		[2]	0	163	0	0	0	210	0	0.00
		[3]	0	163	0	0	0	210	0	0.00
	LWeb	[4]	0	163	0	0	0	210	0	0.00
		[5]	0	163	0	0	0	210	0	0.00
		[6]	0	163	0	0	0	210	0	0.00
	Rweb	[7]	0	163	0	0	0	210	0	0.00
		[8]	0	163	0	0	0	210	0	0.00
		[9]	0	163	0	0	0	210	0	0.00
	Bott	[10]	0	163	0	0	0	210	0	0.00
		[11]	0	163	0	0	0	210	0	0.00
		[12]	0	163	0	0	0	210	0	0.00

D+WtTR'		[Point]	τ sx	τ sy	τ t	Σ τ	τ a	κ
	Top	[1]	0	0	0	0	120	0.00
		[2]	0	0	0	0	120	0.00
		[3]	0	0	0	0	120	0.00
	LWeb	[4]	0	0	0	0	120	0.00
		[5]	0	0	0	0	120	0.00
		[6]	0	0	0	0	120	0.00
	Rweb	[7]	0	0	0	0	120	0.00
		[8]	0	0	0	0	120	0.00
		[9]	0	0	0	0	120	0.00
	Bott	[10]	0	0	0	0	120	0.00
		[11]	0	0	0	0	120	0.00
		[12]	0	0	0	0	120	0.00

D+L+WtTR'		[Point]	σ n	σ na	σ mx	σ my	Σ σ	σ a	σ 435	Cnm
	Top	[1]	0	163	0	0	0	210	0	0.00
		[2]	0	163	0	0	0	210	0	0.00
		[3]	0	163	0	0	0	210	0	0.00
	LWeb	[4]	0	163	0	0	0	210	0	0.00
		[5]	0	163	0	0	0	210	0	0.00
		[6]	0	163	0	0	0	210	0	0.00
	Rweb	[7]	0	163	0	0	0	210	0	0.00
		[8]	0	163	0	0	0	210	0	0.00
		[9]	0	163	0	0	0	210	0	0.00
	Bott	[10]	0	163	0	0	0	210	0	0.00
		[11]	0	163	0	0	0	210	0	0.00
		[12]	0	163	0	0	0	210	0	0.00

D+L+WtTR'		[Point]	τ sx	τ sy	τ t	Σ τ	τ a	κ
	Top	[1]	0	0	0	0	120	0.00
		[2]	0	0	0	0	120	0.00
		[3]	0	0	0	0	120	0.00
	LWeb	[4]	0	0	0	0	120	0.00
		[5]	0	0	0	0	120	0.00
		[6]	0	0	0	0	120	0.00
	Rweb	[7]	0	0	0	0	120	0.00
		[8]	0	0	0	0	120	0.00
		[9]	0	0	0	0	120	0.00
	Bott	[10]	0	0	0	0	120	0.00
		[11]	0	0	0	0	120	0.00
		[12]	0	0	0	0	120	0.00

D+WtTR+T'		[Point]	σ n	σ na	σ mx	σ my	Σ σ	σ a	σ 435	Cnm
	Top	[1]	0	163	0	0	0	210	0	0.00
		[2]	0	163	0	0	0	210	0	0.00
		[3]	0	163	0	0	0	210	0	0.00
	LWeb	[4]	0	163	0	0	0	210	0	0.00
		[5]	0	163	0	0	0	210	0	0.00
		[6]	0	163	0	0	0	210	0	0.00
	Rweb	[7]	0	163	0	0	0	210	0	0.00
		[8]	0	163	0	0	0	210	0	0.00
		[9]	0	163	0	0	0	210	0	0.00
	Bott	[10]	0	163	0	0	0	210	0	0.00
		[11]	0	163	0	0	0	210	0	0.00
		[12]	0	163	0	0	0	210	0	0.00

D+WtTR+T'		[Point]	τ sx	τ sy	τ t	Σ τ	τ a	κ
	Top	[1]	0	0	0	0	120	0.00
		[2]	0	0	0	0	120	0.00
		[3]	0	0	0	0	120	0.00

LWeb	[4]	0	0	0	0	120	0.00
	[5]	0	0	0	0	120	0.00
	[6]	0	0	0	0	120	0.00
Rweb	[7]	0	0	0	0	120	0.00
	[8]	0	0	0	0	120	0.00
	[9]	0	0	0	0	120	0.00
Bott	[10]	0	0	0	0	120	0.00
	[11]	0	0	0	0	120	0.00
	[12]	0	0	0	0	120	0.00

D+L+WtTR+T'	[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
Top	[1]	0	163	0	0	0	210	0	0.00
	[2]	0	163	0	0	0	210	0	0.00
	[3]	0	163	0	0	0	210	0	0.00
LWeb	[4]	0	163	0	0	0	210	0	0.00
	[5]	0	163	0	0	0	210	0	0.00
	[6]	0	163	0	0	0	210	0	0.00
Rweb	[7]	0	163	0	0	0	210	0	0.00
	[8]	0	163	0	0	0	210	0	0.00
	[9]	0	163	0	0	0	210	0	0.00
Bott	[10]	0	163	0	0	0	210	0	0.00
	[11]	0	163	0	0	0	210	0	0.00
	[12]	0	163	0	0	0	210	0	0.00

D+L+WtTR+T'	[Point]	τsx	τsy	τt	Στ	τa	κ
Top	[1]	0	0	0	0	120	0.00
	[2]	0	0	0	0	120	0.00
	[3]	0	0	0	0	120	0.00
LWeb	[4]	0	0	0	0	120	0.00
	[5]	0	0	0	0	120	0.00
	[6]	0	0	0	0	120	0.00
Rweb	[7]	0	0	0	0	120	0.00
	[8]	0	0	0	0	120	0.00
	[9]	0	0	0	0	120	0.00
Bott	[10]	0	0	0	0	120	0.00
	[11]	0	0	0	0	120	0.00
	[12]	0	0	0	0	120	0.00

D+ELG'	[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
Top	[1]	0	163	0	0	0	210	0	0.00
	[2]	0	163	0	0	0	210	0	0.00
	[3]	0	163	0	0	0	210	0	0.00
LWeb	[4]	0	163	0	0	0	210	0	0.00
	[5]	0	163	0	0	0	210	0	0.00
	[6]	0	163	0	0	0	210	0	0.00
Rweb	[7]	0	163	0	0	0	210	0	0.00
	[8]	0	163	0	0	0	210	0	0.00
	[9]	0	163	0	0	0	210	0	0.00
Bott	[10]	0	163	0	0	0	210	0	0.00
	[11]	0	163	0	0	0	210	0	0.00
	[12]	0	163	0	0	0	210	0	0.00

D+ELG'	[Point]	τsx	τsy	τt	Στ	τa	κ
Top	[1]	0	0	0	0	120	0.00
	[2]	0	0	0	0	120	0.00
	[3]	0	0	0	0	120	0.00
LWeb	[4]	0	0	0	0	120	0.00
	[5]	0	0	0	0	120	0.00
	[6]	0	0	0	0	120	0.00

Rweb	[7]	0	0	0	0	120	0.00
	[8]	0	0	0	0	120	0.00
	[9]	0	0	0	0	120	0.00
Bott	[10]	0	0	0	0	120	0.00
	[11]	0	0	0	0	120	0.00
	[12]	0	0	0	0	120	0.00

D+ETR'		[Point]	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	Top	[1]	0	163	0	0	0	210	0	0.00
		[2]	0	163	0	0	0	210	0	0.00
		[3]	0	163	0	0	0	210	0	0.00
	LWeb	[4]	0	163	0	0	0	210	0	0.00
		[5]	0	163	0	0	0	210	0	0.00
		[6]	0	163	0	0	0	210	0	0.00
	Rweb	[7]	0	163	0	0	0	210	0	0.00
		[8]	0	163	0	0	0	210	0	0.00
		[9]	0	163	0	0	0	210	0	0.00
	Bott	[10]	0	163	0	0	0	210	0	0.00
		[11]	0	163	0	0	0	210	0	0.00
		[12]	0	163	0	0	0	210	0	0.00

D+ETR'		[Point]	τsx	τsy	τt	Στ	τa	κ
	Top	[1]	0	0	0	0	120	0.00
		[2]	0	0	0	0	120	0.00
		[3]	0	0	0	0	120	0.00
	LWeb	[4]	0	0	0	0	120	0.00
		[5]	0	0	0	0	120	0.00
		[6]	0	0	0	0	120	0.00
	Rweb	[7]	0	0	0	0	120	0.00
		[8]	0	0	0	0	120	0.00
		[9]	0	0	0	0	120	0.00
	Bott	[10]	0	0	0	0	120	0.00
		[11]	0	0	0	0	120	0.00
		[12]	0	0	0	0	120	0.00

８．６. Evaluation for Girder Stress at Bottom of Tower **(Excerpt)**

（１）Design Principle

Bending of the tower is transferred from middle cell to whole section of the girder, therefore an additional stress is occurred at girder at bottom of the tower. Here, girder stress considering the additional stress is evaluated.
Followings are evaluation conditions;

１）The axial force of the tower dose not affect to the girder.

２）The bending effect of the tower which is transferred from cross beam at bottom of the tower can be ignored.

The bending of the tower is supported by middle cell (rigid area) at bottom of the tower, therefore additional stress caused by the bending shall be added to calculation results of the girder. The additional stress can be calculated as corner part of tower and middle cell.
The total of the girder stress and stress as a corner part is evaluated.

（２）Stress Resultants

１）Girder Stress Resultants

Girder Stress: Already calculated at section 3.5

Stress at section P11L and P11R is the design stress of girder.

２）Tower Stress Resultants

Bending moment and shear force at bottom of the tower are used.

Stress resultants as a corner part is calculated by following assumption:

The reverse T-shape corner beam is supported by the diaphragm.

Shear Force S = ±M / (2*L+3.0 (tower width))

L：distance between tower wall and diaphragm

Girder Bending M = ±S * L (ignore tower shear force)

Tower stress resultants and M and S of girder as a corner part:

	Tower M	Girder S	girder M
D+Lmax	6499	624.9	2312.1
D+Lmin	-6966	-669.8	-2478.3
D+L+T'	-8808	-846.9	-3133.5
D+WtTR'	-464	-44.6	-165.0
D+L+WtTR'	-5573	-535.9	-1982.8
D+WtTR+T'	-2772	-266.5	-986.1
D+L+WtTR+T'	-7503	-721.4	-2669.2
D+ELG'	-6532	-628.1	-2324.0
D+ETR'	-387	-37.2	-137.6

(3) Evaluation for Combination of Girder Effect Stress and Tower Effect Stress

<P11L…Max Case>

	[Point]	Bending Stress								Shear Stress					Composite Stress
		Girder					Tower	Total	Allowable Value	Girder			Total	Allowable Value	
		σn	σna	σmx	σmy	$\Sigma \sigma_0$	$\triangle \sigma mx$	$\Sigma \sigma$	σa	τsx	τsy	τt	$\Sigma \tau$	τa	k
DECK-L	[1]	0	210	0	0	0	25	25	210	0	0	0	0	120	0.01
	[2]	-30	201	52	6	29	25	54	210	9	31	18	46	120	0.21
	[3]	-30	201	47	30	26	0	26	210	8	30	15	30	120	0.08
	[4]	-30	201	42	56	50	0	50	210	0	0	0	0	120	0.06
	[5]	-30	201	42	56	50	0	50	210	0	0	0	0	120	0.06
DECK-R	[6]	0	210	0	0	0	25	25	210	0	0	0	0	120	0.01
	[7]	-30	201	52	-6	29	25	54	210	9	31	18	46	120	0.21
	[8]	-30	201	47	-30	-35	0	-35	210	8	30	15	30	120	0.09
	[9]	-30	201	42	-56	-62	0	-62	210	0	0	0	0	120	0.09
	[10]	-30	201	42	-56	-62	0	-62	210	0	0	0	0	120	0.09
WEB-1	[11]	-30	181	47	30	-18	0	-18	189	3	31	14	45	120	0.15
	[12]	-30	181	23	30	-24	0	-24	189	3	33	14	47	120	0.16
WEB-2	[13]	-30	201	51	6	28	25	53	210	0	18	1	19	120	0.09
	[14]	-30	201	4	6	-29	-25	-54	210	0	21	1	22	120	0.10
	[15]	-30	201	-78	6	-109	-25	-134	210	0	13	1	14	120	0.42
WEB-3	[16]	-30	201	51	-6	28	25	53	210	0	18	1	19	120	0.09
	[17]	-30	201	4	-6	-30	-25	-55	210	0	21	1	22	120	0.10
	[18]	-30	201	-78	-6	-109	-25	-134	210	0	13	1	14	120	0.42
WEB-4	[19]	-30	180	47	-30	-36	0	-36	187	3	31	14	45	120	0.17
	[20]	-30	180	23	-30	-41	0	-41	187	3	33	14	47	120	0.19
WEB-L	[21]	-30	168	23	30	-24	0	-24	175	3	33	14	47	120	0.16
	[22]	-30	168	4	29	-29	0	-29	175	4	33	14	47	120	0.17
	[23]	-30	168	-79	23	-109	0	-109	179	5	25	14	39	120	0.37
LFLG	[24]	-30	201	-79	24	-109	0	-109	210	0	0	0	0	120	0.27
	[25]	-30	160	-79	23	-109	0	-109	167	6	27	16	43	120	0.40
	[26]	-30	151	-79	6	-110	-25	-134	158	9	16	19	33	120	0.48
	[27]	-30	151	-79	0	-110	-25	-135	158	9	0	19	19	120	0.43
	[28]	-30	151	-79	-6	-110	-25	-135	158	9	16	19	33	120	0.49
	[29]	-30	160	-79	-23	-110	0	-110	167	6	27	16	43	120	0.40
	[30]	-30	201	-79	-24	-110	0	-110	210	0	0	0	0	120	0.27
WEB-R	[31]	-30	168	23	-30	-41	0	-41	174	3	33	14	47	120	0.19
	[32]	-30	168	4	-29	-45	0	-45	174	4	33	14	47	120	0.20
	[33]	-30	168	-79	-23	-110	0	-110	179	5	25	14	39	120	0.38

<P11R··Max Case>

	[Point]	Bending Stress								Shear Stress					Composite Stress
		Girder					Tower	Total	Allowable Value	Girder			Total	Allowable Value	
		σ_{n}	σ_{na}	σ_{mx}	σ_{my}	$\Sigma\sigma_{0}$	$\Delta\sigma_{mx}$	$\Sigma\sigma$	σ_{a}	τ_{sx}	τ_{sy}	τ_{t}	$\Sigma\tau$	τ_{a}	k
DECK-L	[1]	0	210	0	0	0	25	25	210	0	0	0	0	120	0.01
	[2]	-34	201	54	6	31	25	56	210	12	30	28	54	120	0.27
	[3]	-34	201	49	30	27	0	27	210	11	29	24	29	120	0.08
	[4]	-34	201	44	55	51	0	51	210	0	0	0	0	120	0.06
	[5]	-34	201	44	55	51	0	51	210	0	0	0	0	120	0.06
DECK-R	[6]	0	210	0	0	0	25	25	210	0	0	0	0	120	0.01
	[7]	-34	201	54	-6	31	25	56	210	12	30	28	54	120	0.27
	[8]	-34	201	49	-30	-33	0	-33	210	11	29	24	29	120	0.08
	[9]	-34	201	44	-55	-60	0	-60	210	0	0	0	0	120	0.08
	[10]	-34	201	44	-55	-60	0	-60	210	0	0	0	0	120	0.08
WEB-1	[11]	-34	183	48	30	-15	0	-15	191	4	30	22	53	120	0.20
	[12]	-34	183	24	30	-25	0	-25	191	4	32	22	54	120	0.22
WEB-2	[13]	-34	201	53	6	30	25	55	210	0	18	2	19	120	0.09
	[14]	-34	201	4	6	-33	-25	-58	210	0	20	2	22	120	0.11
	[15]	-34	201	-81	6	-114	-25	-139	210	1	12	2	14	120	0.45
WEB-3	[16]	-34	201	53	-6	30	25	55	210	0	18	2	19	120	0.10
	[17]	-34	201	4	-6	-33	-25	-58	210	0	20	2	22	120	0.11
	[18]	-34	201	-81	-6	-114	-25	-139	210	1	12	2	14	120	0.45
WEB-4	[19]	-34	183	48	-30	-33	0	-33	187	4	30	22	53	120	0.22
	[20]	-34	183	24	-30	-40	0	-40	187	4	32	22	54	120	0.24
WEB-L	[21]	-34	169	24	30	-25	0	-25	176	4	32	22	54	120	0.22
	[22]	-34	169	4	29	-33	0	-33	176	5	32	22	54	120	0.23
	[23]	-34	169	-81	23	-114	0	-114	179	7	24	22	46	120	0.44
LFLG	[24]	-34	201	-82	23	-115	0	-115	210	0	0	0	0	120	0.30
	[25]	-34	160	-82	23	-115	0	-115	167	8	26	25	52	120	0.48
	[26]	-34	151	-82	6	-115	-25	-140	158	11	15	30	43	120	0.57
	[27]	-34	151	-82	0	-115	-25	-140	158	11	0	30	30	120	0.50
	[28]	-34	151	-82	-6	-115	-25	-140	158	11	15	30	43	120	0.57
	[29]	-34	160	-82	-23	-115	0	-115	167	8	26	25	52	120	0.48
	[30]	-34	201	-82	-23	-115	0	-115	210	0	0	0	0	120	0.30
WEB-R	[31]	-34	169	24	-30	-40	0	-40	174	4	32	22	54	120	0.24
	[32]	-34	169	4	-29	-45	0	-45	174	5	32	22	54	120	0.25
	[33]	-34	169	-81	-23	-115	0	-115	179	7	24	22	46	120	0.45

8. 7. Calculation for Site Joint of Tower (Excerpt)

(1) Tower J20 Top

(a) Stress

$\sigma cmax$ = -0 N/mm^2 0.75σca = 0.75 * 210 = 158 N/mm^2

∴σc = 158 N/mm^2

τmax = 0 N/mm^2

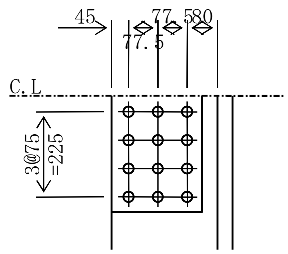
(b) Base Metal Cross Section

1-Top PL 2420 * 40 Ag = 968.0 cm^2 (SM490Y)

2-RIB PL 280 * 27 Agr = 151.2 cm^2 (SM490Y)

ΣAg = Ag + Agr = 968.0 + 151.2 = 1119.2 cm^2

(c) Bolt Arrangement



(d) Design Axial Force

・Rib Pcr = σc * Agr = 158 * 15120 = 2381400 N

(e) Required Splice Section

・Rib AgrR = Agr = 151.2 cm^2

(f) Required No. of Bolt

・Rib nr = Pcr / (108000 * 1.00) = 2381400 / 108000 = 22.0本 (2 @ 12 = 24nos.)

(S10T M22 2 plane allowable friction ρa = 108000 N Inorganic zinc Nmax = 5,4)

(h) Evaluation for Splice

	(SM490Y)	Ags(cm^2)	
4-SPL PL	235 * 17	159.8	＞ AgrR = 151.2cm^2

８．８． Calculation for Tower Welding

(1) Evaluation for Welding Size at Corner

1) Design Principle

Welding for flange and web at corner which transmit shear force shall be pertial penetration welding.
As for the throat thickness, larger weld size (based on shear stress or based on composite stress) shall be selected.

2) Required Throat Thickness

・Required Throat Thickness Based on Shear Stress (JSHB Ⅱ 6.2.7)

$$a1 = \tau \cdot (tu \text{ or } tl) / \tau a$$

where,
- τ : Shear Strass of Top・Bott (N/mm^2)
- τa : Allowable Shear Stress (N/mm^2)
- tw : WEB thickness (mm)
- tu : Top thickness (mm)
- tl : Bott thickness (mm)

・Required Throat Thickness Based on Composite Stress

$$a2 = \tau \cdot (tu \text{ or } tl) / (\tau a \cdot \sqrt{(1.2-(\sigma / \sigma a)^2)})$$

where,
- σ : Vertical Stress at Top・Bott caused by Bending Moment (N/mm^2)
- σa : Allowable Vertical Stress (N/mm^2)

・Required Throat Thickness

$$areq = 1.5 \cdot Max(a1, a2)$$

3) Required pertial penetration welding size

① Design throat thickness in case of ≦ 25 : a = S1 + 0.707・S2

Check 1 : S1≧ tw/2
Check 2 : -
Check 3 : S1 ≧ 2*√t ≧ 6 mm
Check 4 : T1 > S ≧ √(2*T2) ≧ 6 mm

② Design throat thickness in case of > 25: a = S1' + 0.707・(S1″+S2)

Check 1 : S1'+S1″ ≧ tw/2
Check 2 : S2≧S1″・(SEC-1)
Check 3 : S1',S1″ ≧ 2*√t ≧ 6 mm
Check 4 : T1 > S ≧ √(2*T2) ≧ 6 mm

where, t1 : Thickness of thinner base metal (mm)
t2 : Thickness of thicker base metal (mm)

(2) Calculation Results for Welds

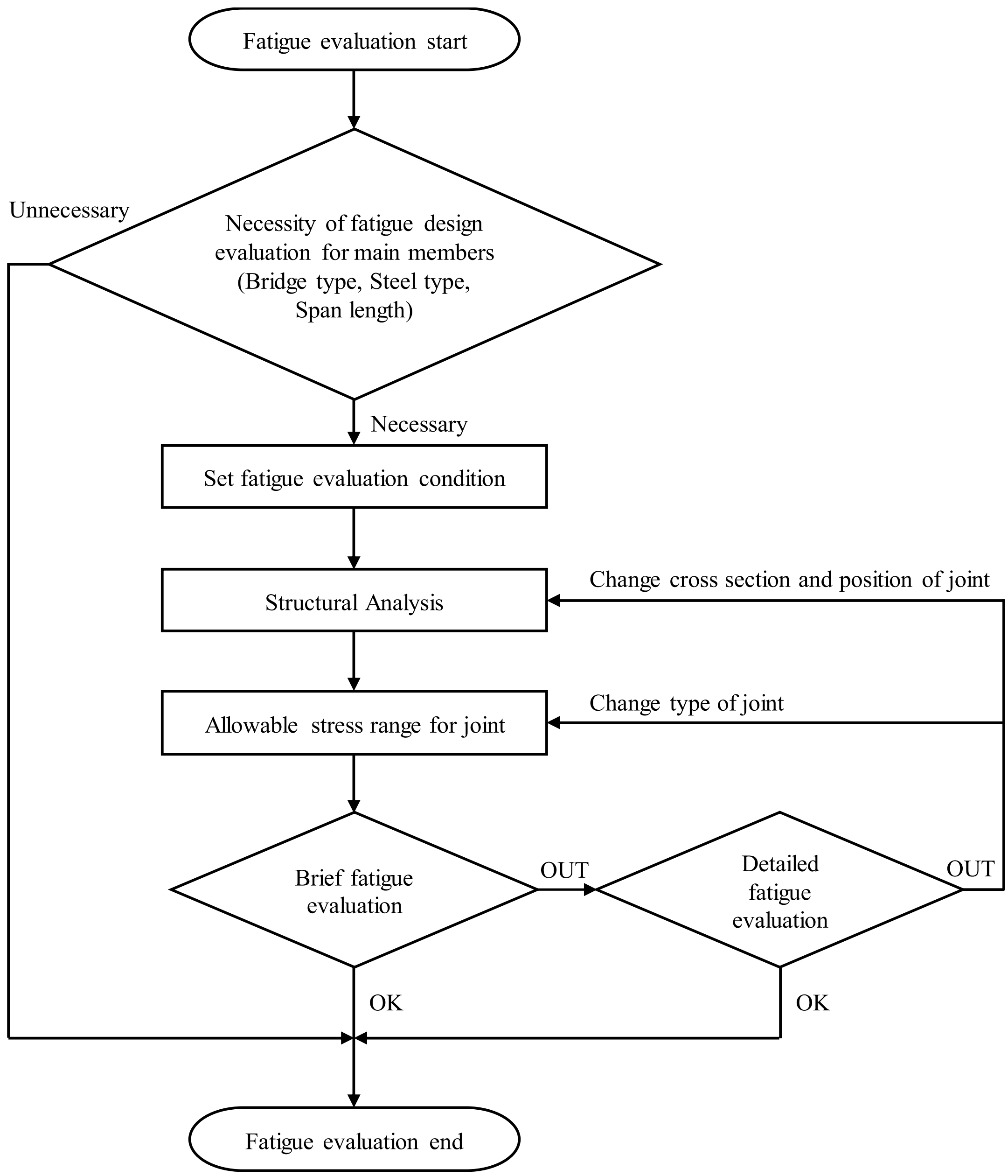
Section	Tu	tw	Stress		Additional		Composite		Allowable		Required Throat Thickness				Weld Size				Evaluation					
	Tl	tw	τ1	σ1	τ2	σ2	Σ τ	Σ σ	τa	σa	a1	a2	areq	areq*1.5	√(2·t)	S1'	S1″	S2	Check1	Check2	Check3	Check4	Design	
	(mm)	(mm)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(N/mm^2)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)					a (mm)	
J20	40	40	0.1	-0.2	-	-	0.1	-0.2	120	210	0.03	0.03	0.03	0.05	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	0.1	-0.2	-	-	0.1	-0.2	120	210	0.03	0.03	0.03	0.05	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J19	40	40	4.3	-10.7	-	-	4.3	-10.7	120	210	1.43	1.31	1.43	2.15	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	4.3	-10.7	-	-	4.3	-10.7	120	210	1.43	1.31	1.43	2.15	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J18	40	40	7.1	-14.7	24.1	-25.1	31.2	-39.8	120	210	10.40	9.64	10.40	15.60	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	7.1	-27.2	31.6	-0.4	38.7	-27.6	120	210	12.90	11.86	12.90	19.35	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J17	40	40	8.3	-19.7	24.1	-25.1	32.4	-44.8	120	210	10.80	10.05	10.80	16.20	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	8.3	-47.7	31.6	-0.4	39.9	-48.1	120	210	13.30	12.42	13.30	19.95	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J16	40	40	8.3	-26.6	28.9	-20.6	37.2	-47.2	120	210	12.40	11.57	12.40	18.60	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	8.3	-70.0	34.0	-12.7	42.3	-82.7	120	210	14.10	13.79	14.10	21.15	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J15	40	40	8.1	-34.4	28.9	-20.6	37.0	-55.0	120	210	12.33	11.60	12.33	18.50	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	8.1	-93.0	34.0	-12.7	42.1	-105.7	120	210	14.03	14.42	14.42	21.63	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J14	40	40	6.6	-39.7	28.9	-20.6	35.5	-60.3	120	210	11.83	11.19	11.83	17.75	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	6.6	-109.5	34.0	-12.7	40.6	-122.2	120	210	13.53	14.58	14.58	21.87	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J13	40	40	5.3	-46.0	17.4	-10.7	22.7	-56.7	120	210	7.57	7.13	7.57	11.36	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	5.3	-125.1	19.7	-8.7	25.0	-133.8	120	210	8.33	9.35	9.35	14.03	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J12	40	40	3.7	-53.0	17.4	-10.7	21.1	-63.7	120	210	7.03	6.68	7.03	10.55	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	3.7	-138.8	19.7	-8.7	23.4	-147.5	120	210	7.80	9.28	9.28	13.92	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J11	40	40	2.2	-60.8	19.8	-1.7	22.0	-62.5	120	210	7.33	6.96	7.33	11.00	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	2.2	-150.3	17.5	-20.9	19.7	-171.2	120	210	6.57	8.97	8.97	13.46	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J10	40	40	2.6	-69.2	19.8	-1.7	22.4	-70.9	120	210	7.47	7.16	7.47	11.21	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	2.6	-159.2	17.5	-20.9	20.1	-180.1	120	210	6.70	9.83	9.83	14.75	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J9	40	40	2.6	-71.2	19.8	-1.7	22.4	-72.9	120	210	7.47	7.19	7.47	11.21	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	2.6	-154.4	17.5	-20.9	20.1	-175.3	120	210	6.70	9.45	9.45	14.18	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J8	40	40	2.7	-74.1	-	-	2.7	-74.1	120	210	0.90	0.87	0.90	1.35	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	2.7	-147.5	-	-	2.7	-147.5	120	210	0.90	1.07	1.07	1.61	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J7	40	40	2.7	-77.3	-	-	2.7	-77.3	120	210	0.90	0.87	0.90	1.35	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
	40	40	2.7	-140.7	-	-	2.7	-140.7	120	210	0.90	1.04	1.04	1.56	8.94	10	10	9	OK	OK	OK	OK	23.4	OK
J6	35	35	3.2	-90.5	-	-	3.2	-90.5	120	210	0.93	0.93	0.93	1.40	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
	35	35	3.2	-150.7	-	-	3.2	-150.7	120	210	0.93	1.13	1.13	1.70	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
J5	35	35	3.2	-96.3	-	-	3.2	-96.3	120	210	0.93	0.94	0.94	1.41	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
	35	35	3.2	-143.4	-	-	3.2	-143.4	120	210	0.93	1.09	1.09	1.64	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
J4	35	35	3.3	-102.8	-	-	3.3	-102.8	120	210	0.96	0.98	0.98	1.47	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
	35	35	3.3	-136.5	-	-	3.3	-136.5	120	210	0.96	1.09	1.09	1.64	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
J3	35	35	3.3	-109.6	-	-	3.3	-109.6	120	210	0.96	1.00	1.00	1.50	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
	35	35	3.3	-130.2	-	-	3.3	-130.2	120	210	0.96	1.07	1.07	1.61	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
J2	35	35	3.5	-116.8	-	-	3.5	-116.8	120	210	1.02	1.08	1.08	1.62	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
	35	35	3.5	-126.9	-	-	3.5	-126.9	120	210	1.02	1.12	1.12	1.68	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
J1	35	35	3.6	-123.6	-	-	3.6	-123.6	120	210	1.05	1.14	1.14	1.71	8.37	9	9	9	OK	OK	OK	OK	21.7	OK
	35	35	3.6	-127.7	-	-	3.6	-127.7	120	210	1.05	1.15	1.15	1.73	8.37	9	9	9	OK	OK	OK	OK	21.7	OK

9. Fatigue Evaluation

9. 1. Evaluation Method

(1) Flowchart for Fatigue Evaluation

Fatigue evaluation is conducted through the following flowchart:



（２） Conditions for Fatigue Evaluation

1)Design Working Life and Loading

- Design working life: 100 years

- Traffic volume of large-sized car: $ADTT_{SLi}$ = 1672 (Design traffic volume of large-sized car per day per lane in one direction)

- Load for fatigue design = (T-load) * (1 + i_f)

T load: 200 kN

i_f: Impact coefficient $i_f = 10 / (50 + L)$

L: Span length for calculating the impact coefficient (m)

- Correction coefficient for live load

Correction coefficient for live load $\gamma_T = \gamma_{T1} * \gamma_{T2}$ (Coefficient is multiplied when calculating stress range)

γ_{T1}: Correction coefficient for T-load

$\gamma_{T1} = \text{Log } L_{B1} + 1.50$ (Here, $2.00 \leq \gamma_{T1} \leq 3.00$.)

L_{B1}: Baseline length employed for calculating the correction coefficient for T-load (m)

(γ_{T1} is rounded to three decimal places)

γ_{T2}: Simultaneous loading coefficient

$ADTT_{SLi}$	$L_{B2} \leqq 50$ m	50 m < L_{B2}
≦2000	1.0	1.0
2000<	1.0	1.1

(In case the influence line of a member does not alternate in positive and negative)

Source: Fatigue Design Recommendations for Steel Structure, JRA 2002

L: Baseline length for calculating the simultaneous loading coefficient (m)

$ADTT_{SLi}$: Design traffic volume of large-sized car per day per lane in one direction

(Car / (Day · Lane))

２）Calculation Method for Stress (General Equation)

$$\sigma = \frac{Rc}{Ri} * \left(\frac{N}{A} + \frac{Mx * (y*Iy+x*Ixy) + My * (x*Ix+y*Ixy)}{Ix*Iy-Ixy^2} \right) * \gamma a$$

Where,

σ: Stress

Rc: Radius of curvature to neutral axis

Ri: Radius of curvature to evaluation position

N: Axial force

Mx: In-plane bending moment

My: Out-plane bending moment

A: Cross sectional area

Ix: Second moment of area with respect to x axis

Iy: Second moment of area with respect to y axis

Ixy: Product of inertia

x: Distance in x axis from neutral axis to evaluation position

y: Distance in y axis from neutral axis to evaluation position

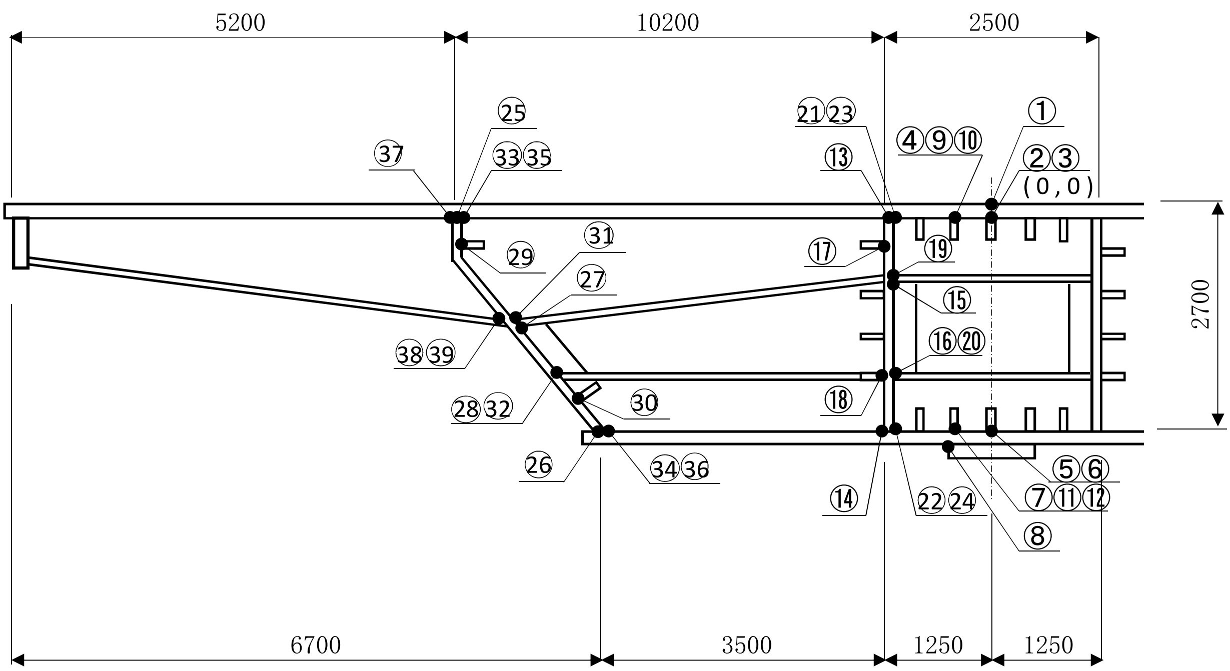
γa: Structural analysis coefficient

γa = 0.8 for RC slab plate girder and box girder (except few main girder bridge)

γa = 1.0 for other types of bridge

9.2 Fatigue Evaluation of Girder (Excerpt)

＜Evaluation Points＞



①	Deck plate joint	㉑	Main girder inner web and transverse rib web (upper)
②	Deck and horizontal rib web	㉒	Main girder inner web and transverse rib web (lower)
③	Deck and diaphragm	㉓	Main girder inner web and diaphragm (upper)
④	Deck and vertical rib	㉔	Main girder inner web and diaphragm (lower)
⑤	Bottom flange and horizontal rib web	㉕	Main girder outer web and deck
⑥	Bottom flange and diaphragm	㉖	Main girder outer web and bottom flange
⑦	Bottom flange and vertical rib	㉗	Main girder outer web (upper) and vertical stiffener
⑧	Sole plate (longitudinal)	㉘	Main girder outer web (lower) and vertical stiffner
⑨	Longitudinal rib of deck and transverse rib	㉙	Main girder outer web (upper) and horizontal stiffener
⑩	Longitudinal rib of deck and diaphragm	㉚	Main girder outer web (lower) and horizontal stiffner
⑪	Longitudinal rib of bottom flange and transverse rib	㉛	Main girder outer web and transverse rib flange (upper)
⑫	Longitudinal rib of bottom flange and diaphragm	㉜	Main girder outer web and transverse rib flange (lower)
⑬	Main girder inner web and deck	㉝	Main girder outer web and transverse rib web (upper)
⑭	Main girder inner web and bottom flange	㉞	Main girder outer web and transverse rib web (lower)
⑮	Main girder inner web (upper) and vertical stiffener	㉟	Main girder outer web and diaphragm (upper)
⑯	Main girder inner web (lower) and vertical stiffner	㊱	Main girder outer web and diaphragm (lower)
⑰	Main girder inner web rib (upper)	㊲	Main girder web and bracket web upper edge
⑱	Main girder inner web rib(lower)	㊳	Main girder web and bracket web lower edge
⑲	Main girder inner web and transverse rib flange (upper)	㊴	Main girder web and bracket bottom flange
⑳	Main girder inner web and transverse rib flange (lower)		

＜Result of Fatigue Evaluation＞

The result of the fatigue evaluation is shown below.

Position	No.	Point-1		Point-2		Point-3		Point-4	
		Grade D		Grade E		Grade E		Grade D	
		a)	b)	a)	b)	a)	b)	a)	b)
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j
Near P10	2	-----	-------	*****	*******	-----	-------	-----	-------
	3	0<85	-------	0<65	-------	*****	*******	0<88	-------
	4	-----	-------	*****	*******	0<81	-------	0<109	-------
Middle od Side Span	24	1<109	-------	*****	*******	1<81	-------	1<109	-------
	25	1<109	-------	1<81	-------	*****	*******	1<109	-------
	26	1<109	-------	*****	*******	1<81	-------	1<109	-------
Near P11	49	1<109	-------	1<81	-------	*****	*******	1<109	-------
	50	1<109	-------	*****	*******	1<81	-------	1<109	-------
	52	2<109	-------	*****	*******	2<81	-------	2<109	-------
Middle of Center	104	1<84	-------	*****	*******	1<62	-------	1<84	-------
	105	1<84	-------	1<62	-------	*****	*******	1<84	-------
	106	1<84	-------	*****	*******	1<62	-------	1<84	-------

Position	No.	Point-5		Point-6		Point-7		Point-8	
		Grade E		Grade E		Grade D		Grade G	
		a)	b)	a)	b)	a)	b)	a)	b)
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j
Near P10	2	*****	*******	10<68	-------	10<92	-------	*****	*******
	3	18<75	-------	*****	*******	18<101	-------	*****	*******
	4	*****	*******	24<71	-------	24<96	-------	*****	*******
Middle od Side Span	24	*****	*******	50<68	-------	50<93	-------	*****	*******
	25	49<68	-------	*****	*******	49<91	-------	*****	*******
	26	*****	*******	47<69	-------	47<94	-------	*****	*******
Near P11	49	15<81	-------	*****	*******	15<109	-------	*****	*******
	50	*****	*******	16<81	-------	16<109	-------	*****	*******
	52	*****	*******	19<81	-------	19<109	-------	19<42	-------
Middle of Center	104	*****	*******	33<62	-------	33<84	-------	*****	*******
	105	32<62	-------	*****	*******	32<84	-------	*****	*******
	106	*****	*******	33<62	-------	33<84	-------	*****	*******

Position	No.	Point-9		Point-10		Point-11		Point-12	
		Grade E		Grade E		Grade E		Grade E	
		a)	b)	a)	b)	a)	b)	a)	b)
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j
Near P10	2	*****	*******	-----	-------	*****	*******	10<68	-------
	3	0<65	-------	*****	*******	18<75	-------	*****	*******
	4	*****	*******	0<81	-------	*****	*******	24<71	-------
Middle od Side Span	24	*****	*******	1<81	-------	*****	*******	50<68	-------
	25	1<81	-------	*****	*******	49<68	-------	*****	*******
	26	*****	*******	1<81	-------	*****	*******	47<69	-------
Near P11	49	1<81	-------	*****	*******	15<81	-------	*****	*******
	50	*****	*******	1<81	-------	*****	*******	16<81	-------
	52	*****	*******	2<81	-------	*****	*******	19<81	-------
Middle of Center	104	*****	*******	1<62	-------	*****	*******	33<62	-------
	105	1<62	-------	*****	*******	32<62	-------	*****	*******
	106	*****	*******	1<62	-------	*****	*******	33<62	-------

Position	No.	Point-13		Point-14		Point-15		Point-16	
		Grade D		Grade D		Grade E		Grade E	
		a)	b)	a)	b)	a)	b)	a)	b)
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j
Near P10	2	-----	-------	10<92	-------	*****	*******	*****	*******
	3	1<90	-------	18<101	-------	5<74	-------	14<75	-------
	4	1<109	-------	24<96	-------	*****	*******	*****	*******
Middle od Side Span	24	2<109	-------	50<93	-------	*****	*******	*****	*******
	25	2<109	-------	49<91	-------	14<81	-------	39<72	-------
	26	2<109	-------	47<94	-------	*****	*******	*****	*******
Near P11	49	1<109	-------	15<109	-------	5<81	-------	12<81	-------
	50	1<109	-------	16<109	-------	*****	*******	*****	*******
	52	2<109	-------	19<109	-------	*****	*******	*****	*******
Middle of Center	104	1<84	-------	33<84	-------	*****	*******	*****	*******
	105	1<84	-------	32<84	-------	10<62	-------	26<62	-------
	106	1<84	-------	33<84	-------	*****	*******	*****	*******

Position	No.	Point-17		Point-18		Point-19		Point-20	
		Grade G		Grade G		Grade G		Grade G	
		a)	b)	a)	b)	a)	b)	a)	b)
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j
Near P10	2	2<35	-------	8<35	-------	*****	*******	*****	*******
	3	4<38	-------	14<38	-------	5<38	-------	14<38	-------
	4	5<42	-------	19<37	-------	*****	*******	*****	*******
Middle od Side Span	24	11<42	-------	41>37	0.62	*****	*******	*****	*******
	25	11<42	-------	39>37	0.58	14<42	-------	39>37	0.57
	26	11<42	-------	38<38	-------	*****	*******	*****	*******
Near P11	49	4<42	-------	12<42	-------	5<42	-------	12<42	-------
	50	4<38	-------	13<38	-------	*****	*******	*****	*******
	52	5<38	-------	16<38	-------	*****	*******	*****	*******
Middle of Center	104	7<32	-------	26<32	-------	*****	*******	*****	*******
	105	7<32	-------	26<32	-------	9<32	-------	26<32	-------
	106	7<32	-------	26<32	-------	*****	*******	*****	*******

Position	No.	Point-21		Point-22		Point-23		Point-24	
		Grade E		Grade E		Grade E		Grade E	
		a)	b)	a)	b)	a)	b)	a)	b)
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j
Near P10	2	*****	*******	*****	*******	-----	-------	10<68	-------
	3	1<67	-------	18<75	-------	*****	*******	*****	*******
	4	*****	*******	*****	*******	1<81	-------	24<71	-------
Middle od Side Span	24	*****	*******	*****	*******	2<81	-------	50<68	-------
	25	2<81	-------	49<68	-------	*****	*******	*****	*******
	26	*****	*******	*****	*******	2<81	-------	47<69	-------
Near P11	49	1<81	-------	15<81	-------	*****	*******	*****	*******
	50	*****	*******	*****	*******	1<81	-------	16<81	-------
	52	*****	*******	*****	*******	2<81	-------	19<81	-------
Middle of Center	104	*****	*******	*****	*******	1<62	-------	33<62	-------
	105	1<62	-------	32<62	-------	*****	*******	*****	*******
	106	*****	*******	*****	*******	1<62	-------	33<62	-------

Position	No.	Point-25		Point-26		Point-27		Point-28	
		Grade D		Grade D		Grade E		Grade E	
		a)	b)	a)	b)	a)	b)	a)	b)
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j
Near P10	2	-----	-------	10<92	-------	*****	*******	*****	*******
	3	1<95	-------	18<101	-------	11<74	-------	14<75	-------
	4	2<109	-------	24<96	-------	*****	*******	*****	*******
Middle od Side Span	24	4<109	-------	50<93	-------	*****	*******	*****	*******
	25	4<109	-------	49<91	-------	29<81	-------	39<72	-------
	26	3<109	-------	47<94	-------	*****	*******	*****	*******
Near P11	49	1<109	-------	15<109	-------	9<81	-------	12<81	-------
	50	1<109	-------	16<109	-------	*****	*******	*****	*******
	52	3<109	-------	19<109	-------	*****	*******	*****	*******
Middle of Center	104	2<84	-------	33<84	-------	*****	*******	*****	*******
	105	2<84	-------	32<84	-------	19<62	-------	26<62	-------
	106	2<84	-------	33<84	-------	*****	*******	*****	*******

Position	No.	Point-29		Point-30		Point-31		Point-32	
		Grade G		Grade G		Grade G		Grade G	
		a)	b)	a)	b)	a)	b)	a)	b)
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j
Near P10	2	2<35	-------	8<35	-------	*****	*******	*****	*******
	3	4<38	-------	15<38	-------	10<38	-------	14<38	-------
	4	6<42	-------	20<37	-------	*****	*******	*****	*******
Middle od Side Span	24	12<42	-------	43>37	0.75	*****	*******	*****	*******
	25	12<42	-------	41>36	0.7	28<42	-------	39>37	0.57
	26	11<42	-------	40>37	0.58	*****	*******	*****	*******
Near P11	49	4<42	-------	13<42	-------	9<42	-------	12<42	-------
	50	4<42	-------	14<42	-------	*****	*******	*****	*******
	52	6<42	-------	16<42	-------	*****	*******	*****	*******
Middle of Center	104	8<32	-------	28<32	-------	*****	*******	*****	*******
	105	8<32	-------	27<32	-------	19<32	-------	26<32	-------
	106	8<32	-------	28<32	-------	*****	*******	*****	*******

Position	No.	Point-33		Point-34		Point-35		Point-36	
		Grade E		Grade E		Grade E		Grade E	
		a)	b)	a)	b)	a)	b)	a)	b)
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j
Near P10	2	*****	*******	*****	*******	-----	-------	10<68	-------
	3	1<70	-------	18<75	-------	*****	*******	*****	*******
	4	*****	*******	*****	*******	2<81	-------	24<71	-------
Middle od Side Span	24	*****	*******	*****	*******	4<81	-------	50<68	-------
	25	4<81	-------	49<68	-------	*****	*******	*****	*******
	26	*****	*******	*****	*******	3<81	-------	47<69	-------
Near P11	49	1<81	-------	15<81	-------	*****	*******	*****	*******
	50	*****	*******	*****	*******	1<81	-------	16<81	-------
	52	*****	*******	*****	*******	3<81	-------	19<81	-------
Middle of Center	104	*****	*******	*****	*******	2<62	-------	33<62	-------
	105	2<62	-------	32<62	-------	*****	*******	*****	*******
	106	*****	*******	*****	*******	2<62	-------	33<62	-------

Position	No.	Point-37		Point-38		Point-39			
		Grade E		Grade E		Grade G			
		a)	b)	a)	b)	a)	b)		
		Judge	D = Σ Di,j	Judge	D = Σ Di,j	Judge	D = Σ Di,j		
Near P10	2	-----	-------	5<68	-------	5<35	-------		
	3	1<70	-------	10<74	-------	10<38	-------		
	4	2<81	-------	13<77	-------	13<40	-------		
Middle od Side Span	24	4<81	-------	27<81	-------	27<42	-------		
	25	4<81	-------	26<81	-------	26<42	-------		
	26	3<81	-------	25<81	-------	25<42	-------		
Near P11	49	1<81	-------	8<81	-------	8<42	-------		
	50	1<81	-------	9<81	-------	9<42	-------		
	52	3<81	-------	11<81	-------	11<42	-------		
Middle of Center	104	2<62	-------	18<62	-------	18<32	-------		
	105	2<62	-------	18<62	-------	18<32	-------		
	106	2<62	-------	18<62	-------	18<32	-------		

9.3 Fatigue Evaluation for Cable Anchor (**Excerpt**)

1） Cable Number C6~C15: Cable Cross Section φ 15.6×37

Fatigue evaluation equation

$\Delta\sigma max \leqq \Delta\sigma ce \cdot C_R \cdot Ct$

$\Delta\sigma max$: Maximum stress range

$\Delta\sigma ce$: Constant stress amplitude

Maximum difference between maximum and minimum tension caused by fatigue load per cable

Δ = 89.3 kN (contains impact coefficient for arget joint membersnstant stress amplitudetigue is ensured if the verification equation stated below is satifatigue evaluation)

Maximum difference between maximum and minimum stress of member caused by fatigue load on each cable anchorage member

			Minimum Yield Stress of Cable		Allowable Stress
Δ =	89.3	/	3870	×	210
=	4.8	N/mm^2	(contains impact coefficient for fatigue evaluation)		

Calculation of maximum stress range Δσmax for entire bridge

$\Delta\sigma max$ = Stress range coefficient × Maximum difference between maximum and minimum stress

= 3.0 × 4.8

= 14.5 N/mm^2 $\leqq \Delta\sigma ce \cdot C_R \cdot Ct$

$\Delta\sigma ce \cdot C_R \cdot Ct$ = 32.0 × 1.0 × 0.71

= 22.7 N/mm^2

Here $\Delta\sigma ce$ = 32.0 N/mm^2 (Application of weld joint of G-grade or higher)

C_R = 1.00

Ct = 0.71

From the result of $\Delta\sigma max \leqq \Delta\sigma ce \cdot CR \cdot Ct$, it can be judged that the safety for fatigue was ensured at the welding connection for cable anchorage.

2) Cable Number C1~C5・C16~C20: Cable Cross Section φ 15.6×37

Fatigue evaluation equation

$\angle\sigma max \leqq \angle\sigma ce \cdot C_R \cdot Ct$

$\angle\sigma max$: Maximum stress range

$\angle\sigma ce$: Constant stress amplitude

Maximum difference between maximum and minimum tension caused by fatigue load per cable

Δ = 209.2 kN (contains impact coefficient for arget joint membersnstant stress amplitudetigue is ensured if the verification equation stated below is satifatigue evaluation)

Maximum difference between maximum and minimum stress of member caused by fatigue load on each cable anchorage member

			Minimum Yield Stress of Cable		Allowable Stress
Δ	=	209.2	/ 7310	×	210
	=	6.0	N/mm²		(contains impact coefficient for fatigue evaluation)

Calculation of maximum stress range Δσmax for entire bridge

$\angle\sigma max$ = Stress range coefficient × Maximum difference between maximum and minimum stress

= 3.0 × 6.0

= 18.0 N/mm^2 $\leqq \angle\sigma ce \cdot C_R \cdot Ct$

$\angle\sigma ce \cdot C_R \cdot Ct$ = 32.0 × 1.0 × 0.71

= 22.7 N/mm^2

Here $\angle\sigma ce$ = 32.0 N/mm^2 (Application of weld joint of G-grade or higher)

C_R = 1.00

Ct = 0.71

From the result of $\angle\sigma max \leqq \angle\sigma ce \cdot CR \cdot Ct$, it can be judged that the safety for fatigue was ensured at the welding connection for cable anchorage.

10. Evaluation during Construction Work

10. 1. Design Principle

(1) Design Stress Resultants

Design stress resultants were calculated based on the following construction steps.
Design stress resultants at Normel State (force devided by 1.25) was used.

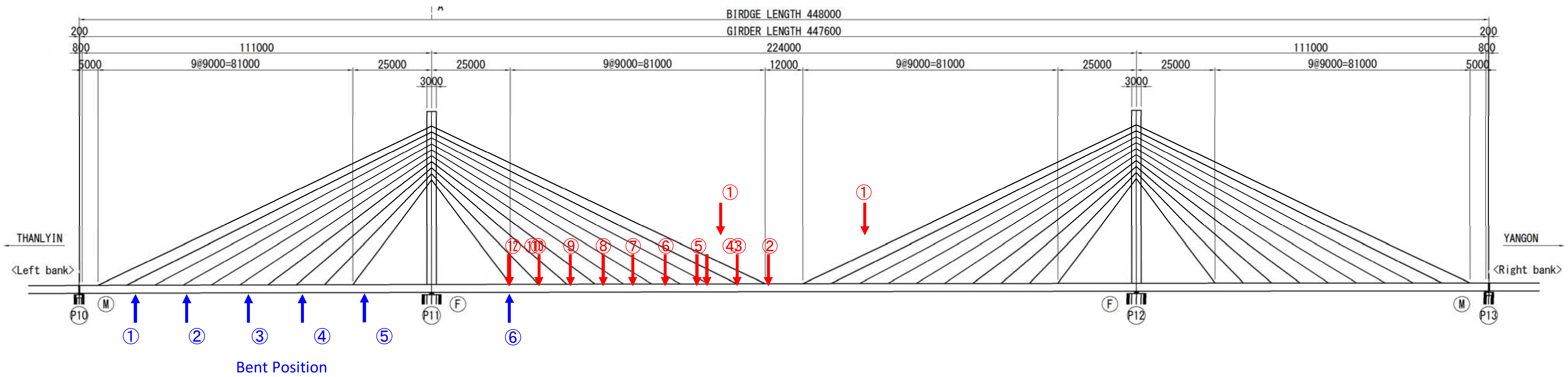
(2) Design Section

・Cross section of girder and tower are shown in the previous section.

10. 2. Stress Resultants of Construction Stage Analysis (Excerpt)

MIDAS analysis step

No.	Case		Description	160ton crane position	Bent	Analysis File	Remarks
	No.	Name					
	1	PS_0	Pre-stressing				
	2	D_0	Before Dead Load+PS				
1	3	CS0	Completion(Before DL+After DL+PS	---	↑	↑	
2	4	CS1	Additional Dead Load	①	↑	↑	
3	5	CS2	G27 Girder (final block) Complete	② C20 anchor position	↑	↑	
4	6	CS3	After C1,20 Cable Tension	③ C19 anchor position	↑	↑	
5	7	CS4	G26 Girder Complete	③ C19 anchor position	↑	↑	
6	8	CS5	After C2,19 Cable Tension	④ C18 anchor position	↑	↑	
7	9	CS6	G25 Girder Complete	④ C18 anchor position	↑	↑	
8	10	CS7	After C3,18 Cable Tension	⑤ C17 anchor position	↑	↑	
9	11	CS8	G24 Girder Complete	⑤ C17 anchor position	↑	↑	
10	12	CS9	After C4,17 Cable Tension	⑥ C16 anchor position	Remove Bent①	↑	
11	13	CS10	G23 Girder Complete	⑥ C16 anchor position	↑	↑	
12	14	CS11	After C5,16 Cable Tension	⑦ C15 anchor position	Remove Bent②	↑	
13	15	CS12	G22 Girder Complete	⑦ C15 anchor position	↑	↑	
14	16	CS13	After C6,15 Cable Tension	⑧ C14 anchor position	↑	↑	
15	17	CS14	G21 Girder Complete	⑧ C14 anchor position	↑	↑	
16	18	CS15	After C7,14 Cable Tension	⑨ C13 anchor position	Remove Bent③	↑	
17	19	CS16	G20 Girder Complete	⑨ C13 anchor position	Remove Bent④⑥	↑	
18	20	CS17	After C8,13 Cable Tension	⑩ C12 anchor position	↑	↑	
19	21	CS18	G19 Girder Complete	⑩ C12 anchor position	Remove Bent⑤	↑	
20	22	CS19	After C9,12 Cable Tension	⑪ C11 anchor position	↑	↑	
21	23	CS20	G18 Girder Complete	⑪ C11 anchor position	↑	↑	
22	24	CS21	After C10,11 Cable Tension	⑫	↑	↑	
23	25	CS22	G17 Girder Complete		↑	↑	
	26	CS23	G16 Girder Complete		Bent ①～⑥		



１０．３. Evaluation of Girder during Construction (Excerpt)

Name：Girder Section：EJ1 （Girder No.= 1 Section No.= 1）

Stress Resultants

	N(kN)	Mx(kN･m)	My(kN･m)	Sx(kN)	Sy(kN)	T(kN･m)
M-Max	-4	3460	0	0	-1471	0
M-Min	4	-2885	0	0	1426	0
N-Max	4	-2885	0	0	1426	0
N-Min	-4	3460	0	0	-1471	0

Effective Bucling Length Lx = 9000 mm Ly = 9000 mm
Curve Radius R = 0.0 m
Gradient DECK-L = 2.0 %
DECK-R = -2.0 %

Effective Width (mm)		All	In-plane	Out-plane
DECK-L	Middle	1250	1250	1250
	Middle	5000	5000	5000
	Middle	5200	5127	5200
DECK-R	Middle	1250	1250	1250
	Middle	5000	5000	5000
	Middle	5200	5096	5200
LFLG	Middle	3500	3500	3500
	Middle	2500	2500	2500
	Middle	3500	3500	3500

Cross Section	Area(cm2)	All	In-plane	Out-plane
1-DECK-L	PL 11472 * 16 (SM400)	1835.6	1823.9	1835.6
2-RIB	PL 200 * 20 (SM400)	80.0	80.0	80.0
2-RIB	PL 250 * 24 (SM400)	120.0	120.0	120.0
6-U.RIB	320 * 240 * 8 (SM400)	323.4	323.4	323.4
1-RIB	PL 250 * 24 (SM400)	60.0	60.0	60.0
7-U.RIB	320 * 240 * 8 (SM400)	377.3	377.3	377.3
1-RIB	PL 250 * 24 (SM400)	60.0	60.0	60.0
1-DECK-R	PL 11472 * 16 (SM400)	1835.6	1818.9	1835.6
2-RIB	PL 200 * 20 (SM400)	80.0	80.0	80.0
2-RIB	PL 250 * 24 (SM400)	120.0	120.0	120.0
6-U.RIB	320 * 240 * 8 (SM400)	323.4	323.4	323.4
1-RIB	PL 250 * 24 (SM400)	60.0	60.0	60.0
7-U.RIB	320 * 240 * 8 (SM400)	377.3	377.3	377.3
1-RIB	PL 250 * 24 (SM400)	60.0	60.0	60.0
1-WEB-1	PL 484 * 14 (SM490Y)	67.8	67.8	67.8
1-RIB	PL 160 * 16 (SM490Y)	0.0	0.0	0.0
1-WEB-2	PL 2659 * 14 (SM490Y)	372.3	372.3	372.3
4-RIB	PL 160 * 16 (SM490Y)	102.4	102.4	102.4
1-WEB-3	PL 2659 * 14 (SM490Y)	372.3	372.3	372.3
4-RIB	PL 160 * 16 (SM490Y)	102.4	102.4	102.4
1-WEB-4	PL 484 * 14 (SM490Y)	67.8	67.8	67.8
1-RIB	PL 160 * 16 (SM490Y)	0.0	0.0	0.0
1-WEB-L	PL 2560 * 14 (SM490Y)	358.5	358.5	358.5
4-RIB	PL 160 * 16 (SM490Y)	0.0	0.0	0.0
1-LFLG	PL 9740 * 14 (SM490Y)	1363.6	1363.6	1363.6
18-RIB	PL 160 * 16 (SM490Y)	460.8	460.8	460.8
1-WEB-R	PL 2560 * 14 (SM490Y)	358.5	358.5	358.5
4-RIB	PL 160 * 16 (SM490Y)	0.0	0.0	0.0

Property			All	In-plane	Out-plane
Area	A	(cm2)	9338.7	9310.4	9338.7
Center of G	ex	(cm)	-0.0	-0.6	-0.0
	ey	(cm)	179.6	179.4	179.6
2nd moment area	Ix	(cm4)	103169489	103042593	103169489
	Iy	(cm4)	2909665244	2872822244	2909665244
Torsion factor	J	(cm4)	189108523		
radius of gyration of area	Rx	(cm)	105.1		
	Ry	(cm)	558.2		
Slenderness ratio	Lx/Rx		8.56		
	Ly/Ry		1.61		
Euler Buckling	0.8*σex		21538		
Stress	0.8*σey		607424		

Resistance Bending Moment

		(+)	(-)
in-plane	Mxr(up)=	159155.3 kN·m	159155.3 kN·m
	Mxr(bot)=	119711.4 kN·m	83749.1 kN·m
Out-plane	Myr(up)=	355146.6 kN·m	355146.6 kN·m
	Myr(bot)=	355146.6 kN·m	355146.6 kN·m

Stress (N/mm^2)

M-Max	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
DECK-L	0	140	-3	0	-3	140	3	0.02
DECK-R	0	140	-3	0	-3	140	3	0.02
WEB-1	0	173	-3	0	-3	173	3	0.01
WEB-2	0	179	6	0	-3	179	3	0.01
WEB-3	0	179	6	0	-3	179	3	0.01
WEB-4	0	173	-3	0	-3	173	3	0.01
WEB-L	0	210	6	0	6	210	1	0.00
LFLG	0	210	6	0	6	210	-6	-0.03
WEB-R	0	210	6	0	6	210	1	0.00

M-Max	τsx	τsy	τt	Στ	τa	κ
DECK-L	0	8	0	8	80	0.01
DECK-R	0	8	0	8	80	0.01
WEB-1	0	11	0	11	120	0.01
WEB-2	0	11	0	11	120	0.01
WEB-3	0	11	0	11	120	0.01
WEB-4	0	11	0	11	120	0.01
WEB-L	0	11	0	11	120	0.01
LFLG	0	8	0	8	120	0.01
WEB-R	0	11	0	11	120	0.01

M-Min	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
DECK-L	0	140	3	0	3	140	0	-0.01
DECK-R	0	140	3	0	3	140	0	-0.01
WEB-1	0	210	2	0	2	210	0	-0.00
WEB-2	0	210	-5	0	-5	152	0	0.02
WEB-3	0	210	-5	0	-5	152	0	0.02
WEB-4	0	210	2	0	2	210	0	-0.00
WEB-L	0	210	-5	0	-5	153	0	0.02
LFLG	0	210	-5	0	-5	147	0	0.02
WEB-R	0	210	-5	0	-5	153	0	0.02

M-Min		τsx	τsy	τt	Στ	τa	κ
	DECK-L	0	7	0	7	80	0.01
	DECK-R	0	7	0	7	80	0.01
	WEB-1	0	11	0	11	120	0.01
	WEB-2	0	11	0	11	120	0.01
	WEB-3	0	11	0	11	120	0.01
	WEB-4	0	11	0	11	120	0.01
	WEB-L	0	11	0	11	120	0.01
	LFLG	0	8	0	8	120	0.00
	WEB-R	0	11	0	11	120	0.01

N-Max		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	DECK-L	0	140	3	0	3	140	0	-0.01
	DECK-R	0	140	3	0	3	140	0	-0.01
	WEB-1	0	210	2	0	2	210	0	-0.00
	WEB-2	0	210	-5	0	-5	152	0	0.02
	WEB-3	0	210	-5	0	-5	152	0	0.02
	WEB-4	0	210	2	0	2	210	0	-0.00
	WEB-L	0	210	-5	0	-5	153	0	0.02
	LFLG	0	210	-5	0	-5	147	0	0.02
	WEB-R	0	210	-5	0	-5	153	0	0.02

N-Max		τsx	τsy	τt	Στ	τa	κ
	DECK-L	0	7	0	7	80	0.01
	DECK-R	0	7	0	7	80	0.01
	WEB-1	0	11	0	11	120	0.01
	WEB-2	0	11	0	11	120	0.01
	WEB-3	0	11	0	11	120	0.01
	WEB-4	0	11	0	11	120	0.01
	WEB-L	0	11	0	11	120	0.01
	LFLG	0	8	0	8	120	0.00
	WEB-R	0	11	0	11	120	0.01

N-Min		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	DECK-L	0	140	-3	0	-3	140	3	0.02
	DECK-R	0	140	-3	0	-3	140	3	0.02
	WEB-1	0	173	-3	0	-3	173	3	0.01
	WEB-2	0	179	6	0	-3	179	3	0.01
	WEB-3	0	179	6	0	-3	179	3	0.01
	WEB-4	0	173	-3	0	-3	173	3	0.01
	WEB-L	0	210	6	0	6	210	1	0.00
	LFLG	0	210	6	0	6	210	-6	-0.03
	WEB-R	0	210	6	0	6	210	1	0.00

N-Min		τsx	τsy	τt	Στ	τa	κ
	DECK-L	0	8	0	8	80	0.01
	DECK-R	0	8	0	8	80	0.01
	WEB-1	0	11	0	11	120	0.01
	WEB-2	0	11	0	11	120	0.01
	WEB-3	0	11	0	11	120	0.01
	WEB-4	0	11	0	11	120	0.01
	WEB-L	0	11	0	11	120	0.01
	LFLG	0	8	0	8	120	0.01
	WEB-R	0	11	0	11	120	0.01

１０．４．Evaluation of Tower during Construction (Excerpt)

Name：Tower Section：C1 (Girder No.= 1 Section No.= 1)

Stress Resultants

	N(kN)	Mx(kN·m)	My(kN·m)	Sx(kN)	Sy(kN)	T(kN·m)
M-Max	-3457	0	0	0	-5	0
M-Min	-3457	0	0	0	-5	0
N-Max	-200	0	0	0	0	0
N-Min	-3457	0	0	0	-5	0

Effective Bucling Length Lx = 37700 mm Ly = 53900 mm

Cross Section

	Area(cm2)	All	In-plane	Out-plane
1-Top	PL 2420 * 40 (SM490Y)	968.0	968.0	968.0
2-RIB	PL 280 * 27 (SM490Y)	151.2	151.2	151.2
1-LWeb	PL 3000 * 40 (SM490Y)	1200.0	1200.0	1200.0
5-RIB	PL 250 * 25 (SM490Y)	312.5	312.5	312.5
1-Rweb	PL 3000 * 40 (SM490Y)	1200.0	1200.0	1200.0
5-RIB	PL 250 * 25 (SM490Y)	312.5	312.5	312.5
1-Bott	PL 2420 * 40 (SM490Y)	968.0	968.0	968.0
2-RIB	PL 280 * 27 (SM490Y)	151.2	151.2	151.2

Property

			All	In-plane	Out-plane
Area	A	(cm2)	5263.4	5263.4	5263.4
Center of G	ex	(cm)	0.0	0.0	0.0
	ey	(cm)	150.0	150.0	150.0
2nd moment area	Ix	(cm4)	68822825	68822825	68822825
	Iy	(cm4)	53763877	53763877	53763877
Torsion Factore	J	(cm4)	78278007		
radius of gyration of area	Rx	(cm)	114.3		
	Ry	(cm)	101.1		
Slenderness ratio	Lx/Rx		32.97		
	Ly/Ry		53.33		
Euler Buckling	0.8*σex		1453		
Stress	0.8*σey		555		

Resistance Bending Moment

		(+)	(-)
In-plane	Mxr(up)=	96352.0 kN·m	96352.0 kN·m
	Mxr(bot)=	96352.0 kN·m	96352.0 kN·m
Out-plane	Myr(up)=	90323.3 kN·m	90323.3 kN·m
	Myr(bot)=	90323.3 kN·m	90323.3 kN·m

Stress (N/mm^2)

M-Max	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
Top	-7	163	0	0	-7	210	7	0.04
LWeb	-7	163	0	0	-7	210	7	0.04
Rweb	-7	163	0	0	-7	210	7	0.04
Bott	-7	163	0	0	-7	210	7	0.04

M-Max	τsx	τsy	τt	Στ	τa	κ
Top	0	0	0	0	120	0.00
LWeb	0	0	0	0	120	0.00
Rweb	0	0	0	0	120	0.00
Bott	0	0	0	0	120	0.00

M-Min		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	Top	-7	163	0	0	-7	210	7	0.04
	LWeb	-7	163	0	0	-7	210	7	0.04
	Rweb	-7	163	0	0	-7	210	7	0.04
	Bott	-7	163	0	0	-7	210	7	0.04

M-Min		τsx	τsy	τt	Στ	τa	κ
	Top	0	0	0	0	120	0.00
	LWeb	0	0	0	0	120	0.00
	Rweb	0	0	0	0	120	0.00
	Bott	0	0	0	0	120	0.00

N-Max		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	Top	0	163	0	0	0	210	0	0.00
	LWeb	0	163	0	0	0	210	0	0.00
	Rweb	0	163	0	0	0	210	0	0.00
	Bott	0	163	0	0	0	210	0	0.00

N-Max		τsx	τsy	τt	Στ	τa	κ
	Top	0	0	0	0	120	0.00
	LWeb	0	0	0	0	120	0.00
	Rweb	0	0	0	0	120	0.00
	Bott	0	0	0	0	120	0.00

N-Min		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	Top	-7	163	0	0	-7	210	7	0.04
	LWeb	-7	163	0	0	-7	210	7	0.04
	Rweb	-7	163	0	0	-7	210	7	0.04
	Bott	-7	163	0	0	-7	210	7	0.04

N-Min		τsx	τsy	τt	Στ	τa	κ
	Top	0	0	0	0	120	0.00
	LWeb	0	0	0	0	120	0.00
	Rweb	0	0	0	0	120	0.00
	Bott	0	0	0	0	120	0.00

10. 5. Evaluation for Cable Anchor

Cable anchor was designed by cable strength, therefore the construction cable tension shall be checked whether it is smaller than the cable strength or not.

Results:

Cable Tension during Construction < Cable Strength

C1-C5,C16-C20(70H)	Max	5172	<	18270	kN
C6-C10,C11-C15(37H)	Max	3515	<	9657	kN

therefore, the safety of the cable anchor was secured.

11. Evaluation of Ultimate Strength

11. 1. Design Principle

(1) Design Stress Resultants

Design Stress Resultants were [1.7*(D+L)+Ps].
Design stress resultants at Normel State (force devided by 1.7) were used.

(2) Design Section

・Cross section of girder and tower are shown in the previous section.

11．2. Design Stress Resultants for Ultimate Strength **(Excerpt)**

Following stress resultants are max or min at each components.

Girder, Tower [before devided by 1.7]

Elem. No.	Node No.	Load Case	Axial Ax(kN)	in-plane shear S2(kN)	out-plane shear S3(kN)	Torsion M TQ(kN・m)	in-plane M M3(kN・m)	out-plane M M2(kN・m)
2	J[3]	1.7(D+L2i1)+Ps	37.2	1.73	6137.27	-15.1	-26407.49	-8.61
15	I[15]	1.7(D+L2i1)+Ps	-32756.51	1.73	-2162.32	-15.09	-72962.12	-55.34
19	I[19]	1.7(D+L2i1)+Ps	-39425.88	1.73	-3353.37	-15.08	-67497.88	-70.91
21	J[22]	1.7(D+L4i1)+Ps	-27430.99	1.73	-27.65	-15.07	71513.05	-82.6
22	I[22]	1.7(D+L2i1)+Ps	-39419.51	1.73	-1023.54	-15.07	-52731.27	-82.6
22	J[23]	1.7(D+L4i1)+Ps	-27428.25	1.73	1173.43	-15.07	70071.31	-86.49
24	I[24]	1.7(D+L4i1)+Ps	-31403	1.73	-720.63	-15.07	72740.17	-90.38
43	I[43]	1.7(D+L1i1)+Ps	-53744.71	1.73	3152.28	-15	-34685.35	-164.37
46	J[47]	1.7(D+L4i1)+Ps	-46331.41	1.73	7294.45	-14.99	-69306.88	-179.94
52	I[52]	1.7(D+L1i2)+Ps	-55259.2	-1.12	-19146.41	-0.13	-138311.63	-192.08
53	I[53]	1.7(D+L2i2)+Ps	-55793.57	-1.12	-9171.48	-0.41	-116513.97	-192.07
57	J[58]	1.7(D+L2i2)+Ps	-55781.38	-1.12	-5473.1	-0.38	-48848.1	-181.67
60	I[60]	1.7(D+L4i2)+Ps	-46737.61	-1.12	-3655.6	-0.37	-52408.53	-176.61
64	I[64]	1.7(D+L2i2)+Ps	-55781.53	-1.12	-58.63	-0.35	-11457.52	-166.49
101	J[102]	1.7(D+L2i2)+Ps	-1666.77	-1.12	-2377.33	-0.23	93734.75	-70.31
104	J[105]	1.7(D+L2i2)+Ps	-1667.91	-1.12	150.85	-0.22	97377.71	-66.09
502	J[501]	1.7(D+L1i3)+Ps	-82828.14	0	-428.27	0	2085.32	0
507	I[507]	1.7(D+L3i3)+Ps	-77554.19	0	-1607.4	0	-31553.15	0
507	I[507]	1.7(D+L4i3)+Ps	-71349.22	0	1140.23	0	24526.31	0
508	J[507]	1.7(D+L1i3)+Ps	-81111.22	0	-422.73	0	-6543.12	0
513	J[512]	1.7(D+L3i3)+Ps	-62129.2	0	709.97	0	-56262.32	0
513	J[512]	1.7(D+L4i3)+Ps	-55555.57	0	-764.13	0	41971.1	0
515	I[515]	1.7(D+L4i3)+Ps	-41647.84	0	-2660.6	0	31555.76	0
516	J[515]	1.7(D+L2i3)+Ps	-46236.43	0	3321.71	0	-37251.58	0
516	J[515]	1.7(D+L3i3)+Ps	-42559.12	0	4140.07	0	-44389.73	0
516	J[515]	1.7(D+L4i3)+Ps	-36266.35	0	-3278.36	0	31555.77	0
521	I[521]	1.7(D+L1i3)+Ps	0	0	0	0	0	0

１１．３．Evaluation of Girder Ultimate Strength (Excerpt)

Girder was evaluated by maximum stress resultants at side span and main span.

(1) Side Span-Section①

Stress Resultants

	N(kN)	Mx(kN·m)	My(kN·m)	Sx(kN)	Sy(kN)	T(kN·m)
M-Max	-16136	42067	-49	1	-16	-9
M-Min	-19269	-42919	-33	1	-1272	-9
N-Max	22	-15534	-5	1	3610	-9
N-Min	-23192	-39705	-42	1	-1973	-9

Effective Bucling Length Lx = 9000 mm Ly = 9000 mm
Curve Radius R = 0.0 m
Gradient DECK-L = 2.0 %
DECK-R = -2.0 %

Effective Width(mm)		All	In-plane	Out-plane
DECK-L	Middle	1250	1250	1250
	Middle	5000	5000	5000
	Middle	5200	5127	5200
DECK-R	Middle	1250	1250	1250
	Middle	5000	5000	5000
	Middle	5200	5096	5200
LFLG	Middle	3500	3500	3500
	Middle	2500	2500	2500
	Middle	3500	3500	3500

Cross Section	Area(cm2)	All	in-plane	out-plane
1-DECK-L	PL 11472 * 16 (SM400)	1835.6	1823.9	1835.6
2-RIB	PL 200 * 20 (SM400)	80.0	80.0	80.0
2-RIB	PL 250 * 24 (SM400)	120.0	120.0	120.0
6-U.RIB	320 * 240 * 8 (SM400)	323.4	323.4	323.4
1-RIB	PL 250 * 24 (SM400)	60.0	60.0	60.0
7-U.RIB	320 * 240 * 8 (SM400)	377.3	377.3	377.3
1-RIB	PL 250 * 24 (SM400)	60.0	60.0	60.0
1-DECK-R	PL 11472 * 16 (SM400)	1835.6	1818.9	1835.6
2-RIB	PL 200 * 20 (SM400)	80.0	80.0	80.0
2-RIB	PL 250 * 24 (SM400)	120.0	120.0	120.0
6-U.RIB	320 * 240 * 8 (SM400)	323.4	323.4	323.4
1-RIB	PL 250 * 24 (SM400)	60.0	60.0	60.0
7-U.RIB	320 * 240 * 8 (SM400)	377.3	377.3	377.3
1-RIB	PL 250 * 24 (SM400)	60.0	60.0	60.0
1-WEB-1	PL 484 * 14 (SM490Y)	67.8	67.8	67.8
1-RIB	PL 160 * 16 (SM490Y)	0.0	0.0	0.0
1-WEB-2	PL 2659 * 14 (SM490Y)	372.3	372.3	372.3
4-RIB	PL 160 * 16 (SM490Y)	102.4	102.4	102.4
1-WEB-3	PL 2659 * 14 (SM490Y)	372.3	372.3	372.3
4-RIB	PL 160 * 16 (SM490Y)	102.4	102.4	102.4
1-WEB-4	PL 484 * 14 (SM490Y)	67.8	67.8	67.8
1-RIB	PL 160 * 16 (SM490Y)	0.0	0.0	0.0
1-WEB-L	PL 2560 * 14 (SM490Y)	358.5	358.5	358.5
4-RIB	PL 160 * 16 (SM490Y)	0.0	0.0	0.0
1-LFLG	PL 9740 * 14 (SM490Y)	1363.6	1363.6	1363.6
18-RIB	PL 160 * 16 (SM490Y)	460.8	460.8	460.8
1-WEB-R	PL 2560 * 14 (SM490Y)	358.5	358.5	358.5
4-RIB	PL 160 * 16 (SM490Y)	0.0	0.0	0.0

Property

			All	In-plane	Out-plane
Area	A	(cm2)	9338.7	9310.4	9338.7
Center of G	ex	(cm)	-0.0	-0.6	-0.0
	ey	(cm)	179.6	179.4	179.6
2^{nd} moment area	Ix	(cm4)	103169489	103042593	103169489
	Iy	(cm4)	290966524428728222442909665244		
Torsion Factor	J	(cm4)	189108523		
Radius of gyration of area	Rx	(cm)	105.1		
	Ry	(cm)	558.2		
Slenderness ratio		Lx/Rx	8.56		
		Ly/Ry	1.61		
Euler Buckling		0.8*σex	21538		
Stress		0.8*σey	607424		

Resistance Bending Moment

		(+)	(-)
In-plane	Mxr(上)=	159155.3 kN･m	159155.3 kN･m
	Mxr(下)=	119711.4 kN･m	83749.1 kN･m
Out-plane	Myr(上)=	355146.6 kN･m	355146.6 kN･m
	Myr(下)=	355146.6 kN･m	355146.6 kN･m

Stress (N/mm^2)

M-Max	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
DECK-L	-17	140	-37	0	-54	140	54	0.39
DECK-R	-17	140	-37	0	-54	140	54	0.39
WEB-1	-17	166	-31	0	-49	166	49	0.25
WEB-2	-17	161	73	0	-53	161	53	0.28
WEB-3	-17	161	73	0	-53	161	53	0.28
WEB-4	-17	166	-31	0	-49	166	49	0.25
WEB-L	-17	182	73	0	-29	182	29	0.15
LFLG	-17	210	74	0	57	210	-56	-0.27
WEB-R	-17	182	73	0	-29	182	29	0.15

M-Max	τsx	τsy	τt	Στ	τa	κ
DECK-L	0	0	0	0	80	0.15
DECK-R	0	0	0	0	80	0.15
WEB-1	0	0	0	0	120	0.05
WEB-2	0	0	0	0	120	0.07
WEB-3	0	0	0	0	120	0.07
WEB-4	0	0	0	0	120	0.05
WEB-L	0	0	0	0	120	0.07
LFLG	0	0	0	0	120	0.07
WEB-R	0	0	0	0	120	0.07

M-Min	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
DECK-L	-21	140	38	0	-21	140	21	0.15
DECK-R	-21	140	38	0	-21	140	21	0.15
WEB-1	-21	210	32	0	11	210	9	0.04
WEB-2	-21	147	-75	0	-95	147	95	0.50
WEB-3	-21	147	-75	0	-95	147	95	0.50
WEB-4	-21	210	32	0	11	210	9	0.04
WEB-L	-21	150	-75	0	-96	150	96	0.49
LFLG	-21	147	-75	0	-96	147	96	0.50
WEB-R	-21	150	-75	0	-96	150	96	0.49

M-Min		τsx	τsy	τt	Στ	τa	κ
	DECK-L	0	7	0	7	80	0.02
	DECK-R	0	7	0	7	80	0.02
	WEB-1	0	10	0	10	120	0.01
	WEB-2	0	10	0	10	120	0.21
	WEB-3	0	10	0	10	120	0.21
	WEB-4	0	10	0	10	120	0.01
	WEB-L	0	10	0	10	120	0.21
	LFLG	0	7	0	7	120	0.21
	WEB-R	0	10	0	10	120	0.21

N-Max		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	DECK-L	0	140	14	0	14	140	0	-0.07
	DECK-R	0	140	14	0	14	140	0	-0.07
	WEB-1	0	210	12	0	12	210	0	-0.02
	WEB-2	0	210	-27	0	-27	152	0	0.13
	WEB-3	0	210	-27	0	-27	152	0	0.13
	WEB-4	0	210	12	0	12	210	0	-0.02
	WEB-L	0	210	-27	0	-27	153	0	0.13
	LFLG	0	210	-27	0	-27	147	0	0.13
	WEB-R	0	210	-27	0	-27	153	0	0.13

N-Max		τsx	τsy	τt	Στ	τa	κ
	DECK-L	0	19	0	19	80	0.06
	DECK-R	0	19	0	19	80	0.06
	WEB-1	0	27	0	27	120	0.05
	WEB-2	0	27	0	27	120	0.05
	WEB-3	0	27	0	27	120	0.05
	WEB-4	0	27	0	27	120	0.05
	WEB-L	0	28	0	28	120	0.05
	LFLG	0	20	0	20	120	0.04
	WEB-R	0	28	0	28	120	0.05

N-Min		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	DECK-L	-25	140	35	0	-25	140	25	0.18
	DECK-R	-25	140	35	0	-25	140	25	0.18
	WEB-1	-25	200	29	0	-14	200	14	0.07
	WEB-2	-25	146	-69	0	-94	146	94	0.50
	WEB-3	-25	146	-69	0	-94	146	94	0.50
	WEB-4	-25	200	29	0	-14	200	14	0.07
	WEB-L	-25	150	-69	0	-94	150	94	0.50
	LFLG	-25	147	-70	0	-94	147	95	0.50
	WEB-R	-25	150	-69	0	-94	150	94	0.50

N-Min		τsx	τsy	τt	Στ	τa	κ
	DECK-L	0	10	0	10	80	0.03
	DECK-R	0	10	0	10	80	0.03
	WEB-1	0	15	0	15	120	0.02
	WEB-2	0	15	0	15	120	0.21
	WEB-3	0	15	0	15	120	0.21
	WEB-4	0	15	0	15	120	0.02
	WEB-L	0	15	0	15	120	0.21
	LFLG	0	11	0	11	120	0.21
	WEB-R	0	15	0	15	120	0.21

１１．４. Evaluation of Tower Ultimate Strength (Excerpt)

Tower was evaluated by maximum stress resultants at upper cable section, lower cable section and bottom.

(1) Upper Cable Section

Stress Resultants

	N(kN)	Mx(kN·m)	My(kN·m)	Sx(kN)	Sy(kN)	T(kN·m)
M-Max	-21333	18562	0	0	-1928	0
M-Min	-25035	-26112	0	0	2435	0
N-Max	0	0	0	0	0	0
N-Min	-27198	-21913	0	0	1954	0

Effective Buckling Length Lx = 37700 mm Ly = 53900 mm

Cross Section		Area(cm2)	All	in-plane	out-plane
1-Top	PL	2420 * 40 (SM490Y)	968.0	968.0	968.0
2-RIB	PL	280 * 27 (SM490Y)	151.2	151.2	151.2
1-LWeb	PL	3000 * 40 (SM490Y)	1200.0	1200.0	1200.0
5-RIB	PL	250 * 25 (SM490Y)	312.5	312.5	312.5
1-Rweb	PL	3000 * 40 (SM490Y)	1200.0	1200.0	1200.0
5-RIB	PL	250 * 25 (SM490Y)	312.5	312.5	312.5
1-Bott	PL	2420 * 40 (SM490Y)	968.0	968.0	968.0
2-RIB	PL	280 * 27 (SM490Y)	151.2	151.2	151.2

Property			All	In-plane	Out-plane
Area	A	(cm2)	5263.4	5263.4	5263.4
Center of G	ex	(cm)	0.0	0.0	0.0
	ey	(cm)	150.0	150.0	150.0
2nd moment area	Ix	(cm4)	68822825	68822825	68822825
	Iy	(cm4)	53763877	53763877	53763877
Torsion Factor	J	(cm4)	78278007		
Radius of gyration of area	Rx	(cm)	114.3		
	Ry	(cm)	101.1		
Slenderness Ratio	Lx/Rx		32.97		
	Ly/Ry		53.33		
Euler Buckling	0.8*σex		1453		
Stress	0.8*σey		555		

Resistance Bending Moment

		(+)	(-)
In-plane	Mxr(上)=	96352.0 kN·m	96352.0 kN·m
	Mxr(下)=	96352.0 kN·m	96352.0 kN·m
Out-plane	Myr(上)=	90323.3 kN·m	90323.3 kN·m
	Myr(下)=	90323.3 kN·m	90323.3 kN·m

Stress (N/mm^2)

M-Max	σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
Top	-41	163	-40	0	-81	210	82	0.45
LWeb	-41	163	-40	0	-81	210	82	0.45
Rweb	-41	163	-40	0	-81	210	82	0.45
Bott	-41	163	40	0	-1	210	0	0.06

M-Max	τsx	τsy	τt	Στ	τa	κ
Top	0	6	0	6	120	0.15
LWeb	0	10	0	10	120	0.15
Rweb	0	10	0	10	120	0.15
Bott	0	6	0	6	120	0.00

M-Min		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	Top	-48	163	57	0	9	210	-10	0.02
	LWeb	-48	163	57	0	-104	210	106	0.57
	Rweb	-48	163	57	0	-104	210	106	0.57
	Bott	-48	163	-57	0	-104	210	106	0.57

M-Min		τsx	τsy	τt	Στ	τa	κ
	Top	0	7	0	7	120	0.01
	LWeb	0	12	0	12	120	0.25
	Rweb	0	12	0	12	120	0.25
	Bott	0	7	0	7	120	0.25

N-Max		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	Top	0	210	0	0	0	210	0	0.00
	LWeb	0	210	0	0	0	210	0	0.00
	Rweb	0	210	0	0	0	210	0	0.00
	Bott	0	210	0	0	0	210	0	0.00

N-Max		τsx	τsy	τt	Στ	τa	κ
	Top	0	0	0	0	120	0.00
	LWeb	0	0	0	0	120	0.00
	Rweb	0	0	0	0	120	0.00
	Bott	0	0	0	0	120	0.00

N-Min		σn	σna	σmx	σmy	Σσ	σa	σ435	Cnm
	Top	-52	163	48	0	-5	210	3	0.09
	LWeb	-52	163	48	0	-99	210	101	0.55
	Rweb	-52	163	48	0	-99	210	101	0.55
	Bott	-52	163	-48	0	-99	210	101	0.55

N-Min		τsx	τsy	τt	Στ	τa	κ
	Top	0	6	0	6	120	0.00
	LWeb	0	10	0	10	120	0.23
	Rweb	0	10	0	10	120	0.23
	Bott	0	6	0	6	120	0.23

11.5. Evaluation for Cable Anchor

Cable anchor was designed by cable strength, therefore the cable tension shall be checked whether it is smaller than the cable strength or not.

Results:

		Cable Tension	<	Cable Strength	
C1-C5,C16-C20(70H)	Max	9698	<	18270	kN
C6-C10,C11-C15(37H)	Max	9124	<	9657	kN

therefore, the safety of the cable anchor was secured.

12.1 Design of Expansion Joint (Excerpt)

(1) Design Conditions of EJ-1 (P10)

The design conditions for the expansion joint are listed in the table below.

Table Design Conditions

Item	Left Girder（P9 side）	Right Girder（P11 side）
Type of bridge	Steel deck slab girder	Steel deck slab girder
Temp range	0 ℃～50 ℃	0 ℃～50 ℃
Load	72.5 kN for back wheel	

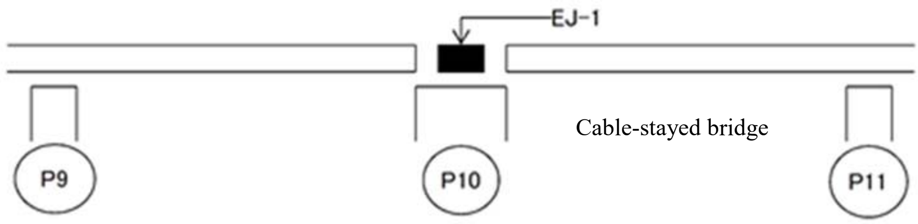


Figure Location of Expansion Joint

(2) Expansion Amount

The design expansion amount of the expansion joint shall consider the regular and seismic conditions.

1) Regular Condition

Table Expansion Amount at Regular Condition

	Left Girder（P9 side）	Right Girder（P11 side）
Elongation amount by temp. change ΔLt	88 mm	136 mm
Elongation tolerance ΔLy（General elongation tolerance × 20%）	18 mm	27 mm
Sum（Regular scenario） ΔLj	269 mm	

2) Seismic Condition

The design expansion amount at seismic condition is as follows:

$$\triangle Lq = \sqrt{2} \times \pm 190 + \pm 15 = 568 \text{ mm}$$

(3) Selection of Expansion Joint Type

The design expansion amount is determined for the regular condition as:

ΔLj：269 mm ＜ ΔLq：568 mm

Due to the design expansion amount, the modular type joint (maximum design movement of 640 mm) was selected.

(4) Evaluation of Cross Section

1) Evaluation of Middle Beam

- Calculation of Bending Moment

The middle beam was considered as a four-span continuous beam and the bending moment was calculated with the wheel loading condition as shown in the figure below.

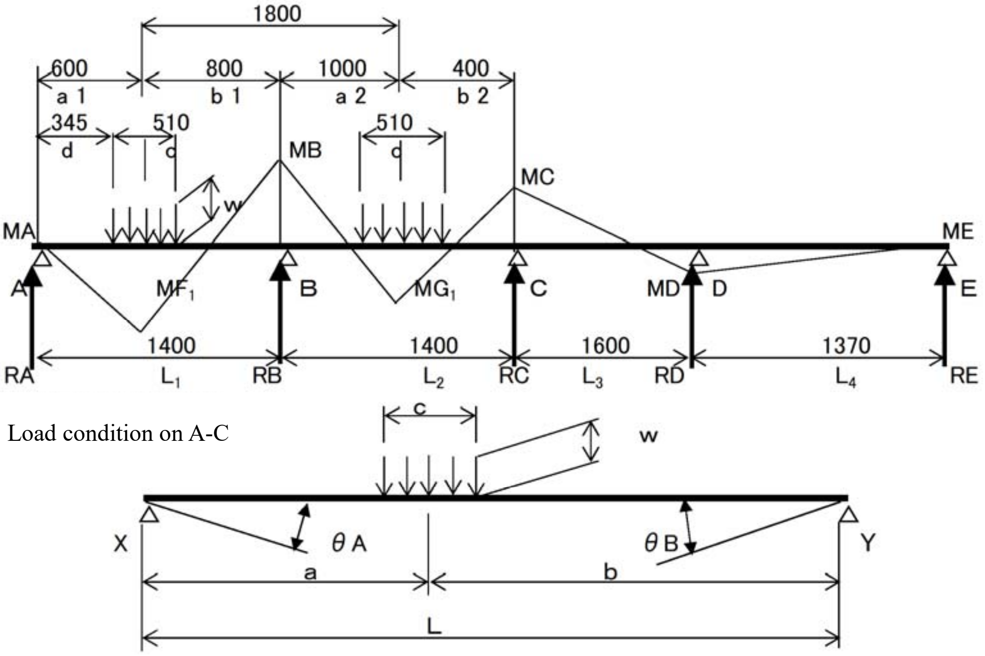
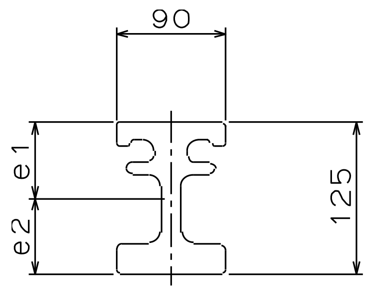


Figure Bending Moment of Middle Beam

The maximum bending moment, calculated as shown above, shall be Mmax = 15240 kN・mm.

- Stress Evaluation



a = 90 mm
b = 125 mm
A = 5904 mm2
e1 = 63 mm
e2 = 62 mm
I = 11552000 mm4

A2 = 1875 mm2 (Cross sectional area of web)

Figure Cross Section of Middle Beam

Impact Coefficient: i

i = 0.4

Maximum bending moment M of A-D

Mmax = 15240 〔KN・mm〕

Bending Stress: $\sigma 1$

$\sigma_1 = Mmax \times (1+i) \times e_1 \times 1000 / I$

$= 15240 \times (1 + 0.4) \times 63 \times 1000 / 11552000$

$= 116.4$ N/mm^2 $< \sigma ba = 210$ N/mm^2 (S355J2 + N)

$\sigma ba = \sigma y / 1.7$
$= 355 / 1.7$
$\fallingdotseq 210$ N/mm^2

Shear Stress: $\tau 1$

$\tau_1 = Rmax \times (1 + i) \times 1000 / A2$

$= 72.5 \times (1 + 0.4) \times 1000 / 1875$

$= 54.1$ N/mm^2 $< \tau a = 120$ N/mm^2 (S355J2 + N)

$\tau a = \sigma y / \sqrt{3} / 1.7$
$= 355 / \sqrt{3} / 1.7$
$\fallingdotseq 120$ N/mm^2

Total Stress: U

U = (σ1 / σba)^2 + (τ1 / τa)^2

= (116.4 / 210)^2 + (54.1 / 120)^2

= 0.51 < 1.2

2) Evaluation of Support Beam

The support beam shall be evaluated as a simple beam with the support located at the position of the bearing during maximum expansion.

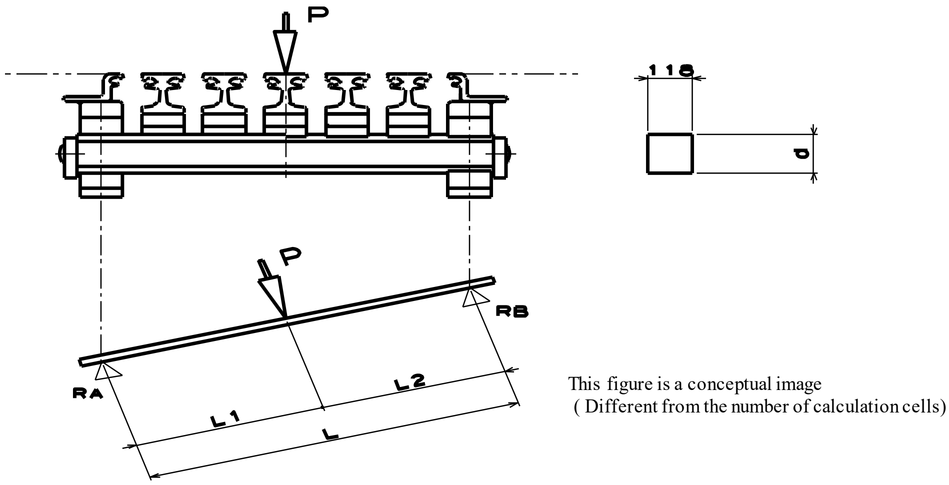


Figure Cross Section of Support Beam

Max load acting on support beam	P = 72.5 kN
Max fulcrum interval	L = 1435 mm
Loading position	L1 = 717.5 mm
Loading position	L2 = 717.5 mm
Support beam height	d = 145mm

Impact coeficient I

I = 0.4

Bending moment M1

M 1 = P x L1 x L2 / L

= 72.5 x 717.5 x 717.5 / 1435 = 26100 KN・mm

Cross-section coefficient Z1

Z 1 = 1/6 x d^2 x 118

= 1 / 6 x 145^2 x 118 = 413500 mm3

Bending stress σ1

σ1 = M 1 x (1 + I) x 1000 / Z 1

= 26100 x (1 + 0.4) x 1000 / 413500

= 88.4 N /mm2 < 167 N /mm2

Shear stress τ1

τ1 = P x (1 + I) x 1000 / (d x H)

= 72.5 x (1 + 0.4) x 1000 / (145 x 118)

= 5.9 N /mm2 < 98 N /mm2

Total stress U

U= (σ1 / σba)^2 + (τ1 / τa)^2

= (88.4 / 167)^2 + (5.9 / 98)^2

= 0.284 < 1.2

12.2 Drainage Device (Excerpt)

(1) Catch Basin Shape

The catch basin shape is shown in the figure below.

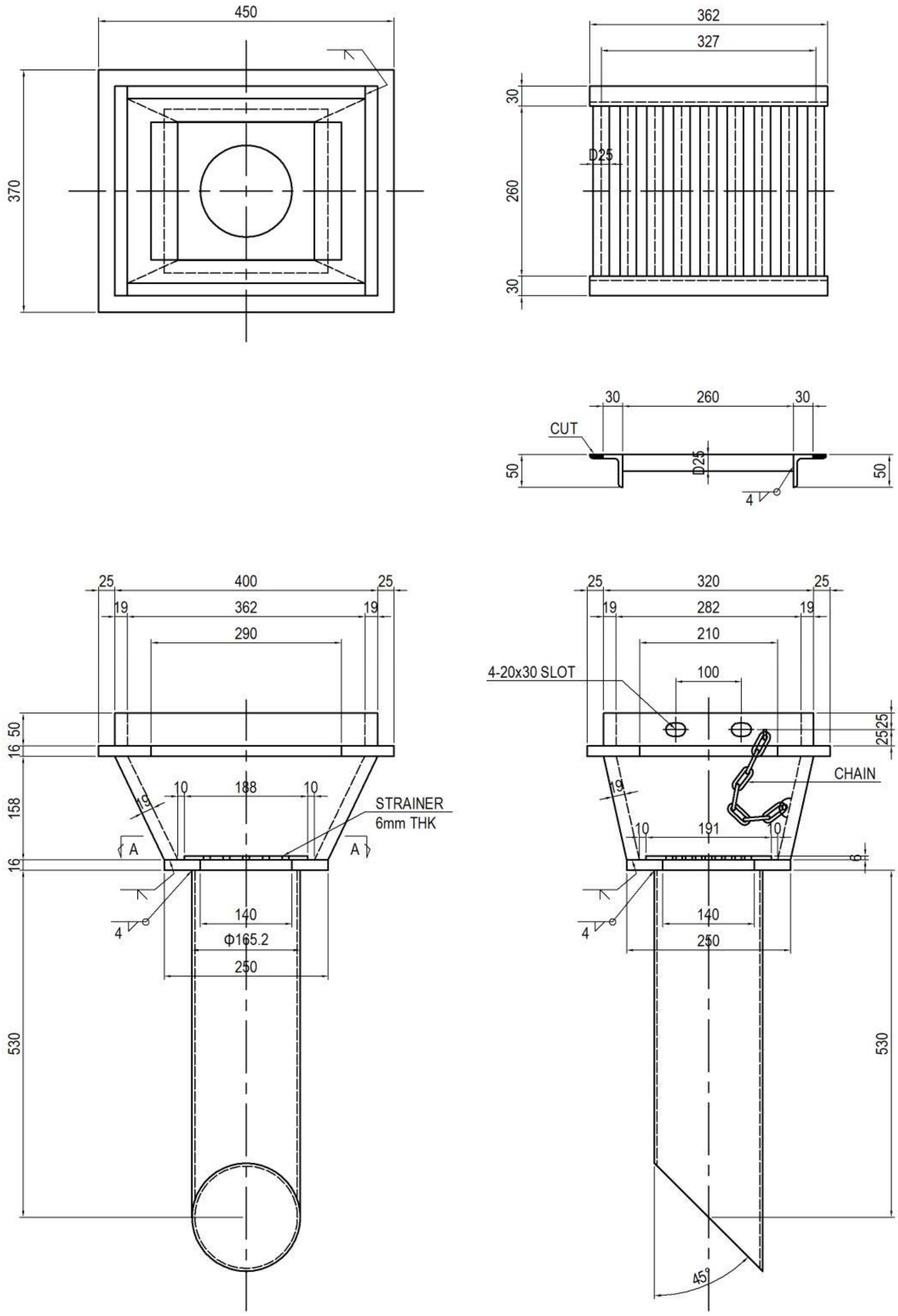


Figure Catch Basin Shape

(2) Configuration of Catch Basin Interval

The design conditions for the catch basin are as follows:

Rain intensity: 149 mm/h, Runoff coefficient: 0.9, Road drainage width: 11.450 m,

Gauckler-Manning coefficient: 0.013, Safety factor of flow: 0.8, Proportion of falling flow: 0.9

1) Calculation of Water Discharge

The water discharge shall be calculated from the following rational runoff formula to determine the size of the drainage structure:

$$q = \frac{1}{3600} \times C \cdot I \cdot W$$

q : Discharge per unit road length (l/sec/m)

C : Rational method runoff coefficient

I : Rainfall intensity (mm/h)

W : Road drainage width (m)

2) Calculation of Flow Rate

The average flow rate within the conduit shall be determined in principle using the following Manning's formula:

$$V = \frac{1}{n} \cdot R^{2/3} \cdot i^{1/2}$$

V : Average velocity (m/sec)

R : Hydraulic radius (m)、 R = A / S

i : Slope of energy grade line

n : Gauckler-Manning coefficient

S : Wetted perimeter (m) $s = h + \sqrt{(b^2 + h^2)}$

A : Cross-sectional area of flow (m2) A=1/2xhxb

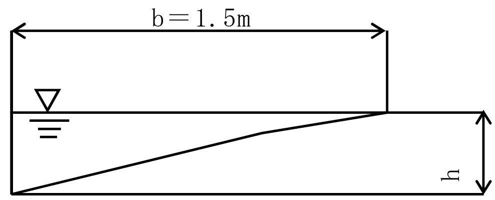


Figure Calculated Cross Section

3) Calculation of Flow Rate

The flow volume within the drainage ditch and drainage pipe shall be determined by the average flow rate and flow area.

$$Q = V \cdot A \cdot \alpha$$

Q : Allowable flow volume (m3/sec)

A : Cross-sectional area of flow

α : Safety factor of flow (＝0.8)

4) Calculation of Maximum Interval of Catch Basin

$$Ls = \frac{\gamma \cdot Q}{q}$$

Ls : Maximum interval of catch baisn (m) (Ls≦20m)

γ : Proportion of flow falling into catch ba γ = 0.9

Q : Allowable flow volume (m3/sec)

q : Discharge per unit road length (m3/sec/m)

5) Configuration of Catch Basin Interval

The calculation results of the maximum interval of catch basin are shown below.

Table Calculation Results of Maximum Interval of Catch Basin

Section		Distance	C.L Design height	Longitudinal slope	Transverse slope	Flow width B	Shoulder depth h	Area of flow A	Wetted perimeter P	Hydraulic radiusR
Edge i	Edge j	(m)	(m)	(%)	(%)	(m)	(m)	(m2)	(m)	(m)
0+860	0+880	20	17.746	-	2	1.5	0.03	0.0225	1.5303	0.014703
0+880	0+900	20	17.801	0.275	2	1.5	0.03	0.0225	1.5303	0.014703
0+900	0+920	20	17.85	0.245	2	1.5	0.03	0.0225	1.5303	0.014703
0+920	0+940	20	17.895	0.225	2	1.5	0.03	0.0225	1.5303	0.014703
0+940	0+960	20	17.934	0.195	2	1.5	0.03	0.0225	1.5303	0.014703
0+960	0+980	20	17.969	0.175	2	1.5	0.03	0.0225	1.5303	0.014703
0+980	0+1000	20	17.998	0.145	2	1.5	0.03	0.0225	1.5303	0.014703
1+0	1+20	20	18.023	0.125	2	1.5	0.03	0.0225	1.5303	0.014703
1+20	1+40	20	18.042	0.095	2	1.5	0.03	0.0225	1.5303	0.014703
1+40	1+60	20	18.057	0.075	2	1.5	0.03	0.0225	1.5303	0.014703
1+60	1+80	20	18.066	0.045	2	1.5	0.03	0.0225	1.5303	0.014703
1+80	1+88	8	18.071	0.025	2	1.5	0.03	0.0225	1.5303	0.014703
1+88	1+100	12	18.071	0	2	1.5	0.03	0.0225	1.5303	0.014703
1+100	1+120	20	18.07	-0.00833	2	1.5	0.03	0.0225	1.5303	0.014703
1+120	1+140	20	18.065	-0.025	2	1.5	0.03	0.0225	1.5303	0.014703
1+140	1+160	20	18.054	-0.055	2	1.5	0.03	0.0225	1.5303	0.014703
1+160	1+180	20	18.039	-0.075	2	1.5	0.03	0.0225	1.5303	0.014703
1+180	1+200	20	18.018	-0.105	2	1.5	0.03	0.0225	1.5303	0.014703
1+200	1+220	20	17.993	-0.125	2	1.5	0.03	0.0225	1.5303	0.014703
1+220	1+240	20	17.962	-0.155	2	1.5	0.03	0.0225	1.5303	0.014703
1+240	1+260	20	17.927	-0.175	2	1.5	0.03	0.0225	1.5303	0.014703
1+260	1+280	20	17.886	-0.205	2	1.5	0.03	0.0225	1.5303	0.014703
1+280	1+300	20	17.841	-0.225	2	1.5	0.03	0.0225	1.5303	0.014703
1+300	1+320	20	17.79	-0.255	2	1.5	0.03	0.0225	1.5303	0.014703

Section		Safety factor	Allowable flow volume Q	Road drainage width	Runoff coefficient	Rain intensity	per unit road length	Propotion of falling flow	Maximum interval of catch basin	Interval of catch basin
Edge i	Edge j	α	(l/sec)	(m)	C	I[mm/h]	q(l/sec/m)	γ	Ls (m)	
0+860	0+880	-	-	-			-	-	-	
0+880	0+900	0.8	5.447235	11.45	0.9	149	0.426513	0.9	9.195532	9
0+900	0+920	0.8	5.141536	11.45	0.9	149	0.426513	0.9	8.679477	8
0+920	0+940	0.8	4.92721	11.45	0.9	149	0.426513	0.9	8.317672	8
0+940	0+960	0.8	4.586983	11.45	0.9	149	0.426513	0.9	7.743331	7
0+960	0+980	0.8	4.345391	11.45	0.9	149	0.426513	0.9	7.335497	7
0+980	0+1000	0.8	3.955431	11.45	0.9	149	0.426513	0.9	6.677202	6
1+0	1+20	0.8	3.672525	11.45	0.9	149	0.426513	0.9	6.199627	6
1+20	1+40	0.8	3.201633	11.45	0.9	149	0.426513	0.9	5.404709	5
1+40	1+60	0.8	2.844726	11.45	0.9	149	0.426513	0.9	4.80221	5
1+60	1+80	0.8	2.203515	11.45	0.9	149	0.426513	0.9	3.719776	5
1+80	1+88	0.8	1.642403	11.45	0.9	149	0.426513	0.9	2.772557	5
1+88	1+100	0.8	0	11.45	0.9	149	0.426513	0.9	0	5
1+100	1+120	0.8	0.948242	11.45	0.9	149	0.426513	0.9	1.600737	5
1+120	1+140	0.8	1.642403	11.45	0.9	149	0.426513	0.9	2.772557	3
1+140	1+160	0.8	2.436078	11.45	0.9	149	0.426513	0.9	4.112367	5
1+160	1+180	0.8	2.844726	11.45	0.9	149	0.426513	0.9	4.80221	5
1+180	1+200	0.8	3.365925	11.45	0.9	149	0.426513	0.9	5.682052	5
1+200	1+220	0.8	3.672525	11.45	0.9	149	0.426513	0.9	6.199627	6
1+220	1+240	0.8	4.089551	11.45	0.9	149	0.426513	0.9	6.903612	6
1+240	1+260	0.8	4.345391	11.45	0.9	149	0.426513	0.9	7.335497	7
1+260	1+280	0.8	4.703127	11.45	0.9	149	0.426513	0.9	7.939396	7
1+280	1+300	0.8	4.92721	11.45	0.9	149	0.426513	0.9	8.317672	8
1+300	1+320	0.8	5.245415	11.45	0.9	149	0.426513	0.9	8.854838	8

Note: Where the calculated value for maximum interval between catch basin is less than 5 m, the catch basin interval is set to more than 5 m

(3) Catch Basin Arrangement

The position of the catch basin is shown below:

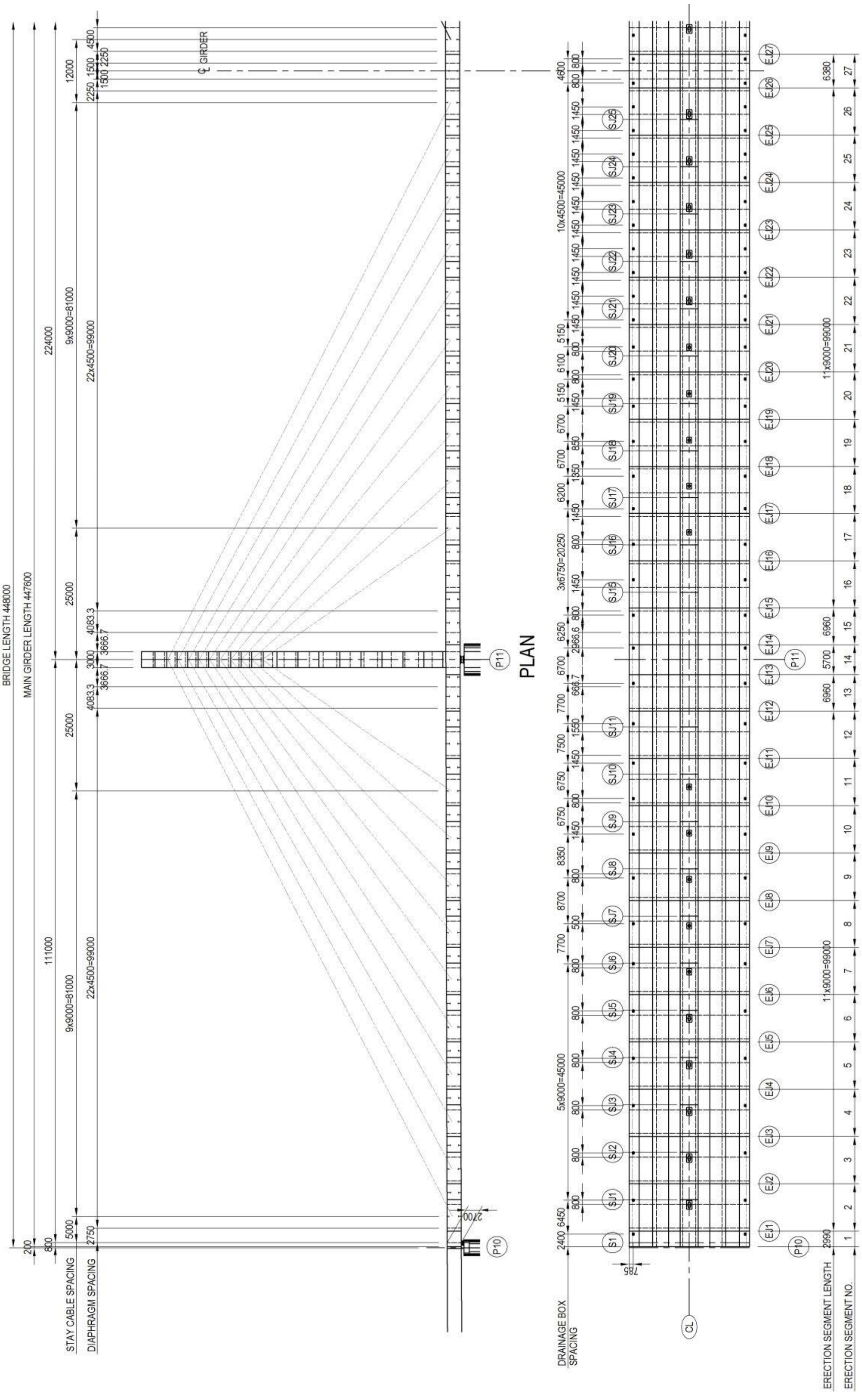


Figure Catch Basin Location

12.3 Main Body Design of Fairing (Excerpt)

(1) Fairing Shape

The fairing is installed at the girder in order to improve the wind resistance of the bridge. The fairing shape was referred from past cases and the wind stability was checked by wind tunnel test.

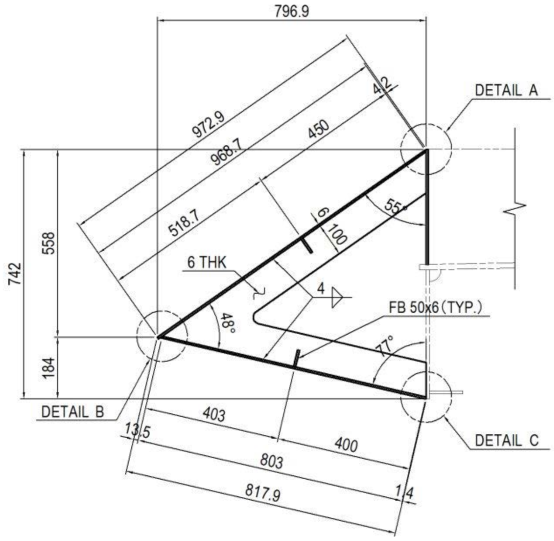


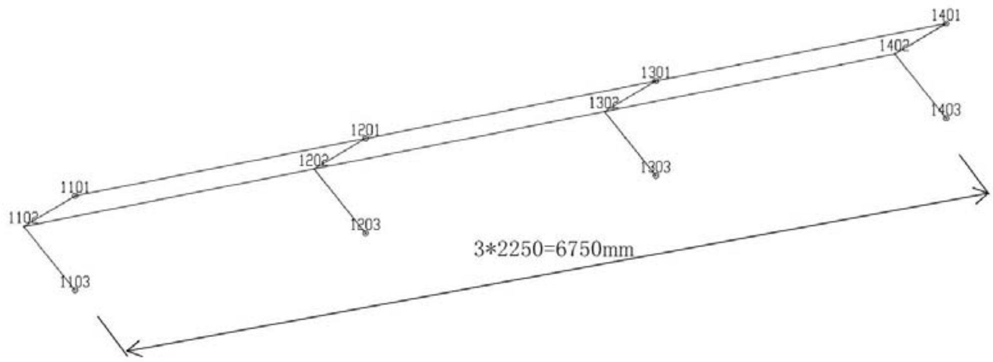
Figure Fairing Shape

(2) Design Method

Design calculation is performed by applying wind and dead load.

The section force of the fairing member is calculated by applying the space frame model shown below.

By referring to past records of cable-stayed bridges, the fairing plate thickness is set to 6 mm.



Note: The interval of frame panel is 2250 mm of the maximum transverse rib interval

Figure Space Frame Model

(3) Design Load

The section force used for the design of the longitudinal member is determined by loading the surface load on the upper surface (a-b) of the space frame.

The section force used for the design of the transverse member is determined by loading the line load on the transverse frame of the space frame as shown below.

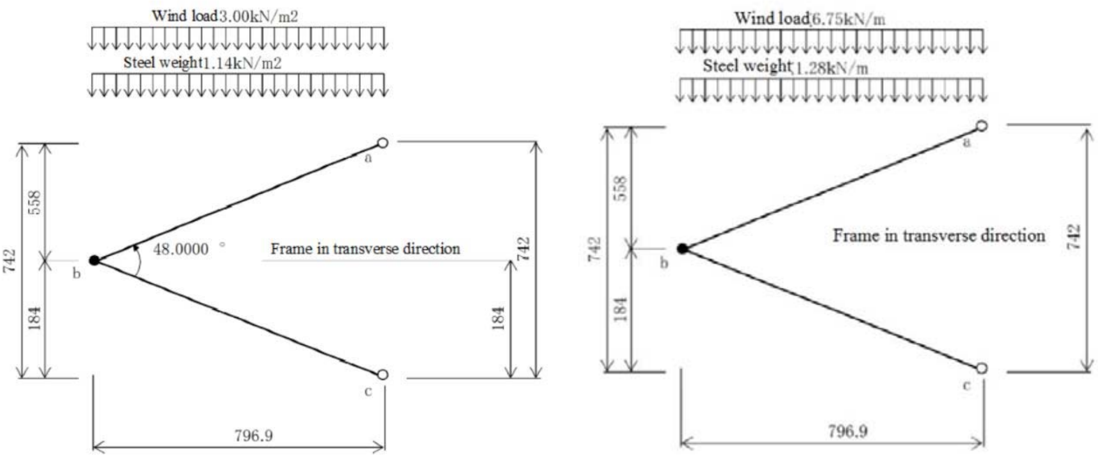


Figure Space Frame Model

The overdesign factor of allowable stress is 1.25 for the steel weight + wind load.

As the section force of the member against the wind load from the side is smaller than that from the perpendicular direction, the calculation of the section force of the member against the wind load from the side is omitted.

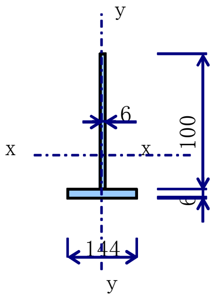
(4) Evaluation of Cross Section

<member ab,bc>

Member ab which has the largest cross-sectional force was employed for this verification.

Cross-sectional force — From solid frame analysis

Member no.	1201			
Bending moment	M =	0.243	kN·m	(Equivalent value with regular scenario)
Shear stress	S =	2.347	kN	(Equivalent value with regular scenario)
Axial force	N =	5.184	kN	(Equivalent value with regular scenario)



Effective width of flange on one side is 12t

Surface outside I_y = 1494792 (mm^4)

(WEB Height 100mm)					A (mm^2)	y (mm)	Ay (mm^3)	Ay^2 (mm^4)	I o(mm^4)
1 − FLG PL	SM400	144	×	6	864	-53	-45792	2426976	2592
1 − WEB PL	SM400	100	×	6	600	0	0	0	500000
					1464		-45792		2929568
								−	1432374
								Ix =	1497194

e = −31.3 mm

yl = −25 mm   ∴ Zl = Ix / yl = −59888 mm^3

yu = 81 mm   ∴ Zu = Ix / yu = 18416 mm^3

Aw = 600 mm^2

Verification of allowable stress

σl = N/A + M / Zl
= 3.5 + −4
= −1 N/mm^2 < 1.00 × 140 = 140 N/mm^2

σu = N/A + M / Zu
= 3.5 + 13.2
= 17 N/mm^2 < 1.00 × 140 = 140 N/mm^2

τ max = S / Aw
= 3.9 N/mm^2 < 1.00 × 80 = 80 N/mm^2

$$F = \left(\frac{\sigma}{\sigma a}\right)^2 + \left(\frac{\tau}{\tau a}\right)^2 = 0.02 \leqq 1.2$$

１２．４. Desing for Pedestal Frame (Excerpt)

[For under Tower]

(1) Design Principle

- Vertical direction force shall be transferred from the pedestal frame bottom surface to substructure.
- Anchor bolt resist to the horizontal force and uplift.
- Anchor frame resist to the uplift and support the pedestal frame during construction work.

(2) Design Force

Bearing Design Force

Case		Reaction Force				Increase Factor
		Rvmax	Rvmin	RH1 (LG)	RH2 (TR)	
Normal Scenario	Normal	57700	44800	4800	100	1
	Temperature	50435	38348	8000	87	1.15
	Wind-trans.	46160	35840	3840	1680	1.25
	Wind + Temp.	42963	32667	6815	1556	1.35
	Seismic1 Longi.	32200	29533	13667	67	1.50
	Seismic1 Trans.	30800	30733	667	9267	1.50
	Seismic2 Longi.	27294	27000	15235	0	1.70
	Seismic2 Trans.	27176	27118	588	12059	1.70

Seismic Uplift

	Row value		Increase Factor	Convert to Normal
	Rd	0.3 Rd		Ru=0.3Rd
Seismic Uplift	46200	13860	1.70	8153

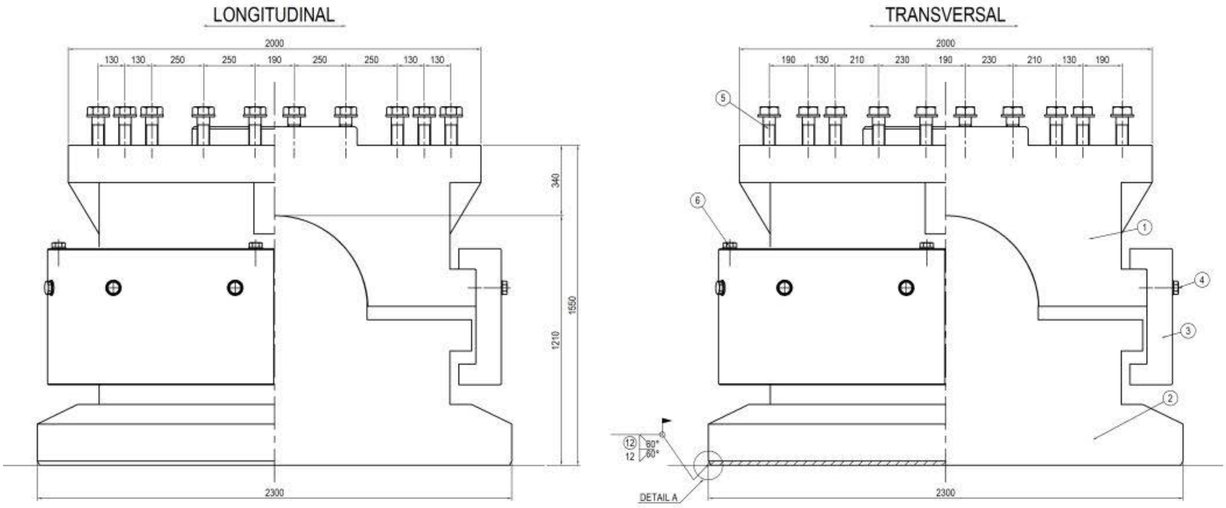
12.5 Design of Pivot Bearing (Excerpt)

The results of the pivot bearing design are listed below.

Table Design Calculation Results

Category				Units	Value		Allowable Value
Spherical Surface Section	Bearing Stress (Regular Scenario)			N/mm2	91.3	<	125.0
	Bearing Stress (Seismic Scenario)			N/mm2	97.5	<	425.0
Upper Shoe	Shear Stress Key	Bearing Stress		N/mm2	404.7	<	425.0
		Shearing Stress		N/mm2	51.5	<	170.0
	Bearing Stress between Supersturcutre	Bearing Stress (Regular Scenario)		N/mm2	16.5	<	250.0
		Bearing Stress (Seismic Scenario-Longitudinal)	Eccentricity	mm	485.3	>	381.7
			Bearing Stress	N/mm2	28.6	<	425.0
			Tensile Stress of Set Bolt	N/mm2	5.5	<	612.0
			Shearing Stress of Set Bolt	N/mm2	313.6	<	340.0
			Combined Stress of Set Bolt	N/mm2	0.9	<	1.2
		Bearing Stress (Seismic Scenario-Transverse)	Eccentricity	mm	369.1	<	381.7
			Bearing Stress	N/mm2	24.4	<	425.0
			Tensile Stress of Set Bolt	N/mm2	-	<	-
			Shearing Stress of Set Bolt	N/mm2	248.2	<	340.0
			Combined Stress of Set Bolt	N/mm2	-	<	-
	Bending Stress of Upper Shoe	Y1-Y1 Cross-Section (※1)	Bending Stress	N/mm2	127.9	<	153.0
		Y2-Y2 Cross-Section (※1)	Bending Stress	N/mm2	35.7	<	78.7
Lower Shoe	Bearing Stress between Substructure	Bearing Stress (Regular Scenario)		N/mm2	10.9	<	210.0
		Bearing Stress (Seismic Scenario- Longitudinal)	Eccentricity	mm	444.3	>	383.3
			Bearing Stress	N/mm2	18.2	<	315.0
			Shearing Stress from Tension on Weld	N/mm2	1.5	<	153.0
			Shearing Stress from Horizontal Force on Weld	N/mm2	135.4	<	153.0
			Combined Stress of Set Bolt	N/mm2	0.8	<	1.0
			Shearing Stress from Uplift Force	N/mm2	72.5	<	153.0
		Bearing Stress (Seismic Scenario-Transverse)	Eccentricity	mm	338.0	<	383.3
			Bearing Stress	N/mm2	16.4	<	315.0
			Shearing Stress from Tension on Weld	N/mm2	-	<	-
			Shearing Stress from Horizontal Force on Weld	N/mm2	107.0	<	153.0
			Combined Stress of Set Bolt	N/mm2	-	<	-
	Bending Stress of Lower Shoe			N/mm2	74.8	<	153.0
Ring	X-X Cross-Section (※2)	Tensile Bending Stress		N/mm2	234.6	<	289.0
	Y-Y Cross- Section(※2)	Bending Stress		N/mm2	135.7	<	289.0
		Shearing Stress		N/mm2	45.2	<	170.0
		Combined Stress		N/mm2	0.3	<	1.2
	C Member Bearing Stress	Bearing Stres		N/mm2	79.5	<	425.0
	Anchor Bolt	Tensile Stress		N/mm2	293.2	<	612.0
Set Bolt	Tensile Stress from Uplift Force			N/mm2	167.8	<	612.0

※Refer to the next page for cross-section position



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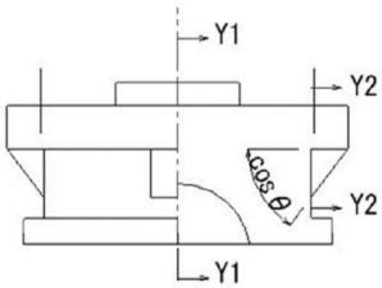

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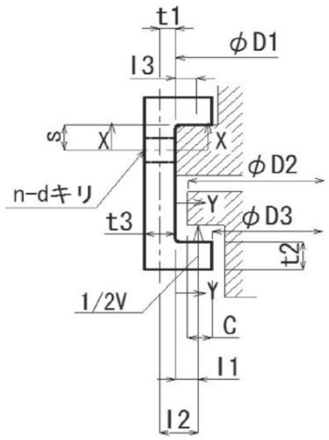


Figure Pivot Bearing Overview and Cross Section Location

12.6 Design of Pin Roller Bearing (Excerpt)

The results of the pin roller bearing design are listed below.

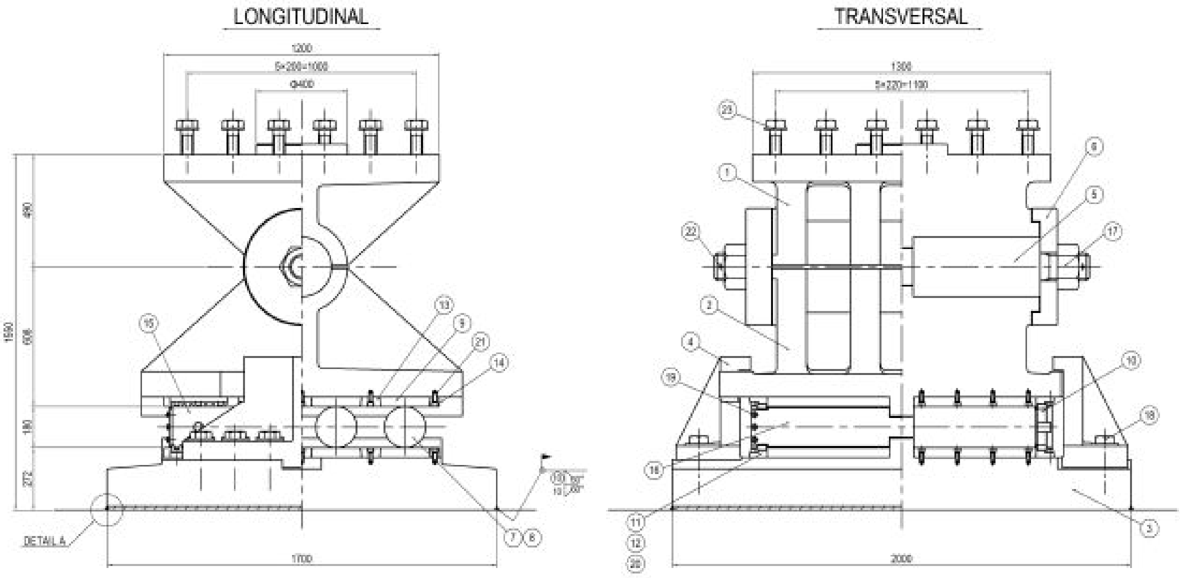
Table Design Calculation Results - 1

Category				Unit	Value		Allowable value
Pin	Bearing Stress of Column Surface			N/mm2	72.7	<	125
	Stress by Horizontal Force in Transverse Direction	Tensile Stress		N/mm2	278.5	<	323
		Bearing Stress		N/mm2	362.2	<	425
		Shear Stress		N/mm2	138.5	<	170
Roller	Required Length			mm	589.6	<	1040
	Stress by Horizontal Force in Longitudinal Direction	Tensile Stress at Cutout Section		N/mm2	220.1	<	510
		Bearing Stress		N/mm	15318.3	<	25490
Upper Shoe	Projection of upper surface of upper shoe	Shear Stress Caused by Horizontal Force		N/mm2	44.6	<	170
		Shear Stress Caused by Horizontal Force		N/mm2	350	<	425
	Bearing Stress between Supersturcutre	Regular Scenario Bearing Stress		N/mm2	14.5	<	250
		Moving scenario bearing stress	Eccentricity	mm	25.5	<	216.1
			Bearing Stress	N/mm2	12.8	<	287.5
		Seismic Scenario Bearing Stress	Eccentricity	mm	232.2	<	233.3
			Bearing Stress	N/mm2	17.1	<	425
			Tensile Stress of Bolt	N/mm2	-	<	-
			Shear Stress	N/mm2	164.3	<	340
			Combined Stress	N/mm2	-	<	-
		Seismic Scenario （Transverse Direction）	Eccentricity	mm	2198	>	250
			Bearing Stress	N/mm2	92.7	<	425
			Tensile Stress of Bolt	N/mm2	549.76	<	612
			Shear Stress	N/mm2	164.3	<	340
			Combined Stress	N/mm2	1	<	1.2
	Bending stress	Center cross section	Bending Stress	N/mm2	149.9	<	153
		Ｙ2-Ｙ2 Cross section (※1)	Bending Stress	N/mm2	60.6	<	153
		Cross section in transverse direction	Bending Stress	N/mm2	169.8	<	289
Lower Shoe	Bensing Stress	Center cross section	Bending Stress	N/mm2	139.3	<	153
	Stopper	Stress by Horizontal Force in Transverse Direction	Bearing stress at Cutout Section	N/mm2	391.5	<	425
		Lower Shoe Bending Stress		N/mm2	176.6	<	289
		Lower Shoe Shear Stress		N/mm2	82.2	<	170
		Stress by Horizontal Force in Transverse Direction	Bending Stress	N/mm2	71.9	<	289
			Shear Stress	N/mm2	73.8	<	170
			Combined Stress	N/mm2	0.25	<	1.2
			Bearing Stress	N/mm2	326.3	<	425

Table　Design Calculation Results - 2

Category				Unit	Value		Allowable value
Bottom Board	Bearing Stress between Substurcutre	Regular Scenario Bearing Stress		N/mm2	6.12	<	210
		Moving scenario bearing stress		N/mm2	8.25	<	241.5
		Seismic Scenario Bearing Stress	Eccentricity	mm	587.6	>	283.3
			Bearing Stress	N/mm2	13.8	<	425
			Shear Stress Caused by Tension of Welded Section	N/mm2	11.6	<	136
			Shear Stress Caused by Horizontal Force	N/mm2	43.7	<	136
			Combined Stress	N/mm2	0.1	<	1
			Lift force Scenario	N/mm2	29	<	136
		Seismic Scenario （Transverse Direction）	Eccentricity	mm	2198	>	333.3
			Bearing Stress	N/mm2	21.7	<	357
			Shear Stress Caused by Tension of Welded Section	N/mm2	95.6	<	136
			Shear Stress Caused by Horizontal Force	N/mm2	43.7	<	136
			Combined Stress	N/mm2	0.6	<	1
	Bending Stress	Y1,2-Y1,2 Cross Section (※2)	Bending Stress	N/mm2	82.4	<	153
		Ｙ3-Ｙ3 Cross Section (※2)	Bending Stress	N/mm2	34.6	<	176
		Ｙ4,5-Ｙ4,5 Cross Section (※2)	Bending Stress	N/mm2	146.6	<	153
Side Block	Stress of Main Body	Stress on Y-Y Cross Section(※3)	Bending Stress	N/mm2	170.5	<	289
			Shear stress	N/mm2	62	<	170
			Combined Stress	N/mm2	0.48	<	1.2
		Tensile Bending Stress on X-X Cross Section(※3)		N/mm2	260.1	<	289
		Stress on X-X Cross Section (※3)	Bending Stress	N/mm2	88.9	<	289
			Shear Stress	N/mm2	98.8	<	170
			Combined Stress	N/mm2	0.43	<	1.2
		Stress on Z-Z Cross Section (※3)	Bending Stress	N/mm2	280.7	<	425
			Shear Stress	N/mm2	57.8	<	170
	Installing Bolt	Verification Considering Horizontal Force in Longitudinal Direction	Tensile Stress of Bolt	N/mm2	236.3	<	612
			Shear Stress	N/mm2	273.8	<	340
			Combined Stress	N/mm2	0.8	<	1.2
		Verification Considering Lift Force	Tensile Stress of Bolt	N/mm2	559.2	<	612
Cap	Bearing Stress			N/mm2	163.6	<	425
	Stress on Y-Y Cross Section (※4)	Bending Stress		N/mm2	180.5	<	425
		Shear Stress		N/mm2	91	<	161.5
		Combined Stress		N/mm2	0.71	<	1.2
Superstructure Installing Bolt	Tensile Force Caused by Lift Force			N/mm2	109.1	<	612
	Shear Stress			N/mm2	131.8	<	340

※See the next page for the cross-section position



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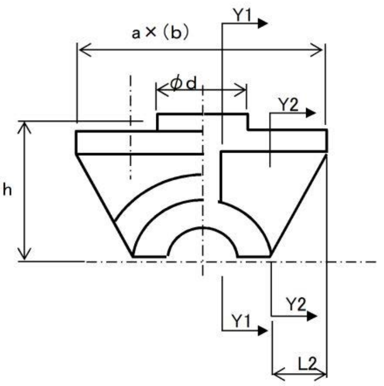

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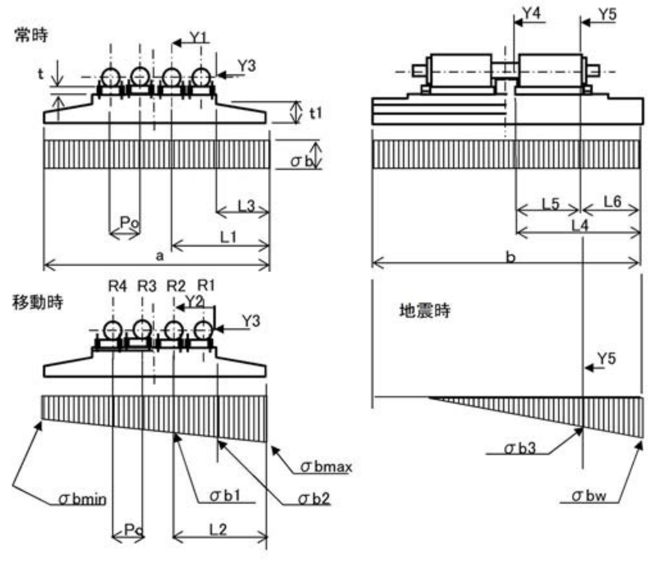

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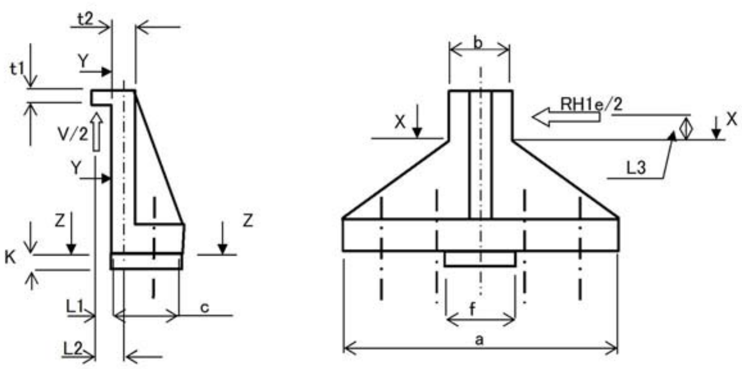

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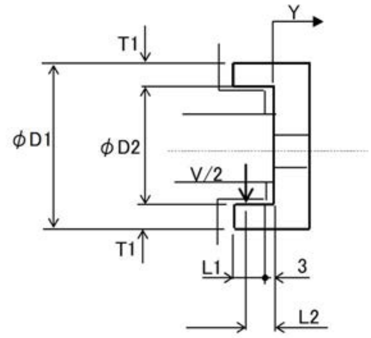


Figure　Pin Roller Bearing Overview and Cross Section Location

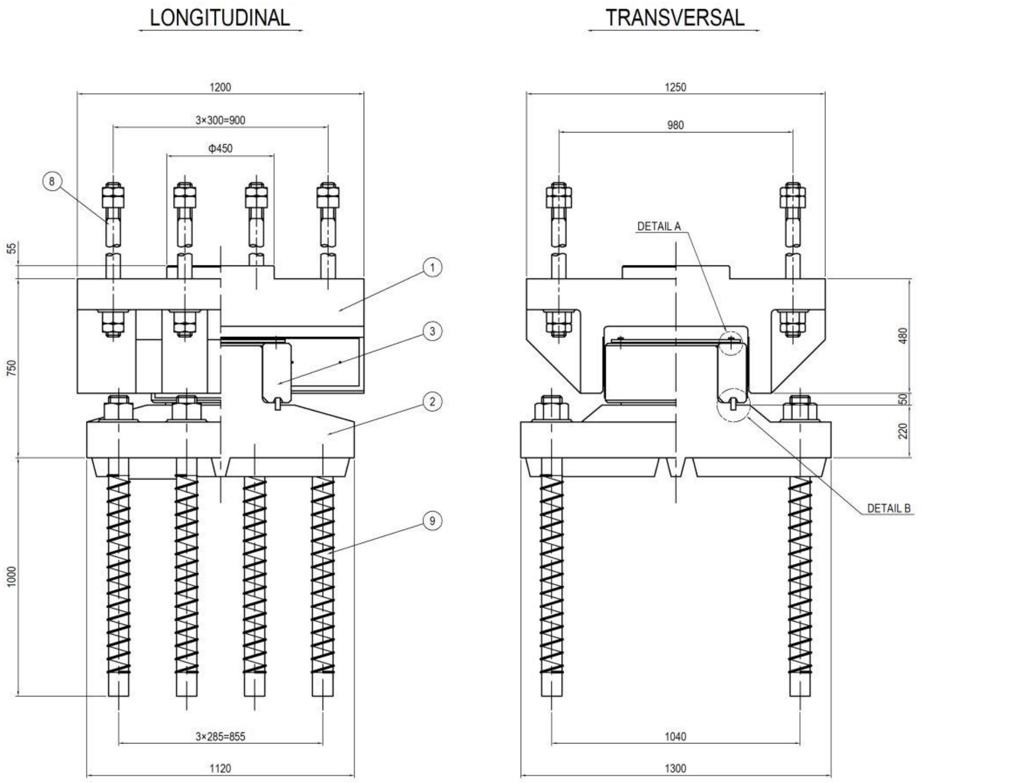
12.7 Design of Horizontal Bearing (Excerpt)

The results of the horizontal bearing design are listed below.

Table Design Calculation Results

Category				Unit	Value		Allowable Value
Slide Slope	Bearing Stress			N/mm2	79.0	<	157.5
Collar	X-X Cross Section (※1)	Bending Stress		N/mm2	60.1	<	229.5
		Tensile Stress		N/mm2	225.2	<	229.5
Upper Shoe	Stress at Projection of upper shoe	Bearing Stress		N/mm2	297.8	<	375.0
		Shear Stress		N/mm2	42.1	<	150.0
	Stress of Main Body	Bearing Stress	Bearing Stress	N/mm2	49.3	<	323.0
			Tensile Stress of Bolt	N/mm2	532.0	<	799.0
		X1-X1 Cross Section (※2)	Bending Stress	N/mm2	234.9	<	255.0
			Shear Stress	N/mm2	56.8	<	150.0
			Combined Stress	N/mm2	1.0	<	1.0
		Y1-Y1 Cross Section (※2)	Bending Stress	N/mm2	199.3	<	255.0
		Z1-Z1 Cross Section (※2)	Bending Stress	N/mm2	216.7	<	255.0
Lower Shoe	Stress of Cylinder Section	Bearing Stress		N/mm2	93.4	<	375.0
		Foundation of Cylinder Section	Bending Stress	N/mm2	218.9	<	229.5
			Shear Stress	N/mm2	69.6	<	135.0
			Combined Stress	N/mm2	1.2	<	1.2
	Stress of Main Body	Bearing Stress	Bearing Stress	N/mm2	7.7	<	12.0
			Tensile Stress of Bolt	N/mm2	125.9	<	285.0
		Y1-Y1Cross Section (※3)	Bending Stress	N/mm2	96.7	<	229.5
		Y2-Y2 Cross Section (※3)	Bending Stress	N/mm2	57.0	<	230.0
Anchor Bolt	Shear Stress			N/mm2	147.6	<	165.0
	Bond Stress			N/mm2	2.3	<	2.4
	Combined Stress			N/mm2	1.0	<	1.2
Installing Girder Bolt	Tensile Stress			N/mm2	532.0	<	799.0
	Shear Stress			N/mm2	296.2	<	405.0
	Combined Stress			N/mm2	1.1	<	1.2

※See the next page for the cross-section position



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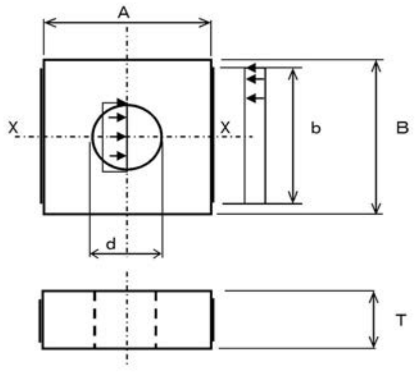

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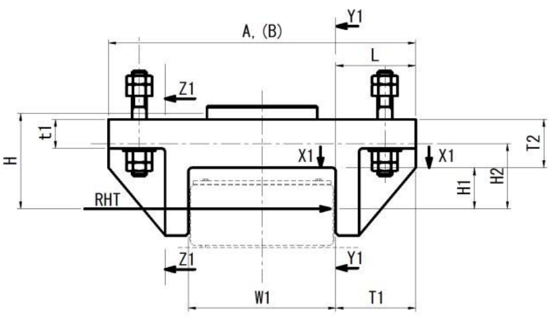

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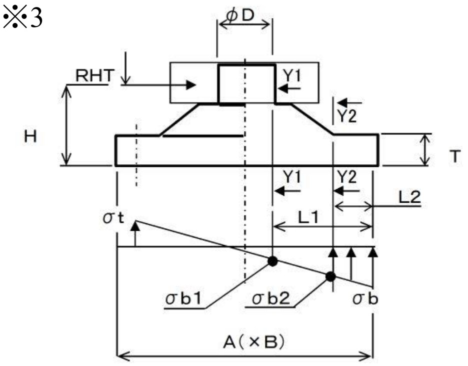


Figure Horizontal Bearing Overview and Cross Section Location

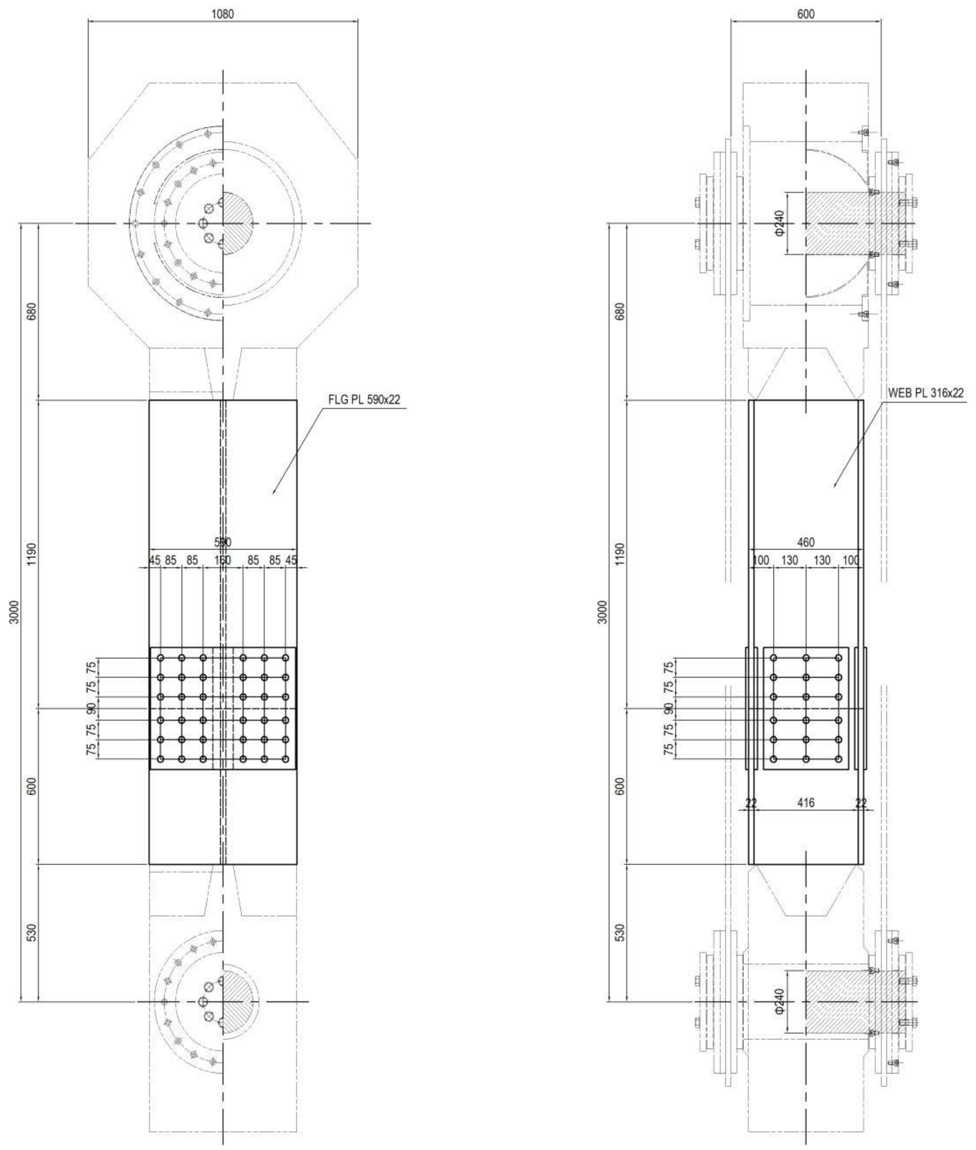
12.8 Design of Rocking Bearing (Excerpt)

The results of the rocking bearing design are listed below.

Table Design Calculation Results

Category				Units	Value		Allowable Value
Endlink	Spherical Surface Bearing	Bearing Pressure（Internal Diameter）		N/mm2	41	<	50
	Spherical Bush Bearing	Maximum Bearing Stress at Center Cross Section		N/mm2	23	<	50
		Tensile Stress		N/mm2	55	<	290
	Pin	Bending Stress		N/mm2	262	<	290
		Shear Stress		N/mm2	57	<	160
	Anchor Structure at Upper Side	Curved Beam Calculation	Cross Section Y （※1）	N/mm2	132	<	153
			Cross Section X （※1）	N/mm2	80	<	153
		Shear Stress		N/mm2	37	<	90
	Anchor Structure at Lower Side	Curved Beam Calculation	Cross Section Y （※1）	N/mm2	101	<	153
			Cross Section X （※1）	N/mm2	49	<	102
		Shear Stress		N/mm2	40	<	60
Rocking Bearing	Tie Bar	Axial Compressive Stress		N/mm2	105	<	131
	Support Beam	Stress (Compression)	σu	N/mm2	73	<	207
			σl	N/mm2	85	<	210
		Stress (Tension)	σu	N/mm2	87	<	210
			σl	N/mm2	102	<	169
	Base of Beam Post	Design as Column	Axial Compressive Stress	N/mm2	47	<	210
			Bearing Stress	N/mm2	129	<	315
		Design as Beam	σ	N/mm2	3	<	210
			τ	N/mm2	9	<	120
	Base Plate	σ		N/mm2	155	<	210
		τ		N/mm2	21	<	120
	Anchor Bolt	σs		N/mm2	204	<	210
	Anchor Frame	Shear Stress of Web		N/mm2	37	<	120
		Compressive Stress of Diaphragm		N/mm2	108	<	210
		Stress of Flange	(A), (B) Panel Combined Stress	N/mm2	96	<	210
			(C), (D) Panel Combined Stress	N/mm2	27	<	210
			(E), (F) Panel Combined Stress	N/mm2	158	<	210

※See the next page for the cross-section position



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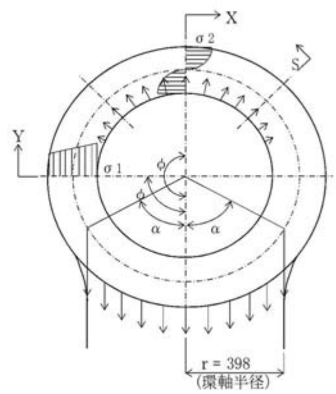


Figure　Rocking Bearing Overview and Cross Section Location

12.9 Design Calculation for Cable (Excerpt)

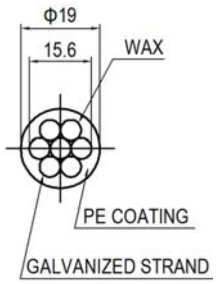
(1) Stay Cable

1) Specifications for Stay Cable

a) Specifications for Strand

Stay cable is composed of strand, which is a set of 7-galvanized strand wire and high-density polyethylene pipe. The specifications for the strand is as follows:

Table Specifications for Strand

Items	Description
Standard Cross Section	
Nominal Area	146.5 mm^2
Tensile Strength	261 kN
Elastic Modulus	190 kN/mm^2
Unit Weight (Strand + HDPE Coating)	1.288 kg/m

b) Cross Section of Stay Cable

The strands are arranged in a hexagonal pattern in the cross section of the stay cable. The number of strands was decided based on the maximum tension, which is calculated by static analysis.

Table Characteristics of Stay Cable

Items	Equation
Area (mm^2)	146.5 x N
Unit Weight (kg/m)	1.288 x N + Wp (weight of outer cover pipe)
Yield Point (kN)	222 x N
Tensile Strength (kN)	261 x N
Young's Modulus (kN/mm^2)	190

Note: N: number of strands, Wp: Weight of outer cover pipe (high-density polyethylene pipe)

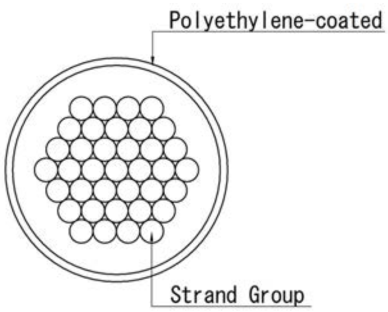


Figure Cross Section of Stay Cable

2) Decision of Stay Cable Cross Section

The calculated results of the cable tension and cross section of the stay cable are shown in the table below.

Table Cable Tension and Cross Section

No.	Load	Tension (kN)	Cable Type
C1	Cable Tension max(all)	6616.6	φ15.6 * 70
C2	Cable Tension max(all)	5935.1	φ15.6 * 70
C3	Cable Tension max(all)	5322.2	φ15.6 * 70
C4	Cable Tension max(all)	5033.1	φ15.6 * 70
C5	Cable Tension max(all)	5291.6	φ15.6 * 70
C6	Cable Tension max(all)	3144.2	φ15.6 * 37
C7	Cable Tension max(all)	3457.4	φ15.6 * 37
C8	Cable Tension max(all)	3675.1	φ15.6 * 37
C9	Cable Tension max(all)	3752.1	φ15.6 * 37
C10	Cable Tension max(all)	3628.3	φ15.6 * 37
C20	Cable Tension max(all)	5622.5	φ15.6 * 70
C19	Cable Tension max(all)	5335.9	φ15.6 * 70
C18	Cable Tension max(all)	5150.0	φ15.6 * 70
C17	Cable Tension max(all)	5177.1	φ15.6 * 70
C16	Cable Tension max(all)	5488.0	φ15.6 * 70
C15	Cable Tension max(all)	3227.5	φ15.6 * 37
C14	Cable Tension max(all)	3521.6	φ15.6 * 37
C13	Cable Tension max(all)	3696.9	φ15.6 * 37
C12	Cable Tension max(all)	3738.0	φ15.6 * 37
C11	Cable Tension max(all)	3607.9	φ15.6 * 37

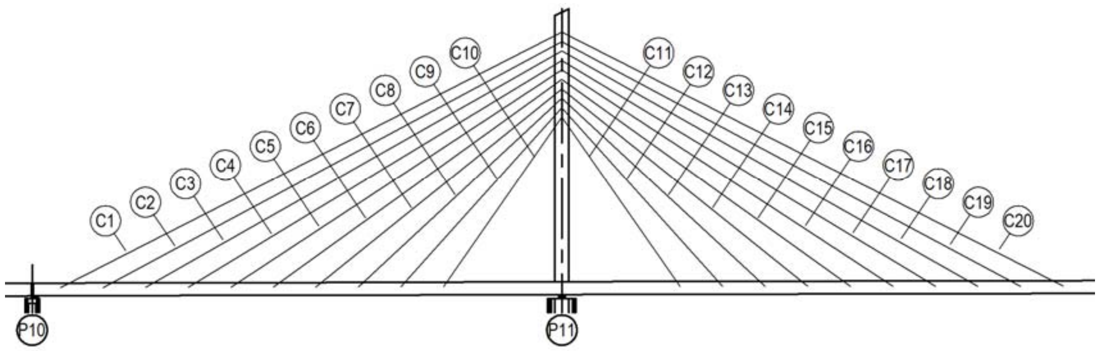


Figure Cable Number

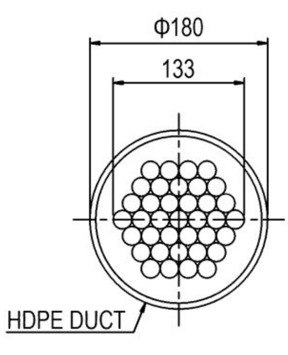
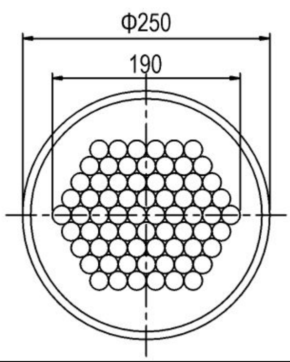
The safety ratio for the cable structure in a cable-stayed bridge is "2.5" in the JSHB. Evaluation result is as follows:

Table Evaluation of Cable Tension

Cable No.	Max. Tension	Cable Strength	Safety Ratio
C1-C2, C16-C20 (70H)	6617 kN	18270 kN	2.76 > 2.5 (OK)
C6-C10, C11-C15 (37H)	3752 kN	9657 kN	2.57 > 2.5 (OK)

The selected cable cross section is as follows:

Table Cross Section of Stay Cable

Items	37H	70H
Cable Cross Section		
Nominal Area	5420 mm^2	10255 mm^2
Tensile Strength	9657 kN	18270 kN
Elastic Modulus	190 kN/mm^2	190 kN/mm^2
Unit Weight (Strand + HDPE Coating)	50.8 kg/m	96.0 kg/m

(2) Calculation of Stay Cable Length

The stay cable length is calculated by considering the “Catenary Curve”. The calculation method is shown in the figure below.

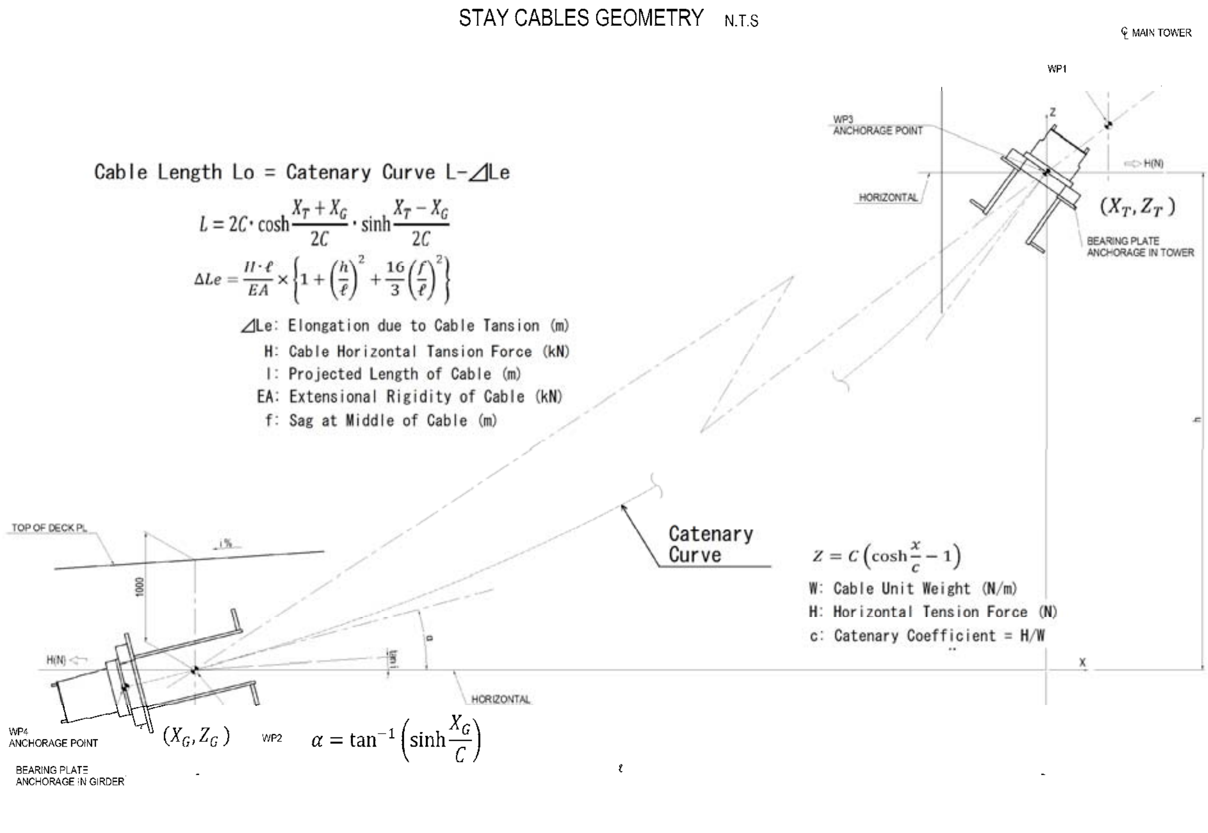


Figure Calculation Method of Catenary Curve

Table　Cable Section and Characteristics

STAY CABLE NO.	X_G (m)	Z_G (m)	X_T (m)	Z_T (m)	ℓ (m)	h (m)	W (N/m)	H (kN)	A (m^2)	f (mm)	α (deg)	⊿Le (m)	L (m)	L_0 (m)
C1	-218.000	-1.297	-112.000	52.922	106.000	54.219	941.400	6093.200	0.010	246.400	26.673	0.410	119.705	119.295
C2	-209.000	-1.273	-112.000	50.922	97.000	52.195	941.400	5346.200	0.010	237.900	27.855	0.336	110.794	110.458
C3	-200.000	-1.250	-112.000	48.922	88.000	50.172	941.400	4678.100	0.010	227.100	29.250	0.275	101.941	101.666
C4	-191.000	-1.228	-112.000	46.922	79.000	48.150	941.400	4317.300	0.010	202.000	30.942	0.236	93.160	92.924
C5	-182.000	-1.207	-112.000	44.922	70.000	46.129	941.400	4405.500	0.010	159.200	33.028	0.223	84.475	84.252
C6	-173.000	-1.187	-112.000	42.922	61.000	44.109	497.900	2534.800	0.005	114.300	35.594	0.224	75.798	75.574
C7	-164.000	-1.168	-112.000	40.922	52.000	42.090	497.900	2652.900	0.005	82.900	38.771	0.218	67.421	67.203
C8	-155.000	-1.150	-112.000	38.922	43.000	40.072	497.900	2655.600	0.005	60.300	42.813	0.204	59.298	59.095
C9	-146.000	-1.133	-112.000	36.922	34.000	38.055	497.900	2453.200	0.005	44.900	48.090	0.180	51.552	51.373
C10	-137.000	-1.117	-112.000	34.922	25.000	36.039	497.900	2024.000	0.005	34.500	55.152	0.149	44.382	44.233
C11	-87.000	-1.047	-112.000	34.922	-25.000	35.969	497.900	2003.300	0.005	34.800	55.098	0.147	44.325	44.178
C12	-78.000	-1.038	-112.000	36.922	-34.000	37.960	497.900	2437.900	0.005	45.100	48.018	0.178	51.481	51.303
C13	-69.000	-1.030	-112.000	38.922	-43.000	39.951	497.900	2672.500	0.005	59.800	42.728	0.204	59.216	59.012
C14	-60.000	-1.023	-112.000	40.922	-52.000	41.944	497.900	2728.100	0.005	80.500	38.680	0.223	67.329	67.106
C15	-51.000	-1.016	-112.000	42.922	-61.000	43.938	497.900	2612.000	0.005	110.800	35.496	0.231	75.698	75.467
C16	-42.000	-1.011	-112.000	44.922	-70.000	45.933	941.400	4591.700	0.010	152.500	32.930	0.232	84.367	84.135
C17	-33.000	-1.007	-112.000	46.922	-79.000	47.928	941.400	4433.800	0.010	196.400	30.836	0.241	93.045	92.804
C18	-24.000	-1.004	-112.000	48.922	-88.000	49.925	941.400	4522.800	0.010	234.600	29.113	0.265	101.819	101.554
C19	-15.000	-1.001	-112.000	50.922	-97.000	51.923	941.400	4800.500	0.010	264.700	27.681	0.301	110.666	110.365
C20	-6.000	-1.000	-112.000	52.922	-106.000	53.922	941.400	5188.300	0.010	289.000	26.472	0.348	119.570	119.222

12.10 Guardrail (Excerpt)

(1) Specifications of Guardrail

The Type-A combination railing (steel) which is shown in the standard drawings for Ministry of Land, Infrastructure, Transport and Tourism Hokuriku Regional Development Bureau was selected. The specifications of guardrail are as follows:

- Post interval : 2.0 m shall be set as the standard.
- Height of guardrail (Outer Side) : 1.1 m from bridge surface
  (Median Side) : 0.9 m from bridge surface

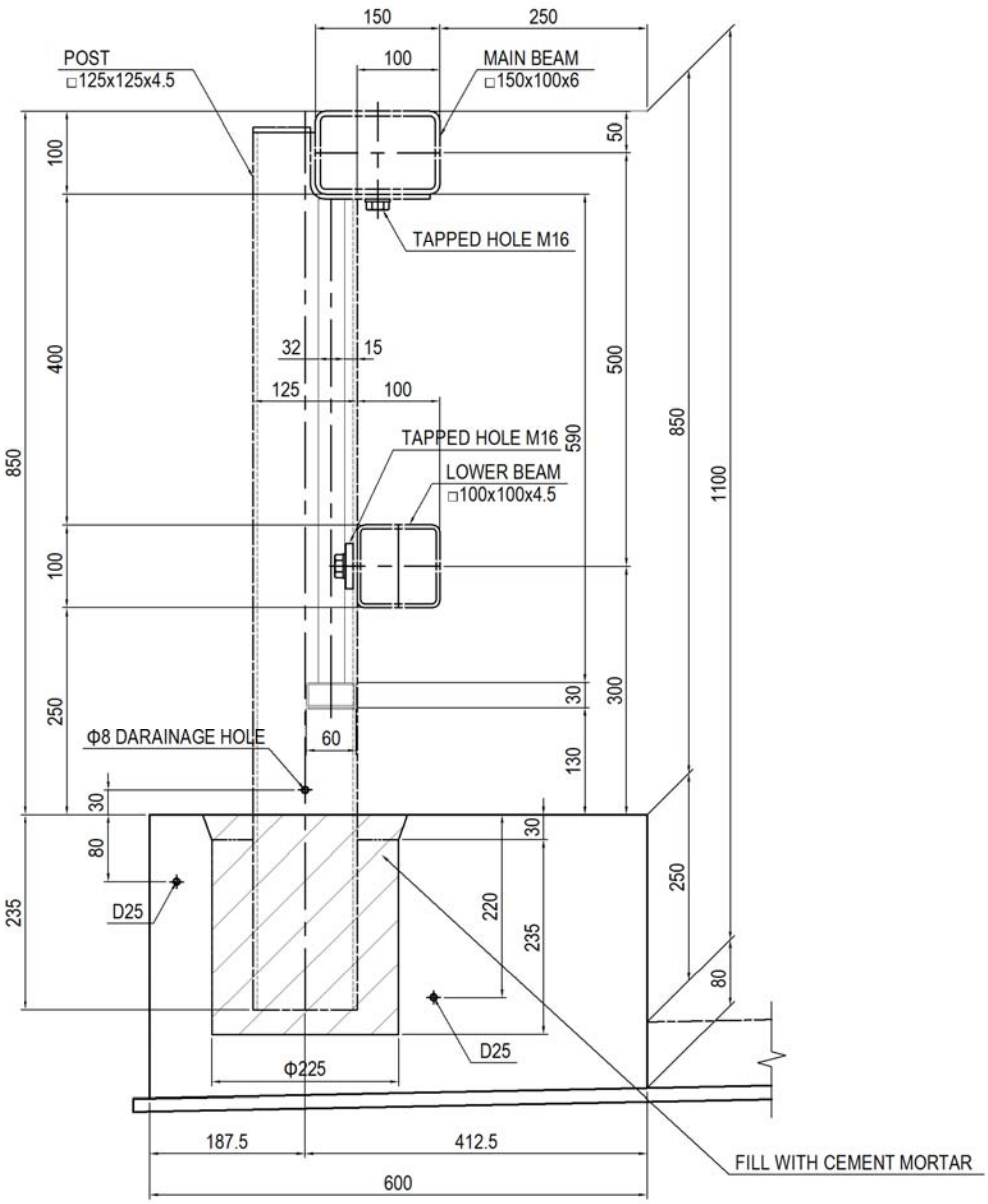


Figure Detailed Plan of Guardrail (Outer Side)

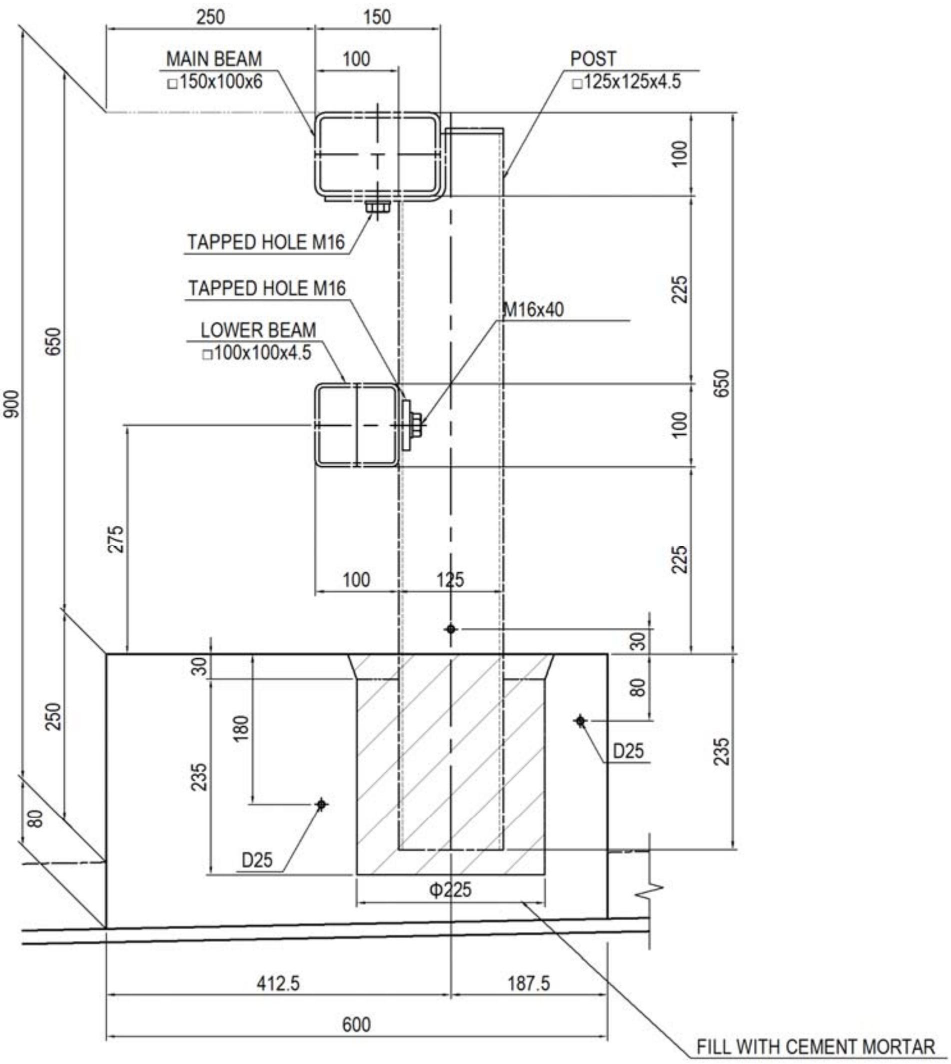


Figure Detailed Plan of Guardrail (Median Side)

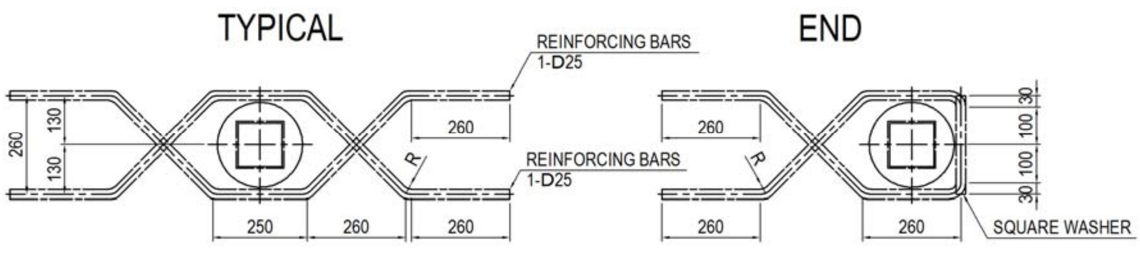


Figure Reinforcing Steel

(2) Design of Barrier Curb Footing

The fixing of the guardrail shall be designed. A continuous footing curb able to withstand the impact of a vehicle shall be installed, and the guardrail post shall be fixed on top of the curb.

1) Design Condition

- Design strength of concrete : $\sigma ck = 24\ N/mm^2$
- Force applied per post : Pmax = 45.0 kN*

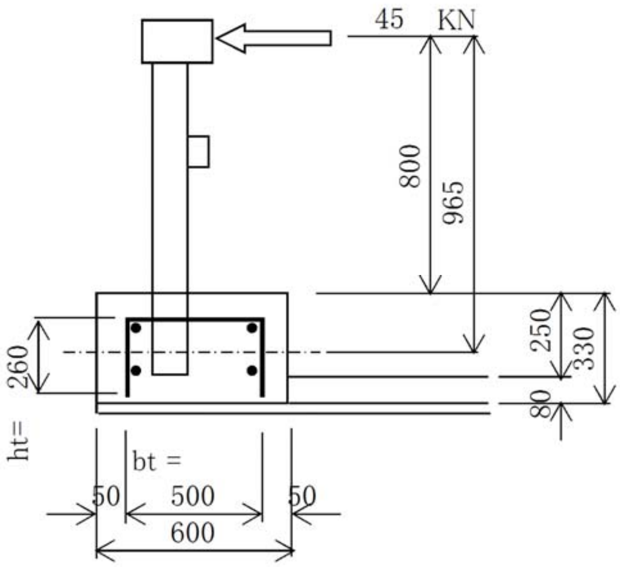


Figure Schematics of Continuous Footing

* Maximum Resistance Force of Railing Post: Pmax

Outline of the Railing Post

Post	: □-125x125x4.5
Cross Section Area	: A = 21.17 cm2
Second Moment of Inertia	: I = 506 cm4
Section Modulus	: Z = 80.09 cm3
Plastic Section Modulus	: Zp = 94.8 cm3

All Plastic Bending Moment

Mp = σv x Zp = 235 / 94,800

= 22,278,000 N・mm

Ultimate Resistance Force of Railing Post

Pw = Mp / H = 22,278,000 / 600

= 37130 N = 37.13kN

Maximum Resistance Force of Railing Post

Pmax = 37 x 1.2

= 44.556 kN ≒ 45.0 kN

The ratio of Pw and Pmax: 1.2 was assumed from experimental results of other railings.

2) Design of Torsion Reinforcement

- Horizontal reinforcement against torque

If the cross sectional area of one bar for horizontal reinforcement against torque, arranged at interval a, is Awt (mm^2), then:

$$Awt = \frac{Mt \cdot a}{1.6 \cdot bt \cdot ht \cdot \sigma y}$$

Here	a	:	Interval of horizontal reinforcement bar (mm)
	Mt	:	Torsion acting on cross section of member N・mm
	σy	:	Yield point of reinforcement bars (N/mm^2)
	bt,ht	:	Width and height specified in the above figure (mm)

$$Mt = P \cdot L = 45000 \times 965 = 43425000 \text{ N・mm}$$

bt = 500 mm

ht = 260 mm

a = 300 mm

If SD345(σy = 345 N/mm^2)is used

$$Awt = \frac{43425000 \times 300}{1.6 \times 500 \times 260 \times 345} = 181.5 \ mm^2 < 198.6 \ mm^2$$

Therefore, SD345-D16 (198.6 mm^2) is utilized.

3) Anchorage Reinforcement against Overturning

The floor deck of the continuous footing shall be fixed using post-installed anchor. The post-installed fixing anchor per effective width, discussed in the next chapter, is designed below.

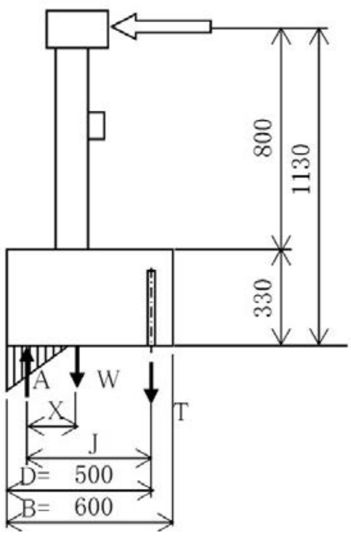


Figure Anchorage of Floor Slab

Tensile force of the anchor is T, and self-weight per effective width is W. Considering equilibrium of forces about the point A, then:

$$T = \frac{Mt - W \cdot X}{J}$$

Effective Width

$$W = 24.5 \times 0.60 \times 0.33 \times 1.050 = 5093.55 \text{ N}$$

Assuming D = 500 mm

$$J = 7/8 \times D = 7 / 8 \times 500 = 438 \text{ mm}$$

$$X = B/2 - D/8 = 600 / 2 - 500 / 8 = 238 \text{ mm}$$

$$T = \frac{43425000 - 5093.55 \times 238}{438} = 96376 \text{ N}$$

Assuming per effective width of 1050 mm, four bars are needed, the tensile strength T1 per bar of anchor is:

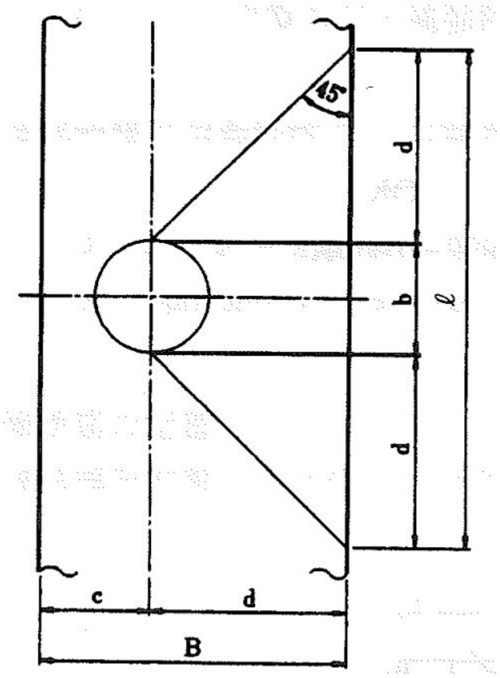
$$T1 = \frac{96376}{4} = 24094 \text{ N}$$

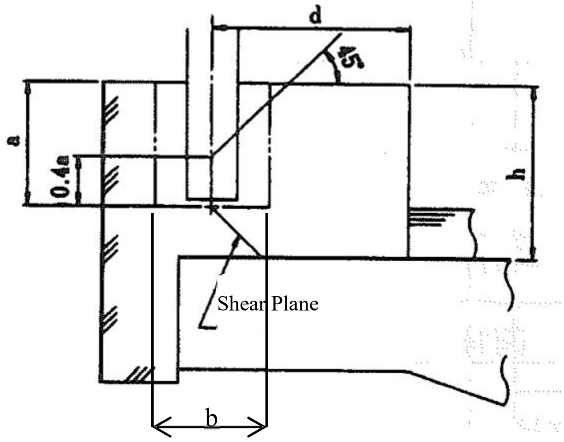
Therefore, the required cross sectional area As per bar is:

$$As = \frac{T1}{\sigma y} = \frac{24094}{345} = 69.8 \text{ mm}^2 < 198.6 \text{ mm}^2$$

Therefore, the guardrail is fixed by SD345-D16-4 post-installed fixing anchors per effective width of 1050 mm.

< Calculation of effective width (*l*)>





b = 225 mm

d = 412.5 mm

l = b + 2d
= 1050 mm

Figure Calculation of Effective Width

- Evaluation of weld between rebar and steel deck

Allowable stress of studs	σsa	= 140 N/mm^2
Increase coefficient at impact		= 1.5
Maximum tensile stress	σs	= T1 / Aw (D16)
		= 24094 / 198.6 = 121.3 N/mm^2 < σca
Allowable tensile stress	σca	= 0.9 x 0.9 x 140 x 1.5 = 170 N/mm^2

- Evaluation of fixation length of reinforcement

Fixation length	L	= T1 / (π x ϕ x nc x τoa)
		= 24094 / (π x 15.9 x 1.5 x 1.60)
		= more than 201 mm
Increase coefficient	nc	= 1.5
Allowable fixation stress	τoa	= 1.60 N/mm^2
Nominal diameter (D16)	ϕ	= 15.9 mm

12.11 Gondola Supporting Member (Excerpt)

The weight of the gondola was assumed as 300kg. Accordingly, the cross-section of the supporting members and stiffeners of the supports were decided as shown below.

・Section Force

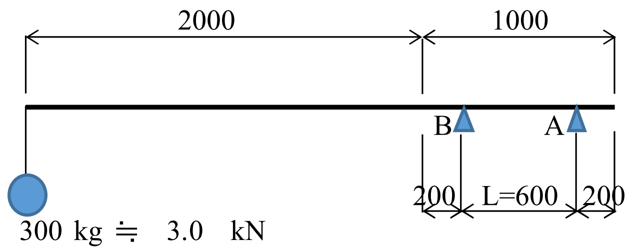


Figure Design Condition for Supporting Member

Reaction Force

R_A = -P × a / L = -3.0 × 2.200 / 0.600
= -11.0 kN

R_B = P × a / L = 3.0 × (0.600 + 2.200) / 0.600
= 14.0 kN

Bending Moment, Shear

M = -P × a = -3.0 × 2.2
= -6.6 kN・m

S = R_A = -11.0 kN

・Examination of applied cross-section

Applied cross-section

H - 250 × 250 × 9 × 14 … Z = 860 cm^3

Verification of bending stress

σ = M / Z
= -6.6 × 10 ^6 / 860 × 10 ^3
= -7.7 N/mm^2 < σ_a = 140 N/mm^2

Verification of shear stress

Aw = 9 × (250 - 2 × 14) = 1998 mm^2

τ = S / Aw = 11.0 × 10 ^3 / 1998
= 5.5 N/mm^2 < τ_a = 80 N/mm^2

・Stiffners for supports

Applied cross-section

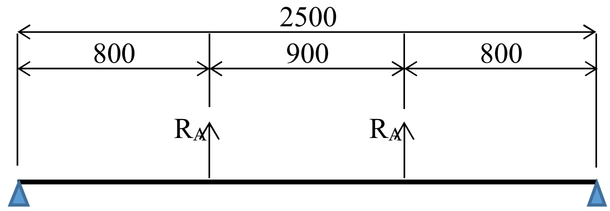
V-Stiff PL 2- 100 × 9

Verification of stress

σ_a = R_B / A_b = 14.0 × 10 ^3 / (2 × 100 × 9)
= 7.8 N/mm^2

3) Reinforcement at Tower Side

・Section Force



$M = R_A \times 0.800$
$= -8.8$ kN・m
$S = R_A = -11.0$ kN

Figure Design Condition for Reinforcement at Tower Side

・Necessary section modulus at reinforced section

Section force shall equal that of gondola suspension member

Shall be adjusted to equal H - 250 × 250 × 9 × 14 … Z = 860 cm^3

・Stiffners for supports

Applied cross-section

V-Stiff PL 2- 100 × 9

Verification of stress

$\sigma_a = R_B / A_b = 14.0 \times 10$ ^3 / (2 × 100 × 9)
$= 7.8$ N/mm^2

・Configuration

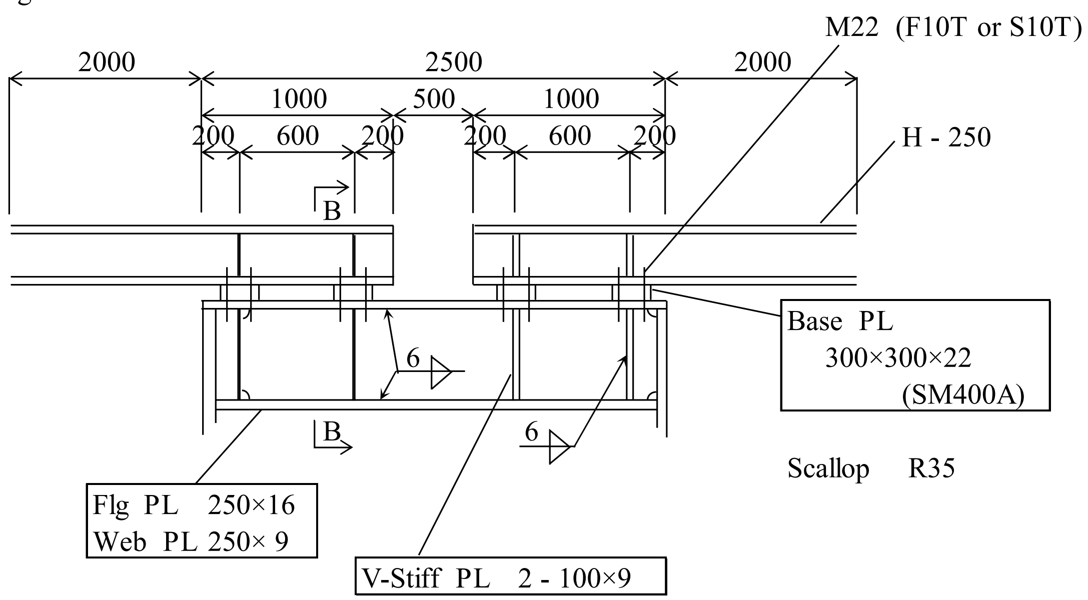


Figure Tower Side Reinforcement Plan

12.12 Base for Road Lighting Pole (Excerpt)

The road lighting pole weight was assumed as shown below, and the design of the base was performed. The calculation results are as follows:

1) Design Load

The assumed weight of the road lighting pole is:

12 m lighting pole (assumed weight) V = 1.900 kN (about 190 kg)

2) Design of Base

$$M = 1.900 \times 0.270 = 0.513 \text{ kNm}$$

$$S = 1.900 \text{ kN}$$

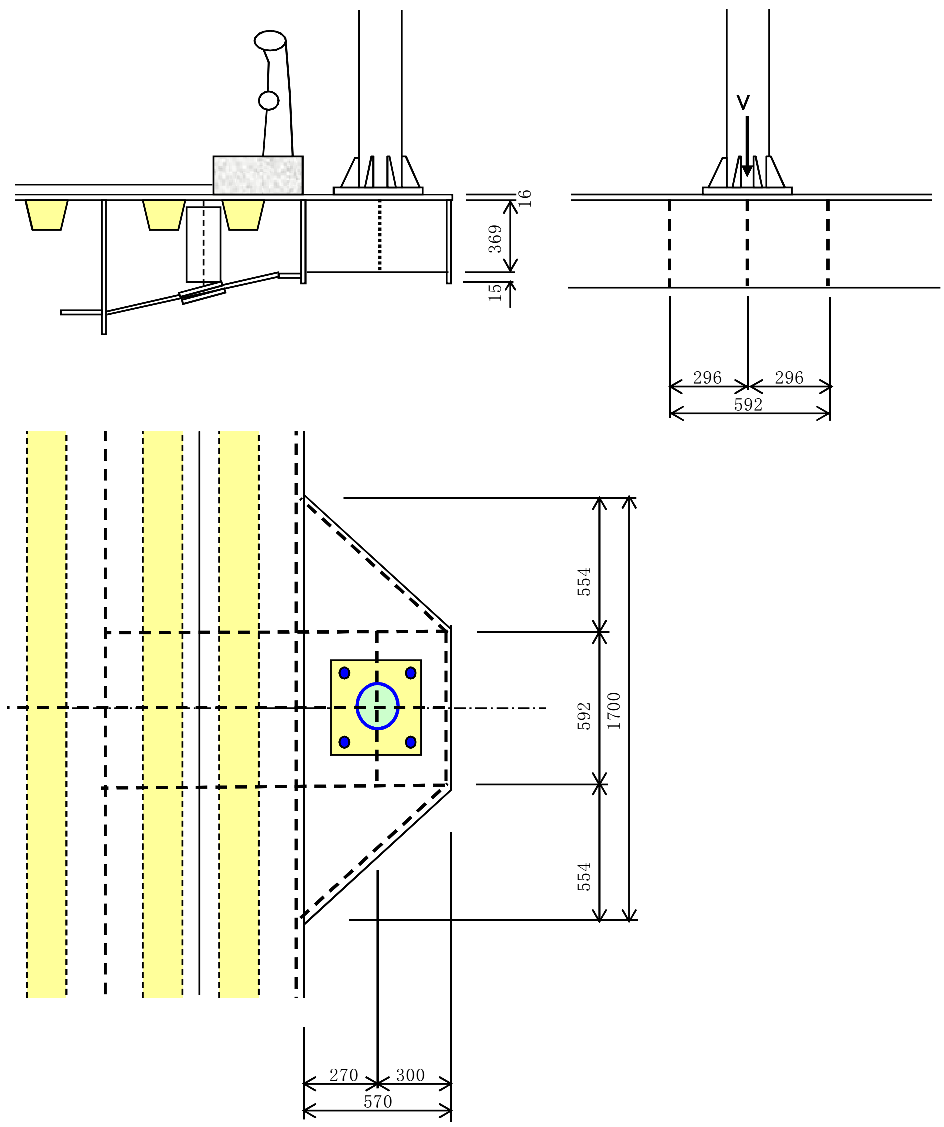


Figure Base for Road Lighting Pole

a) Cross Section Design

(SM400)		A	y	Ay	$Ay^2 + I$
1 - PL	976 × #	156.2	-19.3	-3015	58190
3 - PL	369 × 9	99.6	0	0	11305
		255.8 cm^2		-3015 cm^3	69495 cm^4
					-35536
				I =	33959 cm^4

$\delta = \dfrac{Ay}{A} = -11.8$ cm

$I' = 255.8 \times -11.8^2 = -35536$

yu = - 18.5 - 1.6 - -11.8 = -8.3 cm
yl = + 18.5 + - -11.8 = 30.2 cm

wu = -4091 cm^3
wl = 1124 cm^3

σu	=	M／wu	=	-0.1 N/mm^2	<	σa	=	140 N/mm^2
σl	=	M／wl	=	0.5 N/mm^2	<	σa	=	140 N/mm^2
τ	=	S / Aw	=	0.2 N/mm^2	<	τa	=	80 N/mm^2

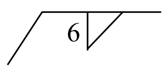
Composite Stress

$(0.5 / 140)^2 + (0.2 / 80)^2 = 0.00 < 1.2$ *OK*

b) Welding Design

Upper Flange: Full Penetration Welding

Web:



Throat Thickness

$a = 6 / \sqrt{2}$
$= 4.2$ mm

(SM400)		A	y	Ay	$Ay^2 + I$
1 - PL	976 × 16	156.2	-19.3	-3015	58190
6 - PL	369 × 4.2	93.9	0	0	10658
		250.1 cm^2		-3015 cm^3	68848 cm^4
					-36346
				I =	32502 cm^4

$\delta = \dfrac{Ay}{A} = -12.1$ cm

$I' = 250.1 \times -12.1^2 = -36346$

yu = - 18.5 - 1.6 - -12.1 = -8.0 cm
yl = + 18.5 + - -12.1 = 30.5 cm

wu = -4063 cm^3
wl = 1066 cm^3

σu	=	M／wu	=	-0.1 N/mm^2	<	τa	=	80 N/mm^2
σl	=	M／wl	=	0.5 N/mm^2	<	τa	=	80 N/mm^2
τ	=	S / Aw	=	0.2 N/mm^2	<	τa	=	80 N/mm^2

Composite Stress

$(0.5 / 80)^2 + (0.2 / 80)^2 = 0.00 < 1$ *OK*

12.13 Base for Navigation Sign (Excerpt)

The navigation sign weight was assumed as shown below, and the design of the base was performed. The calculation results are as follows:

1) Design Load

The assumed weight of the navigation sign is:

Navigation sign (assumed weight) V = 1.000 kN (about 100 kg)

2) Design of Base

M = 1.000 × 0.886
= 0.886 kNm
S = 1.000 kN

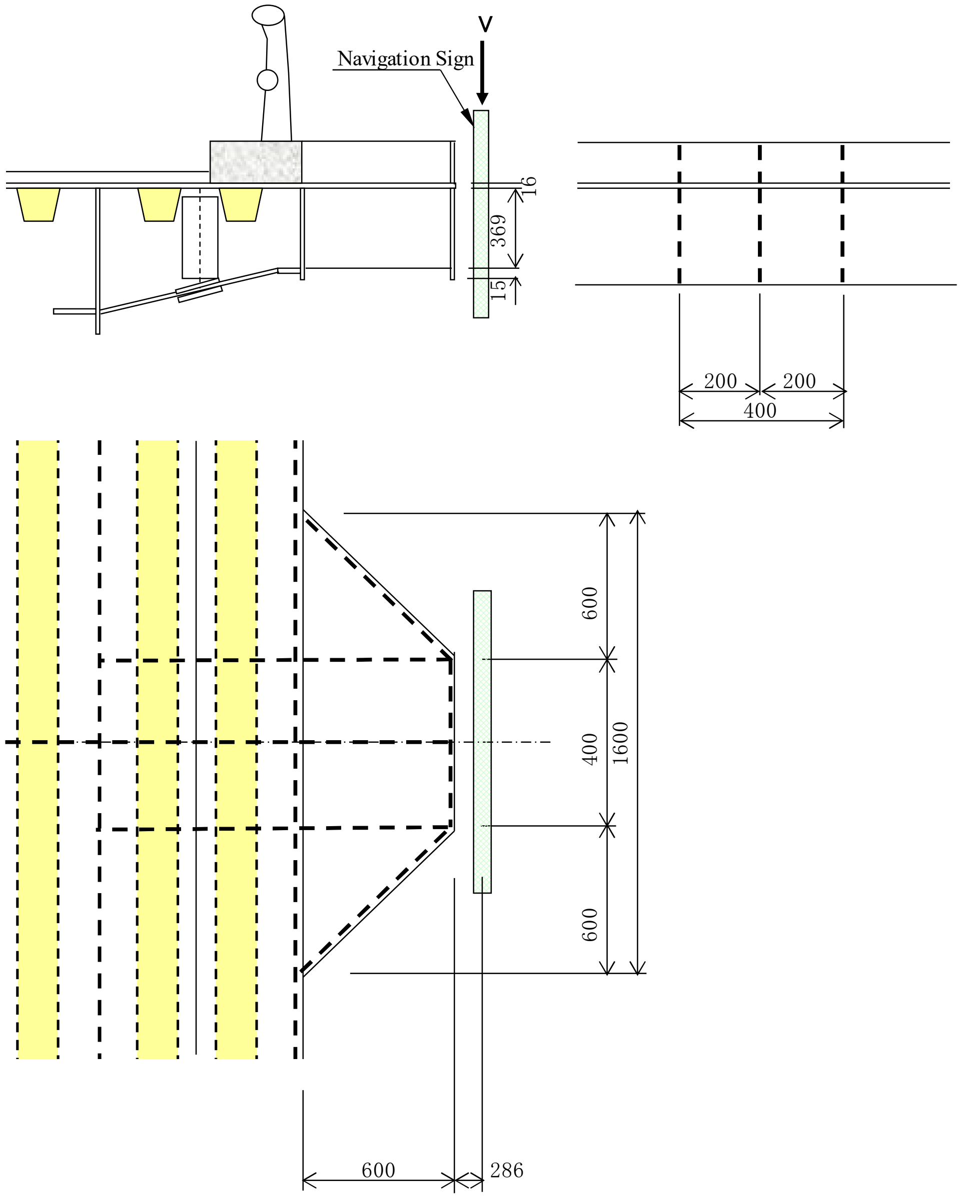


Figure Base for Navigation Sign

a) Cross Section Design

	(SM400)	A	y	Ay	Ay^2+I	
1 - PL	784 × #	125.4	-19.3	-2420	46706	
3 - PL	369 × 9	99.6	0	0	11305	
		225.0 cm^2		-2420 cm^3	58011	cm^4
					-26028	
				I =	31983	cm^4

$\delta = \dfrac{Ay}{A} = -10.8$ cm

I ' = 225.0 × -10.8^2 = -26028

yu = - 18.5 - 1.6 - -10.8 = -9.3 cm
yl = + 18.5 + - -10.8 = 29.2 cm

wu = -3439 cm^3
wl = 1095 cm^3

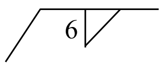
σu = M／wu = -0.3 N/mm^2 < σa = 140 N/mm^2
σl = M／wl = 0.8 N/mm^2 < σa = 140 N/mm^2
τ = S / Aw = 0.1 N/mm^2 < τa = 80 N/mm^2

Composite Stress
$(0.8 / 140)^2 + (0.1 / 80)^2 = 0.00 < 1.2$ *OK*

b) Welding Design

Upper Flange: Full Penetration Welding

Web:



Throat Thickness
a = 6 / $\sqrt{2}$
= 4.2 mm

	(SM400)	A	y	Ay	Ay^2+I	
1 - PL	784 × 16	125.4	-19.3	-2420	46706	
6 - PL	369 × 4.2	93.9	0	0	10658	
		219.3 cm^2		-2420 cm^3	57364	cm^4
					-26705	
				I =	30659	cm^4

$\delta = \dfrac{Ay}{A} = -11.0$ cm

I ' = 219.3 × -11.0^2 = -26705

yu = - 18.5 - 1.6 - -11.0 = -9.0 cm
yl = + 18.5 + - -11.0 = 29.5 cm

wu = -3407 cm^3
wl = 1039 cm^3

σu = M／wu = -0.3 N/mm^2 < τa = 80 N/mm^2
σl = M／wl = 0.9 N/mm^2 < τa = 80 N/mm^2
τ = S / Aw = 0.1 N/mm^2 < τa = 80 N/mm^2

Composite Stress
$(0.9 / 80)^2 + (0.1 / 80)^2 = 0.00 < 1$ *OK*

12.14 Base for Aircraft Warning Light (Excerpt)

The aircraft warning light weight was assumed as shown below, and the design of the base was performed. The calculation results are as follows:

1) Design Load

The assumed weight of the aircraft warning light is:

Aircraft warning light (assumed weight) V = 0.200 kN (about 20 kg)

2) Design of Base

$$M = 0.200 \times 0.210$$
$$= 0.042 \text{ kNm}$$
$$S = 0.200 \text{ kN}$$

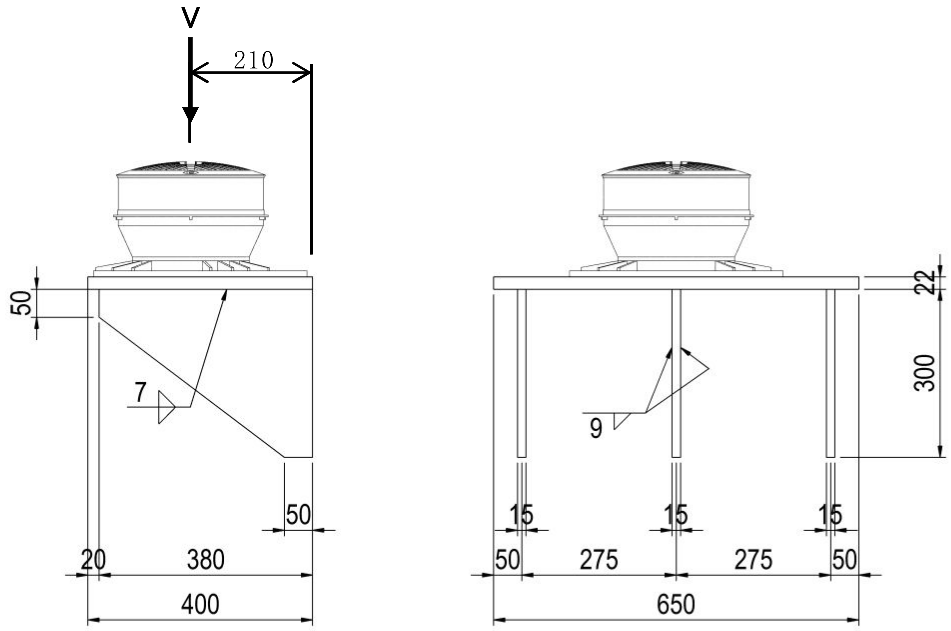


Figure Base for Aircraft Warning Light

a) Cross Section Design

(SM400)		A	y	Ay	$Ay^2 + I$
1 - PL	650 × 22	143.0	-16.1	-2302	37062
3 - PL	300 × 15	135.0	0	0	10125
		278.0 cm^2		-2302 cm^3	47187 cm^4
					-19062
				I =	28125 cm^4

$$\delta = \frac{Ay}{A} = -8.3 \text{ cm}$$

$$I' = 278.0 \times -8.3^2 = -19062$$

yu = - 15 - 2.2 - -8.3 = -8.9 cm

yl = + 15 + - -8.3 = 23.3 cm

wu = -3160 cm^3

wl = 1207 cm^3

σu = M／wu = 0.0 N/mm^2 < σa = 140 N/mm^2

σl = M／wl = 0.0 N/mm^2 < σa = 140 N/mm^2

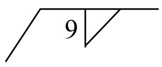
τ = S / Aw = 0.0 N/mm^2 < τa = 80 N/mm^2

Composite Stress

$(0.0 / 140)^2 + (0.0 / 80)^2 = 0.00 < 1.2$ *OK*

b) Welding Design

Upper Flange:

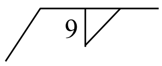


Throat Thickness

a = 9 / $\sqrt{2}$

= 6.4 mm

Web;



Throat Thickness

a = 9 / $\sqrt{2}$

= 6.4 mm

(SM400)		A	y	Ay	$Ay^2 + I$
2 - PL	650 × 6.4	82.7	-15.3	-1265	19355
6 - PL	300 × 6.4	114.6	0	0	8591
		197.3 cm^2		-1265 cm^3	27946 cm^4
					-8111
				I =	19835 cm^4

$$\delta = \frac{Ay}{A} = -6.4 \text{ cm}$$

$$I' = 197.3 \times -6.4^2 = -8111$$

yu = - 15 - 0.6 - -6.4 = -9.2 cm

yl = + 15 + - -6.4 = 21.4 cm

wu = -2156 cm^3

wl = 927 cm^3

σu = M／wu = 0.0 N/mm^2 < τa = 80 N/mm^2

σl = M／wl = 0.0 N/mm^2 < τa = 80 N/mm^2

τ = S / Aw = 0.0 N/mm^2 < τa = 80 N/mm^2

Composite Stress

$(0.0 / 80)^2 + (0.0 / 80)^2 = 0.00 < 1$ *OK*

12.15 Support for Water Pipe (Excerpt)

The water pipe weight (full water) was assumed as shown below, and the design of the water pipe support was performed. The calculation results are as follows:

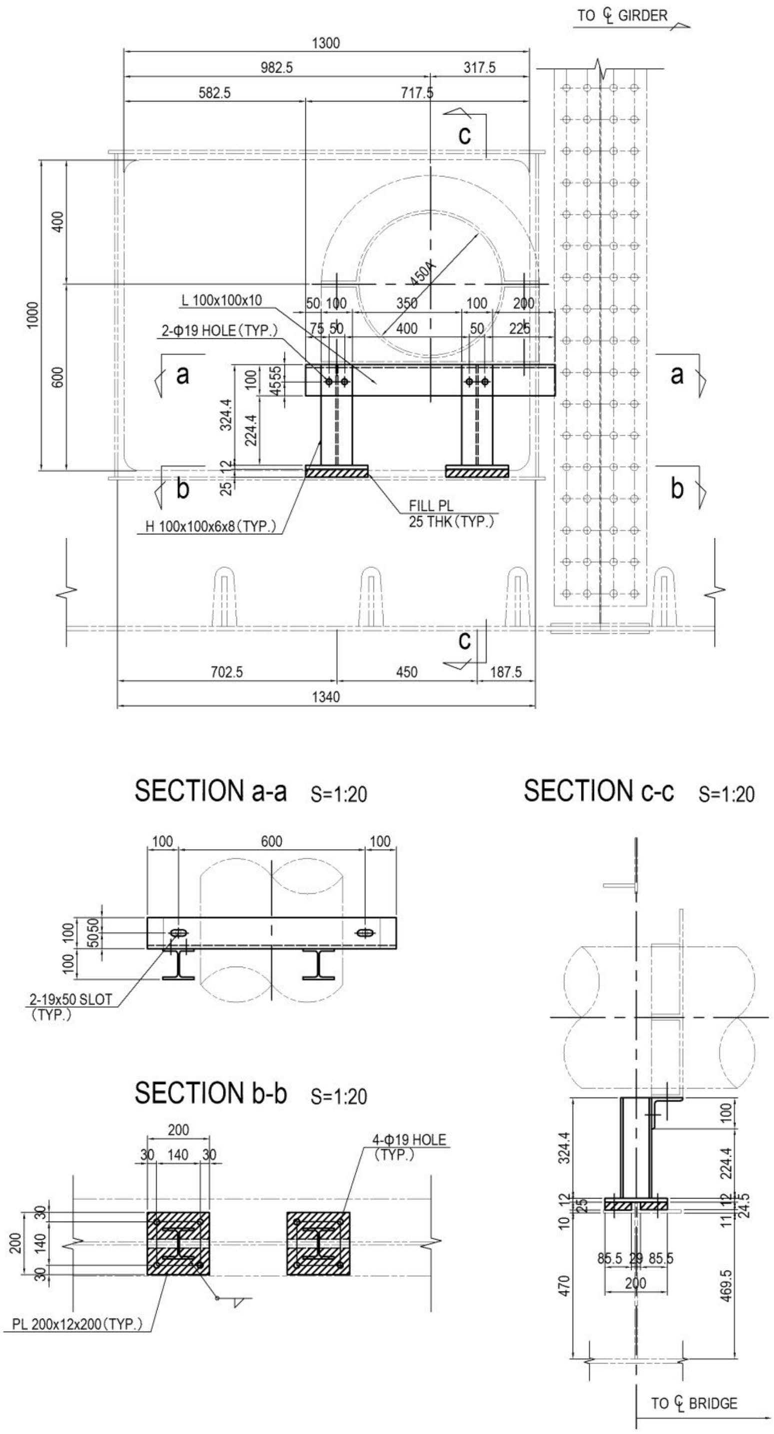


Figure Water Pipe Support

- Design Load

Water Pipe (Full Water)				=	6.00	kN/m		
Supporting Metals	0.015	×	9.81	=	0.15	kN/m		
			W	=	6.15	kN/m	→	6.20 kN/m

- Install Distance L= 2.25 m (less than 2.25m)

-Force at Each Supporting Position P= W・L= 6.20 × 2.25 = 13.95 kN

- Stress Resultants

M= 13.95 × 0.450 / 4 = 1.57 kN・m

S= 13.95 / 2 = 6.98 kN

- Cross Section Design of Supporting Metals

1-L 100 x 100 x 10（SS400)

Z= 24.4 cm3

Aw= 9.0 cm2

σ= M/Z= 1.57 × 10^6 / 24.4 × 10^3 = 64 N/mm2 < 140 N/mm2

τ= S/Aw= 6.98 × 10^3 / 9.0 × 10^2 = 8 N/mm2 < 80 N/mm2

- Evaluation of Bolts

Bolt 2 - M16 (equivalent to SS400)

Calculate as the 2-bolts will work effectively on shear force

A = 13.835^2 × π × 1 / 4 × 2 nos = 301 mm^2

- Shear Stress of Bolts

Shear stress τ calculated from the shear force S

τ = 6.98 × 10^3 / 301 = 23 N/mm^2 < σa= 80 N/mm^2

- Bearing Stress of Bolts: σ

Area A = 14.5 × 6.0 = 87 mm^2

σ= 13.835^2 × π × 1 / 4 × 23 / 87 = 40 N/mm^2 < σa = 210 N/mm^2

- Evaluation of Diaphragm and Transverse Rib

The web cross section directly under the supporting metal was evaluated:

Force at 1 supporting metal P = 13.95 kN

	Effective Width		Thickness			
Web cross section	Aw = 100	×	9	=	900	mm^2
	(Width of shape beam)					

σ= P/Aw= 13.95 × 10^3 / 900 = 16 N/mm^2 < 140 N/mm^2

12.16 Support for Electrical Cables (Excerpt)

The electrical cable weight was assumed as shown below, and the design of the electrical cable support was performed. The calculation results are as follows:

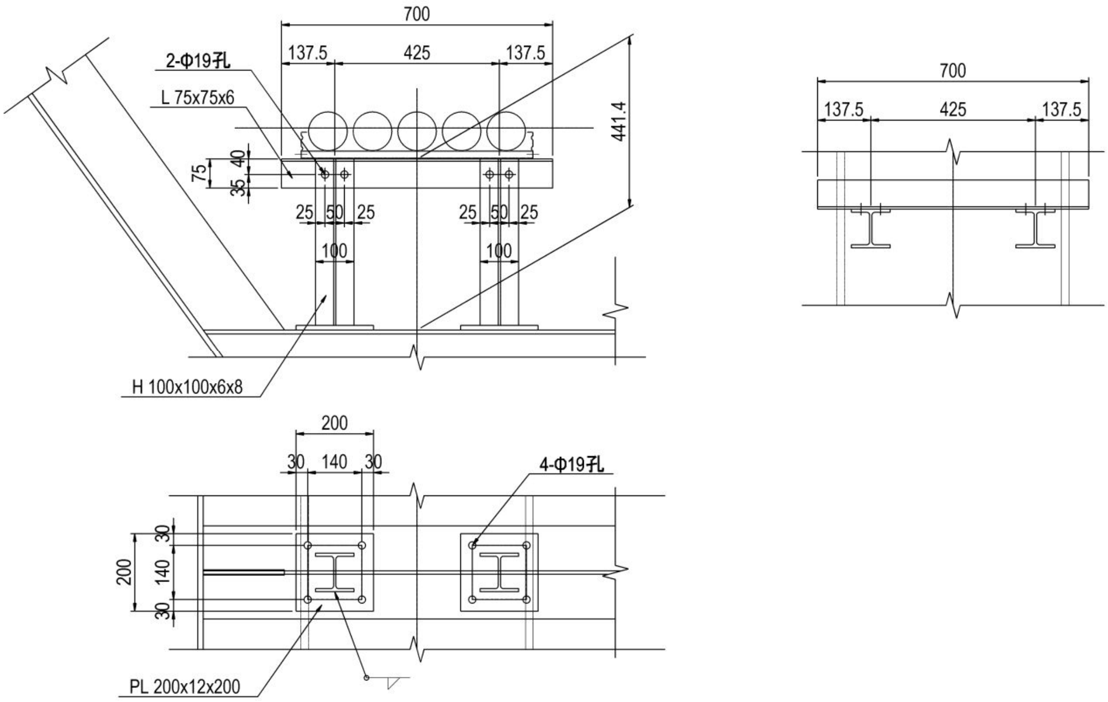


Figure　Electrical Cable Support

- Design Load

Electrical Cable	0.300	×	5	=	1.50	kN/m			
Supporting Metals	0.007	×	9.81	=	0.07	kN/m			
			W	=	1.57	kN/m	→	1.60	kN/m

- Install Distance L= 2.25 m (less than 2.25m)

-Force at Each Supporting Position P= W・L = 1.60 × 2.25 = 3.60 kN

- Stress Resultants

M= 3.60 × 0.425 / 4 = 0.38 kN・m

S= 3.60 / 2 = 1.80 kN

- Cross Section Design of Supporting Metals

1-L 75 x 75 x 6 (SS400)

Z= 8.47 cm3

Aw= 4.1 cm2

σ= M/Z= 0.38 × 10^6 / 8.47 × 10^3 = 45 N/mm2

< 140 N/mm2

τ= S/Aw= 1.80 × 10^3 / 4.1 × 10^2 = 4 N/mm2

< 80 N/mm2

- Evaluation of Bolts

Bolt 2 - M16 (equivalent to SS400)

Calculate as the 2-bolts will work effectively on shear force

A = 13.835^2 × π × 1 / 4 × 2 nos = 301 mm^2

- Shear Stress of Bolts

Shear stress τ calculated from the shear force S

τ = 1.80 × 10^3 / 301 = 6 N/mm^2 < σa= 80 N/mm^2

- Bearing Stress of Bolts: σ

Area A= 14.5 × 6.0 = 87 mm^2

σ= 13.835^2 × π × 1 / 4 × 6 / 87 = 10 N/mm^2

< σa = 210 N/mm^2

- Evaluation of Diaphragm and Transverse Rib

The web cross section directly under the supporting metal was evaluated:

Force at 1 supporting metal P = 3.60 kN

		Effective Width		Thickness		
Web cross section	Aw =	100	×	9	=	900 mm^2
		(Width of shape beam)				

σ= P/Aw= 3.60 × 10^3 / 900 = 4 N/mm^2 < 140 N/mm^2

Cable Stayed Bridge

5) Substructure Design

- Contents -

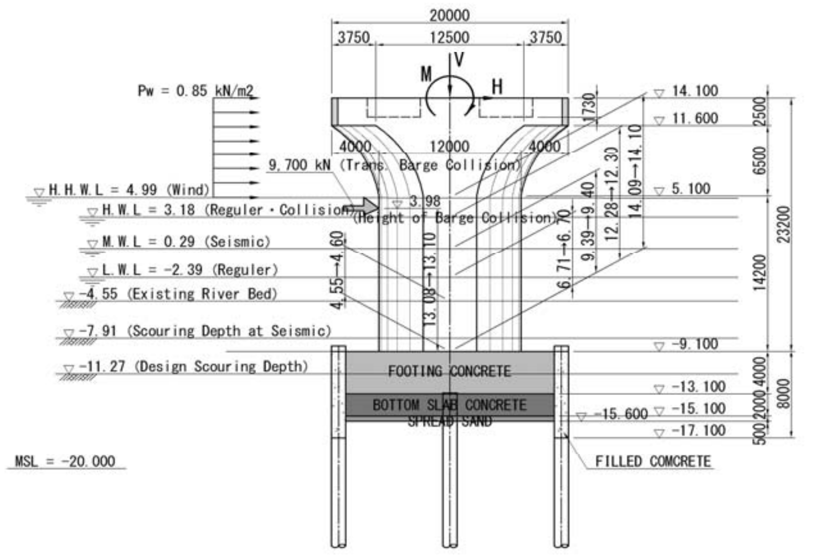
1. Summary of Substructure Calculation

Sunnary of Analysis Results

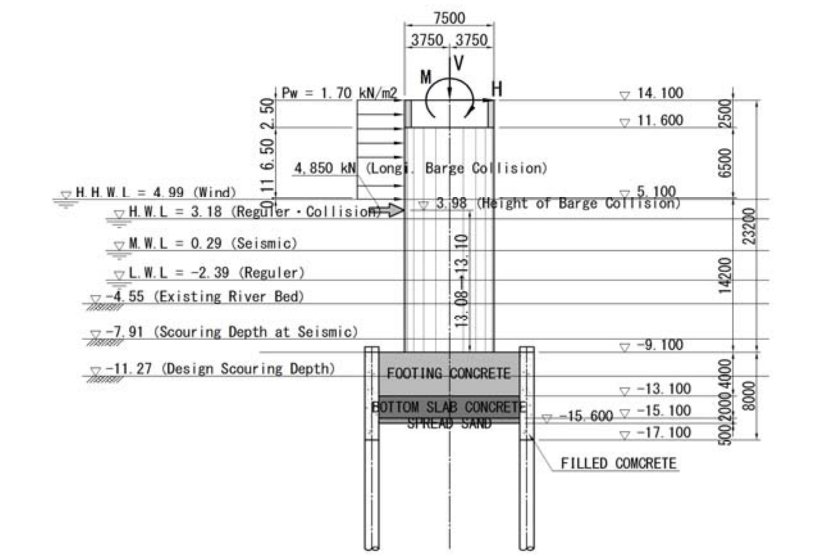
Bago Bridge P10(P13) Pier

[Structure]

Front View



Side View



						Vertical Direction				Horizontal Direction			
Beam	Section	Height			m	9.000				7.500			
		Re-Bar	Main Re-bar	1st layer		D29	—	25nos.		D16	—	49nos.	
				2nd layer		D29	—	18nos.					
			Stirrup			D22-8nos. ctc200				D22-2nos.+D16-1no. ctc200			
	Bridge Seat		Required Re-bar		mm2	---				---			
	Corbel		Required Re-bar		mm2	25,512	≦	27,623	○	11,049	≦	19,463	○
	Calculation	Bending Evaluation	Load Case			Dead Load				Seismic			
			σc		N/mm2	0.83	≦	10.00	○	0.71	≦	15.00	○
			σs		N/mm2	82.6	≦	100.0	○	99.5	≦	300.0	○
		Shear Evaluation	Load Case			Dead + Live Load				Seismic			
			τm		N/mm2	0.006	≦	0.143	○	0.047	≦	0.111	○
			Awreq < Aw		mm2								
		Evaluation for Seismic Performance 2	M < My		KN·m	---				8,704	≦	21,371	○
			S < Ps		KN	---				3,636	≦	16,160	○
Column						Longitudinal				Transverse			
	Section	Height			m	Oval	;	12.000	×	7.500			
		Re-Bar	Main Re-bar	1st layer		D32	ctc	125	※	D32	ctc	135	※
				2nd layer		D32	ctc	125	※				
			Hoop		---	D22	ctc	150		D22	ctc	150	
	Calculation	L1 Seismic	σc		N/mm2	7.29	≦	15.00	○	4.96	≦	15.00	○
			σs		N/mm2	216.0	≦	300.0	○	100.3	≦	300.0	○
			τm		N/mm2	0.283	>	0.171	—	0.259	>	0.152	—
			Aw_req		mm2	721.6	≦	3096.8	○	431.4	≦	2322.6	○
Footing	Re-bar	Arrangament	Top Main Re-bar	1st layer		D32	ctc	270		D35	ctc	190	
				2nd layer		D32	ctc	270		D35	ctc	190	
			Bottom Main Re-bar	1st layer		D51	ctc	270		D51	ctc	190	
				2nd layer		D51	ctc	270		D51	ctc	190	
				3rd layer		---				---			
			Stirrup		---	D22ctc1000×1000				D22ctc1000×1000			
	Calculation	Top Tensile	Critical Case ( ):Shear			Seismic(Seismic)・with Scour				Seismic(Seismic)・with Scour			
			Deep Beam		cm2	43.62	≦	58.83	○	88.71	≦	100.69	○
			σc		N/mm2	2.30	≦	12.00	○	3.68	≦	12.00	○
			σs		N/mm2	146.0	≦	300.0	○	174.4	≦	300.0	○
			τm		N/mm2	---				---			
		Bottom Tensile	Critical Case ( ):Shear			Seismic(Seismic)・with Scour				Seismic(Seismic)・with Scour			
			Deep Beam		cm2	138.20	≦	150.15	○	205.92	≦	213.37	○
			σc		N/mm2	5.48	≦	12.00	○	6.97	≦	12.00	○
			σs		N/mm2	201.3	≦	300.0	○	210.6	≦	300.0	○
			τm		N/mm2	0.87	≦	1.57	○	0.96	≦	1.22	○
SPSP	Pile	Diameter(mm)×Length(m)×Number(no.)				Outer Pile ;	φ1200	×	56.00	×	36nos.		
						Diaphragm Pile ;	φ1200	×	52.10	×	8nos.		
		Thickness	Outer Pile	Top Pile		t = 14 mm (SKY490)							
				Bottom Pile		t = 14 mm (SKY400)							
			Diaphragm Pile		---	t = 14 mm (SKY400)							
	Calculation	Reguler (Existing River Bed)	δ		cm	0.11	≦	5.00	○	0.06	≦	5.00	○
			PNmax		KN/no.	1991	≦	3893	○	1990	≦	3893	○
			PNmin		KN/no.	1682	≧	-1959	○	1684	≧	-1959	○
		Seismic (Existing River Bed)	δ		cm	2.51	≦	5.00	○	3.10	≦	5.00	○
			PNmax		KN/no.	1922	≦	5839	○	1924	≦	5839	○
			PNmin		KN/no.	1638	≧	-3344	○	1608	≧	-3344	○
	Composite Stress (Seismic・Existing River Bed)		SKY400		N/mm2	161.0	≦	210.0	○	194.3	≦	210.0	○
			SKY490		N/mm2	208.5	≦	277.5	○	239.6	≦	277.5	○

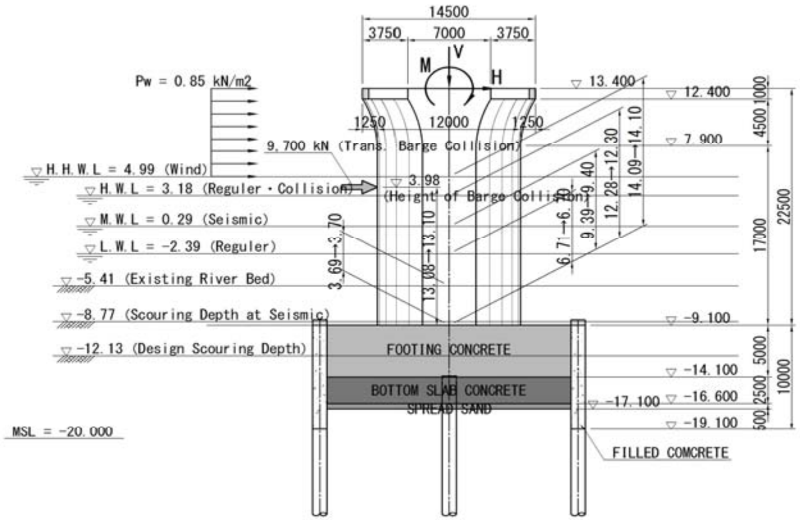
※ Column Axial Re-bar: Decided by Dynamic Analysis

Sunnary of Analysis Results

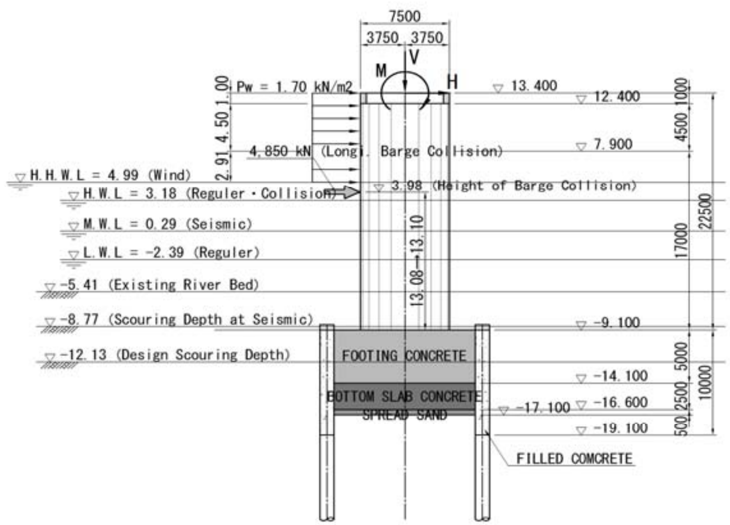
Bago Bridge P11(P12) Pier

[Structure]

Front View



Side View

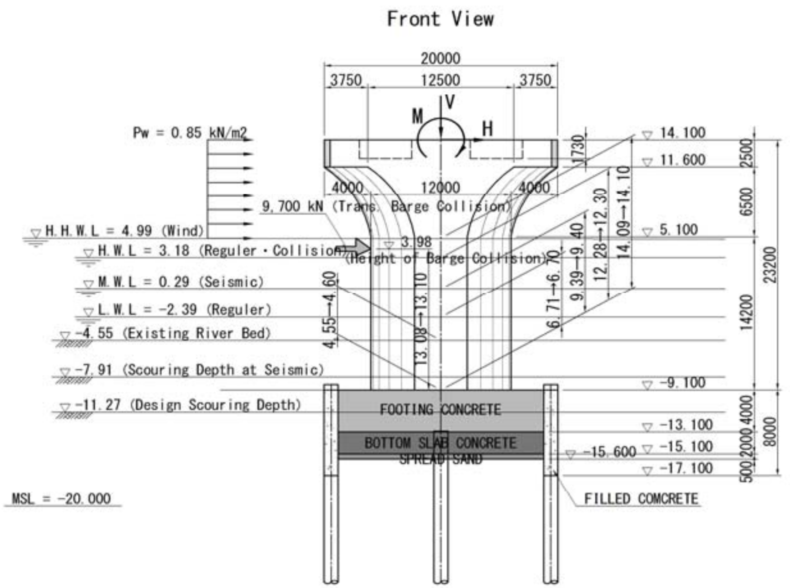


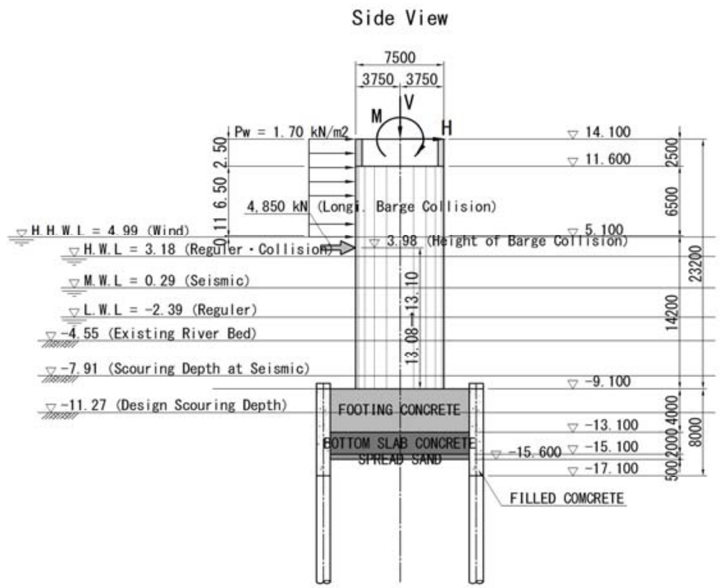
									Transverse			
Beam					Vertical							
Beam	Section	Height		m	5.500							
Beam	Section	Re-Bar: Main Re-bar	1st layer		D32	—	26nos.					
Beam	Section	Re-Bar: Main Re-bar	2nd layer		D32	—	26nos.					
Beam	Section	Re-Bar: Stirrup			---							
Beam	Bridge Seat	Required Re-bar		mm2	38,345	≦	41,298	○				
Beam	Corbel	Required Re-bar		mm2								
Beam	Calculation	Bending Evaluation	Load Case									
Beam	Calculation	Bending Evaluation	σc	N/mm2								
Beam	Calculation	Bending Evaluation	σs	N/mm2								
Beam	Calculation	Shear Evaluation	Load Case									
Beam	Calculation	Shear Evaluation	τm	N/mm2								
Beam	Calculation	Shear Evaluation	Awreq < Aw	mm2								
Beam	Calculation	Evaluation for Seismic Performance 2	M < My	KN·m								
Beam	Calculation	Evaluation for Seismic Performance 2	S < Ps	KN								
Column					Longitudinal				Transverse			
Column	Section	Height		m	Oval	;	12.000	×	7.500			
Column	Section	Re-Bar: Main Re-bar	1st layer		D51	ctc	150		D51	ctc	269	
Column	Section	Re-Bar: Main Re-bar	2nd layer		D51	ctc	150					
Column	Section	Re-Bar: Hoop		---	D22	ctc	150		D22	ctc	150	
Column	Calculation	L1 Seismic	σc	N/mm2	10.46	≦	15.00	○	8.85	≦	15.00	○
Column	Calculation	L1 Seismic	σs	N/mm2	274.4	≦	300.0	○	200.2	≦	300.0	○
Column	Calculation	L1 Seismic	τm	N/mm2	0.439	＞	0.201	—	0.362	＞	0.179	—
Column	Calculation	L1 Seismic	Aw_req	mm2	1523.5	≦	3096.8	○	733.3	≦	2322.6	○
Footing	Re-bar	Arrangament: Top Main Re-bar	1st layer		D38	ctc	286		D38	ctc	226	
Footing	Re-bar	Arrangament: Top Main Re-bar	2nd layer		D38	ctc	286		D38	ctc	226	
Footing	Re-bar	Arrangament: Bottom Main Re-bar	1st layer		D51	ctc	286		D51	ctc	226	
Footing	Re-bar	Arrangament: Bottom Main Re-bar	2nd layer		D51	ctc	286		D51	ctc	226	
Footing	Re-bar	Arrangament: Bottom Main Re-bar	3rd layer		D51	ctc	286		D51	ctc	226	
Footing	Re-bar	Arrangament: Stirrup		---	D22ctc1500×1500				D22ctc1500×1500			
Footing	Calculation	Top Tensile	Critical Case ( ):Shear		Seismic(Seismic)・with Scour				Seismic(Seismic)・with Scour			
Footing	Calculation	Top Tensile	Deep Beam	cm2	47.54	≦	79.72	○	69.19	≦	100.88	○
Footing	Calculation	Top Tensile	σc	N/mm2	1.88	≦	12.00	○	2.46	≦	12.00	○
Footing	Calculation	Top Tensile	σs	N/mm2	115.1	≦	300.0	○	132.5	≦	300.0	○
Footing	Calculation	Top Tensile	τm	N/mm2	---				---			
Footing	Calculation	Bottom Tensile	Critical Case ( ):Shear		Seismic(Seismic)・with Scour				Seismic(Seismic)・with Scour			
Footing	Calculation	Bottom Tensile	Deep Beam	cm2	154.32	≦	212.62	○	252.91	≦	265.64	○
Footing	Calculation	Bottom Tensile	σc	N/mm2	4.65	≦	12.00	○	6.88	≦	12.00	○
Footing	Calculation	Bottom Tensile	σs	N/mm2	163.0	≦	300.0	○	213.3	≦	300.0	○
Footing	Calculation	Bottom Tensile	τm	N/mm2	1.00	≦	1.65	○	0.89	≦	1.02	○
SPSP	Pile	Diameter(mm)×Length(m)×Number(no.)	Outer Pile		;	φ1200	×	60.00	×	40nos.		
SPSP	Pile	Diameter(mm)×Length(m)×Number(no.)	Diaphragm Pile		;	φ1200	×	55.10	×	8nos.		
SPSP	Pile	Thickness: Outer Pile	Top Pile		t = 16 mm (SKY490)							
SPSP	Pile	Thickness: Outer Pile	Bottom Pile		t = 14 mm (SKY400)							
SPSP	Pile	Thickness: Diaphragm Pile	---		t = 14 mm (SKY400)							
SPSP	Calculation	Reguler (Existing River Bed)	δ	cm	0.41	≦	5.00	○	0.07	≦	5.00	○
SPSP	Calculation	Reguler (Existing River Bed)	PNmax	KN/no.	2742	≦	3535	○	2740	≦	3535	○
SPSP	Calculation	Reguler (Existing River Bed)	PNmin	KN/no.	2389	≧	-1865	○	2399	≧	-1865	○
SPSP	Calculation	Seismic (Existing River Bed)	δ	cm	2.68	≦	5.00	○	2.26	≦	5.00	○
SPSP	Calculation	Seismic (Existing River Bed)	PNmax	KN/no.	2607	≦	5267	○	2623	≦	5267	○
SPSP	Calculation	Seismic (Existing River Bed)	PNmin	KN/no.	2293	≧	-3092	○	2277	≧	-3092	○
SPSP	Composite Stress (Seismic・Existing River Bed)		SKY400	N/mm2	142.9	≦	210.0	○	156.4	≦	210.0	○
SPSP	Composite Stress (Seismic・Existing River Bed)		SKY490	N/mm2	244.1	≦	277.5	○	242.1	≦	277.5	○

Sunnary of Analysis Results (Revised Design: 3-span Steel Box Girder at P10)

Bago Bridge P10(P13) Pier

[Structure]





					Vertical Direction				Horizontal Direction			
Beam	Section	Height		m	9.000				7.500			
		Re-Bar	Main Re-bar	1st layer	D29	–	25nos.		D16	–	49nos.	
				2nd layer	D29	–	15nos.					
			Stirrup		D22-8nos. ctc200				D22-2nos.+D16-1no. ctc200			
	Bridge Seat		Required Re-bar	mm2	---				---			
	Corbel		Required Re-bar	mm2	23,101	≦	25,696	○	10,278	≦	19,463	○
	Calculation	Bending Evaluation	Load Case		Dead Load				Seismic			
			σc	N/mm2	0.78	≦	10.00	○	0.70	≦	15.00	○
			σs	N/mm2	80.3	≦	100.0	○	97.1	≦	300.0	○
		Shear Evaluation	Load Case		Dead + Live Load				Seismic			
			τm	N/mm2	0.006	≦	0.140	○	0.045	≦	0.111	○
			Awreq < Aw	mm2								
		Evaluation for Seismic Performance 2	M < My	KN·m	---				7,560	≦	21,371	○
			S < Ps	KN	---				3,217	≦	16,160	○
Column					Longitudinal				Transverse			
	Section	Height		m	Oval	;	12.000	×	7.500			
		Re-Bar	Main Re-bar	1st layer	D32	ctc	125	※	D32	ctc	135	※
				2nd layer	D32	ctc	125	※				
			Hoop	---	D22	ctc	150		D22	ctc	150	
	Calculation	L1 Seismic	σc	N/mm2	7.43	≦	15.00	○	5.02	≦	15.00	○
			σs	N/mm2	231.0	≦	300.0	○	108.2	≦	300.0	○
			τm	N/mm2	0.279	>	0.171	–	0.258	>	0.152	–
			Aw_req	mm2	693.2	≦	3096.8	○	426.5	≦	2322.6	○
Footing	Re-bar	Arrangement	Top Main Re-bar	1st layer	D32	ctc	270		D35	ctc	190	
				2nd layer	D32	ctc	270		D35	ctc	190	
			Bottom Main Re-bar	1st layer	D51	ctc	270		D51	ctc	190	
				2nd layer	D51	ctc	270		D51	ctc	190	
				3rd layer	---				---			
			Stirrup	---	D22ctc1000×1000				D22ctc1000×1000			
	Calculation	Top Tensile	Critical Case	( ):Shear	Seismic(Seismic)・with Scour				Seismic(Seismic)・with Scour			
			Deep Beam	cm2	43.62	≦	58.83	○	88.71	≦	100.69	○
			σc	N/mm2	2.30	≦	12.00	○	3.68	≦	12.00	○
			σs	N/mm2	146.0	≦	300.0	○	174.4	≦	300.0	○
			τm	N/mm2	---				---			
		Bottom Tensile	Critical Case	( ):Shear	Seismic(Seismic)・with Scour				Seismic(Seismic)・with Scour			
			Deep Beam	cm2	138.20	≦	150.15	○	205.92	≦	213.37	○
			σc	N/mm2	5.48	≦	12.00	○	6.97	≦	12.00	○
			σs	N/mm2	201.3	≦	300.0	○	210.6	≦	300.0	○
			τm	N/mm2	0.87	≦	1.57	○	0.96	≦	1.22	○
SPSP	Pile	Diameter(mm)×Length(m)×Number(no.)			Outer Pile	;	φ1200	×	56.00	×	36nos.	
					Diaphragm Pile	;	φ1200	×	52.10	×	8nos.	
		Thickness	Outer Pile	Top Pile	t = 14 mm (SKY490)							
				Bottom Pile	t = 14 mm (SKY400)							
			Diaphragm Pile	---	t = 14 mm (SKY400)							
	Calculation	Reguler (Existing River Bed)	δ	cm	0.04	≦	5.00	○	0.06	≦	5.00	○
			PNmax	KN/no.	1910	≦	4100	○	1912	≦	4100	○
			PNmin	KN/no.	1612	≧	0	○	1610	≧	0	○
		Seismic (Existing River Bed)	δ	cm	2.51	≦	5.00	○	3.10	≦	5.00	○
			PNmax	KN/no.	1922	≦	6200	○	1924	≦	6200	○
			PNmin	KN/no.	1585	≧	-3600	○	1604	≧	-3600	○
	Composite Stress (Seismic・Existing River Bed)		SKY400	N/mm2	161.0	≦	210.0	○	194.3	≦	210.0	○
			SKY490	N/mm2	208.5	≦	277.5	○	239.6	≦	277.5	○

※ Column Axial Re-bar: Decided by Dynamic Analysis

2. Calculation of Pier at P11 (Excerpt)

2.1 Design condition

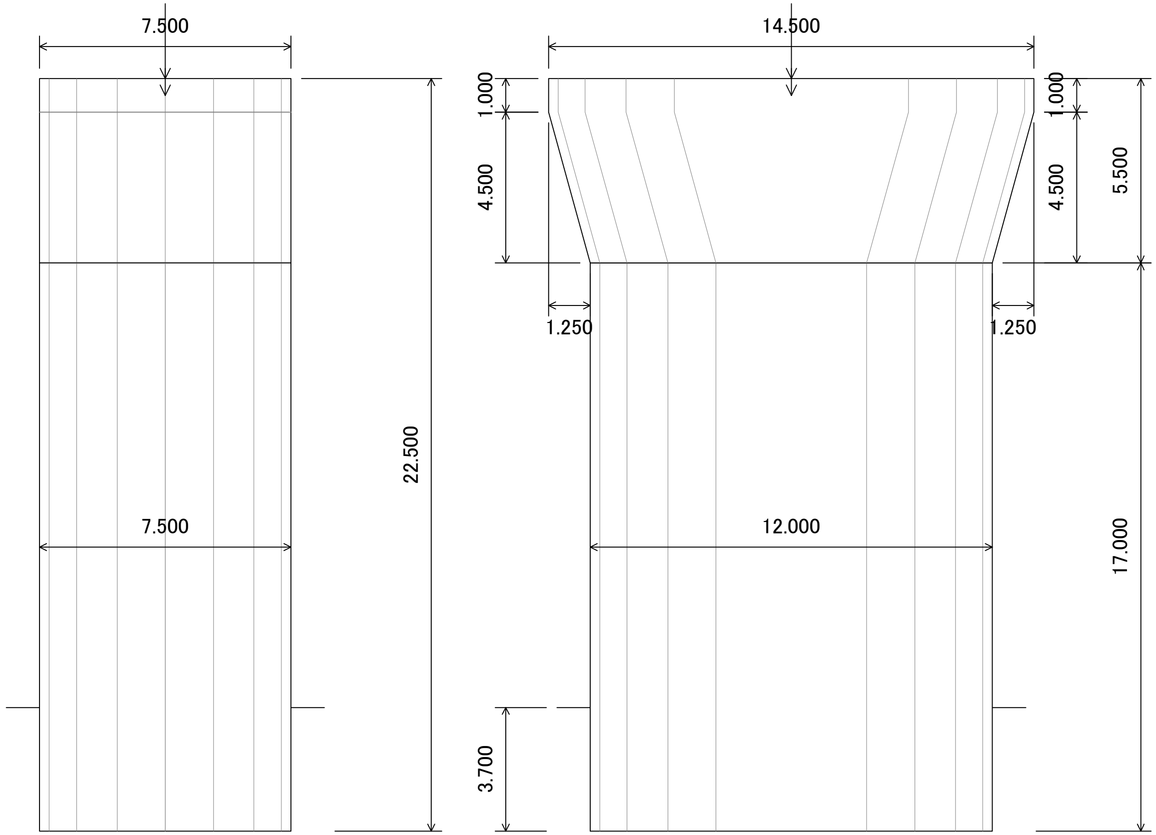
2.1.1 Shape dimension

Type RCOval column pier (new consider)

Beam shape type Beam type (oval)

foundation type Spread foundation

Division of important Deg. BType bridge



(right side is back side)

Items	Symbol	Dimension(m)
Beam height	H	5.500
Bridge axial direction beam width	B_L	0.000
Bridge axial perpendicular direction beam width (left side)	B_{TL}	1.250
Ditto (right side)	B_{TR}	1.250
Lower face bridge axial right angle drawn height	H_t	4.500
Lower face bridge axial right angle drawn length (left side)	B_{tL}	1.250
Ditto (right side)	B_{tR}	1.250
Column height(column base – beam lower face)	H	17.000
Bridge axial direction column width	B_L	7.500
Bridge axial perpendicular direction column width	B_T	12.000
Surface (from column lower edge)	h_G	3.700

2.1.2 Super structure reaction

2.1.2.1 Dead load reaction force and inertia force operated position

super structural dead load reaction force R_D 52100.00 (kN)

bridge axial	bridge axial	right angle
operated position of super structural inertia force h_I (m)	0.000	0.000

2.1.2.2 Allowable stress check method

Live load reaction force and horizontal reaction force in seismic condition

bridge axial	bridge axial	right angle
super structural load reaction force R_L (kN)	10700.00	10700.00
horizontal reaction force in seismic condition R_H (kN)	18500.00	14300.00

2.1.3 Design horizontal seismic coefficient

Religion division : A2 Religion

Ground type : III Type ground

2.1.3.1 Allowable stress check method

	kh
Axial direction	0.30
Perpendicular direction	0.30

kh : design horizontal seismic coefficient for design by allowable stress method

2.1.4 Unit weight

Young's modulus of reinforcement Es $2.00x10^5 (N/mm^2)$

Young's modulus ratio of section design 15

Unit weight of reinforcement concrete Gam.c $24.50 (kN/m^3)$

Water unit weight Gam.w 10.00(kN/m^3)

Unit weight of sediment (backfill) Gam.t 18.00(kN/m^3)

Water unit weight on sediment buoyancy calculation Gam.w 9.00(kN/m^3)

2.1.5 Column

2.1.5.1 Material of use

Design standard strength of concrete Sig.ck 30.0(N/mm^2)

Young's modulus of concrete Ec 2.80x10^4(N/mm^2)

Main reinforcement material SD345

Striped reinforcement material SD345

Tensile stress of column reinforcement uses basic value as the member in water.

Not consider correction coefficient cN to allowable shear stress Tau.a1of column.

2.1.5.2 Rebar

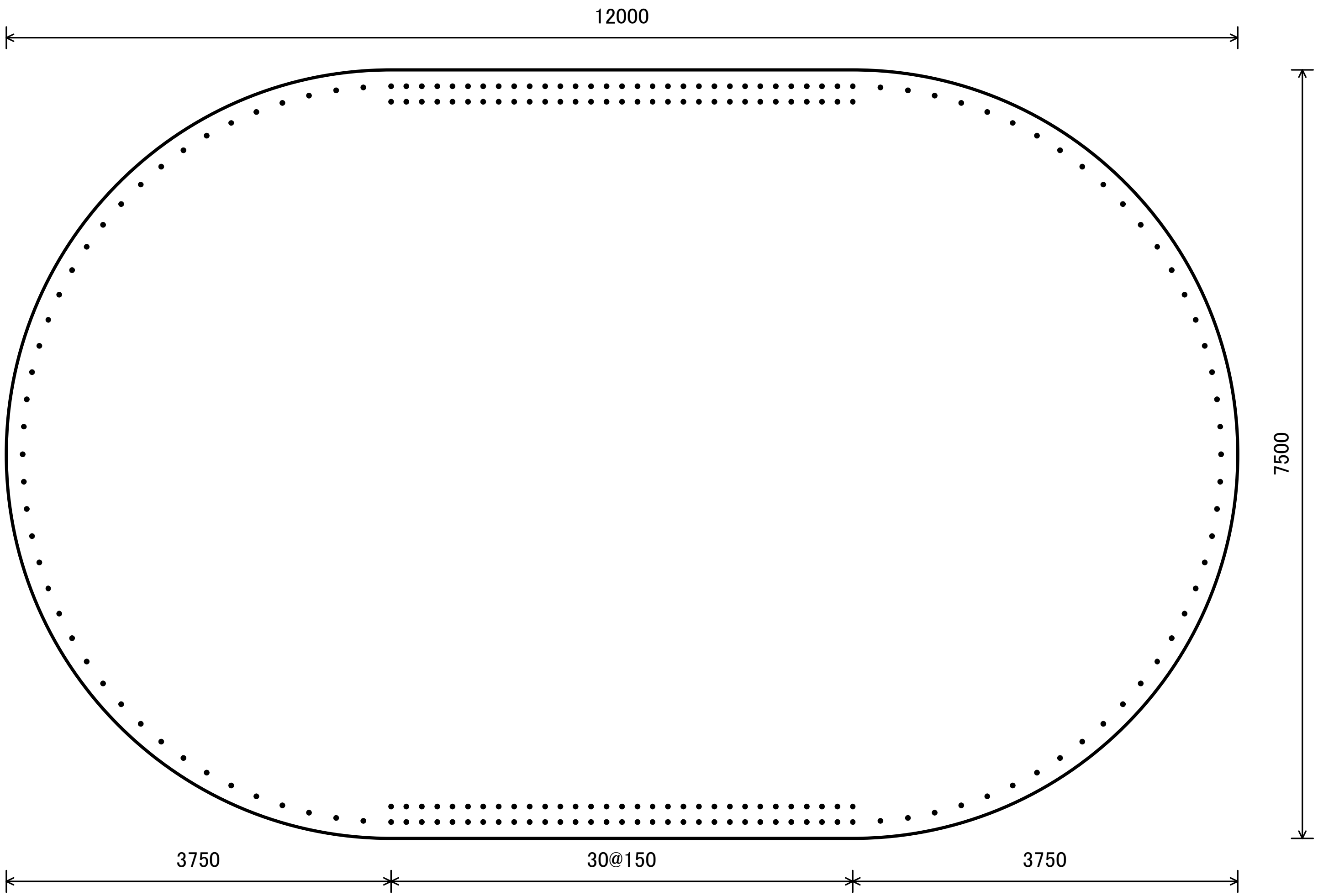
(1) Base main reinforcement

Cover	Straight linear part		Circular arc	
(mm)	Diameter	Bar Arrangement	Diameter	One side Number
160	D51	3750+30@150+3750	D51	41
310	D51	3750+30@150+3750	----	----

Note : Reinforcement amount total 417562.0mm^2,

*Satisfy more than [reinforcement amount of 500mm^2 / m (16281.0mm^2)]Do.

*Satisfy no more than [reinforcement amount (77928646.7mm^2) to be 6% of section area (4675718.8mm^2) 」Do.



(2) Hoop reinforcement

reinforcement diameter　D22

1) Lateral restraint bar, Shear supplemental bar

Section	Starting edge height h(m)	Height interval s(mm)	Lateral restraint rebar section area Ah(mm^2)	Effective length of lateral restraint rebar d (mm)		Shear reinforcement Aw(mm^2)	
				Bridge axial consider	Perpendicular consider	Bridge axial consider	Perpendicular consider
1	0.000	150	387.10	900.0	7180.0	3096.80	2322.60

2) Length of plastic hinged

Section	Starting edge height h(m)	Effective length of lateral restraint rebar d'(mm)		Number of axial direction reinforcement ns(number)			
		Bridge axial consider	Perpendicular consider	Bridge axial back side	Bridge axial front side	Right angle right side	Right angle left side
1	0.000	900.0	7180.0	12	12	24	24

2.1.5.3 Oval column section direction division sets and section correction coefficient

Section direction division sets 50

Section correction coefficient Alp.Beta.

Section correction factor	Bridge axial	Perpendicular
Alpha	0.20	1.00
Beta	0.40	1.00

2.1.6 Other dead load

2.1.6.1 Other dead load operated to pier top edge (concentrated)

No,	Name	x (m)	z (m)	P(kN)	y(m)
1	Beam	0.000	0.000	290.10	-0.500
2	Bearing	0.000	0.000	800.00	0.000

Note : x: vertical force operated position (the distance from pier top edge center)[left side -> right side = plus]

z : vertical force operated position (distance from pier top edge center)[front side -> back side = plus]

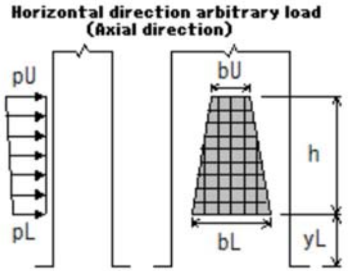
P: vertical force[lower arrow = plus]

y : operated position of inertia force (distance from pier top edge)[upper side = plus]

2.1.7 Allowable stress check method load case

＊Horizontal direction arbitrary load operated to column

Operated direction of load defines that plus from front side to back side arrow.



Considering allowable stress method of column is calculated at the following load case.

2.1.7.1 Axial direction

(1)　case : Regular HWL(abbreviation : Reg HWL) load condition : Dead load(increasing coefficient of allowable stress 1.00)

design water level : 12.300m sediment height:　0.000m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge ＊ beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Other reaction force R_{ex}	-800.00
Total	51300.00

horizontal force R_H(kN)	operated position h_I(m)	moment (kN.m)		
		R_H＊h_I	R_M	total
4700.00	0.000	0.00	0.00	0.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

(2) case : Regular LWL(abbreviation : Reg LWL) load condition : Usual(increasing coefficient of allowable stress 1.00)

design water level : 6.700m sediment height: 3.700m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Live load reaction R_L	10700.00
Total	62800.00

horizontal force R_H(kN)	operated position h_l(m)	moment (kN.m)		
		R_H*h_l	R_M	total
2200.00	0.000	0.00	0.00	0.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

(3) case : Temperature HWL(abbreviation : Temp HWL) load condition : D+T(increasing coefficient of allowable stress 1.15)

design water level : 12.300m sediment height: 0.000m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Other reaction force R_{ex}	−1100.00
Total	51000.00

horizontal force R_H(kN)	operated position h_l(m)	moment (kN.m)		
		R_H*h_l	R_M	total
9300.00	0.000	0.00	0.00	0.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

(4) case : Temperature LWL(abbreviation : Temp LWL) load condition : D+L+T(increasing coefficient of allowable stress 1.15)

design water level : 6.700m sediment height: 3.700m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Live load reaction R_L	10700.00
Other reaction force R_{ex}	100.00
Total	62900.00

horizontal force R_H(kN)	operated position h_I(m)	moment (kN.m)		
		R_H*h_I	R_M	total
6800.00	0.000	0.00	0.00	0.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

(5) case : Wind(abbreviation : Wind) load condition : Wind load(increasing coefficient of allowable stress 1.25)

design water level : 14.100m sediment height: 0.000m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Total	52100.00

horizontal force R_H(kN)	operated position h_I(m)	moment (kN.m)		
		R_H*h_I	R_M	total
1100.00	0.000	0.00	0.00	0.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

Load directly operated to frame body

Wind load bridge axial direction not consider

Horizontal direction arbitrary load operated to column

No.	name	load type	load lower edge height yL (m)	load length h (m)	load upper edge operated width bU (m)	load lower edge operated width bL (m)	load strength upper edge pU (kN/m^2)	load strength lower edge pL (kN/m^2)	operated direction	stability calculation
1	Wind	Spread	21.500	1.000	14.500	14.500	1.70	1.70	Bridge axis	Consider
2	Wind	Spread	17.000	4.500	14.500	12.000	1.70	1.70	Bridge axis	Consider
3	Wind	Spread	14.090	2.910	12.000	12.000	1.70	1.70	Bridge axis	Consider

(6) case : Vessel Collision(abbreviation : Collision) load condition : Collision(increasing coefficient of allowable stress 1.50)

design water level : 12.300m sediment height: 0.000m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Other reaction force R_{ex}	−800.00
Total	51300.00

horizontal force R_H(kN)	operated position h_I(m)	moment (kN.m)		
		R_H*h_I	R_M	total
4700.00	0.000	0.00	0.00	0.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

Load directly operated to frame body

Impact load load bridge axial direction

Height from column lower edge 13.100 (m)

Load strength 4850.00 (kN)

(7) case : Seismic(abbreviation : Seismic) load condition : L1 seismic(increasing coefficient of allowable stress 1.50)

design water level : 9.400m sediment height: 0.000m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Other reaction force R_{ex}	−100.00
Total	52000.00

horizontal force R_H(kN)	operated position h_I(m)	moment (kN.m)		
		R_H*h_I	R_M	total
18500.00	0.000	0.00	0.00	0.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Bridge axial direction upward (plus direction)

Dynamic water pressure Bridge axial direction upward (plus direction)

Load directly operated to frame body

Flowing water pressure bridge axial direction not consider

2.1.7.2 Axial perpendicular direction

(1) case : Regular HWL(abbreviation : Reg HWL) load condition : Dead load(increasing coefficient of allowable stress 1.00)

design water level : 12.300m sediment height: 0.000m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Other reaction force R_{ex}	-800.00
Total	51300.00

horizontal force R_H(kN)	operated position h_l(m)	moment (kN.m)		
		R_H*h_I	R_M	total
100.00	0.000	0.00	32000.00	32000.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

(2) case : Regular LWL(abbreviation : Reg LWL) load condition : Usual(increasing coefficient of allowable stress 1.00)

design water level : 6.700m sediment height: 3.700m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Live load reaction R_L	10700.00
Total	62800.00

horizontal force R_H(kN)	operated position h_l(m)	moment (kN.m)		
		R_H*h_I	R_M	total
100.00	0.000	0.00	32000.00	32000.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

(3) case : Wind(abbreviation : Wind) load condition : Wind load(increasing coefficient of allowable stress 1.25)

design water level : 14.100m sediment height: 0.000m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Total	52100.00

horizontal force R_H(kN)	operated position h_l(m)	moment (kN.m)		
		R_H*h_l	R_M	total
2200.00	0.000	0.00	33400.00	33400.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

Load directly operated to frame body

Wind load Bridge axial perpendicular rightward direction

Beam part load strength 0.85 (kN/m^2)

Column part load strength 0.85 (kN/m^2)

(4) case : Vessel Collision(abbreviation : Collision) load condition : Collision(increasing coefficient of allowable stress 1.50)

design water level : 12.300m sediment height: 0.000m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Other reaction force R_{ex}	-800.00
Total	51300.00

horizontal force R_H(kN)	operated position h_l(m)	moment (kN.m)		
		R_H*h_l	R_M	total
100.00	0.000	0.00	32000.00	32000.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition Do not consider

Load directly operated to frame body

Impact load Load to bridge axial perpendicular direction

Height from column lower edge 13.100 (m)

Load strength 9700.00 (kN)

(5) case : Seismic(abbreviation : Seismic) load condition : L1 seismic(increasing coefficient of allowable stress 1.50)

design water level : 9.400m sediment height: 0.000m (from each Lower edge of column)

1) Load

super structural reaction force (operated to beam top edge * beam center)

	Vertical force (kN)
Dead load reaction R_D	52100.00
Total	52100.00

horizontal force R_H(kN)	operated position h_I(m)	moment (kN.m)		
		R_H*h_I	R_M	total
14300.00	0.000	0.00	93900.00	93900.00

Moment by horizontal force from pier top edge to warking pos. of super structural inertia force is calculated as eccentric moment.

Inertia force in seismic condition perpendicular direction rightward (plus direction)

Dynamic water pressure Do not consider

Load directly operated to frame body

Flowing water pressure Bridge axial perpendicular rightward direction

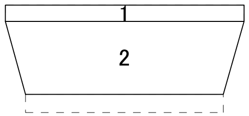
Flow velocity 0.600 (m/sec)

2.2 column design (allowable stress check method)

2.2.1 cross section force of column base

2.2.1.1 Frame body own load

(1) Beam part



No.	Block name	Left height H1(m)	Right height H2(m)	Left upper width W1(m)	Left lower width B1(m)	Right upper width W2(m)	Right lower width B2(m)	Member length L(m)	Volume V(m^3)
1	Drawn upper face	1.000	1.000	7.500	7.500	7.500	7.500	14.500	96.67865
2	Drawn parts	4.500	4.500	7.500	7.500	7.500	7.500	14.500	392.86641

No	volume V(m^3)	Xg (m)	Yg (m)	Zg (m)	V*Xg (m^4)	V*Yg (m^4)	V*Zg (m^4)
1	96.67865	0.0000	5.0000	0.0000	0.0000	483.3932	0.0000
2	392.86641	0.0000	2.3305	0.0000	0.0000	915.5900	0.0000
Sum	489.54506	------	------	------	0.0000	1398.9833	0.0000

Note : Table's center of figure (Xg,Yg,Zg) is the coordinated system that column center of beam lower edge position sets (0,0,0)

Height PH = 17.000 from column base to beam lower edge (m)

W = Sum V *Gam.c = 489.54506*24.50 = 11993.85(kN) Y = Sum (V*Yg)/Sum V + PH = 19.858(m) Xc = Sum (V*Xg)/Sum V = 0.000(m)

(2) Column part

No	block name	Br1 (m)	Br2 (m)	Ba1 (m)	Ba2 (m)	H (m)	volume V(m^3)
1	Oval Column	12.000	12.000	7.500	7.500	17.000	1324.78699

No	volume V(m^3)	Xg (m)	Yg (m)	Zg (m)	V*Xg (m^4)	V*Yg (m^4)	V*Zg (m^4)
1	1324.78699	0.0000	8.5000	0.0000	0.0000	11260.6894	0.0000
Sum	1324.78699	------	------	------	0.0000	11260.6894	0.0000

Note : Table's center of figure (Xg,Yg,Zg) is the coordinated system that column center of column base (Ignore taper width) sets (0,0,0)

W = Sum V *Gam.c = 1324.78699*24.50 = 32457.28(kN) Y = Sum(V*Yg)/Sum V = 8.500(m) Xc = Sum(V*Xg)/Sum V = 0.000(m)

(3) Weight total

Sum W = 44451.14(kN)

(4) Center of gravity position

$$Y = \frac{\text{Sum W*Y}}{\text{Sum W}} = 11.565(m)$$

$$Xc = \frac{\text{Sum W*Xc}}{\text{Sum W}} = 0.000(m)$$

2.2.1.2 Dynamic water pressure in seismic condition

(1) Axial direction

1) Case : Seismic(Water level consider), Load plus direction (Upper load sediment height 0.000(m), water level 9.400(m))

$$P = \frac{3}{4} * k_h * w_0 * A_0 * h \cdot \frac{b}{a} * \left(1 - \frac{b}{4h}\right)$$

$$= \frac{3}{4} * 0.30 * 10.00 * 77.929 * 9.400 * \frac{12.000}{7.500} * \left(1 - \frac{12.000}{4 * 9.400}\right)$$

$$= 1795.48 \text{ (kN)}$$

$$h_g = \frac{3}{7} * h = 4.029 \text{ (m)}$$

$$h_{g0} = h_g + h_s = 4.029 \text{ (m)}$$

The following ;

P : Total force of dynamic water pressure in seismic condition operated to structure (kN)

k_h : design horizontal seismic coefficient against level 1 earth quake vibration

w_0 : water unit volume weight (kN/m^3)

h : water depth (m)

h_s : distance from column base to ground face (m) Note : ground face <= column base,then h_s= 0.0(m)

h_g : The distance from ground face or column base to total force operated point of dynamic water pressure in seismic condition (m)

h_{g0} : The distance from column base to total force operated point of dynamic water pressure in seismic condition (m)

b : frame body width, perpendicular direction against operated direction of dynamic water pressure in seismic condition (m)

a : frame body width of operated direction of dynamic water pressure in seismic condition (m)

A_0 : section area of structure (m^2)

2. 2.1.3 Flowing water pressure

(1) Axial perpendicular direction

1) Case : Seismic(Water level consider), Load plus direction (Upper load sediment height 0.000(m), water level 9.400(m))

$P = K * v^2 * A$

$= 0.4 * 0.600^2 * 70.500$

$= 10.15$ (kN)

$h_{g0} = 0.6 * h + h_s$

$= 0.6 * 9.400 + 0.000$

$= 5.640$ (m)

＊ Vertical projection area (column)

No	Height from column base (m)	Lower side column width (m)	Upper side column width (m)	Vertical projection area (m^2)
1	0.000 － 9.400	7.500	7.500	70.500

The following ;

P : Total force of flowing water pressure operated to structure (kN)

K : resistance coefficient of pier

v : maximum flow velocity (m/s)

A : vertical projection area of pier (m^2)

h : Floating water depth (m)

h_s : distance from column base to ground face (m) Note : ground face <= column base,then h_s= 0.0(m)

h_{g0} : The distance from column base to total force operated point of flowing water pressure (m)

2. 2.1.4 Wind load

(1) Axial perpendicular direction

1) Case : Wind(Water level consider), Load plus direction (Upper load sediment height 0.000(m), water level 14.100(m))

$P = p_b * A_b + p_c * A_c$

$= 0.85 * 41.250 + 0.85 * 21.750$

$= 53.55$ (kN)

$h_{g0} = 18.300$ (m)

* Vertical projection area (beam)

No	Height from column base (m)	Lower side beam width (m)	Upper side beam width (m)	Vertical projection area (m^2)
1	17.000 − 21.500	7.500	7.500	33.750
2	21.500 − 22.500	7.500	7.500	7.500
Sum	----------------------	--------------------	--------------------	41.250

* Vertical projection area (column)

No	Height from column base (m)	Lower side column width (m)	Upper side column width (m)	Vertical projection area (m^2)
1	14.100 − 17.000	7.500	7.500	21.750

The following ;

p_b : wind load strength operated to beam (kN/m^2)

p_c : wind load strength operated to column (kN/m^2)

A_b : vertical projection area of beam (m^2)

A_c : vertical projection area of column (m^2)

h_{g0} : The distance from column base to total force operated point of wind load (m)

2. 2.1.5 Section force of every each load cases (bridge axial direction)

Case:Regular HWL

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	51300.00	4700.00	22.500	0.00	105750.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Total	96841.24	4700.00	-------	----------	105750.00

Case:Regular LWL

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	62800.00	2200.00	22.500	0.00	49500.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Total	108341.24	2200.00	-------	----------	49500.00

Case:Temperature HWL

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	51000.00	9300.00	22.500	0.00	209250.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Total	96541.24	9300.00	-------	----------	209250.00

Case:Temperature LWL

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	62900.00	6800.00	22.500	0.00	153000.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Total	108441.24	6800.00	-------	----------	153000.00

Case:Wind

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	52100.00	1100.00	22.500	0.00	24750.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	185.38	18.468	----------	3423.51
Total	97641.24	1285.38	-------	----------	28173.51

Case:Vessel Collision

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	51300.00	4700.00	22.500	0.00	105750.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	4850.00	13.100	----------	63535.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Total	96841.24	9550.00	-------	----------	169285.00

Case:Seismic

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	52000.00	18500.00	22.500	0.00	416250.00
Frame body	44451.14	13335.34	11.565	0.00	154217.25
Load operated to beam top edge	1090.10	327.03	22.367	0.00	7314.66
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Dynamic water pressure in seismic condition	--------	1795.48	4.029	----------	7233.20
Total	97541.24	33957.85	-------	----------	585015.11

2. 3.1.6 Section force of every each load cases (perpendicular direction)

Case:Regular HWL

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	51300.00	100.00	22.500	32000.00	34250.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Total	96841.24	100.00	-------	----------	34250.00

Case:Regular LWL

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	62800.00	100.00	22.500	32000.00	34250.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Total	108341.24	100.00	-------	----------	34250.00

Case:Wind

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	52100.00	2200.00	22.500	33400.00	82900.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Wind load	------	53.55	18.300	----------	979.97
Total	97641.24	2253.55	-------	----------	83879.96

Case:Vessel Collision

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	51300.00	100.00	22.500	32000.00	34250.00
Frame body	44451.14	0.00	11.565	0.00	0.00
Load operated to beam top edge	1090.10	0.00	22.367	0.00	0.00
Concentrated load operated to column	0.00	9700.00	13.100	----------	127070.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Total	96841.24	9800.00	-------	----------	161320.00

Case:Seismic

	V force (kN)	H force (kN)	Operated height (m)	Eccentric moment (kN.m)	Bending moment (kN.m)
Super structural reaction force	52100.00	14300.00	22.500	93900.00	415650.00
Frame body	44451.14	13335.34	11.565	0.00	154217.25
Load operated to beam top edge	1090.10	327.03	22.367	0.00	7314.66
Concentrated load operated to column	0.00	0.00	0.000	----------	0.00
Spread load operated to column	0.00	0.00	0.000	----------	0.00
Flowing water pressure	------	10.15	5.640	----------	57.26
Total	97641.24	27972.52	-------	----------	577239.17

2. 2.1.7 Section force list(total with column center position)

Bridge axial direction

Case	Water level	Vertical force (kN)	Horizontal force (kN)	Bending moment (kN.m)
Reg HWL	Consider	96841.24	4700.00	105750.00
Reg LWL	Consider	108341.24	2200.00	49500.00
Temp HWL	Consider	96541.24	9300.00	209250.00
Temp LWL	Consider	108441.24	6800.00	153000.00
Wind	Consider	97641.24	1285.38	28173.51
Collision	Consider	96841.24	9550.00	169285.00
Seismic	Consider	97541.24	33957.85	585015.11

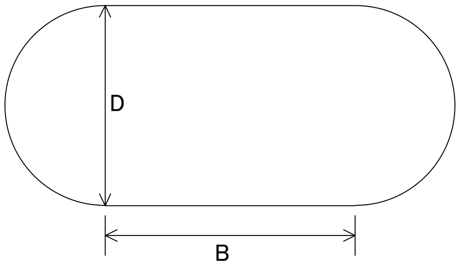
bridge axial perpendicular direction

Case	Water level	Vertical force (kN)	Horizontal force (kN)	Bending moment (kN.m)
Reg HWL	Consider	96841.24	100.00	34250.00
Reg LWL	Consider	108341.24	100.00	34250.00
Wind	Consider	97641.24	2253.55	83879.96
Collision	Consider	96841.24	9800.00	161320.00
Seismic	Consider	97641.24	27972.52	577239.17

2.2.2 Consider of column base section

2.2.2.1 Axial direction

(1) Section shape and reinforcement arrangement



B =　4.500 (m)　D =　7.500 (m)

Main reinforcement for section calculation (position is covering)

No.	Reinforcement position (mm)	Straight line part all reinforcement amount			Circle part part all reinforcement amount		
		Reinforcement diameter	Number sets	Reinforcement amount (mm²)	Reinforcement diameter	Number sets	Reinforcement amount (mm²)
1	160	D51	62	125674.0	D51	82	166214.0
2	310	D51	62	125674.0	----	----	------
					Total Sum As1 = 251348.0	Total Sum As2 =	166214.0
					Reinforcement amount total Sum As =	417562.0	

Total amount of rebar As = 417562.0(mm²)

＊minimum reinforcement amount [all reinforcement amount As >= reinforcement amount per 500mm/ m (16281.0mm²)] OK

＊maximum reinforcement amount [all reinforcement amount As <= reinforcement amount to be 6 % of section area (4675718.8mm²)] OK

(2) Section check

1) Consider against bending moment

Items	Unit	Reg HWL WLConsider	Reg LWL WLConsider	Temp HWL WLConsider	Temp LWL WLConsider
Load condition	------	Dead load	Usual	D+T	D+L+T
Axial force N	kN	96841.24	108341.24	96541.24	108441.24
Bending moment M	kN.m	105750.00	49500.00	209250.00	153000.00
Compressive edge-middle axial x	mm	7838	13519	5148	6855
Compressive stress Sig.c	N/mm^2	2.21	1.78	3.51	2.83
Tensile stress Sig.s	N/mm^2	-2.10	-12.21	22.41	3.00
Increasing coefficient Alp.	------	1.00	1.00	1.15	1.15
Allowable compressive stress Sig.ca	N/mm^2	10.00	10.00	11.50	11.50
Allowable tensile stress Sig.sa	N/mm^2	-200.00	-200.00	184.00	184.00
Crack moment Mc	kN.m	289550.53	301888.19	289228.67	301995.47
First yield moment My0	kN.m	690877.80	720620.98	690097.76	720877.34
Ultimate bending moment Mu	kN.m	822644.51	857066.21	821736.94	857362.01
Minimum rebar amount as bending member	------	1.7M<=Mc	1.7M<=Mc	Mc<=Mu	1.7M<=Mc
Minimum rebar amount axial force member	mm^2	76705.9	85814.8	66494.2	74690.5
Axial force Nu	kN	97641.24	97641.24	97641.24	97641.24
0.008A1' (axial force Na=N)	mm^2	76705.9	85814.8	66494.2	74690.5
0.008A2' (axial force Nu)	mm^2	27640.8	27640.8	27640.8	27640.8
All reinforcement amount As >= Asmin	------	OK	OK	OK	OK
Maximum reinforcement amount check (My0<=Mu)	------	OK	OK	OK	OK

Items	Unit	Wind WLConsider	Collision WLConsider	Seismic WLConsider
Load condition	------	Wind load	Collision	L1 seismic
Axial force N	kN	97641.24	96841.24	97541.24
Bending moment M	kN.m	28173.51	169285.00	585015.11
Compressive edge-middle axial x	mm	19219	6007	2670
Compressive stress Sig.c	N/mm^2	1.44	2.93	10.46
Tensile stress Sig.s	N/mm^2	-13.36	9.73	274.38
Increasing coefficient Alp.	------	1.25	1.50	1.50
Allowable compressive stress Sig.ca	N/mm^2	12.50	15.00	15.00
Allowable tensile stress Sig.sa	N/mm^2	-250.00	300.00	300.00
Crack moment Mc	kN.m	290408.80	289550.53	290301.51
First yield moment My0	kN.m	692959.57	690877.80	692701.74
Ultimate bending moment Mu	kN.m	825061.65	822644.51	824762.94
Minimum rebar amount as bending member	------	1.7M<=Mc	1.7M<=Mc	Mc<=Mu
Minimum rebar amount axial force member	mm^2	61871.7	51137.3	51506.9
Axial force Nu	kN	97641.24	97641.24	97641.24
0.008A1' (axial force Na=N)	mm^2	61871.7	51137.3	51506.9
0.008A2' (axial force Nu)	mm^2	27640.8	27640.8	27640.8
All reinforcement amount As >= Asmin	------	OK	OK	OK
Maximum reinforcement amount check (My0<=Mu)	------	OK	OK	OK

Asmin(0.008A') : minimum reinforcement amount of member received axial direction force

2) Consider against shear force

items	unit	Reg HWL WLConsider	Reg LWL WLConsider	Temp HWL WLConsider	Temp LWL WLConsider
condition	--------	Dead load	Usual	D+T	D+L+T
b	mm	11147	11147	11147	11147
d	mm	6937	6937	6937	6937
S	kN	4700.00	2200.00	9300.00	6800.00
N	kN	96841.24	108341.24	96541.24	108441.24
M	kN.m	105750.00	49500.00	209250.00	153000.00
Alp.	------	1.00	1.00	1.15	1.15
pt	%	0.270	0.270	0.270	0.270
ce	------	0.561	0.561	0.561	0.561
cpt	------	0.970	0.970	0.970	0.970
CN	------	1.000	1.000	1.000	1.000
Tau.m	N/mm^2	0.061	0.028	0.120	0.088
Tau.a$_1$	N/mm^2	0.136	0.136	0.157	0.157
Tau.a$_2$	N/mm^2	1.900	1.900	2.185	2.185
Sig.sa	N/mm^2	------------	------------	------------	------------
s	mm				------------
Sca	kN	------------	------------	------------	------------
Sh'	kN				------------
AwReq	mm^2	------------	------------	------------	------------
Aw	mm^2				------------

items	unit	Wind WLConsider	Collision WLConsider	Seismic WLConsider
condition	--------	Wind load	Collision	L1 seismic
b	mm	11147	11147	11147
d	mm	6937	6937	6937
S	kN	1285.38	9550.00	33957.85
N	kN	97641.24	96841.24	97541.24
M	kN.m	28173.51	169285.00	585015.11
Alp.	------	1.25	1.50	1.50
pt	%	0.270	0.270	0.270
ce	------	0.561	0.561	0.561
cpt	------	0.970	0.970	0.970
CN	------	1.000	1.000	1.000
Tau.m	N/mm^2	0.017	0.123	0.439
Tau.a$_1$	N/mm^2	0.170	0.201	0.201
Tau.a$_2$	N/mm^2	2.375	2.850	2.850
Sig.sa	N/mm^2	------------	------------	300.00
s	mm			150
Sca	kN	------------	------------	15576.54
Sh'	kN			18381.31
AwReq	mm^2	------------	------------	1523.51
Aw	mm^2			3096.80

The following ;

S : Shear force

N : Axial force

M : Bending moment

b : Member section width

d : Effective height

Alp. : Increasing coefficient of allowable stress

pt : Tensile main reinforcement ratio

ce : Correction coefficient of allowable shear stress about effective height d

cpt : Correction coefficient of allowable shear stress about tensile reinforcement ratio

CN : Correction coefficient by axial direction compressive force

Tau.m : Average shear stress

Tau.a1 : Allowable shear stress when share shear force by only concrete

Tau.a2 : Shear supplemental barAllowable shear stress when share the shear force with

Sig.sa : Allowable tensile stress of reinforcement

s : Shear supplemental bar interval of

Sca : Concrete sharing shear force

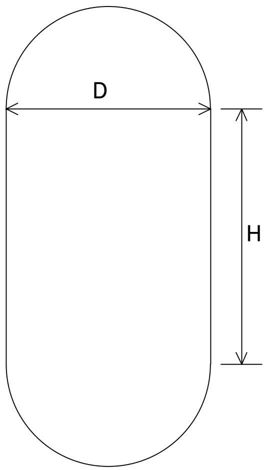
Sh' : Shear supplemental bar sharing shear force

Awreq : Necessary for Tau.a1 < Tau.mShear supplemental barAmount

Aw : Shear supplemental barAmount

2.2.2.2 Axial perpendicular direction

(1) Section shape and reinforcement arrangement



H = 4.500 (m) D = 7.500 (m)

Main reinforcement for section calculation (position is covering)

No.	Reinforcement position (mm)	Straight line part all reinforcement amount			Circle part part all reinforcement amount		
		Reinforcement diameter	Number sets	Reinforcement amount (mm^2)	Reinforcement diameter	Number sets	Reinforcement amount (mm^2)
1	160	D51	62	125674.0	D51	82	166214.0
2	310	D51	62	125674.0	----	----	------
					Total Sum As1 = 251348.0	Total Sum As2 =	166214.0
					Reinforcement amount total Sum As =		417562.0

Total amount of rebar As = 417562.0(mm^2)

＊ minimum reinforcement amount [all reinforcement amount As >= reinforcement amount per 500mm/ m (16281.0mm^2)] OK

＊ maximum reinforcement amount [all reinforcement amount As <= reinforcement amount to be 6 % of section area (4675718.8mm^2)] OK

(2) Section check

1) Consider against bending moment

Items	Unit	Reg HWL WLConsider	Reg LWL WLConsider	Wind WLConsider	Collision WLConsider
Load condition	------	Dead load	Usual	Wind load	Collision
Axial force N	kN	96841.24	108341.24	97641.24	96841.24
Bending moment M	kN.m	34250.00	34250.00	83879.96	161320.00
Compressive edge-middle axial x	mm	33352	36600	17261	11806
Compressive stress Sig.c	N/mm^2	1.40	1.54	1.78	2.34
Tensile stress Sig.s	N/mm^2	-13.57	-15.62	-8.37	0.10
Increasing coefficient Alp.	------	1.00	1.00	1.25	1.50
Allowable compressive stress Sig.ca	N/mm^2	10.00	10.00	12.50	15.00
Allowable tensile stress Sig.sa	N/mm^2	-200.00	-200.00	-250.00	300.00
Crack moment Mc	kN.m	434259.12	452762.77	435546.33	434259.12
First yield moment My0	kN.m	804648.26	847252.37	807625.48	804648.26
Ultimate bending moment Mu	kN.m	1195519.89	1242889.66	1198842.86	1195519.89
Minimum rebar amount as bending member	------	1.7M<=Mc	1.7M<=Mc	1.7M<=Mc	1.7M<=Mc
Minimum rebar amount axial force member	mm^2	76705.9	85814.8	61871.7	51137.3
Axial force Nu	kN	97641.24	97641.24	97641.24	97641.24
0.008A1' (axial force Na=N)	mm^2	76705.9	85814.8	61871.7	51137.3
0.008A2' (axial force Nu)	mm^2	27640.8	27640.8	27640.8	27640.8
All reinforcement amount As >= Asmin	------	OK	OK	OK	OK
Maximum reinforcement amount check (My0<=Mu)	------	OK	OK	OK	OK

Items	Unit	Seismic WLConsider
Load condition	------	L1 seismic
Axial force N	kN	97641.24
Bending moment M	kN.m	577239.17
Compressive edge-middle axial x	mm	4720
Compressive stress Sig.c	N/mm^2	8.85
Tensile stress Sig.s	N/mm^2	200.15
Increasing coefficient Alp.	------	1.50
Allowable compressive stress Sig.ca	N/mm^2	15.00
Allowable tensile stress Sig.sa	N/mm^2	300.00
Crack moment Mc	kN.m	435546.33
First yield moment My0	kN.m	807625.48
Ultimate bending moment Mu	kN.m	1198842.86
Minimum rebar amount as bending member	------	Mc<=Mu
Minimum rebar amount axial force member	mm^2	51559.7
Axial force Nu	kN	97641.24
0.008A1' (axial force Na=N)	mm^2	51559.7
0.008A2' (axial force Nu)	mm^2	27640.8
All reinforcement amount As >= Asmin	------	OK
Maximum reinforcement amount check (My0<=Mu)	------	OK

Asmin(0.008A') : minimum reinforcement amount of member received axial direction force

2) Consider against shear force

items	unit	Reg HWL WLConsider	Reg LWL WLConsider	Wind WLConsider	Collision WLConsider
condition	--------	Dead load	Usual	Wind load	Collision
b d	mm mm	6991 11056	6991 11056	6991 11056	6991 11056
S N M	kN kN kN.m	100.00 96841.24 34250.00	100.00 108341.24 34250.00	2253.55 97641.24 83879.96	9800.00 96841.24 161320.00
Alp. pt ce cpt CN	------ % ------ ------ ------	1.00 0.270 0.500 0.970 1.000	1.00 0.270 0.500 0.970 1.000	1.25 0.270 0.500 0.970 1.000	1.50 0.270 0.500 0.970 1.000
Tau.m $Tau.a_1$ $Tau.a_2$ Sig.sa s Sca Sh' AwReq Aw	N/mm^2 N/mm^2 N/mm^2 N/mm^2 mm kN kN mm^2 mm^2	0.001 0.121 1.900 ------------ ------------ ------------	0.001 0.121 1.900 ------------ ------------ ------------	0.029 0.152 2.375 ------------ ------------ ------------	0.127 0.179 2.850 ------------ ------------ ------------ ------------ ------------ ------------

items	unit	Seismic WLConsider
condition	--------	L1 seismic
b d	mm mm	6991 11056
S N M	kN kN kN.m	27972.52 97641.24 577239.17
Alp. pt ce cpt CN	------ % ------ ------ ------	1.50 0.270 0.500 0.970 1.000
Tau.m $Tau.a_1$ $Tau.a_2$ Sig.sa s Sca Sh' AwReq Aw	N/mm^2 N/mm^2 N/mm^2 N/mm^2 mm	0.362 0.179 2.850 300.00 150

The following ;

S : Shear force

N : Axial force

M : Bending moment

b : Member section width

d : Effective height

Alp. : Increasing coefficient of allowable stress

pt : Tensile main reinforcement ratio

ce : Correction coefficient of allowable shear stress about effective height d

cpt : Correction coefficient of allowable shear stress about tensile reinforcement ratio

CN : Correction coefficient by axial direction compressive force

Tau.m : Average shear stress

Tau.a1 : Allowable shear stress when share shear force by only concrete

Tau.a2 : Shear supplemental barAllowable shear stress when share the shear force with

Sig.sa : Allowable tensile stress of reinforcement

s : Shear supplemental bar interval of

Sca : Concrete sharing shear force

Sh' : Shear supplemental bar sharing shear force

Awreq : Necessary for Tau.a1 < Tau.mShear supplemental barAmount

Aw : Shear supplemental barAmount

2.3 Stability analysis

2.3.1 Buoyancy

Water unit volume weight Gam.w = 10.00(kN/m^3)

Sediment buoyancy (water) Gam.w' = 9.00(kN/m^3)

Note : Table's center of figure (Xg,Zg) is the coordinated system to set column lower face center (0,0)

2.3.1.1 Axial direction

(1) Case Regular HWL(upper load sediment height 0.000m, water level 12.300m)

Frame body buoyancy

	Volume V(m^3)	Bridge axial centroid Zg(m)	V*Zg(m^4)
Column	958.52235	0.0000	0.0000
Sum	958.52235	--------------------------	0.0000

Frame body buoyancy V = -Sum V*Gam.w = -9585.22(kN)

Moment Mz = -Sum (V*Zg)*Gam.w = 0.00(kN.m)

Center of gravity position z = Sum (V*Zg)/Sum V = 0.000(m)

(2) Case Regular LWL(upper load sediment height 3.700m, water level 6.700m)

Frame body buoyancy

	Volume V(m^3)	Bridge axial centroid Zg(m)	V*Zg(m^4)
Column	522.12193	0.0000	0.0000
Sum	522.12193	--------------------------	0.0000

Frame body buoyancy V = -Sum V*Gam.w = -5221.22(kN)

Moment Mz = -Sum (V*Zg)*Gam.w = 0.00(kN.m)

Center of gravity position z = Sum (V*Zg)/Sum V = 0.000(m)

(3) Case Temperature HWL(upper load sediment height 0.000m, water level 12.300m)

Frame body buoyancy

	Volume V(m^3)	Bridge axial centroid Zg(m)	V*Zg(m^4)
Column	958.52235	0.0000	0.0000
Sum	958.52235	--------------------------	0.0000

Frame body buoyancy V = -Sum V*Gam.w = -9585.22(kN)

Moment Mz = -Sum (V*Zg)*Gam.w = 0.00(kN.m)

Center of gravity position z = Sum (V*Zg)/Sum V = 0.000(m)

(4) Case Temperature LWL(upper load sediment height 3.700m, water level 6.700m)

Frame body buoyancy

	Volume V(m^3)	Bridge axial centroid Zg(m)	V*Zg(m^4)
Column	522.12193	0.0000	0.0000
Sum	522.12193	--------------------------	0.0000

Frame body buoyancy V = -Sum V*Gam.w = -5221.22(kN)

Moment Mz = -Sum (V*Zg)*Gam.w = 0.00(kN.m)

Center of gravity position z = Sum (V*Zg)/Sum V = 0.000(m)

(5) Case Wind(upper load sediment height 0.000m, water level 14.100m)

Frame body buoyancy

	Volume V(m^3)	Bridge axial centroid Zg(m)	V*Zg(m^4)
Column	1098.79392	0.0000	0.0000
Sum	1098.79392	--------------------------	0.0000

Frame body buoyancy V = -Sum V*Gam.w = -10987.94(kN)

Moment Mz = -Sum (V*Zg)*Gam.w = 0.00(kN.m)

Center of gravity position z = Sum (V*Zg)/Sum V = 0.000(m)

(6) Case Vessel Collision(upper load sediment height 0.000m, water level 12.300m)

Frame body buoyancy

	Volume V(m^3)	Bridge axial centroid Zg(m)	V*Zg(m^4)
Column	958.52235	0.0000	0.0000
Sum	958.52235	--------------------------	0.0000

Frame body buoyancy V = -Sum V*Gam.w = -9585.22(kN)

Moment Mz = -Sum (V*Zg)*Gam.w = 0.00(kN.m)

Center of gravity position z = Sum (V*Zg)/Sum V = 0.000(m)

(7) Case Seismic(upper load sediment height 0.000m, water level 9.400m)

Frame body buoyancy

	Volume V(m^3)	Bridge axial centroid Zg(m)	V*Zg(m^4)
Column	732.52928	0.0000	0.0000
Sum	732.52928	--------------------------	0.0000

Frame body buoyancy V = -Sum V*Gam.w = -7325.29(kN)

Moment Mz = -Sum (V*Zg)*Gam.w = 0.00(kN.m)

Center of gravity position z = Sum (V*Zg)/Sum V = 0.000(m)

2.4.1.2 Axial perpendicular direction

(1) Case Regular HWL(upper load sediment height 0.000m, water level 12.300m)

Frame body buoyancy

	Volume V(m^3)	Perpendicular centroid Xg(m)	V*Xg(m^4)
Column	958.52235	0.0000	0.0000
Sum	958.52235	--------------------------	0.0000

Frame body buoyancy V = -Sum V*Gam.w = -9585.22(kN)

Moment Mx = -Sum (V*Xg)*Gam.w = 0.00(kN.m)

Center of gravity position x = Sum (V*Xg)/Sum V = 0.000(m)

(2) Case Regular LWL(upper load sediment height 3.700m, water level 6.700m)

Frame body buoyancy

	Volume V(m^3)	Perpendicular centroid Xg(m)	V*Xg(m^4)
Column	522.12193	0.0000	0.0000
Sum	522.12193	--------------------------	0.0000

Frame body buoyancy V = -Sum V*Gam.w = -5221.22(kN)

Moment Mx = -Sum (V*Xg)*Gam.w = 0.00(kN.m)

Center of gravity position x = Sum (V*Xg)/Sum V = 0.000(m)

(3) Case Wind(upper load sediment height 0.000m, water level 14.100m)

Frame body buoyancy

	Volume V(m^3)	Perpendicular centroid Xg(m)	V*Xg(m^4)
Column	1098.79392	0.0000	0.0000
Sum	1098.79392	--------------------------	0.0000

Frame body buoyancy V = −Sum V*Gam.w = −10987.94(kN)

Moment Mx = −Sum (V*Xg)*Gam.w = 0.00(kN.m)

Center of gravity position x = Sum (V*Xg)/Sum V = 0.000(m)

(4) Case Vessel Collision(upper load sediment height 0.000m, water level 12.300m)

Frame body buoyancy

	Volume V(m^3)	Perpendicular centroid Xg(m)	V*Xg(m^4)
Column	958.52235	0.0000	0.0000
Sum	958.52235	--------------------------	0.0000

Frame body buoyancy V = −Sum V*Gam.w = −9585.22(kN)

Moment Mx = −Sum (V*Xg)*Gam.w = 0.00(kN.m)

Center of gravity position x = Sum (V*Xg)/Sum V = 0.000(m)

(5) Case Seismic(upper load sediment height 0.000m, water level 9.400m)

Frame body buoyancy

	Volume V(m^3)	Perpendicular centroid Xg(m)	V*Xg(m^4)
Column	732.52928	0.0000	0.0000
Sum	732.52928	--------------------------	0.0000

Frame body buoyancy V = −Sum V*Gam.w = −7325.29(kN)

Moment Mx = −Sum (V*Xg)*Gam.w = 0.00(kN.m)

Center of gravity position x = Sum (V*Xg)/Sum V = 0.000(m)

2.3.2 total of reaction force of every each load cases and stability calculation (bridge axial direction)

2.3.2.1 Case Regular HWL(upper load sediment height　0.000m, water level 12.300m)

(1)　reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	51300.00	4700.00	105750.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−9585.22	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Additional acting force	0.00	0.00	0.00
Total	87256.01	4700.00	105750.00

2.3.2.2 Case Regular LWL(upper load sediment height　3.700m, water level　6.700m)

(1)　reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	62800.00	2200.00	49500.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−5221.22	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Additional acting force	0.00	0.00	0.00
Total	103120.02	2200.00	49500.00

2.3.2.3 Case Temperature HWL(upper load sediment height 0.000m, water level 12.300m)

(1) reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	51000.00	9300.00	209250.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−9585.22	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Additional acting force	0.00	0.00	0.00
Total	86956.01	9300.00	209250.00

2.3.2.4 Case Temperature LWL(upper load sediment height 3.700m, water level 6.700m)

(1) reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	62900.00	6800.00	153000.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−5221.22	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Additional acting force	0.00	0.00	0.00
Total	103220.02	6800.00	153000.00

2.3.2.5 Case Wind(upper load sediment height 0.000m, water level 14.100m)

(1) reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	52100.00	1100.00	24750.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	185.38	3423.51
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−10987.94	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Additional acting force	0.00	0.00	0.00
Total	86653.30	1285.38	28173.51

2.3.2.6 Case Vessel Collision(upper load sediment height 0.000m, water level 12.300m)

(1) reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	51300.00	4700.00	105750.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	4850.00	63535.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−9585.22	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Additional acting force	0.00	0.00	0.00
Total	87256.01	9550.00	169285.00

2.3.2.7 Case Seismic(upper load sediment height 0.000m, water level 9.400m)

(1) reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	52000.00	18500.00	416250.00
Frame body own load (beam, column)	44451.14	13335.34	154217.25
Beam the load operated to top edge	1090.10	327.03	7314.66
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−7325.29	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Dynamic water pressure in seismic condition	------------------	1795.48	7233.20
Additional acting force	0.00	0.00	0.00
Total	90215.94	33957.85	585015.11

2.3.3 total of reaction force of every each load cases and stability calculation (bridge axial perpendicular direction)

2.3.3.1 Case Regular HWL(upper load sediment height 0.000m, water level 12.300m)

(1) reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	51300.00	100.00	34250.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	-9585.22	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Additional acting force	0.00	0.00	0.00
Total	87256.01	100.00	34250.00

2.3.3.2 Case Regular LWL(upper load sediment height 3.700m, water level 6.700m)

(1) reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	62800.00	100.00	34250.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	-5221.22	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Additional acting force	0.00	0.00	0.00
Total	103120.02	100.00	34250.00

2.3.3.3 Case Wind(upper load sediment height　0.000m, water level 14.100m)

(1)　reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	52100.00	2200.00	82900.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−10987.94	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Wind load	-----------------	53.55	979.97
Additional acting force	0.00	0.00	0.00
Total	86653.30	2253.55	83879.96

2.3.3.4 Case Vessel Collision(upper load sediment height　0.000m, water level 12.300m)

(1)　reaction force total

	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	51300.00	100.00	34250.00
Frame body own load (beam, column)	44451.14	0.00	0.00
Beam the load operated to top edge	1090.10	0.00	0.00
Concentrated load operated to column	0.00	9700.00	127070.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−9585.22	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Additional acting force	0.00	0.00	0.00
Total	87256.01	9800.00	161320.00

2.3.3.5 Case Seismic(upper load sediment height　0.000m, water level　9.400m)

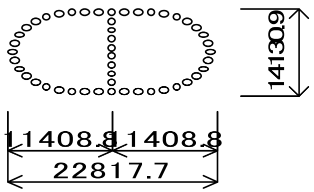
(1)　reaction force total

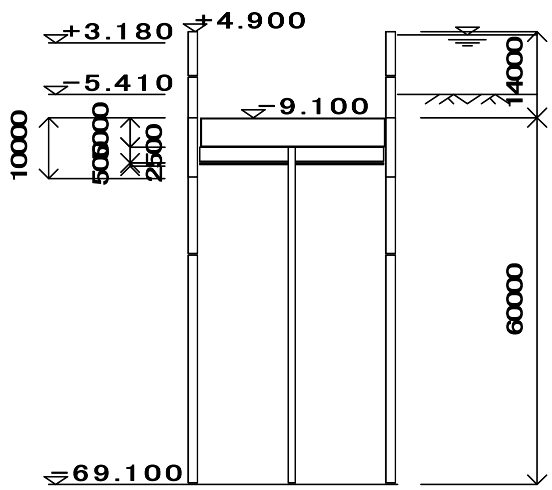
	Vertical force (kN)	Horizontal force (kN)	Moment (kN.m)
Super structural reaction force	52100.00	14300.00	415650.00
Frame body own load (beam, column)	44451.14	13335.34	154217.25
Beam the load operated to top edge	1090.10	327.03	7314.66
Concentrated load operated to column	0.00	0.00	0.00
Separated load operated to column	0.00	0.00	0.00
Frame body own load (footing)	0.00	0.00	0.00
Upper load sediment	0.00	0.00	0.00
Frame body buoyancy	−7325.29	0.00	0.00
Sediment buoyancy	0.00	0.00	0.00
Flowing water pressure	――――――――――	10.15	57.26
Additional acting force	0.00	0.00	0.00
Total	90315.94	27972.52	577239.17

3. Calculation of Foundation at P11

3.1 concrete body calculation

3.1.1 foundation shape dimension diagram





3.1.2 steel pipe sheet pile composing points

1)periphery sheet pile

external diameter = 1200.0(mm)

pile length = 74.000(m)

number = 40(number)

steel pipe thickness (mm)	length (m)	material
14.0	7.500	SKY400
16.0	29.000	SKY490
14.0	37.500	SKY400

2)separation wall sheet pile

external diameter = 1200.0(mm)

pile length = 55.100(m)

number = 8(number)

steel pipe thickness (mm)	length (m)	material
14.0	55.100	SKY400

3.1.3 ground condition

No	soil	layer thickness (m)	average N value	unit weight Gam.(kN/m³)		c (kN/m²)	Phi. (angle)	modulus of elasticity Alp.*Eo(kN/m²)		reduction coefficient		
				Gam.	Gam.'			usual	earthquake	DE	DE' Type1	DE' Type2
1	chsv	3.060	1.0	17.5	7.5	10.0	0.00	3600	7200	0.333	0.333	0.333
2	sand	6.950	13.0	17.0	8.0	0.0	33.00	20800	41600	0.666	0.666	0.666
3	sand	5.040	13.0	17.0	8.0	0.0	33.00	20800	41600	1.000	1.000	1.000
4	chsv	2.030	9.0	17.5	7.5	54.0	0.00	25200	50400	1.000	1.000	1.000
5	chsv	2.930	7.0	17.5	7.5	42.0	0.00	19600	39200	1.000	1.000	1.000
6	chsv	16.060	7.0	17.5	7.5	42.0	0.00	19600	39200	1.000	1.000	1.000
7	sand	2.990	25.0	17.0	8.0	0.0	33.00	70000	140000	1.000	1.000	1.000
8	chsv	16.010	18.0	18.0	8.0	108.0	0.00	50400	100800	1.000	1.000	1.000
9	sand	6.970	30.0	17.0	8.0	0.0	34.00	84000	168000	1.000	1.000	1.000
10	sand	10.000	50.0	19.0	10.0	0.0	35.00	140000	280000	1.000	1.000	1.000

3.1.4 section properties

(1)section properties of steel pipe pile body

erosion margin external side = 2.0 (mm) internal side = 0.0 (mm)

1)periphery sheet pile Do = 1200(mm) number = 40

to(mm)	L(m)	Ao(cm²)	Io(cm⁴)	Zo(cm³)	material
16.0	22.500	519.9	908031	15184	SKY490
14.0	37.500	446.4	782242	13081	SKY400

2)separation wall sheet pile Do = 1200(mm) number = 8

to(mm)	L(m)	Ao(cm²)	Io(cm⁴)	Zo(cm³)	material
14.0	55.000	446.4	782242	13081	SKY400

(2)sum of squared distance from centroid of steel pipe sheet to neutral axis of horizontal section of celler IB(m^2)

	bridge axis direction	perpendicular direction
periphery sheet pile	1086.85	2190.04
separation wall sheet pile	86.70	0.00

(3)sum of moment of inertia in celler part I(m^4)

bridge axis direction I = SumIoi + Mu * Sum(Aoi * Yi^2)

perpendicular direction I = SumIoi + Mu * Sum(Aoi * Xi^2)

Mu : composite efficiency - 0.75

No	L(m)	bridge axis direction	perpendicular direction
1	22.500	45.704829	85.816074
2	37.500	39.662253	73.691150

foundation length = 60.000 (m)

(4)coordinates of cetroid of steel pipe sheet pile

1) periphery sheet pile

No	Y(m)	X(m)	number
1	6.4654	0.0000	2
2	6.4654	1.4478	4

No	Y(m)	X(m)	number
3	6.4654	2.8956	4
4	6.4654	4.3434	4
5	0.0000	10.8088	2
6	1.4387	10.6467	4
7	2.8053	10.1686	4
8	4.0311	9.3983	4
9	5.0549	8.3745	4
10	5.8252	7.1486	4
11	6.3033	5.7821	4

2) separation wall sheet pile

No	Y(m)	X(m)	number
1	5.0287	0.0000	2
2	3.5919	0.0000	2
3	2.1551	0.0000	2
4	0.7184	0.0000	2

3.1.5 ground constant

(1) ground modulus of elasticity

layer No	usual time		earthquake time		
	layer thickness (m)	Alp.*Eo(kN/m²)	layer thickness (m)	Alp.*Eo(kN/m²)	DE
protrusion length	0.000	------	0.000	------	----
1	6.320	20800	6.320	41600	0.666
2	5.040	20800	5.040	41600	1.000
3	2.030	25200	2.030	50400	1.000
4	2.930	19600	2.930	39200	1.000
5	16.060	19600	16.060	39200	1.000
6	2.990	70000	2.990	140000	1.000
7	16.010	50400	16.010	100800	1.000
8	6.970	84000	6.970	168000	1.000
9	1.650	140000	1.650	280000	1.000

(2)vertical modulus of subgrade reaction

$$kv = \frac{1}{0.3} * Alp. * Eo * \left(\frac{Bv}{0.3}\right)^{-3/4}$$

where kv : vertical modulus of subgrade reaction (kN/m³)

Alp.*Eo: ground modulus of elasticity (kN/m²)

usual time = 140000

earthquake time = 280000

Bv : foundation equivalent loading width of foundation (m) -- external diameter of steel pipe sheet pile main body

	Bv (mm)	kv(kN/m³)	
		usual	earthquake
periphery sheet pile	1200.0	164992	329983
separation wall sheet pile	1200.0	164992	329983

(3)horizontal modulus of subgrade reaction

$$kH = \frac{1}{0.3} * Alp. * Eo * \left(\frac{BH}{0.3}\right)^{-3/4}$$

where kH : horizontal modulus of subgrade reaction (kN/m^3)

BH : equivalent loading width of foundation in orthogonal to load working direction (m)

$$BH = \sqrt{D/Beta} \quad <= \quad \sqrt{De*Le}$$

D : loading width of foundation in orthogonal to load working direction (m)

De : effective loading width of foundation in orthogonal to load working direction (m)

1/Beta : ground depth to relate with horizontal resistance, less than foundation length (m)

Beta : characteristic value of foundation(m^{-1})

$$Beta = \sqrt[4]{\frac{kH*D}{4*E*I}}$$

E : Young's modulus of foundation = 2.00 * 10^8(kN/m^2)

I : moment of inertia of foundation (m^4)

Le : effective embedment depth of foundation(m)

$$kH1 = (1 + Alp.H)*kH*\left(\frac{y}{yo}\right)^{-1/2}$$

where kH1 : in case of considering strain-dependance, standard modulus of subgrade reaction in horizontal direction (kN/m^3)

(assuming y = yo, standard value)

Alp.H : shear subgrade reaction on celler part side in horizontal direction and resistance of internal soil increment coefficient including sharing etc (= 1.00)

y : horizontal displacemen of foundation on design ground surfacet (m)

yo : standard displacement (m)

	bridge axis direction		perpendicular direction	
	usual time	earthquake time	usual time	earthquake time
I (cm^4)	4.5705E+009		8.5816E+009	
D (cm)	2281.77		1413.09	
Beta(cm^{-1})	0.000351	0.000351	0.000285	0.000285
1/Beta(cm)	2847.7	2847.7	3511.2	3511.2
average Alp.*Eo (N/cm^2)	2047.8	2047.8	2423.4	2423.4
BH, $\sqrt{De*Le}$ (cm)	2549.1 < 3700.1	2549.1 < 3700.1	2227.5 < 2911.8	2227.5 < 2911.8

layer No	layer thickness (m)		Alp.*Eo(kN/m²)		bridge axis direction kH1(kN/m³)		perpendicular direction kH1(kN/m³)	
	usual	earthquake	usual	earthquake	usual	in earthquake	usual	in earthquake
protrusion length	0.000	0.000	------	------	-----	------	------	------
1	6.320	6.320	20800	41600	4955	6600	5482	7302
2	5.040	5.040	20800	41600	4955	9910	5482	10964
3	2.030	2.030	25200	50400	6003	12006	6642	13284
4	2.930	2.930	19600	39200	4669	9338	5166	10332
5	16.060	16.060	19600	39200	4669	9338	5166	10332
6	2.990	2.990	70000	140000	16675	33350	18450	36899
7	16.010	16.010	50400	100800	12006	24012	13284	26567
8	6.970	6.970	84000	168000	20010	40020	22140	44279
9	1.650	1.650	140000	280000	33350	66700	36899	73798

horizontal modulus of subgrade reaction(using value)(kN/m³)

layer No	layer thickness (m)		bridge axis direction		perpendicular direction	
	usual time	in quakes	usual time	in quakes	usual time	in quakes
protrusion length	0.000	0.000	------	------	------	------
1	6.320	6.320	4955	6600	5482	7302
2	5.040	5.040	4955	9910	5482	10964
3	2.030	2.030	6003	12006	6642	13284
4	2.930	2.930	4669	9338	5166	10332
5	16.060	16.060	4669	9338	5166	10332
6	2.990	2.990	16675	33350	18450	36899
7	16.010	16.010	12006	24012	13284	26567
8	6.970	6.970	20010	40020	22140	44279
9	1.650	1.650	33350	66700	36899	73798

(4)horizontal direction shear modulus of subgrade reaction at bottom of celler

$ks = 0.3 * kv$

where ks :horizontal direction shear modulus of subgrade reaction at bottom of celler (kN/m^3)

	usual time	in quakes
periphery sheet pile	49497	98995
separation wall sheet pile	49497	98995

(5)spring constant at bottom of celler

1)vertical spring constant

$$Kv = \sum_{i=1}^{3} \left((ni*kvi*A1i) \right) \ (kN/m)$$

where A1i : close sectional area of steel pipe sheet pile and intermediate driven single pile (m^2)

periphery sheet pile		separation wall sheet pile		intermediate driven pile		Kv (kN/m)	
A11(m^2)	n1(number)	A12(m^2)	n2(number)	A13(m^2)	n3(number)	usual time	earthquake time
1.1310	40	1.1310	8	0.0000	0	8.9569E+006	1.7914E+007

2) shear spring constant

$$Ks = \sum_{i=1}^{2} \left((ni*ksi*A1i) \right) \ (kN/m)$$

usual time	in quakes
2.6871E+006	5.3741E+006

3)rotational spring constant

$$Kr = \sum_{i=1}^{2} \left((kvi*A1i*IBi) \right) \ (kN.m/rad)$$

where IB : celler composed with steel pipe sheet pile

sum of squared distance from centroid to neutral axis of horizontal section of celler (m^2)

	periphery sheet pile IB1 (m^2)	separation wall sheet pile IB2 (m^2)	Kr (kN.m/rad)	
			usual time	in quakes
bridge axis direction	1086.85	86.70	2.1899E+008	4.3797E+008
perpendicular direction	2190.04	0.00	4.0866E+008	8.1733E+008

spring constant at bottom of celler(using value)

		usual time	in quakes
vertical spring Kv (kN/m)		8.9569E+006	1.7914E+007
shear spring Ks (kN/m)		2.6871E+006	5.3741E+006
rotational spring Kr (kN.m/rad)	bridge axis direction	2.1899E+008	4.3797E+008
	perpendicular direction	4.0866E+008	8.1733E+008

3.1.6 allowable bearing capacity

(1)allowable compressive bearing capacity of steel pipe sheet pile

work method : driven construction method

steel pipe sheet pile main body external diameter :Phi.1200.0 (mm)

$$Ra = \frac{1}{n} * Ru$$

$$Ru = qd*A1 + \frac{1}{n1+n2+n3} * \{ U1*\Sigma(Li*fi) + U2*\Sigma(Lj*fj) \}$$

where Ra: allowable compressive bearing capacity of steel pipe sheet pile(kN/pile)

n : factor of safety usual time n = 3

earthquake time n = 2

Ru: ultimate bearing capacity of steel pipe sheet pile in lower ground (kN)

A1: close sectional area of steel pipe sheet pile body (m^2)

A1 = 1.131 (m^2)

qd: ultimate bearing capacity per unit area supporting steel pipe sheet pile tip (kN/m^2)

$$\frac{\text{equivalent embedment depth to bearing strata}}{\text{pile diameter}} = \frac{1.370}{1.2000} = 1.14$$

$qd / \bar{N} = 68$

$\bar{N}$:design N value in steel pipe sheet pile tip ground $\bar{N}$ = 40.0

qd = 68 * 40.0 = 2740 (kN/m^2)

n1 : celler part periphery steel pipe sheet pile number (number) n1 = 40

n2 : number of steel pipe sheet pile in separation wall part (number) n2 = 8

n3 : intermediate driven single pile number (number) n3 = 0

U1 : enveloping celler part periphery length (m) U1 = 61.767 (m)

U2 : enveloping celler part and separation wall part periphery length
and sum of perimeter of intermediate driven single pile U2 = 75.289 (m)

Li : thickness which celler skin friction of external periphery is considered (m)

fi : maximum skin friction angle of layer which celler skin friction of external periphery is considered (kN/m^2)

Lj : thickness which celler skin friction of internal periphery is considered (m)

fj : maximum skin friction angle of layer which celler skin friction of internal periphery is considered (kN/m^2)
range of internal soil short side length(Lo) from bottom is only considered

Lo = 9.609 (m)

skin friction of external periphery

No	soil	average N value	layer thick Li (m)	fi (kN/m^2)		DEi	Li*fi(DEi) (kN/m)	
				usual time	in quakes		usual time	in quakes
1	sandy	13.0	6.320	26.0	26.0	0.666	164.3	109.4
2	sandy	13.0	5.040	26.0	26.0	1.000	131.0	131.0
3	cohesv	9.0	2.030	90.0	90.0	1.000	182.7	182.7
4	cohesv	7.0	2.930	70.0	70.0	1.000	205.1	205.1
5	cohesv	7.0	16.060	70.0	70.0	1.000	1124.2	1124.2
6	sandy	25.0	2.990	50.0	50.0	1.000	149.5	149.5
7	cohesv	18.0	16.010	150.0	150.0	1.000	2401.5	2401.5
8	sandy	30.0	6.970	60.0	60.0	1.000	418.2	418.2
9	sandy	50.0	1.650	100.0	100.0	1.000	165.0	165.0
Sum			60.000				4941.6	4886.7

DE: reduction coefficient in earthquake time

skin friction of internal periphery

No	soil	average N value	layer thick Lj (m)	fj (kN/m^2)		DEj	Lj*fj(DEj) (kN/m)	
				usual time	in quakes		usual time	in quakes
7	cohesv	18.0	0.989	150.0	150.0	1.000	148.3	148.3
8	sandy	30.0	6.970	60.0	60.0	1.000	418.2	418.2
9	sandy	50.0	1.650	100.0	100.0	1.000	165.0	165.0
Sum			9.609				731.5	731.5

DE: reduction coefficient in earthquake time

ultimate bearing capacity

$$Ru = qd*A1 + \frac{1}{n1+n2+n3}*\left\{ U1*\Sigma(Li*fi) + U2*\Sigma(Lj*fj) \right\}$$

= 3099 + 7506 = 10605 (kN/number) (usual time)

= 3099 + 7436 = 10535 (kN/number) (earthquake time)

allowable compressive bearing capacity

usual time Ra = (1 / 3) * 10605 = 3535 (kN/number)

earthquake Ra = (1 / 2) * 10535 = 5267 (kN/number)

(2)allowable uplifting force of steel pipe sheet pile

$$Pa = \frac{1}{n} * Pu + W$$

$$Pu = \frac{1}{n1+n2+n3} * \{ U1*\Sigma(Li*fi) + U2*\Sigma(Lj*fj) \}$$

where, Pa: allowable uplifting force of steel pipe sheet pile(kN/number)

n : factor of safety usual time n = 6

earthquake time n = 3

Pu: determined from ground, ultimate uplifting force of steel pipe sheet pile (kN/number)

W : effective weight of steel pipe sheet pile(kN)

effective weight of steel pipe sheet pile W(= w1 + w2 + w3 + w4)

		usual time	earthquake time
steel pipe weight	w1 (kN) =	190.5	190.5
joint weight	w2 (kN) =	0.0	0.0
soil weight inside of pipe	w3 (kN) =	423.1	423.1
filling concrete weight	w4 (kN) =	0.0	0.0
	W (kN) =	613.6	613.6

skin friction of external periphery

No	soil	average N value	layer thick Li (m)	fi (kN/m²)		DEi	Li*fi(DEi) (kN/m)	
				usual time	in quakes		usual time	in quakes
1	sandy	13.0	6.320	26.0	26.0	0.666	164.3	109.4
2	sandy	13.0	5.040	26.0	26.0	1.000	131.0	131.0
3	cohesv	9.0	2.030	90.0	90.0	1.000	182.7	182.7
4	cohesv	7.0	2.930	70.0	70.0	1.000	205.1	205.1
5	cohesv	7.0	16.060	70.0	70.0	1.000	1124.2	1124.2
6	sandy	25.0	2.990	50.0	50.0	1.000	149.5	149.5
7	cohesv	18.0	16.010	150.0	150.0	1.000	2401.5	2401.5
8	sandy	30.0	6.970	60.0	60.0	1.000	418.2	418.2
9	sandy	50.0	1.650	100.0	100.0	1.000	165.0	165.0
Sum			60.000				4941.6	4886.7

DE: reduction coefficient in earthquake time skin friction of internal periphery

No	soil	average N value	layer thick Lj (m)	fj (kN/m²)		DEj	Lj*fj(DEj) (kN/m)	
				usual time	in quakes		usual time	in quakes
7	cohesv	18.0	0.989	150.0	150.0	1.000	148.3	148.3
8	sandy	30.0	6.970	60.0	60.0	1.000	418.2	418.2
9	sandy	50.0	1.650	100.0	100.0	1.000	165.0	165.0
Sum			9.609				731.5	731.5

DE: reduction coefficient in earthquake time

ultimate uplifting force

Pu = 7506 (kN/number) (usual time time)

Pu = 7436 (kN/number) (earthquake time)

allowable uplifting force

usual time Pa - (1 / 6) * 7506 + 614 - 1865 (kN/number)

earthquake Pa - (1 / 3) * 7436 + 614 - 3092 (kN/number)

allowable compressive bearing capacity / uplifting force of steel pipe sheet pile(using value)(kN/number)

allowable compressive bearing capacity	usual time	3535
	in quakes	5267
allowable uplifting force bearing capacity	usual time	1865
	in quakes	3092

3.1.7 design force

in steel pipe sheet pile foundation, for coffering double use method, external force which works at the center of crest is considered.
yet, vertical load is sum of crest of pile cap load, pile cap weight, filling concrete weight and backfilling soil weight
consider

(1) input shape, unit weight and design seismic coefficient

pile cap shape :oval
pile cap dimension : 14.1309 (m) * 22.8177 (m)
pile cap thickness h1 = 5.000 (m)
steel pipe pile body external diameter Phi. = 1200.0 (mm)
number of external wallsteel pipe sheet pile n = 40
filling concrete cast height h2 = 10.000 (m)
leg column cross sectional area Ap = 77.930 (m^2)
shape : oval
dimension : a = 12.000 (m) perpendicular direction
: b = 7.500 (m) bridge axis direction
unit weight : backfilling soil(wet) Gam.t = 18.0 (kN/m^3)
backfilling soil(saturated) Gam.sat = 19.0 (kN/m^3)
pile cap concrete Gam.c1 = 24.5 (kN/m^3)
filling concrete Gam.c2 = 23.0 (kN/m^3)
footing concrete = 23.0 (kN/m^3)
paving sand (wet) = 19.0 (kN/m^3)
(saturated) = 20.0 (kN/m^3)
water Gam.w = 10.00 (kN/m^3)
design seismic coefficient : pile cap kh = 0.30 bridge axis direction
kh = 0.30 perpendicular direction
internal soil kh = 0.00 bridge axis direction
kh = 0.00 perpendicular direction
ground surface in seismic design = 0.000 (m) (depth from crest of)

1)bridge axis direction

No	load name	backfilling soil height (m)	water table height (m)
1	RegularHWL[W]	-5.410	3.180
2	RegularLWL[W]	-5.410	-2.390
3	Temp.HWL[W]	-5.410	3.180

No	load name	backfilling soil height (m)	water table height (m)
4	Temp.LWL[W]	-5.410	-2.390
5	Wind[W]	-5.410	4.990
6	Vessel Impact[W]	-5.410	3.180
7	Seismic[W]	-5.410	0.290
8	Seismic[dyn Smax]	-5.410	0.290
9	Seismic[dyn Mmax]	-5.410	0.290

2)perpendicular direction

No	load name	backfilling soil height (m)	water table height (m)
1	Reg HWL [W]	-5.410	3.180
2	Reg LWL[W]	-5.410	-2.390
3	wind[W]	-5.410	4.990
4	vessel impact[W]	-5.410	3.180
5	seismic[W]	-5.410	0.290
6	Seismic[dyn Smax]	-5.410	0.290
7	Seismic[dyn Mmax]	-5.410	0.290

(2) working force at leg column bottom

1)bridge axis direction

No	load name	V(kN)	H(kN)	M(kN.m)
1	RegularHWL[W]	96841.2	4700.0	105750.0
2	RegularLWL[W]	108341.2	2200.0	49500.0
3	Temp.HWL[W]	96541.2	9300.0	209250.0
4	Temp.LWL[W]	108441.2	6800.0	153000.0
5	Wind[W]	97641.2	1285.4	28173.5
6	Vessel Impact[W]	96841.2	9550.0	169285.0
7	Seismic[W]	97541.2	33957.8	585015.1
8	Seismic[dyn Smax]	95587.4	30839.6	564659.0
9	Seismic[dyn Mmax]	95256.4	28637.3	590183.0

2)perpendicular direction

No	load name	V(kN)	H(kN)	M(kN.m)
1	Reg HWL [W]	96841.2	100.0	34250.0
2	Reg LWL[W]	108341.2	100.0	34250.0
3	wind[W]	97641.2	2253.6	83880.0
4	vessel impact[W]	96841.2	9800.0	161320.0
5	seismic[W]	97641.2	27972.5	577239.2
6	Seismic[dyn Smax]	94298.8	-20268.8	-439530.0
7	Seismic[dyn Mmax]	94298.8	-20217.6	-440242.0

(3) pile cap area

oval

$$A1 = \frac{Pai}{4} * (B-D)^2 + (B-D)*(L-B) - \frac{Pai}{4} * D^2 * \frac{n}{2} = 221.033\ (m^2)$$

filling concrete area

$$A2 = \frac{Pai}{4} * D^2 * n = 45.239\ (m^2)$$

backfilling soil area

$A3 = A1 + A2 - Ap = 188.342\ (m^2)$

1)bridge axis direction

No	load abbreviation	hw (m)	backfilling soil thickness	V1 (kN)	V2 (kN)	V3 (kN)	Vp (kN)	Sum.V (kN)
1	RegularHWL[W]	12.280	3.690	16024.9	5881.1	6254.8	9569.8	18591.0
2	RegularLWL[W]	6.710	3.690	16024.9	5881.1	6254.8	5229.1	22931.7
3	Temp.HWL[W]	12.280	3.690	16024.9	5881.1	6254.8	9569.8	18591.0
4	Temp.LWL[W]	6.710	3.690	16024.9	5881.1	6254.8	5229.1	22931.7
5	Wind[W]	14.090	3.690	16024.9	5881.1	6254.8	10980.3	17180.5
6	Vessel[W]	12.280	3.690	16024.9	5881.1	6254.8	9569.8	18591.0
7	Seismic[W]	9.390	3.690	16024.9	5881.1	6254.8	7317.6	20843.2
8	dyn Smax	9.390	3.690	16024.9	5881.1	6254.8	7317.6	20843.2
9	dyn Mmax	9.390	3.690	16024.9	5881.1	6254.8	7317.6	20843.2

2)perpendicular direction

No	load abbreviation	hw (m)	backfilling soil thickness	V1 (kN)	V2 (kN)	V3 (kN)	Vp (kN)	Sum.V (kN)
1	Reg HWL [W]	12.280	3.690	16024.9	5881.1	6254.8	9569.8	18591.0
2	Reg LWL [W]	6.710	3.690	16024.9	5881.1	6254.8	5229.1	22931.7
3	wind[W]	14.090	3.690	16024.9	5881.1	6254.8	10980.3	17180.5
4	vessel[W]	12.280	3.690	16024.9	5881.1	6254.8	9569.8	18591.0
5	seismic[W]	9.390	3.690	16024.9	5881.1	6254.8	7317.6	20843.2
6	dyn Smax	9.390	3.690	16024.9	5881.1	6254.8	7317.6	20843.2
7	dyn Mmax	9.390	3.690	16024.9	5881.1	6254.8	7317.6	20843.2

hw: water table(m), height upward from crest of pile cap

V1: weight of pile cap

V2: weight of filling concrete

V3: backfilling soil weight

Vp: buoyancy works at column

V1 = A1*{ h11*Gam.c1 + h21*(Gam.c1 - Gam.w) }

V2 = A2*{ h12*Gam.c2 + h22*(Gam.c2 - Gam.w) }

V3 = A3*{ h13*Gam.t + h23*(Gam.sat - Gam.w) }

h1i: thickness upper than water table(m)

h2i: thickness lower than water table(m)

Vp = Ap*hw*Gam.w

$\Sigma V = V1 + V2 + V3 - Vp$

(4) design external force sum up

1)bridge axis direction

No	load name	Vo(kN)	Ho(kN)	Mo(kN.m)	increment coefficient	ground spring	bearing capacity
1	RegularHWL[W]	115432.2	4700.0	105750.0	1.00	usual time	usual time
2	RegularLWL[W]	131272.9	2200.0	49500.0	1.00	usual time	usual time
3	Temp.HWL[W]	115132.2	9300.0	209250.0	1.15	usual time	usual time
4	Temp.LWL[W]	131372.9	6800.0	153000.0	1.15	usual time	usual time
5	Wind[W]	114821.7	1285.4	28173.5	1.25	usual time	earthquake time
6	Vessel Impact[W]	115432.2	9550.0	169285.0	1.50	usual time	usual time
7	Seismic[W]	118384.4	33957.8	585015.1	1.50	earthquake time	earthquake time
8	Seismic[dyn Smax]	116430.6	30839.6	564659.0	1.50	earthquake time	earthquake time
9	Seismic[dyn Mmax]	116099.6	28637.3	590183.0	1.50	earthquake time	earthquake time

2)perpendicular direction

No	load name	Vo(kN)	Ho(kN)	Mo(kN.m)	increment coefficient	ground spring	bearing capacity
1	Reg HWL [W]	115432.2	100.0	34250.0	1.00	usual time	usual time
2	Reg LWL[W]	131272.9	100.0	34250.0	1.00	usual time	usual time
3	wind[W]	114821.7	2253.6	83880.0	1.25	usual time	earthquake time
4	vessel impact[W]	115432.2	9800.0	161320.0	1.50	usual time	usual time
5	seismic[W]	118484.4	27972.5	577239.2	1.50	earthquake time	earthquake time
6	Seismic[dyn Smax]	115142.0	-20268.8	-439530.0	1.50	earthquake time	earthquake time
7	Seismic[dyn Mmax]	115142.0	-20217.6	-440242.0	1.50	earthquake time	earthquake time

3.1.8 design external force(using value)

1)bridge axis direction

No	load name	Vo(kN)	Ho(kN)	Mo(kN.m)	increment coefficient	ground spring	bearing capacity
1	RegularHWL[W]	115432.2	4700.0	105750.0	1.00	usual time	usual time
2	RegularLWL[W]	131272.9	2200.0	49500.0	1.00	usual time	usual time
3	Temp.HWL[W]	115132.2	9300.0	209250.0	1.15	usual time	usual time
4	Temp.LWL[W]	131372.9	6800.0	153000.0	1.15	usual time	usual time
5	Wind[W]	114821.7	1285.4	28173.5	1.25	usual time	earthquake time
6	Vessel Impact[W]	115432.2	9550.0	169285.0	1.50	usual time	usual time
7	Seismic[W]	118384.4	33957.8	585015.1	1.50	earthquake time	earthquake time
8	Seismic[dyn Smax]	116430.6	30839.6	564659.0	1.50	earthquake time	earthquake time
9	Seismic[dyn Mmax]	116099.6	28637.3	590183.0	1.50	earthquake time	earthquake time

2)perpendicular direction

No	load name	Vo(kN)	Ho(kN)	Mo(kN.m)	increment coefficient	ground spring	bearing capacity
1	Reg HWL [W]	115432.2	100.0	34250.0	1.00	usual time	usual time
2	Reg LWL[W]	131272.9	100.0	34250.0	1.00	usual time	usual time
3	wind[W]	114821.7	2253.6	83880.0	1.25	usual time	earthquake time
4	vessel impact[W]	115432.2	9800.0	161320.0	1.50	usual time	usual time
5	seismic[W]	118484.4	27972.5	577239.2	1.50	earthquake time	earthquake time
6	Seismic[dyn Smax]	115142.0	-20268.8	-439530.0	1.50	earthquake time	earthquake time
7	Seismic[dyn Mmax]	115142.0	-20217.6	-440242.0	1.50	earthquake time	earthquake time

3.1.9 calculation result table

1)bridge axis direction

item			unit	RegularHWL[W]	RegularLWL[W]	Temp.HWL[W]	Temp.LWL[W]	Wind[W]	Vessel[W]
working force		Vo	kN	115432.2	131272.9	131372.9	114821.7	115432.2	115132.2
		Ho	kN	4700.0	2200.0	6800.0	1285.4	9550.0	9300.0
		Mo	kN.m	105750.0	49500.0	153000.0	28173.5	169285.0	209250.0
foundation crest	displacement	Del.1	cm	0.409	0.591	0.110	0.736	0.191	0.809
	deflexion angle	Theta.1	mrad	-0.319	-0.461	-0.086	-0.552	-0.149	-0.630
design ground surface	displacement	Del.2	cm	0.409	0.591	0.110	0.736	0.191	0.809
	deflexion angle	Theta.2	mrad	-0.319	-0.461	-0.086	-0.552	-0.149	-0.630
celler part maximum bending moment		Mmax	kN.m	-118087.0	-55275.0	-170849.0	-31605.0	-198003.0	-233661.0
Mmax accrue location		Lm	m	-15.100	-15.100	-15.100	-15.100	-15.420	-15.100
stress	periphery sheet pile(SKY400)	Sigma x	N/mm²	66.36	79.38	56.95	75.87	67.11	78.44
		Lm	m	-31.600	-31.600	-31.600	-31.600	-31.600	-31.600
	periphery sheet pile(SKY490)	Sigma x	N/mm²	66.15	81.08	52.15	78.85	62.66	84.40
		Lm	m	-15.100	-15.100	-15.100	-15.420	-15.100	-15.100
	separation wall sheet pile(SKY400)	Sigma x	N/mm²	64.56	77.18	56.47	74.33	66.27	79.06
		Lm	m	-31.600	-15.100	-31.600	-15.420	-31.600	-15.100
	separation wall sheet pile(SKY490)	Sigma x	N/mm²	--------	--------	--------	--------	--------	--------
		Lm	m	--------	--------	--------	--------	--------	--------
	intermediate driven pile (SKK400)	Sig.max	N/mm²	--------	--------	--------	--------	--------	--------
	intermediate driven pile (SKK490)	Sig.max	N/mm²	--------	--------	--------	--------	--------	--------
celler partbottom bending moment		MB	kN.m	2860.0	1339.0	4138.0	767.0	4892.0	5659.0
vertical reaction	maximum	Rmax	kN/num	2421	2760	2396	2432	2742	2430
	minimum	Rmin	kN/num	2389	2714	2388	2378	2727	2367
allowable value	displacement	Del.a	cm	5.000	5.000	5.000	5.000	5.000	5.000
	compressive bearing capacity	Ra	kN/num	3535	3535	5267	3535	3535	3535
	uplifting force	Pa	kN/num	-1865	-1865	-3092	-1865	-1865	-1865
	stress(SKY400)	Sig.a	N/mm²	140.00	161.00	175.00	210.00	140.00	161.00
	stress(SKY490)	Sig.a	N/mm²	185.00	212.75	231.25	277.50	185.00	212.75

note)Lm is elevation

item			unit	Seismic[W]	dyn Smax	dyn Mmax
working force		Vo	kN	118384.4	116430.6	116099.6
		Ho	kN	33957.8	30839.6	28637.3
		Mo	kN.m	585015.1	564659.0	590183.0
foundation crest	displacement	Del.1	cm	2.680	2.435	2.386
	deflexion angle	Theta.1	mrad	-1.986	-1.847	-1.848
design ground surface	displacement	Del.2	cm	2.680	2.435	2.386
	deflexion angle	Theta.2	mrad	-1.986	-1.847	-1.848
celler part maximum bending moment		Mmax	kN.m	-710854.0	-673577.0	-684630.0
Mmax accrue location		Lm	m	-17.100	-16.600	-16.300
stress	periphery sheet pile(SKY400)	Sigmax	N/mm²	135.89	128.66	127.77
		Lm	m	-31.600	-31.600	-31.600
	periphery sheet pile(SKY490)	Sigmax	N/mm²	161.60	154.87	156.50
		Lm	m	-17.100	-16.600	-16.300
	separation wall sheet pile(SKY400)	Sigmax	N/mm²	145.36	139.49	140.85
		Lm	m	-17.100	-16.600	-16.300
	separation wall sheet pile(SKY490)	Sigmax	N/mm²	--------	--------	--------
		Lm	m	--------	--------	--------
	intermediate driven pile (SKK400)	Sig.max	N/mm²	--------	--------	--------
	intermediate driven pile (SKK490)	Sig.max	N/mm²	--------	--------	--------
celler partbottom bending moment		MB	kN.m	25513.0	22998.0	22801.0
vertical reaction	maximum	Rmax	kN/num	2607	2552	2544
	minimum	Rmin	kN/num	2326	2299	2293
allowable value	displacement	Del.a	cm	5.000	5.000	5.000
	compressive bearing capacity	Ra	kN/num	5267	5267	5267
	uplifting force	Pa	kN/num	-3092	-3092	-3092
	stress(SKY400)	Sig.a	N/mm²	210.00	210.00	210.00
	stress(SKY490)	Sig.a	N/mm²	277.50	277.50	277.50

note)Lm is elevation

2)perpendicular direction

item			unit	Reg HWL [W]	Reg LWL [W]	wind[W]	vessel[W]	seismic[W]	dyn Smax	dyn Mmax
working force		Vo	kN	115432.2	131272.9	115432.2	118484.4	115142.0	114821.7	115142.0
		Ho	kN	100.0	100.0	9800.0	27972.5	-20268.8	2253.6	-20217.6
		Mo	kN.m	34250.0	34250.0	161320.0	577239.2	-439530.0	83880.0	-440242.0
foundation crest	displacement	Del.1	cm	0.068	0.753	2.262	-1.471	0.068	0.259	-1.470
	deflexion angle	Theta.1	mrad	-0.051	-0.411	-1.325	0.923	-0.051	-0.161	0.923
design ground surface	displacement	Del.2	cm	0.068	0.753	2.262	-1.471	0.068	0.259	-1.470
	deflexion angle	Theta.2	mrad	-0.051	-0.411	-1.325	0.923	-0.051	-0.161	0.923
celler part maximum bending moment		Mmax	kN.m	-34288.0	-34288.0	-205259.0	-708520.0	525810.0	-90274.0	526133.0
Mmax accrue location		Lm	m	-10.300	-10.300	-19.100	-18.700	-17.500	-15.100	-17.500
stress	periphery sheet pile(SKY400)	Sigma x	N/mm²	57.24	81.97	148.25	118.98	64.63	64.46	118.97
		Lm	m	-31.600	-31.600	-31.600	-31.600	-31.600	-31.600	-31.600
	periphery sheet pile(SKY490)	Sigma x	N/mm²	52.43	77.61	153.00	124.72	58.93	60.42	124.76
		Lm	m	-10.300	-19.100	-18.700	-17.500	-10.300	-15.100	-17.500
	separation wall sheet pile(SKY400)	Sigma x	N/mm²	55.14	64.41	90.16	78.21	62.53	57.67	78.21
		Lm	m	-31.600	-31.600	-31.600	-31.600	-31.600	-31.600	-31.600
	separation wall sheet pile(SKY490)	Sigma x	N/mm²	--------	--------	--------	--------	--------	--------	--------
		Lm	m	--------	--------	--------	--------	--------	--------	--------
	intermediate driven pile (SKK400)	Sig.max	N/mm²	--------	--------	--------	--------	--------	--------	--------
	intermediate driven pile (SKK490)	Sig.max	N/mm²	--------	--------	--------	--------	--------	--------	--------
celler partbottom bending moment		MB	kN.m	1143.0	1143.0	3465.0	31306.0	-24614.0	2387.0	-24638.0
vertical reaction	maximum	Rmax	kN/num	2410	2422	2623	2520	2740	2404	2520
	minimum	Rmin	kN/num	2399	2388	2314	2277	2729	2380	2277
allowable value	displacement	Del.a	cm	5.000	5.000	5.000	5.000	5.000	5.000	5.000
	compressive bearing capacity	Ra	kN/num	3535	3535	5267	5267	3535	5267	5267
	uplifting force	Pa	kN/num	-1865	-1865	-3092	-3092	-1865	-3092	-3092
	stress(SKY400)	Sig.a	N/mm²	140.00	210.00	210.00	210.00	140.00	175.00	210.00
	stress(SKY490)	Sig.a	N/mm²	185.00	277.50	277.50	277.50	185.00	231.25	277.50

note)Lm is elevation

3.1.10 detail output

(1)bridge axis direction

1)RegularHWL[W]

working force	vertical force	Vo	kN	115432.2
	horizontal force	Ho	kN	4700.0
	moment	Mo	kN.m	105750.0
calcu lation kh	standard displacement	Del.o	cm	5.000
	assumed displacement	Del.1	cm	1.000
	calculation displacement	Del.	cm	0.409

if Del.< 1.000 cm, let Del.1 = 1.000 cm

No	standardKH1(kN/m³)	calculation KH1(kN/m³)
1	4955	11080
2	4955	11080
3	6003	13423
4	4669	10440
5	4669	10440
6	16675	37286
7	12006	26846
8	20010	44744
9	33350	74573

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-9.100	0.409	-0.319	-4700.0	-105750.0	64.19	61.77	
-10.300	0.371	-0.304	-3517.3	-110669.0	64.97	62.44	
-11.500	0.336	-0.290	-2445.3	-114235.7	65.54	62.93	
-12.700	0.302	-0.274	-1478.8	-116579.9	65.91	63.25	
-13.900	0.270	-0.259	-612.2	-117824.8	66.11	63.42	
-14.100	0.265	-0.256	-477.1	-117933.7	66.12	63.43	
-15.100	0.240	-0.244	160.2	-118086.9	66.15	63.45	*
-15.420	0.232	-0.239	350.9	-118004.9	66.14	63.44	
-16.300	0.211	-0.228	843.8	-117475.9	66.05	63.37	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm^2)	separation wall Sig.(N/mm^2)	Mmax
-16.600	0.205	-0.224	1001.5	-117199.0	66.01	63.33	
-17.100	0.194	-0.218	1253.1	-116634.7	65.92	63.25	
-17.500	0.185	-0.213	1444.4	-116094.9	65.83	63.18	
-18.700	0.160	-0.198	1967.6	-114040.3	65.51	62.90	
-19.100	0.152	-0.193	2125.7	-113221.4	65.38	62.79	
-19.900	0.137	-0.183	2418.8	-111401.5	65.09	62.54	
-20.460	0.127	-0.176	2606.2	-109993.9	64.86	62.35	
-21.100	0.116	-0.168	2845.1	-108248.3	64.59	62.11	
-22.300	0.097	-0.154	3236.8	-104592.0	64.00	61.61	
-22.490	0.094	-0.152	3292.4	-103971.7	63.91	61.53	
-23.500	0.079	-0.141	3500.8	-100538.1	63.36	61.06	
-24.700	0.063	-0.128	3704.1	-96210.5	62.67	60.47	
-25.420	0.054	-0.121	3804.7	-93506.4	62.24	60.10	
-25.900	0.049	-0.116	3863.5	-91665.8	61.95	59.85	
-27.100	0.035	-0.104	3983.1	-86954.0	61.20	59.21	
-28.300	0.024	-0.093	4067.1	-82120.5	60.43	58.55	
-29.500	0.013	-0.082	4119.2	-77205.7	59.65	57.89	
-30.700	0.004	-0.073	4143.0	-72245.8	58.86	57.21	
-31.600	-0.002	-0.066	4144.3	-68515.6	58.27	56.70	
-31.600	-0.002	-0.066	4144.3	-68515.6	66.36	64.56	
-31.900	-0.004	-0.063	4141.8	-67272.6	66.13	64.36	
-33.100	-0.011	-0.053	4119.0	-62314.1	65.23	63.59	
-34.300	-0.017	-0.044	4077.9	-57394.3	64.33	62.82	
-35.500	-0.022	-0.036	4021.6	-52533.1	63.45	62.07	
-36.700	-0.026	-0.028	3953.0	-47747.3	62.58	61.32	
-37.900	-0.029	-0.021	3874.6	-43049.9	61.72	60.59	
-39.100	-0.031	-0.015	3788.8	-38451.2	60.88	59.87	
-40.300	-0.033	-0.010	3697.7	-33958.9	60.06	59.17	
-41.480	-0.033	-0.005	3604.8	-29650.1	59.28	58.50	
-41.500	-0.033	-0.005	3599.1	-29578.1	59.27	58.49	
-42.700	-0.034	-0.001	3255.5	-25464.9	58.52	57.85	
-43.900	-0.034	0.003	2910.7	-21765.3	57.84	57.27	
-44.470	-0.033	0.004	2747.8	-20152.8	57.55	57.02	
-45.100	-0.033	0.006	2619.1	-18462.2	57.24	56.75	
-46.300	-0.032	0.008	2378.2	-15464.5	56.69	56.29	
-47.500	-0.031	0.010	2144.5	-12751.7	56.20	55.86	
-48.700	-0.030	0.012	1919.9	-10314.1	55.76	55.48	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-49.900	-0.028	0.014	1706.1	-8139.6	55.36	55.15	
-51.100	-0.027	0.015	1504.2	-6214.7	55.01	54.85	
-52.300	-0.025	0.015	1315.1	-4524.4	54.70	54.58	
-53.500	-0.023	0.016	1139.7	-3052.9	54.43	54.35	
-54.700	-0.021	0.016	978.3	-1783.6	54.20	54.15	
-55.900	-0.019	0.017	831.4	-699.2	54.00	53.99	
-57.100	-0.017	0.017	699.0	217.5	53.92	53.91	
-58.300	-0.015	0.016	581.3	984.2	54.06	54.03	
-59.500	-0.013	0.016	478.1	1618.4	54.17	54.13	
-60.480	-0.011	0.016	404.5	2050.1	54.25	54.20	
-60.700	-0.011	0.016	379.1	2136.3	54.27	54.21	
-61.900	-0.009	0.016	254.6	2514.2	54.33	54.27	
-63.100	-0.007	0.015	153.1	2756.6	54.38	54.31	
-64.300	-0.006	0.015	74.0	2890.6	54.40	54.33	
-65.500	-0.004	0.014	16.7	2942.9	54.41	54.34	
-66.700	-0.002	0.014	-19.4	2939.2	54.41	54.34	
-67.450	-0.001	0.014	-31.6	2919.5	54.41	54.33	
-67.900	0.000	0.013	-37.4	2903.8	54.41	54.33	
-69.100	0.001	0.013	-30.5	2859.9	54.40	54.32	

design ground surface displacement

elevation (m)	Del.(cm)	Theta(mrad)	Del.a(cm)
-9.100	0.409	-0.319	5.000

maximum stress

	Sig.(N/mm²)	elevation(m)
periphery sheet pile (SKY400)	66.36	-31.600
periphery sheet pile (SKY490)	66.15	-15.100
separation wall sheet pile (SKY400)	64.56	-31.600
separation wall sheet pile (SKY490)	------	--------

vertical reaction

$$R = \frac{Vo*Ao1}{\Sigma(ni*Aoi)} +/- \frac{(MB*Ao1)*xi}{\Sigma(IBi*Aoi)}$$

MB = 2859.9 (kN.m)
Sum(ni*Aoi) = 2.143 (m^2)
Sum(IBi*Aoi) = 52.382 (m^4)
periphery n1 = 40 (number) IB1 = 1086.85 (m^2) Ao1 = 0.0446 (m^2/number)
separation wall n1 = 8 (number) IB1 = 86.70 (m^2) Ao1 = 0.0446 (m^2/number)
intermediate drive n1 = 0 (number) IB1 = 0.00 (m^2) Ao1 = 0.0000 (m^2/number)
x = 6.465
maximum Rmax = 2421 (kN/number)
minimum Rmin = 2389 (kN/number)

2)RegularLWL[W]

working force	vertical force	Vo	kN	131272.9
	horizontal force	Ho	kN	2200.0
	moment	Mo	kN.m	49500.0
calcu lation kh	standard displacement	Del.o	cm	5.000
	assumed displacement	Del.1	cm	1.000
	calculation displacement	Del.	cm	0.191

if Del.< 1.000 cm, let Del.1 = 1.000 cm

No	standardKH1(kN/m^3)	calculation KH1(kN/m^3)
1	4955	11080
2	4955	11080
3	6003	13423
4	4669	10440
5	4669	10440
6	16675	37286
7	12006	26846
8	20010	44744
9	33350	74573

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm^2)	separation wall Sig.(N/mm^2)	Mmax
-9.100	0.191	-0.149	-2200.0	-49500.0	61.75	60.62	
-10.300	0.174	-0.142	-1646.4	-51802.5	62.11	60.93	
-11.500	0.157	-0.136	-1144.6	-53472.1	62.38	61.16	
-12.700	0.141	-0.128	-692.2	-54569.3	62.55	61.31	
-13.900	0.126	-0.121	-286.5	-55152.0	62.64	61.38	
-14.100	0.124	-0.120	-223.3	-55203.0	62.65	61.39	
-15.100	0.112	-0.114	75.0	-55274.7	62.66	61.40	*
-15.420	0.109	-0.112	164.2	-55236.3	62.66	61.40	
-16.300	0.099	-0.107	395.0	-54988.7	62.62	61.36	
-16.600	0.096	-0.105	468.8	-54859.1	62.60	61.34	
-17.100	0.091	-0.102	586.6	-54595.0	62.56	61.31	
-17.500	0.087	-0.100	676.1	-54342.3	62.52	61.27	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm^2)	separation wall Sig.(N/mm^2)	Mmax
-18.700	0.075	-0.093	921.0	-53380.6	62.36	61.14	
-19.100	0.071	-0.090	995.0	-52997.2	62.30	61.09	
-19.900	0.064	-0.086	1132.2	-52145.4	62.17	60.98	
-20.460	0.060	-0.082	1219.9	-51486.5	62.06	60.89	
-21.100	0.054	-0.079	1331.8	-50669.4	61.93	60.77	
-22.300	0.045	-0.072	1515.1	-48958.0	61.66	60.54	
-22.490	0.044	-0.071	1541.1	-48667.6	61.61	60.50	
-23.500	0.037	-0.066	1638.7	-47060.4	61.36	60.28	
-24.700	0.030	-0.060	1733.8	-45034.7	61.04	60.01	
-25.420	0.025	-0.056	1780.9	-43768.9	60.83	59.83	
-25.900	0.023	-0.054	1808.4	-42907.4	60.70	59.72	
-27.100	0.017	-0.049	1864.4	-40701.9	60.35	59.42	
-28.300	0.011	-0.043	1903.7	-38439.4	59.99	59.11	
-29.500	0.006	-0.039	1928.1	-36138.9	59.62	58.80	
-30.700	0.002	-0.034	1939.3	-33817.2	59.25	58.48	
-31.600	-0.001	-0.031	1939.9	-32071.1	58.98	58.24	
-31.600	-0.001	-0.031	1939.9	-32071.1	67.11	66.27	
-31.900	-0.002	-0.030	1938.7	-31489.3	67.01	66.18	
-33.100	-0.005	-0.025	1928.1	-29168.3	66.58	65.82	
-34.300	-0.008	-0.021	1908.8	-26865.4	66.17	65.46	
-35.500	-0.010	-0.017	1882.5	-24590.0	65.75	65.10	
-36.700	-0.012	-0.013	1850.3	-22349.8	65.34	64.75	
-37.900	-0.014	-0.010	1813.6	-20151.0	64.94	64.41	
-39.100	-0.015	-0.007	1773.5	-17998.4	64.55	64.08	

-40.300	-0.015	-0.005	1730.8	-15895.6	64.17	63.75	
-41.480	-0.016	-0.002	1687.4	-13878.8	63.80	63.43	
-41.500	-0.016	-0.002	1684.7	-13845.0	63.79	63.43	
-42.700	-0.016	0.000	1523.8	-11919.7	63.44	63.13	
-43.900	-0.016	0.001	1362.4	-10188.0	63.13	62.86	
-44.470	-0.016	0.002	1286.2	-9433.2	62.99	62.74	
-45.100	-0.016	0.003	1226.0	-8641.9	62.84	62.62	
-46.300	-0.015	0.004	1113.2	-7238.7	62.59	62.40	
-47.500	-0.015	0.005	1003.8	-5968.9	62.36	62.20	
-48.700	-0.014	0.006	898.7	-4827.9	62.15	62.02	
-49.900	-0.013	0.006	798.6	-3810.0	61.96	61.86	
-51.100	-0.012	0.007	704.1	-2909.0	61.80	61.72	
-52.300	-0.012	0.007	615.6	-2117.8	61.66	61.60	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-53.500	-0.011	0.007	533.5	-1429.0	61.53	61.49	
-54.700	-0.010	0.008	457.9	-834.9	61.42	61.40	
-55.900	-0.009	0.008	389.2	-327.3	61.33	61.32	
-57.100	-0.008	0.008	327.2	101.8	61.29	61.29	
-58.300	-0.007	0.008	272.1	460.7	61.35	61.34	
-59.500	-0.006	0.008	223.8	757.6	61.41	61.39	
-60.480	-0.005	0.008	189.3	959.6	61.45	61.42	
-60.700	-0.005	0.007	177.5	1000.0	61.45	61.43	
-61.900	-0.004	0.007	119.2	1176.9	61.48	61.45	
-63.100	-0.003	0.007	71.7	1290.3	61.51	61.47	
-64.300	-0.003	0.007	34.6	1353.0	61.52	61.48	
-65.500	-0.002	0.007	7.8	1377.5	61.52	61.49	
-66.700	-0.001	0.007	-9.1	1375.8	61.52	61.48	
-67.450	-0.001	0.006	-14.8	1366.6	61.52	61.48	
-67.900	0.000	0.006	-17.5	1359.2	61.52	61.48	
-69.100	0.001	0.006	-14.3	1338.7	61.51	61.48	

design ground surface displacement

elevation (m)	Del.(cm)	Theta(mrad)	Del.a(cm)
-9.100	0.191	-0.149	5.000

maximum stress

	Sig.(N/mm^2)	elevation(m)
periphery sheet pile (SKY400)	67.11	-31.600
periphery sheet pile (SKY490)	62.66	-15.100
separation wall sheet pile (SKY400)	66.27	-31.600
separation wall sheet pile (SKY490)	------	--------

vertical reaction

$$R = \frac{Vo*Ao1}{\Sigma(ni*Aoi)} + / - \frac{(MB*Ao1)*xi}{\Sigma(IBi*Aoi)}$$

MB = 1338.7 (kN.m)

Sum(ni*Aoi) = 2.143 (m^2)

Sum(IBi*Aoi) = 52.382 (m^4)

periphery n1 = 40 (number) IB1 = 1086.85 (m^2) Ao1 = 0.0446 (m^2/number)

separation wall n1 = 8 (number) IB1 = 86.70 (m^2) Ao1 = 0.0446 (m^2/number)

intermediate drive n1 = 0 (number) IB1 = 0.00 (m^2) Ao1 = 0.0000 (m^2/number)

x = 6.465

maximum Rmax = 2742 (kN/number)

minimum Rmin = 2727 (kN/number)

3)Temp.HWL[W]

working force	vertical force	Vo	kN	115132.2
	horizontal force	Ho	kN	9300.0
	moment	Mo	kN.m	209250.0
calcu lation kh	standard displacement	Del.o	cm	5.000
	assumed displacement	Del.1	cm	1.000
	calculation displacement	Del.	cm	0.809

if Del.< 1.000 cm, let Del.1 = 1.000 cm

No	standardKH1(kN/m³)	calculation KH1(kN/m³)
1	4955	11080
2	4955	11080
3	6003	13423
4	4669	10440
5	4669	10440
6	16675	37286
7	12006	26846
8	20010	44744
9	33350	74573

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-9.100	0.809	-0.630	-9300.0	-209250.0	80.52	75.74	
-10.300	0.735	-0.602	-6959.7	-218983.4	82.07	77.06	
-11.500	0.664	-0.573	-4838.6	-226040.9	83.19	78.03	
-12.700	0.597	-0.543	-2926.1	-230679.5	83.93	78.66	
-13.900	0.534	-0.513	-1211.3	-233142.7	84.32	78.99	
-14.100	0.524	-0.507	-944.0	-233358.1	84.35	79.02	
-15.100	0.474	-0.482	316.9	-233661.2	84.40	79.06	*
-15.420	0.459	-0.474	694.3	-233499.1	84.38	79.04	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-16.300	0.418	-0.451	1669.7	-232452.3	84.21	78.90	
-16.600	0.405	-0.444	1981.7	-231904.4	84.12	78.82	
-17.100	0.383	-0.431	2479.5	-230787.9	83.94	78.67	
-17.500	0.366	-0.421	2858.1	-229719.8	83.77	78.53	
-18.700	0.317	-0.391	3893.3	-225654.2	83.13	77.97	
-19.100	0.302	-0.381	4206.2	-224033.8	82.87	77.75	
-19.900	0.272	-0.362	4786.1	-220432.8	82.30	77.26	
-20.460	0.252	-0.348	5157.0	-217647.4	81.86	76.88	
-21.100	0.230	-0.333	5629.7	-214193.4	81.31	76.41	
-22.300	0.192	-0.306	6404.8	-206958.6	80.16	75.43	
-22.490	0.186	-0.301	6514.8	-205731.2	79.96	75.26	
-23.500	0.157	-0.279	6927.2	-198937.1	78.88	74.34	
-24.700	0.125	-0.253	7329.5	-190374.0	77.52	73.17	
-25.420	0.107	-0.239	7528.5	-185023.3	76.67	72.44	
-25.900	0.096	-0.229	7644.8	-181381.2	76.09	71.95	
-27.100	0.070	-0.206	7881.5	-172057.9	74.61	70.68	
-28.300	0.047	-0.184	8047.6	-162493.7	73.09	69.37	
-29.500	0.026	-0.163	8150.7	-152768.8	71.54	68.05	
-30.700	0.007	-0.144	8197.8	-142954.5	69.98	66.71	
-31.600	-0.005	-0.130	8200.3	-135573.4	68.81	65.71	
-31.600	-0.005	-0.130	8200.3	-135573.4	78.44	74.87	
-31.900	-0.009	-0.125	8195.5	-133113.9	77.99	74.48	
-33.100	-0.022	-0.105	8150.4	-123302.4	76.20	72.96	
-34.300	-0.034	-0.088	8069.1	-113567.4	74.43	71.44	
-35.500	-0.044	-0.071	7957.7	-103948.6	72.68	69.94	
-36.700	-0.051	-0.056	7821.9	-94478.6	70.95	68.46	
-37.900	-0.057	-0.043	7666.7	-85183.8	69.26	67.01	

-39.100	-0.061	-0.030	7497.0	-76084.3	67.60	65.60	
-40.300	-0.064	-0.020	7316.8	-67195.2	65.98	64.21	
-41.480	-0.066	-0.010	7133.0	-58669.4	64.43	62.88	
-41.500	-0.066	-0.010	7121.7	-58526.8	64.40	62.86	
-42.700	-0.067	-0.002	6441.7	-50388.0	62.92	61.59	
-43.900	-0.067	0.005	5759.4	-43067.6	61.58	60.45	
-44.470	-0.066	0.008	5437.1	-39876.7	61.00	59.95	
-45.100	-0.066	0.011	5182.5	-36531.6	60.39	59.43	
-46.300	-0.064	0.016	4705.7	-30599.9	59.31	58.51	
-47.500	-0.062	0.021	4243.3	-25232.1	58.33	57.67	
-48.700	-0.059	0.024	3799.0	-20408.7	57.46	56.92	
-49.900	-0.056	0.027	3375.9	-16106.0	56.67	56.25	
-51.100	-0.053	0.029	2976.3	-12297.1	55.98	55.65	
-52.300	-0.049	0.031	2602.3	-8952.6	55.37	55.13	
elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-53.500	-0.045	0.032	2255.1	-6040.9	54.84	54.68	
-54.700	-0.042	0.032	1935.8	-3529.2	54.38	54.29	
-55.900	-0.038	0.033	1645.0	-1383.6	53.99	53.95	
-57.100	-0.034	0.033	1383.2	430.4	53.82	53.80	
-58.300	-0.030	0.033	1150.2	1947.5	54.09	54.04	
-59.500	-0.026	0.032	946.0	3202.4	54.32	54.24	
-60.480	-0.023	0.032	800.4	4056.6	54.48	54.37	
-60.700	-0.022	0.032	750.2	4227.1	54.51	54.40	
-61.900	-0.018	0.031	503.8	4974.9	54.64	54.51	
-63.100	-0.015	0.030	302.9	5454.5	54.73	54.59	
-64.300	-0.011	0.029	146.4	5719.7	54.78	54.63	
-65.500	-0.008	0.028	33.1	5823.2	54.80	54.64	
-66.700	-0.004	0.028	-38.5	5815.8	54.80	54.64	
-67.450	-0.002	0.027	-62.5	5777.0	54.79	54.64	
-67.900	-0.001	0.027	-74.1	5745.9	54.78	54.63	
-69.100	0.002	0.026	-60.3	5658.9	54.77	54.62	

design ground surface displacement

elevation (m)	Del.(cm)	Theta(mrad)	Del.a(cm)
-9.100	0.809	-0.630	5.000

maximum stress

	Sig.(N/mm²)	elevation(m)
periphery sheet pile (SKY400)	78.44	-31.600
periphery sheet pile (SKY490)	84.40	-15.100
separation wall sheet pile (SKY400)	79.06	-15.100
separation wall sheet pile (SKY490)	------	--------

vertical reaction

$$R = \frac{Vo*Ao1}{\Sigma(ni*Aoi)} + / - \frac{(MB*Ao1)*xi}{\Sigma(IBi*Aoi)}$$

MB = 5658.9 (kN.m)

Sum(ni*Aoi) = 2.143 (m^2)

Sum(IBi*Aoi) = 52.382 (m^4)

periphery n1 = 40 (number) IB1 = 1086.85 (m^2) Ao1 = 0.0446 (m^2/number)

separation wall n1 = 8 (number) IB1 = 86.70 (m^2) Ao1 = 0.0446 (m^2/number)

intermediate drive n1 = 0 (number) IB1 = 0.00 (m^2) Ao1 = 0.0000 (m^2/number)

x = 6.465

maximum Rmax = 2430 (kN/number)

minimum Rmin = 2367 (kN/number)

4)Temp.LWL[W]

working force	vertical force	Vo	kN	131372.9
	horizontal force	Ho	kN	6800.0
	moment	Mo	kN.m	153000.0
calculation kh	standard displacement	Del.o	cm	5.000
	assumed displacement	Del.1	cm	1.000
	calculation displacement	Del.	cm	0.591

if Del.< 1.000 cm, let Del.1 = 1.000 cm

No	standardKH1(kN/m³)	calculation KH1(kN/m³)
1	4955	11080
2	4955	11080

3	6003	13423
4	4669	10440
5	4669	10440
6	16675	37286
7	12006	26846
8	20010	44744
9	33350	74573

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-9.100	0.591	-0.461	-6800.0	-153000.0	78.24	74.75	
-10.300	0.537	-0.440	-5088.8	-160116.9	79.37	75.72	
-11.500	0.486	-0.419	-3537.9	-165277.3	80.19	76.42	
-12.700	0.437	-0.397	-2139.5	-168668.8	80.73	76.88	
-13.900	0.390	-0.375	-885.7	-170469.9	81.02	77.13	
-14.100	0.383	-0.371	-690.2	-170627.5	81.04	77.15	
-15.100	0.347	-0.352	231.7	-170849.1	81.08	77.18	*
-15.420	0.336	-0.346	507.7	-170730.5	81.06	77.16	
-16.300	0.306	-0.330	1220.8	-169965.1	80.94	77.06	
-16.600	0.296	-0.324	1449.0	-169564.5	80.88	77.00	
-17.100	0.280	-0.315	1813.0	-168748.1	80.75	76.89	
-17.500	0.268	-0.308	2089.8	-167967.2	80.62	76.78	
-18.700	0.232	-0.286	2846.7	-164994.4	80.15	76.38	
-19.100	0.221	-0.279	3075.5	-163809.6	79.96	76.22	
-19.900	0.199	-0.265	3499.5	-161176.7	79.54	75.86	
-20.460	0.184	-0.255	3770.7	-159140.1	79.22	75.58	
-21.100	0.168	-0.244	4116.3	-156614.5	78.82	75.24	
-22.300	0.140	-0.223	4683.1	-151324.6	77.98	74.52	
-22.490	0.136	-0.220	4763.5	-150427.1	77.83	74.40	

-23.500	0.115	-0.204	5065.0	-145459.4	77.04	73.72	
-24.700	0.091	-0.185	5359.2	-139198.2	76.05	72.87	
-25.420	0.078	-0.174	5504.7	-135285.8	75.43	72.34	
-25.900	0.070	-0.167	5589.7	-132622.8	75.00	71.97	
-27.100	0.051	-0.150	5762.8	-125805.8	73.92	71.04	
-28.300	0.034	-0.134	5884.3	-118812.6	72.81	70.09	
-29.500	0.019	-0.119	5959.6	-111701.9	71.68	69.12	
-30.700	0.005	-0.105	5994.1	-104525.8	70.54	68.15	
-31.600	-0.004	-0.095	5995.9	-99128.9	69.68	67.41	
-31.600	-0.004	-0.095	5995.9	-99128.9	79.38	76.77	
-31.900	-0.006	-0.091	5992.4	-97330.6	79.05	76.49	
-33.100	-0.016	-0.077	5959.4	-90156.6	77.74	75.37	
-34.300	-0.025	-0.064	5900.0	-83038.5	76.45	74.26	
-35.500	-0.032	-0.052	5818.5	-76005.4	75.17	73.16	
-36.700	-0.037	-0.041	5719.2	-69081.1	73.90	72.08	
-37.900	-0.042	-0.031	5605.8	-62284.9	72.67	71.03	
-39.100	-0.045	-0.022	5481.7	-55631.5	71.45	69.99	
-40.300	-0.047	-0.014	5349.9	-49132.0	70.27	68.98	
-41.480	-0.048	-0.007	5215.5	-42898.1	69.13	68.00	
-41.500	-0.048	-0.007	5207.3	-42793.8	69.11	67.99	
-42.700	-0.049	-0.001	4710.1	-36842.9	68.03	67.06	
-43.900	-0.049	0.004	4211.2	-31490.3	67.05	66.23	
-44.470	-0.048	0.006	3975.5	-29157.2	66.63	65.86	
-45.100	-0.048	0.008	3789.3	-26711.3	66.18	65.48	
-46.300	-0.047	0.012	3440.7	-22374.1	65.39	64.80	
-47.500	-0.045	0.015	3102.6	-18449.3	64.68	64.19	
-48.700	-0.043	0.018	2777.8	-14922.5	64.04	63.64	
-49.900	-0.041	0.020	2468.4	-11776.4	63.46	63.15	
-51.100	-0.039	0.021	2176.2	-8991.4	62.96	62.72	
-52.300	-0.036	0.022	1902.7	-6546.0	62.51	62.34	
elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-53.500	-0.033	0.023	1648.9	-4417.0	62.12	62.01	
-54.700	-0.030	0.024	1415.4	-2580.5	61.79	61.72	
-55.900	-0.027	0.024	1202.8	-1011.7	61.50	61.47	
-57.100	-0.025	0.024	1011.3	314.7	61.37	61.37	
-58.300	-0.022	0.024	841.0	1424.0	61.58	61.54	

-59.500	-0.019	0.024	691.7	2341.5	61.74	61.68	
-60.480	-0.017	0.023	585.2	2966.1	61.86	61.78	
-60.700	-0.016	0.023	548.5	3090.8	61.88	61.80	
-61.900	-0.013	0.023	368.4	3637.6	61.98	61.88	
-63.100	-0.011	0.022	221.5	3988.2	62.04	61.94	
-64.300	-0.008	0.021	107.1	4182.1	62.08	61.97	
-65.500	-0.006	0.021	24.2	4257.8	62.09	61.98	
-66.700	-0.003	0.020	-28.1	4252.4	62.09	61.98	
-67.450	-0.002	0.020	-45.7	4224.0	62.09	61.98	
-67.900	-0.001	0.020	-54.2	4201.3	62.08	61.97	
-69.100	0.002	0.019	-44.1	4137.7	62.07	61.96	

design ground surface displacement

elevation (m)	Del.(cm)	Theta(mrad)	Del.a(cm)
-9.100	0.591	-0.461	5.000

maximum stress

	Sig.(N/mm²)	elevation(m)
periphery sheet pile (SKY400)	79.38	-31.600
periphery sheet pile (SKY490)	81.08	-15.100
separation wall sheet pile (SKY400)	77.18	-15.100
separation wall sheet pile (SKY490)	------	--------

vertical reaction

$$R = \frac{Vo*Ao1}{\Sigma(ni*Aoi)} +/- \frac{(MB*Ao1)*xi}{\Sigma(IBi*Aoi)}$$

MB = 4137.7 (kN.m)

Sum(ni*Aoi) = 2.143 (m^2)

Sum(IBi*Aoi) = 52.382 (m^4)

periphery n1 = 40 (number) IB1 = 1086.85 (m^2) Ao1 = 0.0446 (m^2/number)

separation wall n1 = 8 (number) IB1 = 86.70 (m^2) Ao1 = 0.0446 (m^2/number)

intermediate drive n1 = 0 (number) IB1 = 0.00 (m^2) Ao1 = 0.0000 (m^2/number)

x = 6.465

maximum Rmax = 2760 (kN/number)

minimum Rmin = 2714 (kN/number)

5)Wind[W]

working force	vertical force	Vo	kN	114821.7
	horizontal force	Ho	kN	1285.4
	moment	Mo	kN.m	28173.5
calcu lation kh	standard displacement	Del.o	cm	5.000
	assumed displacement	Del.1	cm	1.000
	calculation displacement	Del.	cm	0.110

if Del.< 1.000 cm, let Del.1 = 1.000 cm

No	standardKH1(kN/m^3)	calculation KH1(kN/m^3)
1	4955	11080
2	4955	11080
3	6003	13423
4	4669	10440
5	4669	10440
6	16675	37286
7	12006	26846
8	20010	44744
9	33350	74573

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm^2)	separation wall Sig.(N/mm^2)	Mmax
-9.100	0.110	-0.086	-1285.4	-28173.5	51.60	50.96	
-10.300	0.100	-0.082	-966.3	-29521.5	51.82	51.14	
-11.500	0.091	-0.078	-677.0	-30504.6	51.97	51.28	
-12.700	0.082	-0.074	-416.1	-31157.7	52.08	51.37	
-13.900	0.073	-0.070	-182.0	-31513.9	52.13	51.41	
-14.100	0.072	-0.069	-145.5	-31546.7	52.14	51.42	
-15.100	0.065	-0.066	26.8	-31604.6	52.15	51.43	*
-15.420	0.063	-0.064	78.4	-31587.7	52.15	51.42	
-16.300	0.057	-0.061	211.7	-31459.2	52.13	51.41	
-16.600	0.055	-0.060	254.3	-31389.3	52.11	51.40	
-17.100	0.052	-0.059	322.4	-31244.9	52.09	51.38	
-17.500	0.050	-0.057	374.2	-31105.5	52.07	51.36	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm^2)	separation wall Sig.(N/mm^2)	Mmax
-18.700	0.043	-0.053	515.9	-30569.4	51.98	51.29	
-19.100	0.041	-0.052	558.8	-30354.4	51.95	51.26	
-19.900	0.037	-0.049	638.2	-29875.0	51.87	51.19	
-20.460	0.035	-0.047	689.1	-29503.2	51.82	51.14	
-21.100	0.032	-0.045	754.0	-29041.1	51.74	51.08	
-22.300	0.026	-0.042	860.4	-28070.6	51.59	50.95	
-22.490	0.026	-0.041	875.5	-27905.7	51.56	50.92	
-23.500	0.022	-0.038	932.3	-26991.9	51.42	50.80	
-24.700	0.017	-0.035	987.7	-25838.7	51.23	50.64	
-25.420	0.015	-0.033	1015.3	-25117.3	51.12	50.54	
-25.900	0.013	-0.031	1031.3	-24626.1	51.04	50.48	
-27.100	0.010	-0.028	1064.2	-23367.7	50.84	50.31	
-28.300	0.007	-0.025	1087.5	-22075.8	50.63	50.13	
-29.500	0.004	-0.022	1102.1	-20761.2	50.43	49.95	
-30.700	0.001	-0.020	1109.1	-19433.7	50.21	49.77	
-31.600	0.000	-0.018	1109.9	-18434.9	50.06	49.63	
-31.600	0.000	-0.018	1109.9	-18434.9	56.95	56.47	
-31.900	-0.001	-0.017	1109.4	-18102.0	56.89	56.41	
-33.100	-0.003	-0.014	1103.7	-16773.6	56.65	56.21	
-34.300	-0.004	-0.012	1093.1	-15455.0	56.41	56.00	
-35.500	-0.006	-0.010	1078.4	-14151.7	56.17	55.80	
-36.700	-0.007	-0.008	1060.4	-12868.1	55.94	55.60	
-37.900	-0.008	-0.006	1039.6	-11607.9	55.71	55.40	
-39.100	-0.008	-0.004	1016.9	-10373.8	55.48	55.21	
-40.300	-0.009	-0.003	992.7	-9168.0	55.26	55.02	
-41.480	-0.009	-0.001	967.9	-8011.2	55.05	54.84	
-41.500	-0.009	-0.001	966.4	-7991.8	55.05	54.84	
-42.700	-0.009	0.000	874.8	-6887.0	54.85	54.67	
-43.900	-0.009	0.001	782.7	-5892.5	54.67	54.51	
-44.470	-0.009	0.001	739.2	-5458.8	54.59	54.44	
-45.100	-0.009	0.001	704.8	-5004.0	54.50	54.37	
-46.300	-0.009	0.002	640.4	-4197.0	54.36	54.25	
-47.500	-0.008	0.003	577.8	-3466.3	54.22	54.13	
-48.700	-0.008	0.003	517.7	-2809.3	54.10	54.03	
-49.900	-0.008	0.004	460.4	-2222.7	54.00	53.94	
-51.100	-0.007	0.004	406.2	-1703.1	53.90	53.86	
-52.300	-0.007	0.004	355.5	-1246.4	53.82	53.79	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-53.500	-0.006	0.004	308.4	-848.4	53.75	53.72	
-54.700	-0.006	0.004	265.1	-504.7	53.68	53.67	
-55.900	-0.005	0.004	225.6	-210.7	53.63	53.62	
-57.100	-0.005	0.004	190.0	38.2	53.60	53.60	
-58.300	-0.004	0.004	158.3	246.8	53.64	53.63	
-59.500	-0.004	0.004	130.5	419.7	53.67	53.66	
-60.480	-0.003	0.004	110.7	537.7	53.69	53.68	
-60.700	-0.003	0.004	103.8	561.3	53.69	53.68	
-61.900	-0.002	0.004	70.2	665.1	53.71	53.70	
-63.100	-0.002	0.004	42.8	732.3	53.73	53.71	
-64.300	-0.002	0.004	21.4	770.2	53.73	53.71	
-65.500	-0.001	0.004	5.8	785.9	53.74	53.71	
-66.700	-0.001	0.004	-4.1	786.4	53.74	53.71	
-67.450	0.000	0.004	-7.5	781.9	53.73	53.71	
-67.900	0.000	0.004	-9.2	778.1	53.73	53.71	
-69.100	0.000	0.004	-7.7	767.1	53.73	53.71	

design ground surface displacement

elevation (m)	Del.(cm)	Theta(mrad)	Del.a(cm)
-9.100	0.110	-0.086	5.000

maximum stress

	Sig.(N/mm²)	elevation(m)
periphery sheet pile (SKY400)	56.95	-31.600
periphery sheet pile (SKY490)	52.15	-15.100
separation wall sheet pile (SKY400)	56.47	-31.600
separation wall sheet pile (SKY490)	------	--------

vertical reaction

$$R = \frac{Vo*Ao1}{\Sigma(ni*Aoi)} +/- \frac{(MB*Ao1)*xi}{\Sigma(IBi*Aoi)}$$

MB = 767.1 (kN.m)
Sum(ni*Aoi) = 2.143 (m^2)
Sum(IBi*Aoi) = 52.382 (m^4)
periphery n1 = 40 (number) IB1 = 1086.85 (m^2) Ao1 = 0.0446 (m^2/number)
separation wall n1 = 8 (number) IB1 = 86.70 (m^2) Ao1 = 0.0446 (m^2/number)
intermediate drive n1 = 0 (number) IB1 = 0.00 (m^2) Ao1 = 0.0000 (m^2/number)
x = 6.465
maximum Rmax = 2396 (kN/number)
minimum Rmin = 2388 (kN/number)

6)Vessel Impact[W]

working force	vertical force	Vo	kN	115432.2
	horizontal force	Ho	kN	9550.0
	moment	Mo	kN.m	169285.0
calculation kh	standard displacement	Del.o	cm	5.000
	assumed displacement	Del.1	cm	1.000
	calculation displacement	Del.	cm	0.736

if Del.< 1.000 cm, let Del.1 = 1.000 cm

No	standardKH1(kN/m^3)	calculation KH1(kN/m^3)
1	4955	11080
2	4955	11080
3	6003	13423
4	4669	10440
5	4669	10440
6	16675	37286
7	12006	26846
8	20010	44744
9	33350	74573

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-9.100	0.736	-0.552	-9550.0	-169285.0	74.29	70.42	
-10.300	0.671	-0.529	-7415.2	-179444.4	75.90	71.80	
-11.500	0.609	-0.505	-5472.8	-187158.4	77.13	72.85	
-12.700	0.550	-0.480	-3714.3	-192652.8	78.00	73.60	
-13.900	0.494	-0.454	-2130.4	-196142.6	78.56	74.08	
-14.100	0.485	-0.450	-1882.8	-196543.8	78.62	74.13	
-15.100	0.441	-0.428	-711.9	-197831.9	78.83	74.31	
-15.420	0.428	-0.422	-360.4	-198003.2	78.85	74.33	*
-16.300	0.391	-0.402	550.6	-197913.6	78.84	74.32	
-16.600	0.380	-0.396	843.0	-197704.3	78.81	74.29	
-17.100	0.360	-0.385	1310.3	-197165.0	78.72	74.22	
-17.500	0.345	-0.377	1666.6	-196569.1	78.63	74.14	
elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-18.700	0.301	-0.351	2645.5	-193968.6	78.21	73.78	
-19.100	0.287	-0.342	2942.9	-192850.5	78.04	73.63	
-19.900	0.261	-0.326	3496.6	-190271.1	77.63	73.28	
-20.460	0.243	-0.314	3852.7	-188212.1	77.30	73.00	
-21.100	0.223	-0.301	4308.8	-185598.4	76.88	72.64	
-22.300	0.188	-0.277	5063.5	-179962.2	75.99	71.88	
-22.490	0.183	-0.273	5171.5	-178989.9	75.83	71.74	
-23.500	0.156	-0.254	5579.5	-173555.2	74.97	71.00	
-24.700	0.127	-0.231	5984.3	-166608.6	73.86	70.06	
-25.420	0.111	-0.218	6188.7	-162224.6	73.17	69.46	
-25.900	0.101	-0.210	6309.8	-159224.5	72.69	69.05	
-27.100	0.077	-0.190	6563.2	-151493.9	71.46	68.00	
-28.300	0.055	-0.170	6751.5	-143498.9	70.19	66.91	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-29.500	0.036	-0.152	6881.3	-135313.8	68.89	65.80	
-30.700	0.019	-0.135	6959.0	-127004.7	67.57	64.67	
-31.600	0.007	-0.123	6986.5	-120727.4	66.57	63.81	
-31.600	0.007	-0.123	6986.5	-120727.4	75.87	72.69	
-31.900	0.004	-0.118	6990.4	-118630.7	75.49	72.37	
-33.100	-0.010	-0.101	6981.3	-110244.0	73.96	71.06	
-34.300	-0.021	-0.085	6937.6	-101889.4	72.44	69.76	
-35.500	-0.030	-0.070	6864.9	-93605.3	70.93	68.47	
-36.700	-0.037	-0.056	6768.1	-85423.3	69.44	67.19	
-37.900	-0.044	-0.044	6652.0	-77369.4	67.97	65.94	
-39.100	-0.048	-0.033	6520.7	-69464.5	66.53	64.70	
-40.300	-0.051	-0.023	6378.1	-61724.2	65.12	63.50	
-41.480	-0.054	-0.014	6230.1	-54284.8	63.77	62.34	
-41.500	-0.054	-0.014	6221.0	-54160.2	63.74	62.32	
-42.700	-0.055	-0.007	5665.7	-47026.9	62.45	61.21	
-43.900	-0.055	0.000	5102.3	-40565.7	61.27	60.20	
-44.470	-0.055	0.003	4834.2	-37733.9	60.75	59.76	
-45.100	-0.055	0.006	4621.4	-34755.3	60.21	59.29	
-46.300	-0.054	0.011	4220.6	-29450.8	59.24	58.47	
-47.500	-0.052	0.015	3829.1	-24622.1	58.36	57.71	
-48.700	-0.051	0.018	3450.3	-20255.9	57.57	57.03	
-49.900	-0.048	0.021	3087.5	-16335.0	56.85	56.42	
-51.100	-0.046	0.023	2742.9	-12838.7	56.22	55.88	
-52.300	-0.043	0.025	2418.5	-9744.0	55.65	55.40	
-53.500	-0.040	0.026	2115.9	-7025.6	55.16	54.97	
-54.700	-0.036	0.027	1836.1	-4656.8	54.73	54.60	
-55.900	-0.033	0.027	1579.9	-2609.6	54.35	54.28	
-57.100	-0.030	0.028	1347.9	-855.3	54.03	54.01	
-58.300	-0.027	0.028	1140.2	635.1	53.99	53.98	
-59.500	-0.023	0.027	956.9	1891.0	54.22	54.17	
-60.480	-0.021	0.027	825.2	2762.9	54.38	54.31	
-60.700	-0.020	0.027	779.6	2939.4	54.41	54.34	
-61.900	-0.017	0.027	554.2	3735.7	54.56	54.46	
-63.100	-0.014	0.026	367.8	4285.0	54.66	54.54	
-64.300	-0.011	0.025	219.6	4633.7	54.72	54.60	

-65.500	-0.008	0.025	108.6	4827.0	54.76	54.63	
-66.700	-0.005	0.024	33.7	4908.8	54.77	54.64	
-67.450	-0.003	0.023	4.7	4922.4	54.77	54.64	
-67.900	-0.002	0.023	-13.5	4920.1	54.77	54.64	
-69.100	0.001	0.022	-23.4	4892.5	54.77	54.64	

design ground surface displacement

elevation (m)	Del.(cm)	Theta(mrad)	Del.a(cm)
-9.100	0.736	-0.552	5.000

maximum stress

	Sig.(N/mm²)	elevation(m)
periphery sheet pile (SKY400)	75.87	-31.600
periphery sheet pile (SKY490)	78.85	-15.420
separation wall sheet pile (SKY400)	74.33	-15.420
separation wall sheet pile (SKY490)	------	--------

vertical reaction

$$R = \frac{Vo*Ao1}{\Sigma(ni*Aoi)} + / - \frac{(MB*Ao1)*xi}{\Sigma(IBi*Aoi)}$$

MB = 4892.5 (kN.m)

Sum(ni*Aoi) = 2.143 (m^2)

Sum(IBi*Aoi) = 52.382 (m^4)

periphery n1 = 40 (number) IB1 = 1086.85 (m^2) Ao1 = 0.0446 (m^2/number)

separation wall n1 = 8 (number) IB1 = 86.70 (m^2) Ao1 = 0.0446 (m^2/number)

intermediate drive n1 = 0 (number) IB1 = 0.00 (m^2) Ao1 = 0.0000 (m^2/number)

x = 6.465

maximum Rmax = 2432 (kN/number)

minimum Rmin = 2378 (kN/number)

7)Seismic[W]

working force	vertical force	Vo	kN	118384.4
	horizontal force	Ho	kN	33957.8
	moment	Mo	kN.m	585015.1
calcu lation kh	standard displacement	Del. o	cm	5.000
	assumed displacement	Del. 1	cm	2.690
	calculation displacement	Del.	cm	2.680

convergence rate (Del.1 - Del.) / Del.1 = 0.38 (%) < 1.00 (%)

No	standardKH1(kN/m³)	calculation KH1(kN/m³)
1	6600	8998
2	9910	13511
3	12006	16369
4	9338	12731
5	9338	12731
6	33350	45468
7	24012	32737
8	40020	54562
9	66700	90936

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-9.100	2.680	-1.986	-33957.8	-585015.1	141.60	128.23	
-10.300	2.446	-1.907	-27645.2	-621919.3	147.46	133.26	
-11.500	2.222	-1.823	-21896.3	-651589.1	152.18	137.29	
-12.700	2.009	-1.736	-16686.4	-674686.0	155.85	140.44	
-13.900	1.806	-1.647	-11989.8	-691841.7	158.58	142.77	
-14.100	1.773	-1.631	-11255.1	-694165.9	158.95	143.09	
-15.100	1.614	-1.555	-7780.0	-703656.3	160.46	144.38	
-15.420	1.564	-1.530	-6736.1	-705977.9	160.83	144.70	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-16.300	1.433	-1.462	-2672.6	-710091.6	161.48	145.26	
-16.600	1.389	-1.439	-1367.9	-710696.6	161.58	145.34	
-17.100	1.318	-1.400	718.2	-710854.5	161.60	145.36	*
-17.500	1.263	-1.369	2309.3	-710246.7	161.51	145.28	
-18.700	1.104	-1.276	6683.6	-704792.3	160.64	144.54	
-19.100	1.054	-1.245	8013.7	-701850.8	160.17	144.14	
-19.900	0.956	-1.184	10491.4	-694432.8	158.99	143.13	
-20.460	0.891	-1.142	12086.1	-688105.8	157.99	142.27	
-21.100	0.820	-1.094	14130.5	-679707.4	156.65	141.12	
-22.300	0.694	-1.006	17518.7	-660661.4	153.62	138.53	
-22.490	0.675	-0.992	18004.3	-657286.5	153.09	138.07	
-23.500	0.578	-0.920	19841.0	-638150.8	150.04	135.46	
-24.700	0.473	-0.838	21670.4	-613207.2	146.08	132.07	
-25.420	0.414	-0.791	22597.5	-597263.4	143.54	129.90	
-25.900	0.377	-0.759	23149.0	-586282.1	141.80	128.40	
-27.100	0.290	-0.684	24309.8	-557776.6	137.27	124.52	
-28.300	0.213	-0.613	25184.2	-528053.1	132.54	120.48	
-29.500	0.143	-0.546	25802.1	-497437.0	127.67	116.31	
-30.700	0.082	-0.482	26191.5	-466219.3	122.71	112.06	
-31.600	0.040	-0.438	26349.7	-442567.8	118.95	108.84	
-31.600	0.040	-0.438	26349.7	-442567.8	135.89	124.24	
-31.900	0.027	-0.421	26379.0	-434658.1	134.45	123.00	
-33.100	-0.019	-0.358	26390.4	-402980.1	128.68	118.07	
-34.300	-0.059	-0.299	26252.0	-371380.9	122.92	113.14	
-35.500	-0.091	-0.245	25988.3	-340025.3	117.21	108.25	
-36.700	-0.118	-0.196	25621.7	-309050.1	111.56	103.43	
-37.900	-0.139	-0.152	25172.9	-278566.0	106.01	98.67	

-39.100	-0.155	-0.112	24660.4	-248660.5	100.56	94.01	
-40.300	-0.166	-0.077	24100.9	-219399.8	95.23	89.45	
-41.480	-0.173	-0.046	23519.3	-191301.7	90.11	85.07	
-41.500	-0.173	-0.046	23483.3	-190831.4	90.02	85.00	
-42.700	-0.177	-0.019	21301.5	-163955.8	85.13	80.81	
-43.900	-0.178	0.004	19091.1	-139719.2	80.71	77.03	
-44.470	-0.177	0.014	18041.3	-129136.8	78.78	75.38	
-45.100	-0.176	0.024	17209.8	-118032.8	76.76	73.65	
-46.300	-0.172	0.040	15647.7	-98321.7	73.17	70.58	
-47.500	-0.167	0.053	14128.3	-80461.2	69.91	67.80	
-48.700	-0.159	0.064	12666.1	-64390.9	66.99	65.29	
-49.900	-0.151	0.073	11273.0	-50034.8	64.37	63.05	
-51.100	-0.142	0.080	9958.4	-37304.2	62.05	61.07	
-52.300	-0.132	0.084	8729.2	-26100.5	60.01	59.32	

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-53.500	-0.122	0.088	7590.6	-16317.9	58.23	57.80	
-54.700	-0.111	0.089	6546.2	-7845.4	56.68	56.48	
-55.900	-0.100	0.090	5597.8	-568.7	55.36	55.34	
-57.100	-0.090	0.090	4746.1	5628.0	56.28	56.13	
-58.300	-0.079	0.088	3990.8	10860.6	57.23	56.95	
-59.500	-0.068	0.086	3330.5	15244.0	58.03	57.63	
-60.480	-0.060	0.084	2860.3	18272.4	58.58	58.10	
-60.700	-0.058	0.084	2698.3	18883.8	58.70	58.20	
-61.900	-0.048	0.081	1902.7	21629.7	59.20	58.63	
-63.100	-0.039	0.077	1251.8	23508.2	59.54	58.92	
-64.300	-0.030	0.074	739.4	24689.4	59.75	59.10	
-65.500	-0.021	0.070	359.1	25335.7	59.87	59.20	
-66.700	-0.013	0.066	104.0	25601.3	59.92	59.25	
-67.450	-0.008	0.064	5.0	25639.4	59.93	59.25	
-67.900	-0.005	0.062	-58.1	25626.5	59.92	59.25	
-69.100	0.002	0.058	-100.5	25513.3	59.90	59.23	

design ground surface displacement

elevation (m)	Del.(cm)	Theta(mrad)	Del.a(cm)
-9.100	2.680	-1.986	5.000

maximum stress

	Sig.(N/mm^2)	elevation(m)
periphery sheet pile (SKY400)	135.89	-31.600
periphery sheet pile (SKY490)	161.60	-17.100
separation wall sheet pile (SKY400)	145.36	-17.100
separation wall sheet pile (SKY490)	------	--------

vertical reaction

$$R = \frac{Vo*Ao1}{\Sigma(ni*Aoi)} + / - \frac{(MB*Ao1)*xi}{\Sigma(IBi*Aoi)}$$

MB = 25513.3 (kN.m)

Sum(ni*Aoi) = 2.143 (m^2)

Sum(IBi*Aoi) = 52.382 (m^4)

periphery n1 = 40 (number) IB1 = 1086.85 (m^2) Ao1 = 0.0446 (m^2/number)

separation wall n1 = 8 (number) IB1 = 86.70 (m^2) Ao1 = 0.0446 (m^2/number)

intermediate drive n1 = 0 (number) IB1 = 0.00 (m^2) Ao1 = 0.0000 (m^2/number)

x = 6.465

maximum Rmax = 2607 (kN/number)

minimum Rmin = 2326 (kN/number)

8)Seismic[dyn Smax]

working force	vertical force	Vo	kN	116430.6
	horizontal force	Ho	kN	30839.6
	moment	Mo	kN.m	564659.0
calculation kh	standard displacement	Del.o	cm	5.000
	assumed displacement	Del.1	cm	2.445
	calculation displacement	Del.	cm	2.435

convergence rate (Del.1 - Del.) / Del.1 = 0.43 (%) < 1.00 (%)

No	standardKH1(kN/m³)	calculation KH1(kN/m³)
1	6600	9438
2	9910	14172
3	12006	17169
4	9338	13354
5	9338	13354
6	33350	47692
7	24012	34338
8	40020	57230
9	66700	95384

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-9.100	2.435	-1.847	-30839.6	-564659.0	137.56	124.66	
-10.300	2.217	-1.770	-24830.5	-598004.9	142.86	129.20	
-11.500	2.010	-1.690	-19370.2	-624471.7	147.07	132.80	
-12.700	1.812	-1.606	-14433.9	-644703.0	150.28	135.56	
-13.900	1.624	-1.521	-9995.7	-659312.3	152.61	137.54	
-14.100	1.594	-1.506	-9302.6	-661241.9	152.91	137.81	
-15.100	1.447	-1.434	-6029.2	-668881.4	154.13	138.85	
-15.420	1.402	-1.410	-5047.6	-670652.8	154.41	139.09	
-16.300	1.280	-1.345	-1233.1	-673391.1	154.85	139.46	
-16.600	1.240	-1.323	-10.5	-673576.6	154.87	139.49	*
-17.100	1.175	-1.286	1941.9	-673089.4	154.80	139.42	
-17.500	1.124	-1.257	3428.8	-672013.1	154.63	139.27	
elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-18.700	0.979	-1.169	7505.3	-665396.1	153.57	138.37	
-19.100	0.932	-1.140	8741.1	-662144.9	153.06	137.93	
-19.900	0.844	-1.083	11037.3	-654218.3	151.80	136.85	
-20.460	0.784	-1.043	12510.6	-647619.	150.75	135.95	

				8			
-21.100	0.719	-0.998	14393.9	-639001.7	149.38	134.78	
-22.300	0.604	-0.915	17499.2	-619811.9	146.33	132.17	
-22.490	0.587	-0.902	17942.4	-616444.7	145.79	131.71	
-23.500	0.499	-0.835	19611.4	-597457.3	142.77	129.12	
-24.700	0.403	-0.758	21258.6	-572900.4	138.87	125.78	
-25.420	0.351	-0.714	22085.1	-557289.6	136.39	123.65	
-25.900	0.317	-0.685	22573.1	-546569.7	134.68	122.20	
-27.100	0.239	-0.615	23586.9	-518845.2	130.27	118.42	
-28.300	0.169	-0.549	24330.9	-490068.9	125.70	114.50	
-29.500	0.107	-0.486	24834.1	-460547.2	121.01	110.48	
-30.700	0.052	-0.428	25123.9	-430552.3	116.24	106.40	
-31.600	0.016	-0.386	25216.6	-407891.6	112.63	103.32	
-31.600	0.016	-0.386	25216.6	-407891.6	128.66	117.92	
-31.900	0.004	-0.371	25225.9	-400324.9	127.28	116.74	
-33.100	-0.037	-0.313	25165.2	-370075.3	121.77	112.02	
-34.300	-0.071	-0.259	24967.1	-339983.4	116.29	107.33	
-35.500	-0.099	-0.210	24655.1	-310199.8	110.86	102.69	
-36.700	-0.121	-0.165	24250.9	-280848.0	105.51	98.12	
-37.900	-0.139	-0.125	23774.0	-252026.7	100.26	93.63	
-39.100	-0.151	-0.089	23242.2	-223812.3	95.12	89.23	
-40.300	-0.160	-0.057	22671.2	-196261.1	90.10	84.93	
-41.480	-0.165	-0.030	22085.0	-169853.4	85.29	80.82	
-41.500	-0.165	-0.030	22049.0	-169411.8	85.21	80.75	
-42.700	-0.167	-0.006	19872.9	-144256.0	80.63	76.83	
-43.900	-0.167	0.014	17687.2	-121720.6	76.52	73.31	
-44.470	-0.166	0.023	16654.9	-111933.6	74.74	71.79	
-45.100	-0.164	0.031	15840.2	-101697.9	72.87	70.19	

-46.300	-0.160	0.045	14317.2	-83607.7	69.58	67.37	
-47.500	-0.153	0.057	12844.9	-67316.3	66.61	64.84	
-48.700	-0.146	0.066	11436.1	-52754.6	63.95	62.57	
-49.900	-0.138	0.073	10101.1	-39840.1	61.60	60.55	
-51.100	-0.129	0.078	8847.8	-28479.2	59.53	58.78	
-52.300	-0.119	0.081	7682.1	-18570.3	57.73	57.24	
elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-53.500	-0.109	0.083	6608.0	-10005.5	56.17	55.90	
-54.700	-0.099	0.084	5627.8	-2673.5	54.83	54.76	
-55.900	-0.089	0.084	4742.7	3539.3	54.99	54.89	
-57.100	-0.079	0.083	3952.7	8747.1	55.94	55.71	
-58.300	-0.069	0.082	3256.5	13063.3	56.72	56.38	
-59.500	-0.059	0.079	2652.5	16599.6	57.37	56.93	
-60.480	-0.052	0.077	2225.8	18985.2	57.80	57.30	
-60.700	-0.050	0.077	2079.6	19458.7	57.89	57.38	
-61.900	-0.041	0.074	1366.3	21512.1	58.26	57.70	
-63.100	-0.032	0.070	791.4	22793.2	58.50	57.90	
-64.300	-0.024	0.067	348.4	23464.2	58.62	58.00	
-65.500	-0.016	0.063	30.9	23679.6	58.66	58.03	
-66.700	-0.009	0.060	-167.8	23585.9	58.64	58.02	
-67.450	-0.005	0.057	-234.7	23432.3	58.61	58.00	
-67.900	-0.002	0.056	-267.8	23318.2	58.59	57.98	
-69.100	0.004	0.053	-236.8	22998.5	58.53	57.93	

design ground surface displacement

elevation (m)	Del.(cm)	Theta(mrad)	Del.a(cm)
-9.100	2.435	-1.847	5.000

maximum stress

	Sig.(N/mm²)	elevation(m)
periphery sheet pile (SKY400)	128.66	-31.600
periphery sheet pile (SKY490)	154.87	-16.600
separation wall sheet pile (SKY400)	139.49	-16.600
separation wall sheet pile (SKY490)	------	--------

vertical reaction

$$R = \frac{Vo*Ao1}{\Sigma(ni*Aoi)} + / - \frac{(MB*Ao1)*xi}{\Sigma(IBi*Aoi)}$$

MB = 22998.5 (kN.m)
Sum(ni*Aoi) = 2.143 (m^2)
Sum(IBi*Aoi) = 52.382 (m^4)
periphery n1 = 40 (number) IB1 = 1086.85 (m^2) Ao1 = 0.0446 (m^2/number)
separation wall n1 = 8 (number) IB1 = 86.70 (m^2) Ao1 = 0.0446 (m^2/number)
intermediate drive n1 = 0 (number) IB1 = 0.00 (m^2) Ao1 = 0.0000 (m^2/number)
x = 6.465
maximum Rmax = 2552 (kN/number)
minimum Rmin = 2299 (kN/number)

9)Seismic[dyn Mmax]

working force	vertical force	Vo	kN	116099.6
	horizontal force	Ho	kN	28637.3
	moment	Mo	kN.m	590183.0
calcu lation kh	standard displacement	Del. o	cm	5.000
	assumed displacement	Del. 1	cm	2.396
	calculation displacement	Del.	cm	2.386

convergence rate (Del.1 - Del.) / Del.1 = 0.42 (%) < 1.00 (%)

No	standardKH1(kN/m^3)	calculation KH1(kN/m^3)
1	6600	9535
2	9910	14316
3	12006	17344
4	9338	13490
5	9338	13490
6	33350	48179
7	24012	34689
8	40020	57815
9	66700	96358

elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-9.100	2.386	-1.848	-28637.3	-590183.0	141.48	128.00	
-10.300	2.169	-1.768	-22694.3	-620925.3	146.37	132.18	
-11.500	1.961	-1.685	-17305.1	-644870.8	150.18	135.44	
-12.700	1.764	-1.599	-12443.8	-662668.8	153.00	137.87	
-13.900	1.578	-1.511	-8083.5	-674936.4	154.96	139.54	
-14.100	1.548	-1.497	-7403.6	-676484.9	155.20	139.75	
-15.100	1.402	-1.422	-4196.6	-682258.5	156.12	140.53	
-15.420	1.357	-1.398	-3236.5	-683447.0	156.31	140.69	
-16.300	1.236	-1.332	489.1	-684630.5	156.50	140.85	*
-16.600	1.197	-1.310	1681.3	-684304.0	156.44	140.81	
-17.100	1.132	-1.273	3583.0	-682983.5	156.23	140.63	
-17.500	1.082	-1.243	5029.5	-681258.8	155.96	140.40	
elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-18.700	0.938	-1.154	8985.3	-672793.6	154.61	139.24	
-19.100	0.893	-1.124	10181.2	-668958.4	154.00	138.72	
-19.900	0.805	-1.066	12398.2	-659911.3	152.57	137.49	
-20.460	0.746	-1.026	13816.8	-652566.1	151.40	136.49	
-21.100	0.682	-0.981	15625.3	-643136.0	149.90	135.21	
-22.300	0.569	-0.898	18593.3	-622551.3	146.63	132.40	
-22.490	0.553	-0.885	19015.1	-618978.3	146.06	131.92	
-23.500	0.467	-0.817	20597.6	-598951.4	142.87	129.19	
-24.700	0.373	-0.740	22145.6	-573271.0	138.79	125.69	
-25.420	0.321	-0.696	22914.8	-557042.4	136.21	123.49	
-25.900	0.289	-0.667	23365.4	-545933.3	134.45	121.97	
-27.100	0.213	-0.597	24289.4	-517312.3	129.89	118.08	
-28.300	0.145	-0.531	24948.5	-487744.6	125.19	114.05	

-29.500	0.085	-0.469	25372.1	-457530.1	120.39	109.94	
-30.700	0.033	-0.411	25587.6	-426934.8	115.53	105.77	
-31.600	-0.003	-0.370	25628.2	-403880.4	111.86	102.63	
-31.600	-0.003	-0.370	25628.2	-403880.4	127.77	117.14	
-31.900	-0.013	-0.355	25620.7	-396192.8	126.37	115.94	
-33.100	-0.053	-0.297	25496.6	-365508.0	120.78	111.16	
-34.300	-0.085	-0.244	25240.4	-335053.8	115.23	106.41	
-35.500	-0.111	-0.196	24875.7	-304974.3	109.75	101.72	
-36.700	-0.132	-0.152	24424.0	-275386.7	104.36	97.11	
-37.900	-0.148	-0.113	23904.7	-246383.6	99.08	92.59	
-39.100	-0.159	-0.078	23335.3	-218035.4	93.91	88.17	
-40.300	-0.167	-0.047	22731.3	-190392.7	88.88	83.86	
-41.480	-0.171	-0.020	22117.0	-163931.0	84.06	79.74	
-41.500	-0.171	-0.020	22079.4	-163488.8	83.98	79.67	
-42.700	-0.172	0.003	19815.9	-138350.3	79.40	75.75	
-43.900	-0.170	0.022	17556.5	-115928.8	75.31	72.26	
-44.470	-0.169	0.030	16493.8	-106225.1	73.54	70.75	
-45.100	-0.167	0.038	15657.0	-96098.0	71.70	69.17	
-46.300	-0.161	0.051	14098.2	-78249.9	68.45	66.38	
-47.500	-0.154	0.062	12597.6	-62238.9	65.53	63.89	
-48.700	-0.147	0.070	11167.3	-47987.5	62.93	61.67	
-49.900	-0.138	0.076	9816.8	-35405.4	60.64	59.71	
-51.100	-0.128	0.081	8553.2	-24392.4	58.63	57.99	
-52.300	-0.118	0.084	7381.8	-14840.8	56.89	56.50	
elevation (m)	Del.(cm)	Theta(mrad)	S(kN)	M(kN.m)	external wall Sig.(N/mm²)	separation wall Sig.(N/mm²)	Mmax
-53.500	-0.108	0.086	6305.8	-6638.0	55.40	55.22	
-54.700	-0.098	0.086	5327.3	332.1	54.25	54.24	
-55.900	-0.088	0.085	4446.6	6186.7	55.32	55.15	
-57.100	-0.077	0.084	3663.3	11042.9	56.20	55.91	
-58.300	-0.067	0.082	2975.9	15016.9	56.92	56.53	
-59.500	-0.058	0.080	2382.0	18222.4	57.51	57.03	
-60.480	-0.050	0.077	1964.5	20347.3	57.90	57.36	

-60.700	-0.048	0.077	1821.9	20763.8	57.97	57.42	
-61.900	-0.039	0.073	1129.1	22520.1	58.29	57.70	
-63.100	-0.031	0.070	575.7	23529.3	58.48	57.86	
-64.300	-0.023	0.066	155.1	23954.8	58.55	57.92	
-65.500	-0.015	0.063	-139.5	23951.9	58.55	57.92	
-66.700	-0.007	0.059	-315.0	23667.5	58.50	57.88	
-67.450	-0.003	0.057	-367.3	23409.0	58.45	57.84	
-67.900	-0.001	0.056	-385.6	23238.6	58.42	57.81	
-69.100	0.006	0.052	-315.1	22801.2	58.34	57.74	

design ground surface displacement

elevation (m)	Del.(cm)	Theta(mrad)	Del.a(cm)
-9.100	2.386	-1.848	5.000

maximum stress

	Sig.(N/mm^2)	elevation(m)
periphery sheet pile (SKY400)	127.77	-31.600
periphery sheet pile (SKY490)	156.50	-16.300
separation wall sheet pile (SKY400)	140.85	-16.300
separation wall sheet pile (SKY490)	------	--------

vertical reaction

$$R = \frac{Vo*Ao1}{\Sigma(ni*Aoi)} + / - \frac{(MB*Ao1)*xi}{\Sigma(IBi*Aoi)}$$

MB = 22801.2 (kN.m)

Sum(ni*Aoi) = 2.143 (m^2)

Sum(IBi*Aoi) = 52.382 (m^4)

periphery n1 = 40 (number) IB1 = 1086.85 (m^2) Ao1 = 0.0446 (m^2/number)

separation wall n1 = 8 (number) IB1 = 86.70 (m^2) Ao1 = 0.0446 (m^2/number)

intermediate drive n1 = 0 (number) IB1 = 0.00 (m^2) Ao1 = 0.0000 (m^2/number)

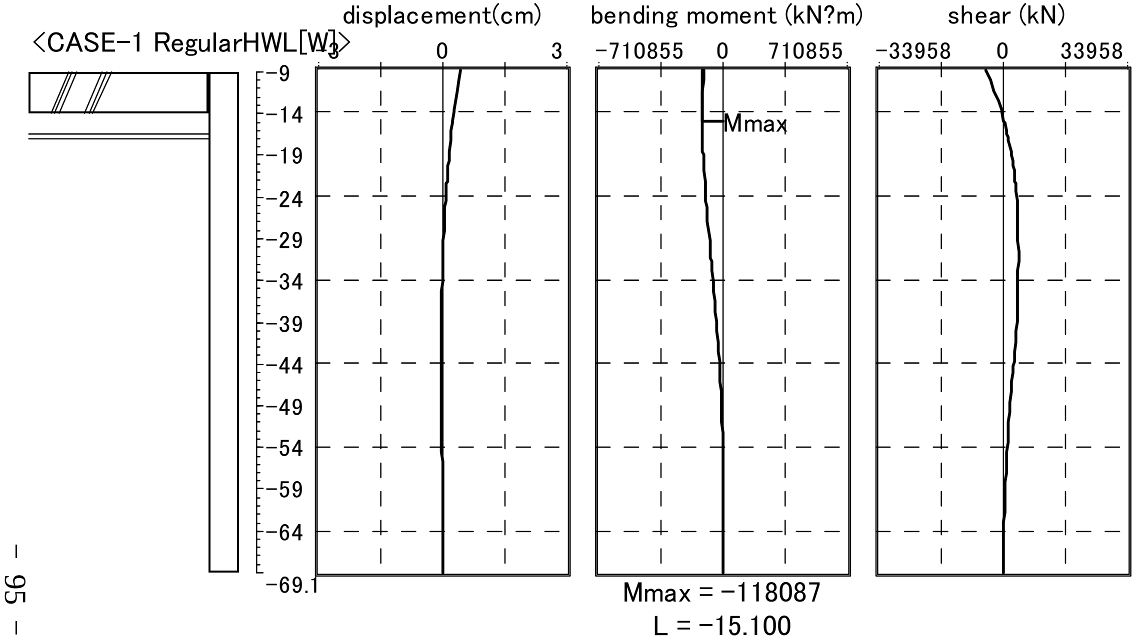
x = 6.465

maximum Rmax = 2544 (kN/number)

minimum Rmin = 2293 (kN/number)

3.1.11 displacement / member force diagram

bridge axis direction



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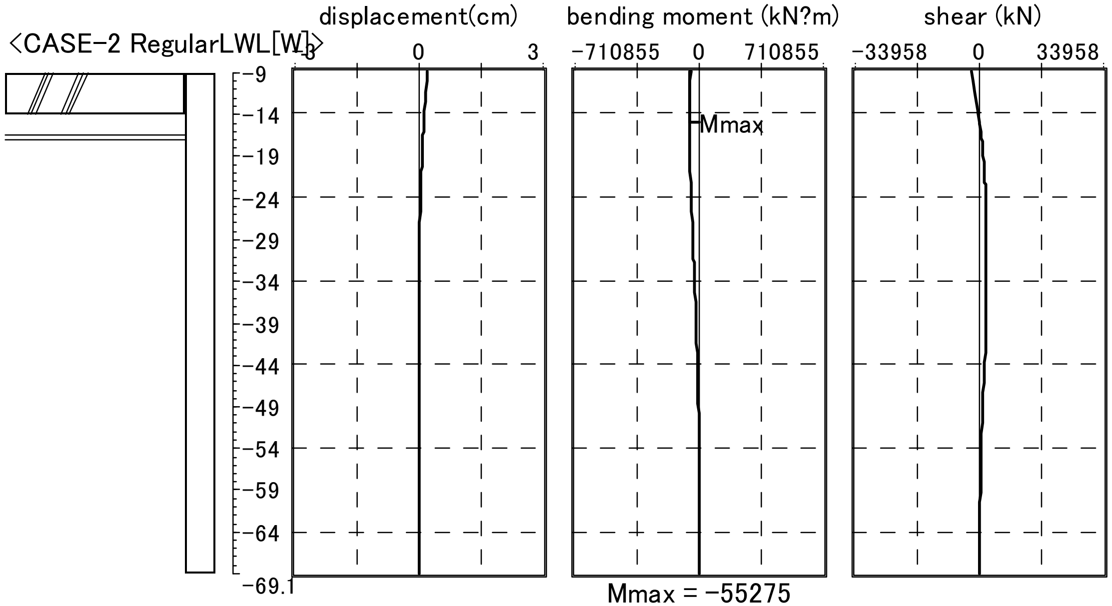

Mmax = -55275
L = -15.100

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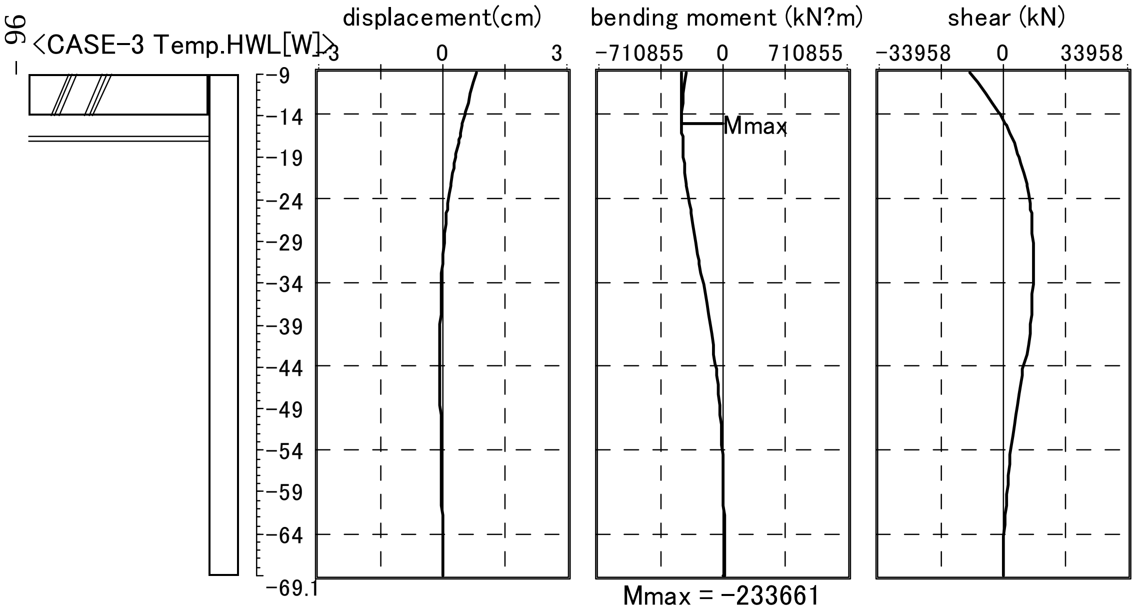
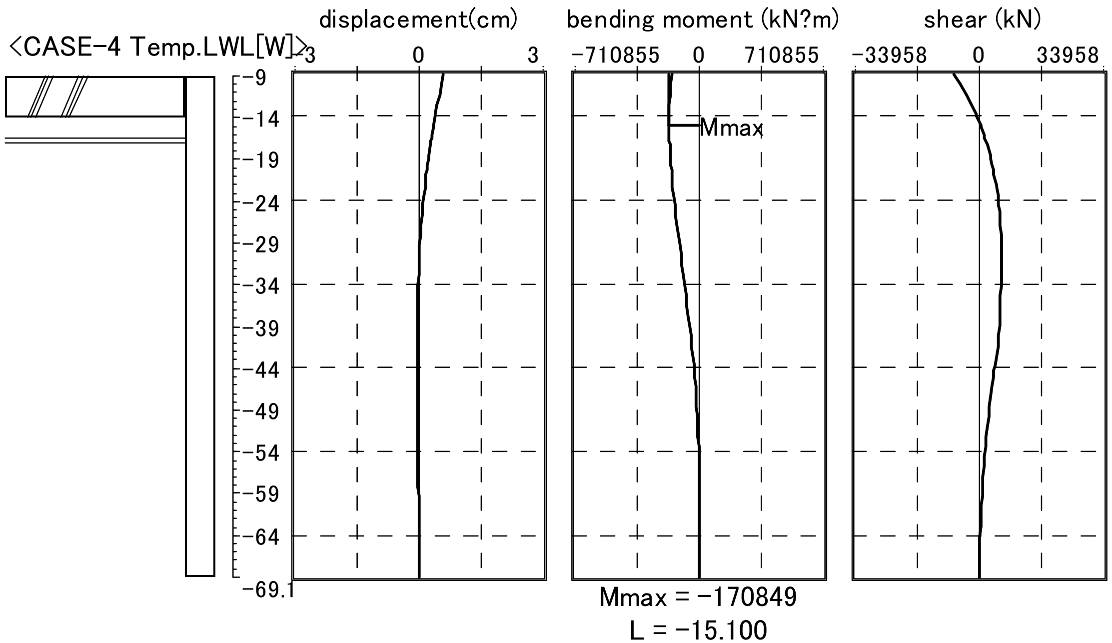
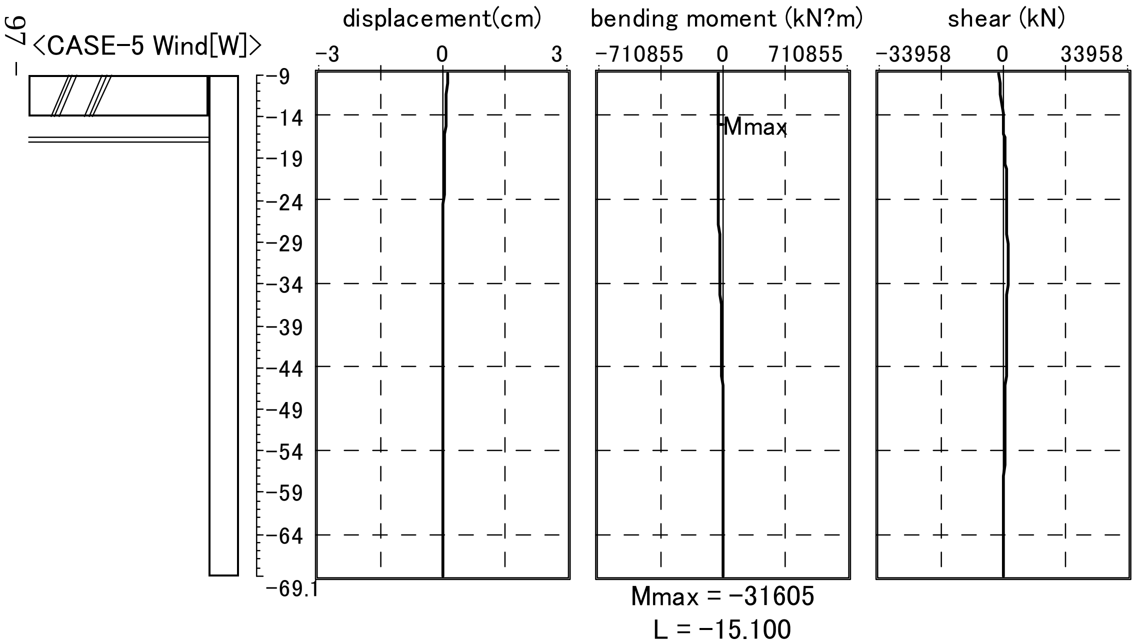


Mmax = -233661
L = -15.100


<CASE-4 Temp.LWL[W]>
displacement(cm)
-3
0
3
bending moment (kN?m)
-710855
0
710855
shear (kN)
-33958
0
33958
-9
-14
-19
-24
-29
-34
-39
-44
-49
-54
-59
-64
-69.1
Mmax
Mmax = -170849
L = -15.100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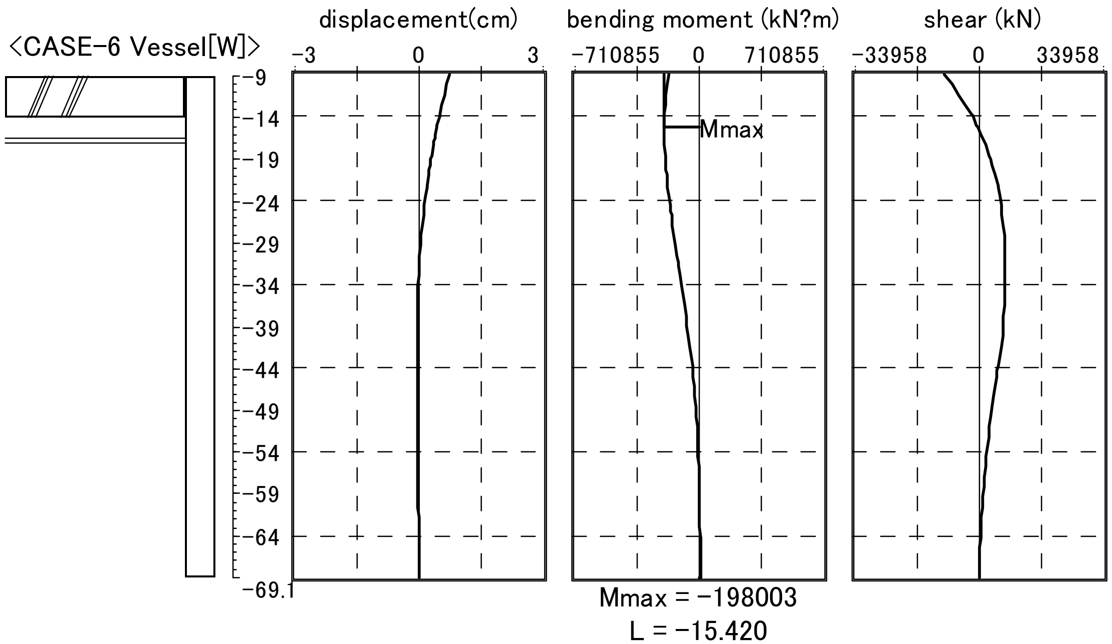
displacement(cm)
-3
0
3
bending moment (kN?m)
-710855
0
710855
shear (kN)
-33958
0
33958
-9
-14
-19
-24
-29
-34
-39
-44
-49
-54
-59
-64
-69.1
Mmax
Mmax = -31605
L = -15.100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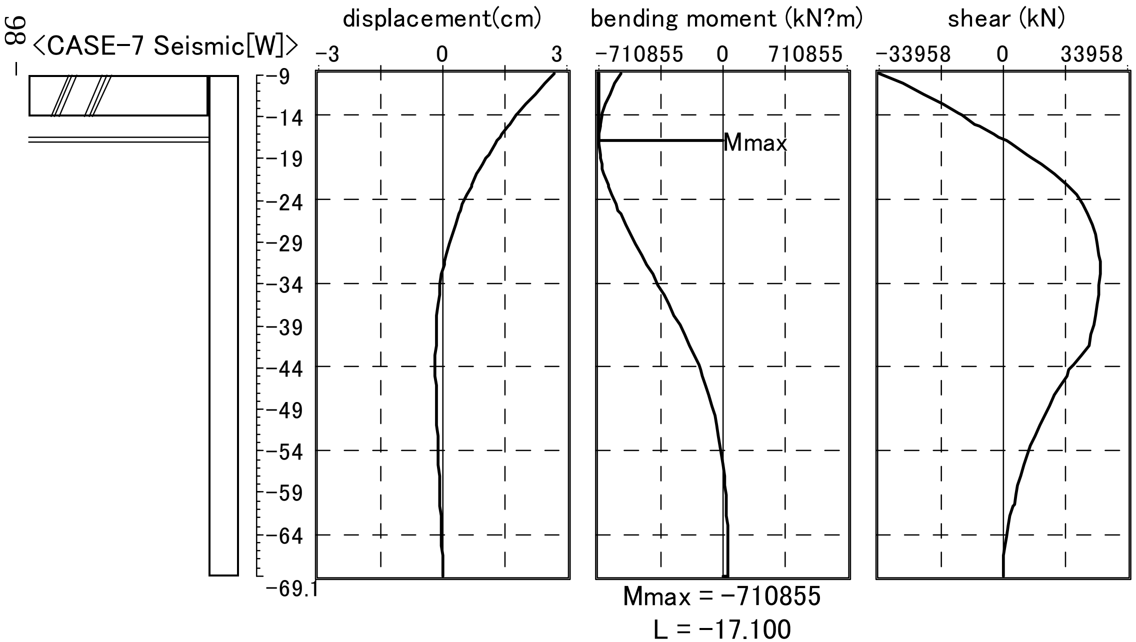
displacement(cm)
-3
0
3
bending moment (kN?m)
-710855
0
710855
shear (kN)
-33958
0
33958
-9
-14
-19
-24
-29
-34
-39
-44
-49
-54
-59
-64
-69.1
Mmax
Mmax = -198003
L = -15.420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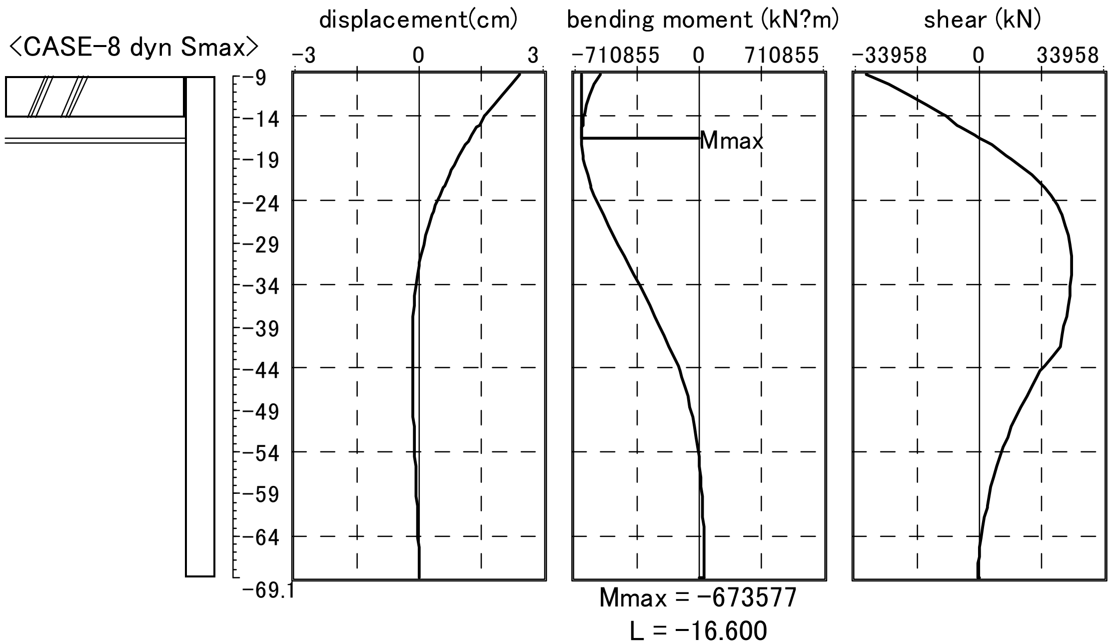
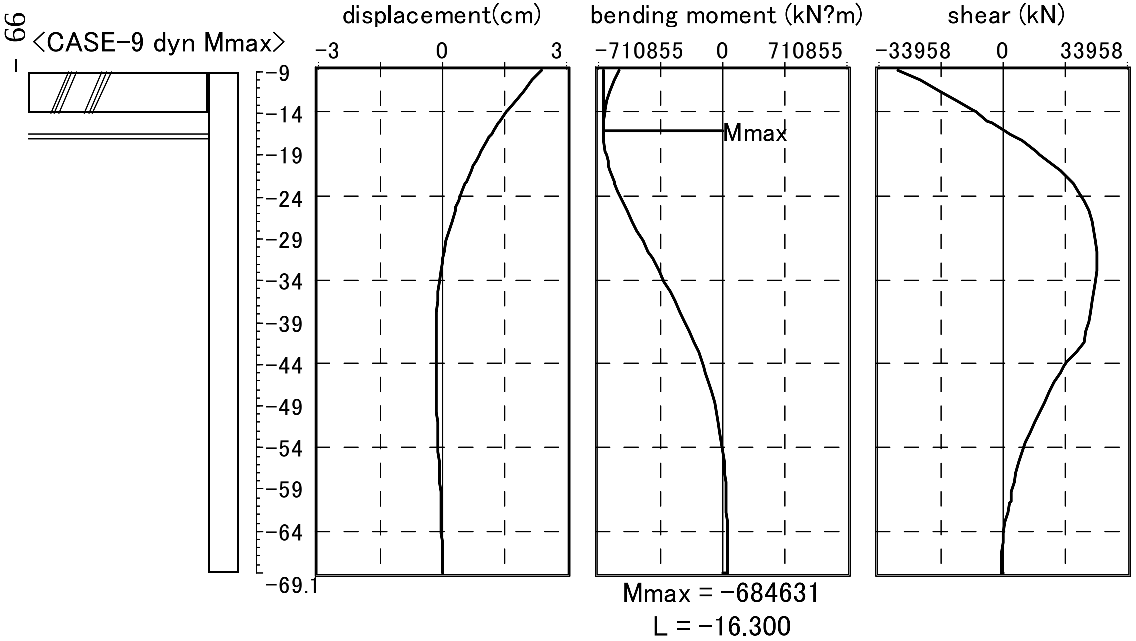
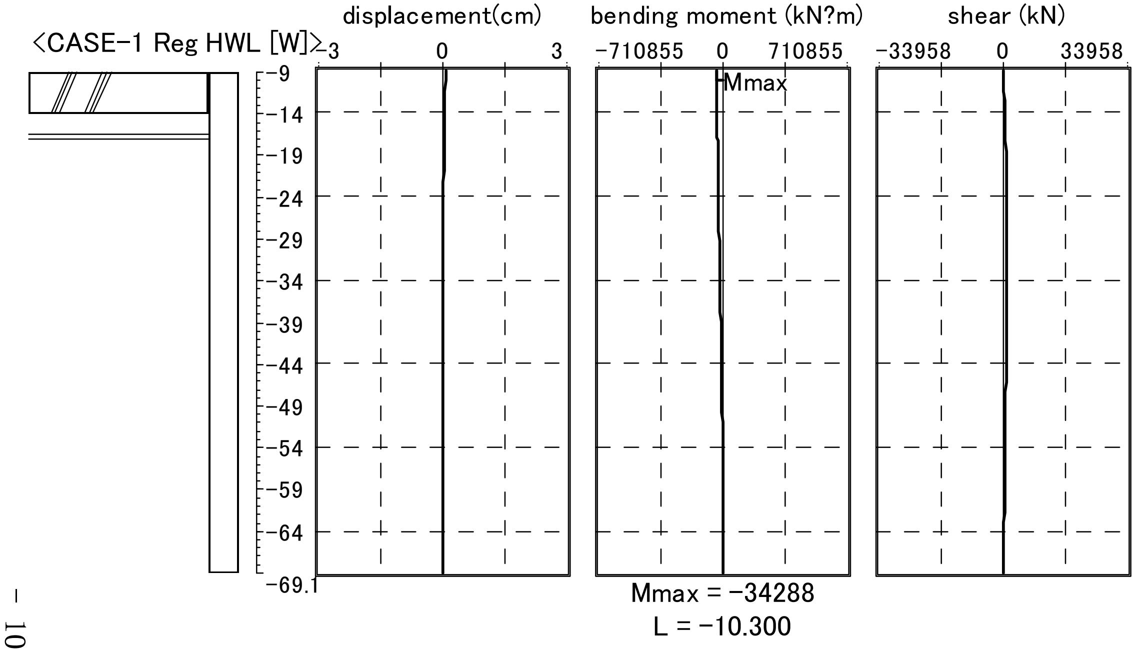
displacement(cm)
-3
0
3
bending moment (kN?m)
-710855
0
710855
shear (kN)
-33958
0
33958
-9
-14
-19
-24
-29
-34
-39
-44
-49
-54
-59
-64
-69.1
Mmax
Mmax = -710855
L = -17.100

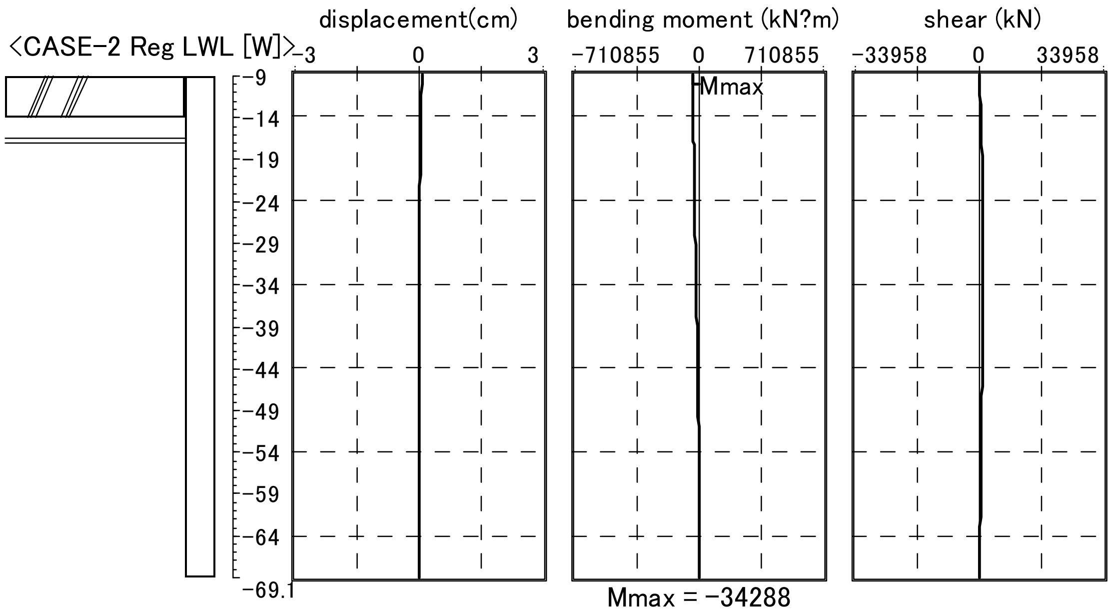

<CASE-8 dyn Smax>
displacement(cm)
-3 0 3
bending moment (kN?m)
-710855 0 710855
shear (kN)
-33958 0 33958
-9 -14 -19 -24 -29 -34 -39 -44 -49 -54 -59 -64 -69.1
Mmax
Mmax = -673577
L = -16.600


<CASE-9 dyn Mmax>
displacement(cm)
-3 0 3
bending moment (kN?m)
-710855 0 710855
shear (kN)
-33958 0 33958
-9 -14 -19 -24 -29 -34 -39 -44 -49 -54 -59 -64 -69.1
Mmax
Mmax = -684631
L = -16.300

perpendicular direction



<CASE-2 Reg LWL [W]>



Mmax = -34288
L = -10.300

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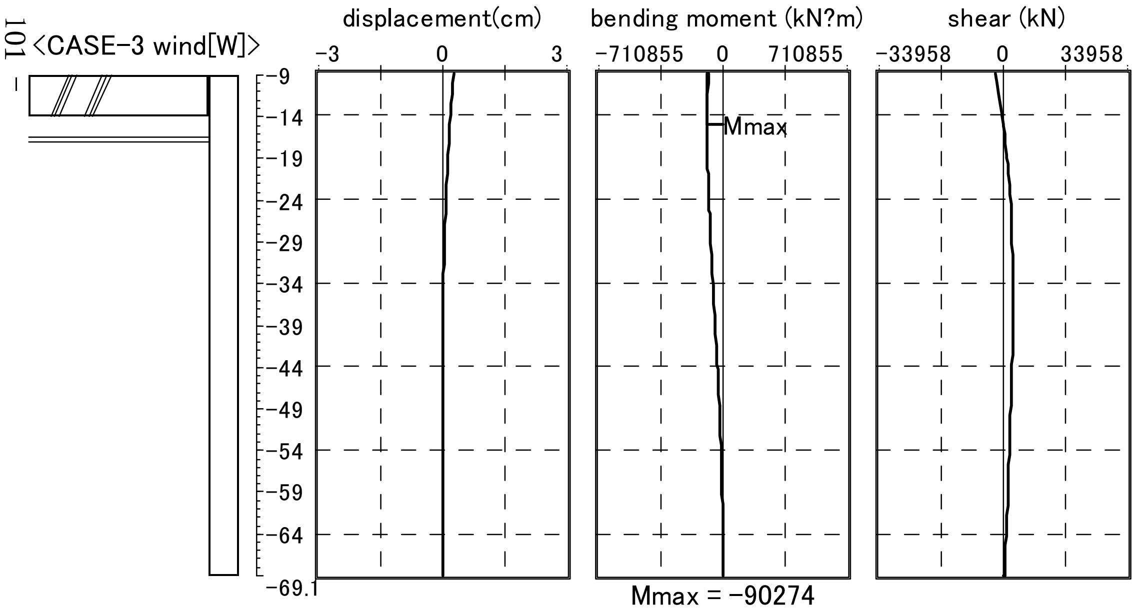
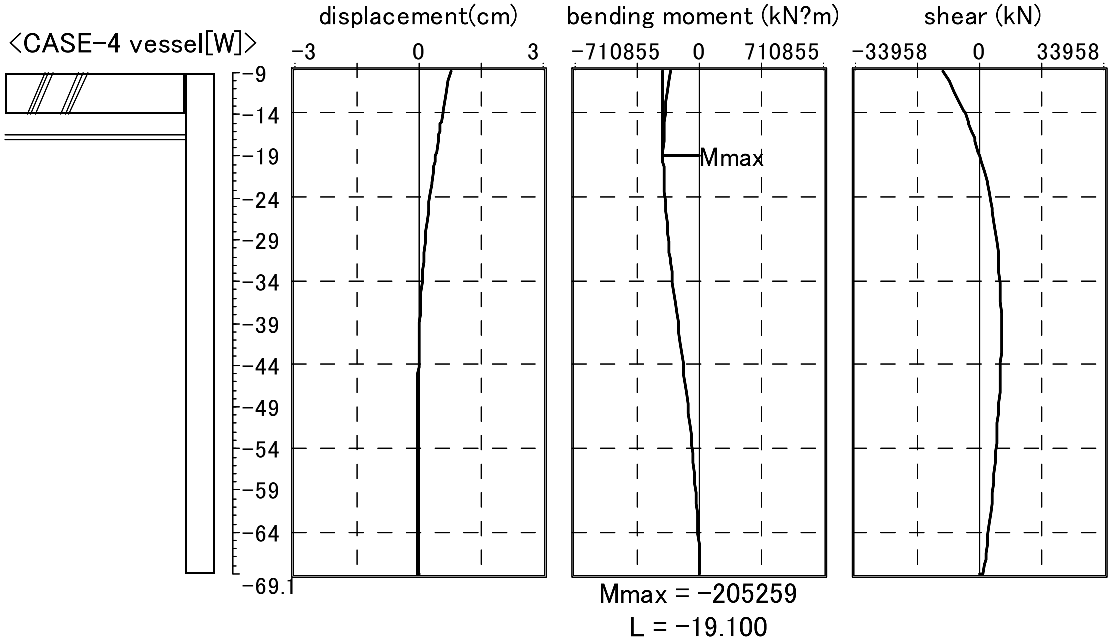


Mmax = -90274
L = -15.100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displacement(cm)
-3 0 3
bending moment (kN?m)
-710855 0 710855
shear (kN)
-33958 0 33958
-9
-14
-19
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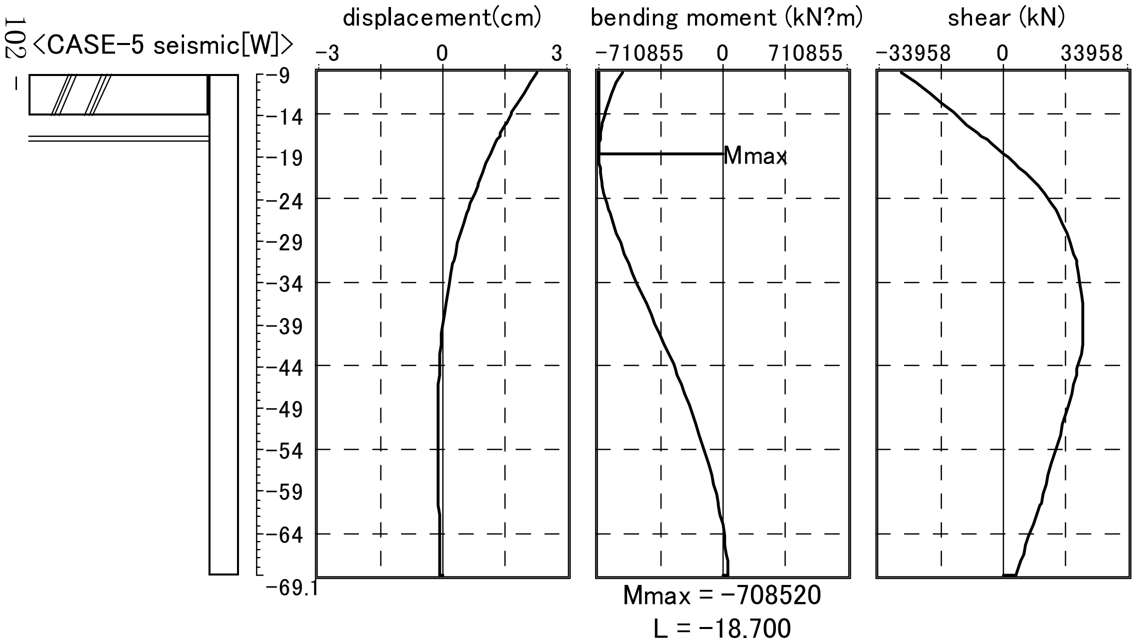
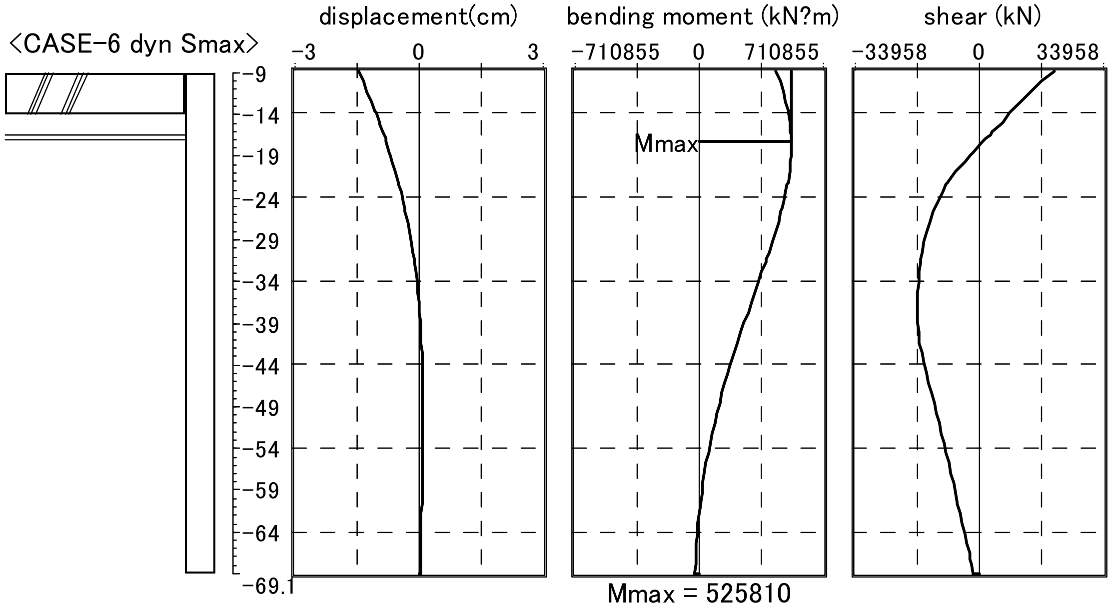
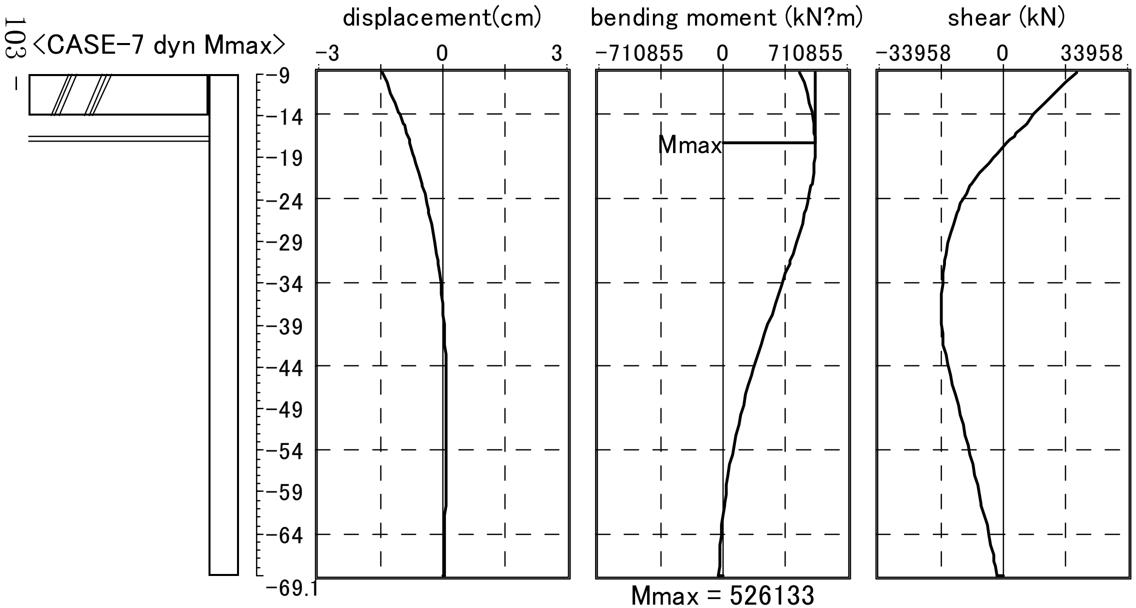
-69.1
Mmax
Mmax = -205259
L = -19.100


<CASE-5 seismic[W]>
displacement(cm)
-3 0 3
bending moment (kN?m)
-710855 0 710855
shear (kN)
-33958 0 33958
-9
-14
-19
-24
-29
-34
-39
-44
-49
-54
-59
-64
-69.1
Mmax
Mmax = -708520
L = -18.700



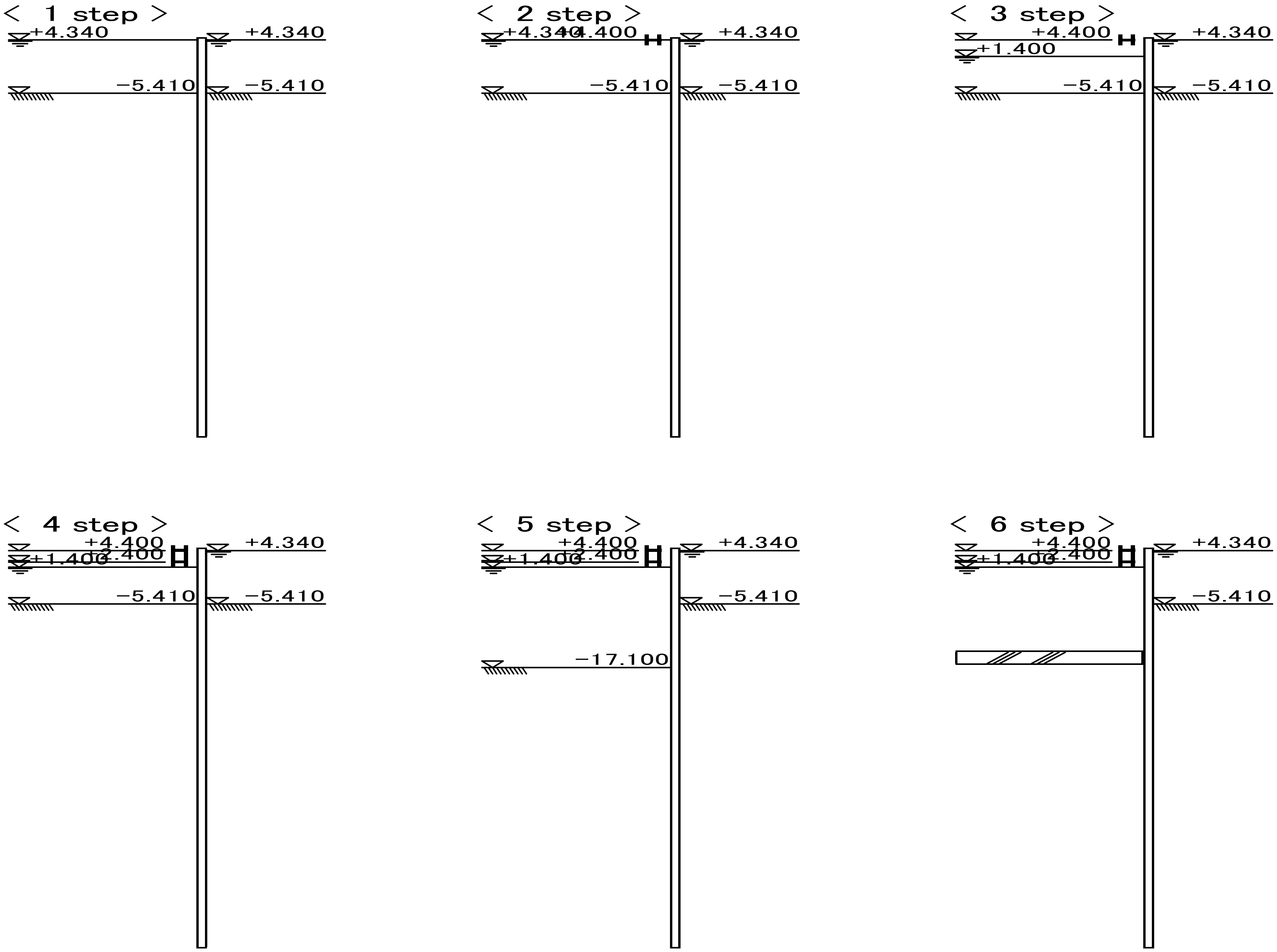
Mmax = 525810
L = -17.500



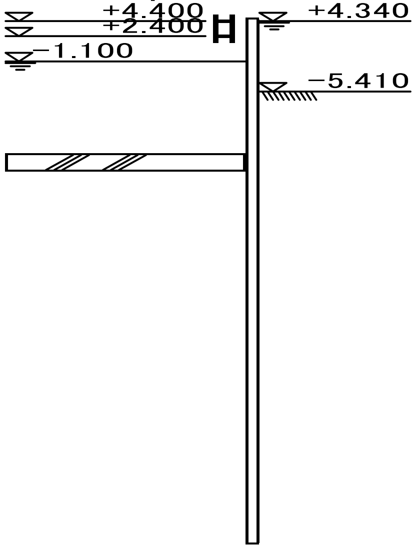
Mmax = 526133
L = -17.500

3.2 coffering calculation

3.2.1 construction step diagram



< 7 step >



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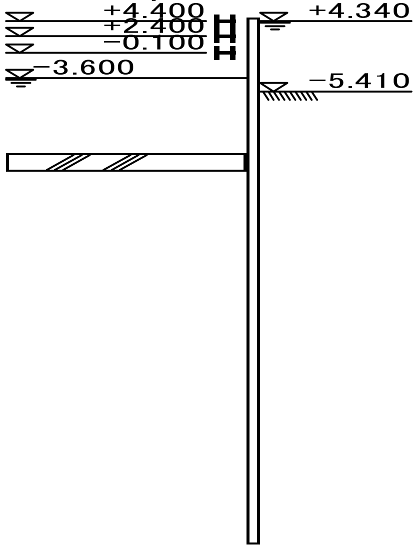

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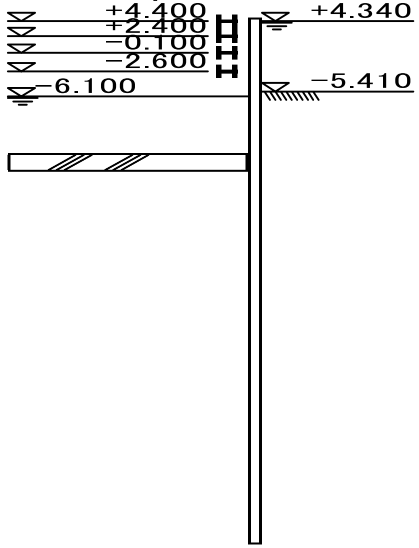

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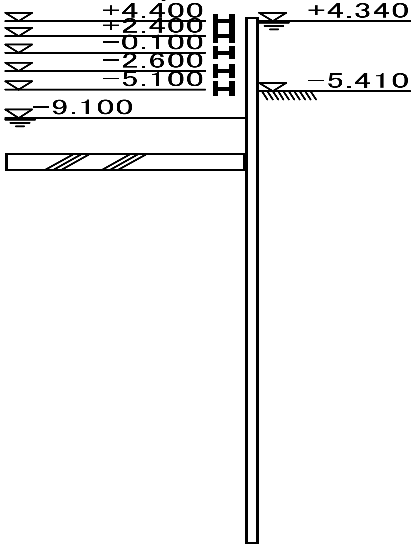

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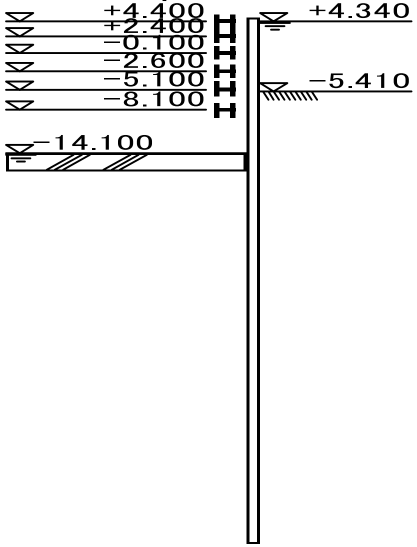

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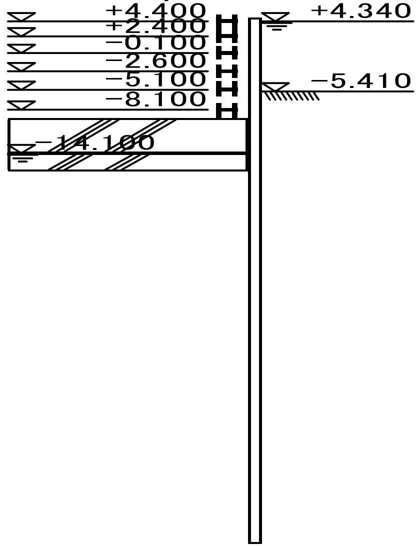

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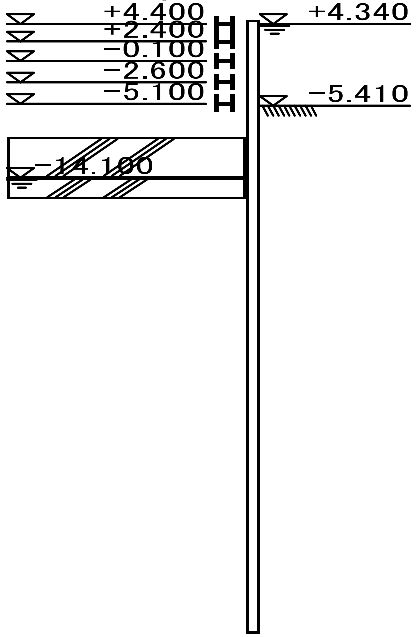

3.2.2 section properties

steel pipe pile body external diameter Phi.1200.0 (mm)

errosion allowance external side = 0.0 (mm) internal side = 0.0 (mm)

No	L (m)	bridge axis direction		perpendicular direction		material
		$I(cm^4/m)$	$Z(cm^3/m)$	$I(cm^4/m)$	$Z(cm^3/m)$	
1	7.500	633569.6	10559.5	633569.6	10559.5	SKY400
2	29.000	720452.4	12007.5	720452.4	12007.5	SKY490
3	37.500	633569.6	10559.5	633569.6	10559.5	SKY400
(m)					Sig.= 74.000	

3.2.3 soil condition

current ground surface elevation -5.410 (m)

riverside water table elevation +4.340 (m)

boundary condition of steel pipe sheet pile tip :free

No	soil	layer thickness (m)	average N value	unit weight $Gam.(kN/m^3)$		c (kN/m^2)	Phi. Deg.	elastic assing (*)
				Gam.	Gam.'			
1	cohesv	3.060	1.0	17.5	7.5	10.0	0.0	0
2	sandy	6.950	13.0	17.0	8.0	0.0	33.0	0
3	sandy	5.040	13.0	17.0	8.0	0.0	33.0	0
4	cohesv	2.030	9.0	17.5	7.5	54.0	0.0	0
5	cohesv	2.930	7.0	17.5	7.5	42.0	0.0	0
6	cohesv	16.060	7.0	17.5	7.5	42.0	0.0	0
7	sandy	2.990	25.0	17.0	8.0	0.0	33.0	0
8	cohesv	16.010	18.0	18.0	8.0	108.0	0.0	0
9	sandy	6.970	30.0	17.0	8.0	0.0	34.0	0
10	sandy	1.650	50.0	19.0	10.0	0.0	35.0	0

(*)0:if subgrade reaction> upper limit of subgrade reaction plastic area, 1: always elastic area horizontal modulus of subgrade reaction kH (kN/m³)

No	bridge axis direction		perpendicular direction		step
	KH1	KH2	KH1	KH2	
1	865	865	865	865	0
2	4998	4998	4998	4998	0
3	4998	4998	4998	4998	0
4	6055	6055	6055	6055	0
5	4710	4710	4710	4710	0
6	4710	4710	4710	4710	0
7	16820	16820	16820	16820	0
8	12110	12110	12110	12110	0
9	20184	20184	20184	20184	0
10	33639	33639	33639	33639	0

3.2.4 timbering, construction step

(1) timbering

row	installation level(m)	step No		support point condition (tensile)	H shaped steel		
		set	remove		arc part	linear part(wailing)	linear part(strut)
1	+4.400	2	0	invld	H-350*350*12*19	H-350*350*12*19	H-350*350*12*19
2	+2.400	4	0	invld	2H-400*400*13*21	2H-400*400*13*21	2H-400*400*13*21
3	-0.100	8	0	invld	H-350*350*12*19	H-350*350*12*19	H-350*350*12*19
4	-2.600	9	0	invld	H-350*350*12*19	H-350*350*12*19	H-350*350*12*19
5	-5.100	10	0	invld	H-300*300*10*15	H-300*300*10*15	H-300*300*10*15
6	-8.100	11	13	invld	H-300*300*10*15	H-300*300*10*15	H-300*300*10*15

(2)H shaped steel

1)linear

**wailing

row	H (cm)	B (cm)	A (cm^2)	Aw (cm^2)	Iy (cm^4)	Zy (cm^3)	ry (cm)	rz (cm)
1	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
2	40.0	40.0	218.70	46.54	66600	3330	17.50	10.10
3	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
4	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
5	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55
6	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55

**strut

row	H (cm)	B (cm)	A (cm^2)	Aw (cm^2)	Iy (cm^4)	Zy (cm^3)	ry (cm)	rz (cm)
1	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
2	40.0	40.0	218.70	46.54	66600	3330	17.50	10.10
3	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
4	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
5	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55
6	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55

2) arc

row	H (cm)	B (cm)	A (cm^2)	Aw (cm^2)	Iy (cm^4)	Zy (cm^3)	ry (cm)	rz (cm)
1	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
2	40.0	40.0	218.70	46.54	66600	3330	17.50	10.10
3	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
4	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
5	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55
6	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55

(3) strut spacing/brace span

row	perpendicular direction	
	strut spacing L1(m)	brace span L2(m)
1	4.000	1.300
2	4.000	1.300
3	4.000	1.300
4	4.000	1.300
5	4.000	1.300
6	4.000	1.300

(4)construction step

step	excavation area(m)	inside water level(m)
1	-5.410	+4.340
2	-5.410	+4.340
3	-5.410	+1.400
4	-5.410	+1.400
5	-17.100	+1.400
6	-17.100	+1.400
7	-17.100	-1.100
8	-17.100	-3.600
9	-17.100	-6.100
10	-17.100	-9.100
11	-17.100	-14.100
12	-17.100	-14.100
13	-17.100	-14.100

footing concrete cast --- 6 step

pile capcast --- 12 step

3.2.5 arbitrary load

No	working elevation (m)	load type	working width (m)	load (kN,kN/m)		working step number	
				top end	bottom end	begin	end
1	+4.340	distributed	9.750	0.271	0.068	1	13

note: positive load is applied from back side, negative load is applied from excavation area side

3.2.6 support point spring

(1) spring constant of timbering

arc part

$$K = \frac{E*A1}{r^2} \quad (kN/m/m)$$

linear part

$$K = \frac{E*A2}{\frac{L1}{2}} * \frac{1}{L2} \quad (kN/m/m)$$

Here, E : Young's modulus of timbering = 2.00 * 10^8(kN/m^2)

A1 : sectional area of wailing(m^2)

A2 : sectional area of strut (m^2)

r : timbering radius in arc part (m)

L1 : strut length (m)

L2 : strut spacing (m)

1)bridge axis direction

linear part

row	A2 (cm^2)	L1 (m)	L2 (m)	K (kN/m/m)
1	171.90	11.381	4.000	1.5104E+005
2	437.40	11.331	4.000	3.8602E+005
3	171.90	11.381	4.000	1.5104E+005
4	171.90	11.381	4.000	1.5104E+005
5	118.40	11.431	4.000	1.0358E+005
6	118.40	11.431	4.000	1.0358E+005

arc part

row	A1 (cm^2)	r (m)	K (kN/m/m)
1	171.90	5.690	1.0617E+005
2	437.40	5.665	2.7255E+005
3	171.90	5.690	1.0617E+005
4	171.90	5.690	1.0617E+005
5	118.40	5.715	7.2491E+004
6	118.40	5.715	7.2491E+004

(2)footing concrete spring constant

$$K = \frac{Alp.*(Ec*Ac)}{\frac{B}{2}} \quad (kN/m/m)$$

where, Alp. : reduction coefficient of spring = 0.050

Ec : Young's modulus of concrete at bottom = 2.35 * 10^7(kN/m^2)

Ac : sectional area per unit width of footing concrete = 2.500 (m^2/m)

B : footing concrete width (m)

bridge axis direction B = 11.731

perpendicular direction B = 20.418

1)bridge axis direction

K = 5.0081E+005 (kN/m/m)

2)perpendicular direction

K = 2.8774E+005 (kN/m/m)

(4) using value

1)support point spring constant (kN/m/m)

	support point condition(tensile)	bridge axis direction	perpendicular direction
timbering 1row	invld	1.5104E+005	1.0617E+005
timbering 2row	invld	3.8602E+005	2.7255E+005
timbering 3row	invld	1.5104E+005	1.0617E+005
timbering 4row	invld	1.5104E+005	1.0617E+005
timbering 5row	invld	1.0358E+005	7.2491E+004
timbering 6row	invld	1.0358E+005	7.2491E+004
footing concrete	invld	5.0082E+005	2.8774E+005

3.2.7 side pressure

(1) active side pressure

sand soil

$$Pa = Ka(Gam.*h - pw1 + q) - 2c * \sqrt{Ka} + pw1$$

where, Pa : active side pressure (kN/m^2)

Ka : active earth pressure coefficient $Ka = \tan^2(45Deg.- Phi. / 2)$

q : surcharge load (kN/m^2) (including weight of water upper than ground surface)

Gam. : unit weight of wet soil (kN/m^3)

pw1 : backsides water pressure at depth h (kN/m^2)

h : depth from ground surface (m)

Phi. : internal friction angle of soil (Deg.)

c : cohesion of soil (kN/m^2)

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h<=H

$$Pa = Ka1(Gam.*h + q)$$

h>H

$$Pa = Ka1(Gam.*H + q) + Ka2*Gam.(h - H)$$

where, Ka1,Ka2 : active earth pressure coefficient for cohesive soil

cohesive soil N value	Ka1		Ka2
	presumption equation	minimum	
8 <= N	0.5 - 0.010H	0.3	0.5
4 <= N < 8	0.6 - 0.010H	0.4	0.6
2 <= N < 4	0.7 - 0.025H	0.5	0.7
N < 2	0.8 - 0.025H	0.6	0.8

H : excavation depth

(2)passive side pressure

sand soil

$$Pp = Kp(Gam.*h - pw2 + q) + 2c* \sqrt{Kp} + pw2$$

$$Pp = Kp(Gam.*h + q) + 2c*\sqrt{Kp}$$

where, Pp : passive side pressure (kN/m^2)

Kp : passive earth pressure coefficient

$$Kp = \frac{\cos^2 Phi}{\left(1 - \sqrt{\sin(Phi - Del.)*\frac{\sin Phi}{\cos Del.}} \right)^2}$$

pw2 : water pressure on excavation side at depth h (kN/m^2)

Del. : friction angle between steel pipe sheet pile and soil (Deg.) (Del. = -Phi./3)

q : surcharge load (kN/m^2) (including weight of water upper than ground surface)

(after concrete is casted to footing, includes weight of footing concrete and paving sand)

(3)at rest side pressure

use less value of either Po or Po'

1)before excavation

sand soil

Po = Ko(Gam.*h - pw1 + q) + pw1

cohesive soil

Po = ko(Gam.*h + q)

where, Po : side pressure at rest before excavation (kN/m^2)

Ko : at rest side pressure coefficient

Ko = 1 - sinPhi.(sand soil)

cohesive soil

N value of cohesive soil	Ko
8 <= N	0.5
4 <= N < 8	0.6
2 <= N < 4	0.7
N < 2	0.8

q : surcharge load (kN/m^2) (including weight of water upper than ground surface)

2)after excavation

sand soil

$$Po' = Ko(\ Gam.*h' - pw2 + q\ ) + Ko*\frac{f*h'}{B} + pw2$$

cohesive soil

$$Po' = Ko(\ Gam.*h' + q\ ) + Ko*\frac{f*h'}{B}$$

where, Po' : side pressure at rest after excavation (kN/m^2)

h' : depth from excavation areah (m)

q : surcharge load (kN/m^2) (including weight of water upper than ground surface)

(after concrete is casted to footing, includes weight of footing concrete and paving sand)

B : range of friction influence (m)

(let B=5.0m, if excavation width is less than 10m, then let excavation width 1/2)

f : friction force between steel pipe sheet pile and ground (kN/m^2)

sand soil : 1 * N(<=50)

cohesive soil : 0.5 * c or 5 * N(<=100)

where, if N<=2 weak layer, then friction force is not considered

steel pipe sheet pile length L = 74.000 (m)

design water tableelevation +4.340 (m)

design ground elevation -5.410 (m)

(4)sum up

1) 1 step

excavation area elevation = -5.410 (m)

landside water table elevation = +4.340 (m)

before footing concrete cast, before pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m^2)	passive side pressure (kN/m^2)	at rest side pressure (kN/m^2)	effective side pressure (kN/m^2)	
						active	passive
1	+4.340	9.750	0.00 97.50	0.00 97.50	0.00 97.50	0.00 0.00	0.00 0.00
2	-5.410	3.060	78.00	117.50	78.00	0.00 0.00	39.50

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
3	-8.470 -15.420	6.950	134.87 218.71	240.37 547.87	138.55 230.20	0.00 0.00	101.82 317.67
4	-15.420 -20.460	5.040	218.71 279.51	547.87 770.87	230.20 296.67	0.00 0.00	317.67 474.20
5	-20.460 -22.490	2.030	177.44 195.20	462.88 498.40	177.44 195.20	0.00 0.00	285.44 303.20
6	-22.490 -25.420	2.930	234.24 265.01	474.40 525.68	234.24 265.01	0.00 0.00	240.16 260.67
7	-25.420 -41.480	16.060	265.01 433.64	525.68 806.73	265.01 433.64	0.00 0.00	260.67 373.09
8	-41.480 -44.470	2.990	536.18 572.25	1752.31 1884.60	578.66 618.09	0.00 0.00	1173.65 1266.51
9	-44.470 -60.480	16.010	386.78 530.87	989.56 1277.74	386.78 530.87	0.00 0.00	602.78 746.87
10	-60.480 -67.450	6.970	765.11 848.61	2803.75 3127.76	830.49 921.70	0.00 0.00	1973.26 2206.06
11	-67.450 -69.100	1.650	843.19 863.71	3289.77 3388.88	915.05 937.88	0.00 0.00	2374.72 2451.00

perpendicular direction

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 97.50	0.00 97.50	0.00 0.00	0.00 0.00
2	-5.410 -8.470	3.060	78.00 120.84	117.50 171.05	78.00 120.84	0.00 0.00	39.50 50.21
3	-8.470 -15.420	6.950	134.87 218.71	240.37 547.87	138.55 230.20	0.00 0.00	101.82 317.67
4	-15.420	5.040	218.71	547.87	230.20	0.00 0.00	317.67

	-20.460		279.51	770.87	296.67		474.20
5	-20.460	2.030	177.44	462.88	177.44	0.00	285.44
	-22.490		195.20	498.40	195.20	0.00	303.20
6	-22.490	2.930	234.24	474.40	234.24	0.00	240.16
	-25.420		265.01	525.68	265.01	0.00	260.67
7	-25.420	16.060	265.01	525.68	265.01	0.00	260.67
	-41.480		433.64	806.73	433.64	0.00	373.09

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
8	-41.480	2.990	536.18	1752.31	578.66	0.00	1173.65
	-44.470		572.25	1884.60	618.09	0.00	1266.51
9	-44.470	16.010	386.78	989.56	386.78	0.00	602.78
	-60.480		530.87	1277.74	530.87	0.00	746.87
10	-60.480	6.970	765.11	2803.75	830.49	0.00	1973.26
	-67.450		848.61	3127.76	921.70	0.00	2206.06
11	-67.450	1.650	843.19	3289.77	915.05	0.00	2374.72
	-69.100		863.71	3388.88	937.88	0.00	2451.00

2) 2 step

excavation area elevation = -5.410 (m)

landside water table elevation = +4.340 (m)

before footing concrete cast, before pile cap cast

bridge axis direction

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 97.50	0.00 97.50	0.00 0.00	0.00 0.00
2	-5.410 -8.470	3.060	78.00 120.84	117.50 171.05	78.00 120.84	0.00 0.00	39.50 50.21
3	-8.470 -15.420	6.950	134.87 218.71	240.37 547.87	138.55 230.20	0.00 0.00	101.82 317.67
4	-15.420 -20.460	5.040	218.71 279.51	547.87 770.87	230.20 296.67	0.00 0.00	317.67 474.20
5	-20.460 -22.490	2.030	177.44 195.20	462.88 498.40	177.44 195.20	0.00 0.00	285.44 303.20
6	-22.490 -25.420	2.930	234.24 265.01	474.40 525.68	234.24 265.01	0.00 0.00	240.16 260.67
7	-25.420 -41.480	16.060	265.01 433.64	525.68 806.73	265.01 433.64	0.00 0.00	260.67 373.09
8	-41.480 -44.470	2.990	536.18 572.25	1752.31 1884.60	578.66 618.09	0.00 0.00	1173.65 1266.51
9	-44.470 -60.480	16.010	386.78 530.87	989.56 1277.74	386.78 530.87	0.00 0.00	602.78 746.87
10	-60.480 -67.450	6.970	765.11 848.61	2803.75 3127.76	830.49 921.70	0.00 0.00	1973.26 2206.07
11	-67.450 -69.100	1.650	843.19 863.71	3289.77 3388.88	915.05 937.88	0.00 0.00	2374.72 2451.00

perpendicular direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340	9.750	0.00 97.50	0.00 97.50	0.00 97.50	0.00 0.00	0.00 0.00

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
2	-5.410 -8.470	3.060	78.00 120.84	117.50 171.05	78.00 120.84	0.00 0.00	39.50 50.21
3	-8.470 -15.420	6.950	134.87 218.71	240.37 547.87	138.55 230.20	0.00 0.00	101.82 317.67
4	-15.420 -20.460	5.040	218.71 279.51	547.87 770.87	230.20 296.67	0.00 0.00	317.67 474.20
5	-20.460 -22.490	2.030	177.44 195.20	462.88 498.40	177.44 195.20	0.00 0.00	285.44 303.20
6	-22.490 -25.420	2.930	234.24 265.01	474.40 525.68	234.24 265.01	0.00 0.00	240.16 260.67
7	-25.420 -41.480	16.060	265.01 433.64	525.68 806.73	265.01 433.64	0.00 0.00	260.67 373.09
8	-41.480 -44.470	2.990	536.18 572.25	1752.31 1884.60	578.66 618.09	0.00 0.00	1173.65 1266.51
9	-44.470 -60.480	16.010	386.78 530.87	989.56 1277.74	386.78 530.87	0.00 0.00	602.78 746.87
10	-60.480 -67.450	6.970	765.11 848.61	2803.75 3127.76	830.49 921.70	0.00 0.00	1973.26 2206.07
11	-67.450 -69.100	1.650	843.19 863.71	3289.77 3388.88	915.05 937.88	0.00 0.00	2374.72 2451.00

3) 3 step

excavation area elevation = -5.410 (m)

landside water table elevation = +1.400 (m)

before footing concrete cast, before pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 +1.400	2.940	0.00 29.40	0.00 0.00	0.00 0.00	0.00 29.40	0.00 0.00
2	+1.400 -5.410	6.810	29.40 97.50	0.00 68.10	0.00 68.10	29.40 29.40	0.00 0.00
3	-5.410 -8.470	3.060	78.00 120.84	88.10 141.65	54.48 97.32	23.52 23.52	33.62 44.33
4	-8.470 -15.420	6.950	134.87 218.71	210.97 518.47	109.15 209.03	25.72 9.68	101.82 309.44
5	-15.420 -19.612	4.192	218.71 269.28	518.47 703.97	209.03 269.28	9.68 0.00	309.44 434.68
6	-19.612 -20.460	0.848	269.28 279.51	703.97 741.47	269.28 281.46	0.00 0.00	434.68 460.00
7	-20.460 -22.490	2.030	177.44 195.20	433.48 469.01	177.44 195.20	0.00 0.00	256.04 273.80
8	-22.490 -25.420	2.930	234.24 265.01	445.01 496.28	234.24 265.01	0.00 0.00	210.76 231.27
9	-25.420 -41.480	16.060	265.01 433.64	496.28 777.33	265.01 433.64	0.00 0.00	231.27 343.69
10	-41.480 -44.470	2.990	536.18 572.25	1722.91 1855.20	578.66 618.09	0.00 0.00	1144.25 1237.11
11	-44.470 -60.480	16.010	386.78 530.87	960.16 1248.34	386.78 530.87	0.00 0.00	573.38 717.47
12	-60.480 -67.450	6.970	765.11 848.61	2650.50 2974.52	830.49 921.70	0.00 0.00	1820.01 2052.82
13	-67.450 -69.100	1.650	843.19 863.71	3126.22 3225.33	915.05 937.88	0.00 0.00	2211.17 2287.45

perpendicular direction

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 +1.400	2.940	0.00 29.40	0.00 0.00	0.00 0.00	0.00 29.40	0.00 0.00
2	+1.400 -5.410	6.810	29.40 97.50	0.00 68.10	0.00 68.10	29.40 29.40	0.00 0.00
3	-5.410 -8.470	3.060	78.00 120.84	88.10 141.65	54.48 97.32	23.52 23.52	33.62 44.33
4	-8.470 -15.420	6.950	134.87 218.71	210.97 518.47	109.15 209.03	25.72 9.68	101.82 309.44
5	-15.420 -19.612	4.192	218.71 269.28	518.47 703.97	209.03 269.28	9.68 0.00	309.44 434.68
6	-19.612 -20.460	0.848	269.28 279.51	703.97 741.47	269.28 281.46	0.00 0.00	434.68 460.00
7	-20.460 -22.490	2.030	177.44 195.20	433.48 469.01	177.44 195.20	0.00 0.00	256.04 273.80
8	-22.490 -25.420	2.930	234.24 265.01	445.01 496.28	234.24 265.01	0.00 0.00	210.76 231.27
9	-25.420 -41.480	16.060	265.01 433.64	496.28 777.33	265.01 433.64	0.00 0.00	231.27 343.69
10	-41.480 -44.470	2.990	536.18 572.25	1722.91 1855.20	578.66 618.09	0.00 0.00	1144.25 1237.11
11	-44.470 -60.480	16.010	386.78 530.87	960.16 1248.34	386.78 530.87	0.00 0.00	573.38 717.47
12	-60.480 -67.450	6.970	765.11 848.61	2650.50 2974.52	830.49 921.70	0.00 0.00	1820.01 2052.82
13	-67.450 -69.100	1.650	843.19 863.71	3126.22 3225.33	915.05 937.88	0.00 0.00	2211.17 2287.45

4) 4 step

excavation area elevation = -5.410 (m)

landside water table elevation = +1.400 (m)

before footing concrete cast, before pile cap cast

bridge axis direction

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 +1.400	2.940	0.00 29.40	0.00 0.00	0.00 0.00	0.00 29.40	0.00 0.00
2	+1.400 -5.410	6.810	29.40 97.50	0.00 68.10	0.00 68.10	29.40 29.40	0.00 0.00
3	-5.410 -8.470	3.060	78.00 120.84	88.10 141.65	54.48 97.32	23.52 23.52	33.62 44.33
4	-8.470 -15.420	6.950	134.87 218.71	210.97 518.47	109.15 209.03	25.72 9.68	101.82 309.44
5	-15.420 -19.612	4.192	218.71 269.28	518.47 703.97	209.03 269.28	9.68 0.00	309.44 434.68
6	-19.612 -20.460	0.848	269.28 279.51	703.97 741.47	269.28 281.46	0.00 0.00	434.68 460.00
7	-20.460 -22.490	2.030	177.44 195.20	433.48 469.01	177.44 195.20	0.00 0.00	256.04 273.80
8	-22.490 -25.420	2.930	234.24 265.01	445.01 496.28	234.24 265.01	0.00 0.00	210.76 231.27
9	-25.420 -41.480	16.060	265.01 433.64	496.28 777.33	265.01 433.64	0.00 0.00	231.27 343.69
10	-41.480 -44.470	2.990	536.18 572.25	1722.91 1855.20	578.66 618.09	0.00 0.00	1144.25 1237.11
11	-44.470 -60.480	16.010	386.78 530.87	960.16 1248.34	386.78 530.87	0.00 0.00	573.38 717.47
12	-60.480 -67.450	6.970	765.11 848.61	2650.50 2974.52	830.49 921.70	0.00 0.00	1820.01 2052.82
13	-67.450 -69.100	1.650	843.19 863.71	3126.22 3225.33	915.05 937.88	0.00 0.00	2211.17 2287.45

perpendicular direction

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 +1.400	2.940	0.00 29.40	0.00 0.00	0.00 0.00	0.00 29.40	0.00 0.00
2	+1.400 -5.410	6.810	29.40 97.50	0.00 68.10	0.00 68.10	29.40 29.40	0.00 0.00
3	-5.410 -8.470	3.060	78.00 120.84	88.10 141.65	54.48 97.32	23.52 23.52	33.62 44.33
4	-8.470 -15.420	6.950	134.87 218.71	210.97 518.47	109.15 209.03	25.72 9.68	101.82 309.44
5	-15.420 -19.612	4.192	218.71 269.28	518.47 703.97	209.03 269.28	9.68 0.00	309.44 434.68
6	-19.612 -20.460	0.848	269.28 279.51	703.97 741.47	269.28 281.46	0.00 0.00	434.68 460.00
7	-20.460 -22.490	2.030	177.44 195.20	433.48 469.01	177.44 195.20	0.00 0.00	256.04 273.80
8	-22.490 -25.420	2.930	234.24 265.01	445.01 496.28	234.24 265.01	0.00 0.00	210.76 231.27
9	-25.420 -41.480	16.060	265.01 433.64	496.28 777.33	265.01 433.64	0.00 0.00	231.27 343.69
10	-41.480 -44.470	2.990	536.18 572.25	1722.91 1855.20	578.66 618.09	0.00 0.00	1144.25 1237.11
11	-44.470 -60.480	16.010	386.78 530.87	960.16 1248.34	386.78 530.87	0.00 0.00	573.38 717.47
12	-60.480 -67.450	6.970	765.11 848.61	2650.50 2974.52	830.49 921.70	0.00 0.00	1820.01 2052.82
13	-67.450 -69.100	1.650	843.19 863.71	3126.22 3225.33	915.05 937.88	0.00 0.00	2211.17 2287.45

5) 5 step

excavation area elevation   = -17.100 (m)

landside water table elevation =   +1.400 (m)

before footing concrete cast,   before pile cap cast

bridge axis direction

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 +1.400	2.940	0.00 29.40	0.00 0.00	0.00 0.00	0.00 29.40	0.00 0.00
2	+1.400 -5.410	6.810	29.40 97.50	0.00 68.10	0.00 68.10	29.40 29.40	0.00 0.00
3	-5.410 -8.470	3.060	58.50 90.63	68.10 98.70	68.10 98.70	0.00 0.00	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	98.70 168.20	98.70 168.20	36.17 50.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	168.20 185.00	168.20 185.00	50.51 53.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	185.00 333.66	185.00 233.29	53.97 46.22	0.00 100.37
7	-20.460 -22.490	2.030	142.63 160.39	350.12 385.64	125.43 148.67	17.20 11.72	224.69 236.97
8	-22.490 -25.420	2.930	199.43 230.20	361.64 412.92	178.41 216.55	21.03 13.65	183.24 196.37
9	-25.420 -30.835	5.415	230.20 287.06	412.92 507.68	216.55 287.06	13.65 0.00	196.37 220.62
10	-30.835 -41.480	10.645	287.06 398.83	507.68 693.97	287.06 425.66	0.00 0.00	220.62 268.31
11	-41.480 -44.470	2.990	536.18 572.25	1315.10 1447.39	556.59 602.82	0.00 0.00	758.52 844.57
12	-44.470 -60.480	16.010	351.97 496.06	876.80 1164.98	386.78 530.87	0.00 0.00	490.02 634.11
13	-60.480 -67.450	6.970	765.11 848.61	2216.00 2540.01	830.49 921.70	0.00 0.00	1385.50 1618.31
14	-67.450 -69.100	1.650	843.19 863.71	2662.50 2761.61	915.05 937.88	0.00 0.00	1747.45 1823.73

perpendicular direction

No	elevation (m)	layer thick	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 +1.400	2.940	0.00 29.40	0.00 0.00	0.00 0.00	0.00 29.40	0.00 0.00
2	+1.400 -5.410	6.810	29.40 97.50	0.00 68.10	0.00 68.10	29.40 29.40	0.00 0.00
3	-5.410 -8.470	3.060	58.50 90.63	68.10 98.70	68.10 98.70	0.00 0.00	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	98.70 168.20	98.70 168.20	36.17 50.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	168.20 185.00	168.20 185.00	50.51 53.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	185.00 333.66	185.00 233.29	53.97 46.22	0.00 100.37
7	-20.460 -22.490	2.030	142.63 160.39	350.12 385.64	125.43 148.67	17.20 11.72	224.69 236.97
8	-22.490 -25.420	2.930	199.43 230.20	361.64 412.92	178.41 216.55	21.03 13.65	183.24 196.37
9	-25.420 -30.835	5.415	230.20 287.06	412.92 507.68	216.55 287.06	13.65 0.00	196.37 220.62
10	-30.835 -41.480	10.645	287.06 398.83	507.68 693.97	287.06 425.66	0.00 0.00	220.62 268.31
11	-41.480 -44.470	2.990	536.18 572.25	1315.10 1447.39	556.59 602.82	0.00 0.00	758.52 844.57
12	-44.470 -60.480	16.010	351.97 496.06	876.80 1164.98	386.78 530.87	0.00 0.00	490.02 634.11
13	-60.480 -67.450	6.970	765.11 848.61	2216.00 2540.01	830.49 921.70	0.00 0.00	1385.50 1618.31
14	-67.450 -69.100	1.650	843.19 863.71	2662.50 2761.61	915.05 937.88	0.00 0.00	1747.45 1823.73

6) 6 step

excavation area elevation = -17.100 (m)

landside water table elevation = +1.400 (m)

after footing concrete cast, before pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 +1.400	2.940	0.00 29.40	0.00 0.00	0.00 0.00	0.00 29.40	0.00 0.00
2	+1.400 -5.410	6.810	29.40 97.50	0.00 68.10	0.00 68.10	29.40 29.40	0.00 0.00
3	-5.410 -8.470	3.060	58.50 90.63	68.10 98.70	68.10 98.70	0.00 0.00	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	98.70 168.20	98.70 168.20	36.17 50.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	168.20 185.00	168.20 185.00	50.51 53.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	368.45 517.12	202.08 250.36	36.90 29.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	387.62 423.14	144.18 167.42	0.00 0.00	243.44 255.72
8	-22.490 -25.420	2.930	199.43 230.20	399.14 450.42	200.91 239.05	0.00 0.00	198.24 211.37
9	-25.420 -35.719	10.299	230.20 338.34	450.42 630.65	239.05 373.15	0.00 0.00	211.37 257.51
10	-35.719 -41.480	5.761	338.34 398.83	630.65 731.47	373.15 433.64	0.00 0.00	257.51 297.83
11	-41.480 -43.674	2.194	536.18 562.65	1498.56 1595.61	573.66 607.59	0.00 0.00	924.89 988.03
12	-43.674 -44.470	0.796	562.65 572.25	1595.61 1630.85	607.59 618.09	0.00 0.00	988.03 1012.76
13	-44.470 -60.480	16.010	351.97 496.06	914.30 1202.48	386.78 530.87	0.00 0.00	527.52 671.61
14	-60.480 -67.450	6.970	765.11 848.61	2411.46 2735.48	830.49 921.70	0.00 0.00	1580.97 1813.78
15	-67.450 -69.100	1.650	843.19 863.71	2871.11 2970.22	915.05 937.88	0.00 0.00	1956.06 2032.34

perpendicular direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 +1.400	2.940	0.00 29.40	0.00 0.00	0.00 0.00	0.00 29.40	0.00 0.00
2	+1.400 -5.410	6.810	29.40 97.50	0.00 68.10	0.00 68.10	29.40 29.40	0.00 0.00
3	-5.410 -8.470	3.060	58.50 90.63	68.10 98.70	68.10 98.70	0.00 0.00	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	98.70 168.20	98.70 168.20	36.17 50.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	168.20 185.00	168.20 185.00	50.51 53.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	368.45 517.12	202.08 250.36	36.90 29.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	387.62 423.14	144.18 167.42	0.00 0.00	243.44 255.72
8	-22.490 -25.420	2.930	199.43 230.20	399.14 450.42	200.91 239.05	0.00 0.00	198.24 211.37
9	-25.420 -35.719	10.299	230.20 338.34	450.42 630.65	239.05 373.15	0.00 0.00	211.37 257.51
10	-35.719 -41.480	5.761	338.34 398.83	630.65 731.47	373.15 433.64	0.00 0.00	257.51 297.83
11	-41.480 -43.674	2.194	536.18 562.65	1498.56 1595.61	573.66 607.59	0.00 0.00	924.89 988.03
12	-43.674 -44.470	0.796	562.65 572.25	1595.61 1630.85	607.59 618.09	0.00 0.00	988.03 1012.76
13	-44.470 -60.480	16.010	351.97 496.06	914.30 1202.48	386.78 530.87	0.00 0.00	527.52 671.61
14	-60.480 -67.450	6.970	765.11 848.61	2411.46 2735.48	830.49 921.70	0.00 0.00	1580.97 1813.78
15	-67.450 -69.100	1.650	843.19 863.71	2871.11 2970.22	915.05 937.88	0.00 0.00	1956.06 2032.34

7) 7 step

excavation area elevation = -17.100 (m)

landside water table elevation = -1.100 (m)

after footing concrete cast, before pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -1.100	5.440	0.00 54.40	0.00 0.00	0.00 0.00	0.00 54.40	0.00 0.00
2	-1.100 -5.410	4.310	54.40 97.50	0.00 43.10	0.00 43.10	54.40 54.40	0.00 0.00
3	-5.410 -8.470	3.060	58.50 90.63	43.10 73.70	43.10 73.70	15.40 16.93	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	73.70 143.20	73.70 143.20	61.17 75.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	143.20 160.00	143.20 160.00	75.51 78.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	343.45 492.12	177.08 225.36	61.90 54.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	362.62 398.14	131.68 154.92	10.95 5.47	230.94 243.22
8	-22.490 -25.420	2.930	199.43 230.20	374.14 425.42	185.91 224.05	13.53 6.15	188.24 201.37
9	-25.420 -27.859	2.439	230.20 255.81	425.42 468.10	224.05 255.81	6.15 0.00	201.37 212.29
10	-27.859 -41.480	13.621	255.81 398.83	468.10 706.47	255.81 433.16	0.00 0.00	212.29 273.31
11	-41.480 -44.470	2.990	536.18 572.25	1473.56 1605.85	548.66 594.90	0.00 0.00	924.89 1010.95
12	-44.470 -60.480	16.010	351.97 496.06	889.30 1177.48	386.78 530.87	0.00 0.00	502.52 646.61
13	-60.480 -67.450	6.970	765.11 848.61	2281.15 2605.16	830.49 921.70	0.00 0.00	1450.66 1683.47
14	-67.450 -69.100	1.650	843.19 863.71	2732.04 2831.15	915.05 937.88	0.00 0.00	1816.99 1893.27

perpendicular direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -1.100	5.440	0.00 54.40	0.00 0.00	0.00 0.00	0.00 54.40	0.00 0.00
2	-1.100 -5.410	4.310	54.40 97.50	0.00 43.10	0.00 43.10	54.40 54.40	0.00 0.00
3	-5.410 -8.470	3.060	58.50 90.63	43.10 73.70	43.10 73.70	15.40 16.93	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	73.70 143.20	73.70 143.20	61.17 75.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	143.20 160.00	143.20 160.00	75.51 78.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	343.45 492.12	177.08 225.36	61.90 54.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	362.62 398.14	131.68 154.92	10.95 5.47	230.94 243.22
8	-22.490 -25.420	2.930	199.43 230.20	374.14 425.42	185.91 224.05	13.53 6.15	188.24 201.37
9	-25.420 -27.859	2.439	230.20 255.81	425.42 468.10	224.05 255.81	6.15 0.00	201.37 212.29
10	-27.859 -41.480	13.621	255.81 398.83	468.10 706.47	255.81 433.16	0.00 0.00	212.29 273.31
11	-41.480 -44.470	2.990	536.18 572.25	1473.56 1605.85	548.66 594.90	0.00 0.00	924.89 1010.95
12	-44.470 -60.480	16.010	351.97 496.06	889.30 1177.48	386.78 530.87	0.00 0.00	502.52 646.61
13	-60.480 -67.450	6.970	765.11 848.61	2281.15 2605.16	830.49 921.70	0.00 0.00	1450.66 1683.47
14	-67.450 -69.100	1.650	843.19 863.71	2732.04 2831.15	915.05 937.88	0.00 0.00	1816.99 1893.27

8) 8 step

excavation area elevation = -17.100 (m)

landside water table elevation = -3.600 (m)

after footing concrete cast, before pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²) active	effective side pressure (kN/m²) passive
1	+4.340 -3.600	7.940	0.00 79.40	0.00 0.00	0.00 0.00	0.00 79.40	0.00 0.00
2	-3.600 -5.410	1.810	79.40 97.50	0.00 18.10	0.00 18.10	79.40 79.40	0.00 0.00
3	-5.410 -8.470	3.060	58.50 90.63	18.10 48.70	18.10 48.70	40.40 41.93	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	48.70 118.20	48.70 118.20	86.17 100.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	118.20 135.00	118.20 135.00	100.51 103.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	318.45 467.12	152.08 200.36	86.90 79.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	337.62 373.14	119.18 142.42	23.45 17.97	218.44 230.72
8	-22.490 -25.420	2.930	199.43 230.20	349.14 400.42	170.91 209.05	28.53 21.15	178.24 191.37
9	-25.420 -33.811	8.391	230.20 318.31	400.42 547.26	209.05 318.31	21.15 0.00	191.37 228.96
10	-33.811 -41.480	7.669	318.31 398.83	547.26 681.47	318.31 418.16	0.00 0.00	228.96 263.31
11	-41.480 -44.470	2.990	536.18 572.25	1448.56 1580.85	523.66 569.90	12.52 2.35	924.89 1010.95
12	-44.470 -45.475	1.005	351.97 361.02	864.30 882.39	381.35 395.82	0.00 0.00	482.95 486.57
13	-45.475 -60.480	15.005	361.02 496.06	882.39 1152.48	395.82 530.87	0.00 0.00	486.57 621.61
14	-60.480 -67.450	6.970	765.11 848.61	2150.84 2474.85	830.49 921.70	0.00 0.00	1320.35 1553.16
15	-67.450 -69.100	1.650	843.19 863.71	2592.97 2692.08	915.05 937.88	0.00 0.00	1677.92 1754.19

perpendicular direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -3.600	7.940	0.00 79.40	0.00 0.00	0.00 0.00	0.00 79.40	0.00 0.00
2	-3.600 -5.410	1.810	79.40 97.50	0.00 18.10	0.00 18.10	79.40 79.40	0.00 0.00
3	-5.410 -8.470	3.060	58.50 90.63	18.10 48.70	18.10 48.70	40.40 41.93	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	48.70 118.20	48.70 118.20	86.17 100.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	118.20 135.00	118.20 135.00	100.51 103.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	318.45 467.12	152.08 200.36	86.90 79.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	337.62 373.14	119.18 142.42	23.45 17.97	218.44 230.72
8	-22.490 -25.420	2.930	199.43 230.20	349.14 400.42	170.91 209.05	28.53 21.15	178.24 191.37
9	-25.420 -33.811	8.391	230.20 318.31	400.42 547.26	209.05 318.31	21.15 0.00	191.37 228.96
10	-33.811 -41.480	7.669	318.31 398.83	547.26 681.47	318.31 418.16	0.00 0.00	228.96 263.31
11	-41.480 -44.470	2.990	536.18 572.25	1448.56 1580.85	523.66 569.90	12.52 2.35	924.89 1010.95
12	-44.470 -45.475	1.005	351.97 361.02	864.30 882.39	381.35 395.82	0.00 0.00	482.95 486.57
13	-45.475 -60.480	15.005	361.02 496.06	882.39 1152.48	395.82 530.87	0.00 0.00	486.57 621.61
14	-60.480 -67.450	6.970	765.11 848.61	2150.84 2474.85	830.49 921.70	0.00 0.00	1320.35 1553.16
15	-67.450 -69.100	1.650	843.19 863.71	2592.97 2692.08	915.05 937.88	0.00 0.00	1677.92 1754.19

9) 9 step

excavation area elevation = -17.100 (m)

landside water table elevation = -6.100 (m)

after footing concrete cast, before pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -6.100	0.690	58.50 65.75	0.00 0.00	0.00 0.00	58.50 65.75	0.00 0.00
3	-6.100 -8.470	2.370	65.75 90.63	0.00 23.70	0.00 23.70	65.75 66.93	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	23.70 93.20	23.70 93.20	111.17 125.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	93.20 110.00	93.20 110.00	125.51 128.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	293.45 442.12	127.08 175.36	111.90 104.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	312.62 348.14	106.68 129.92	35.95 30.47	205.94 218.22
8	-22.490 -25.420	2.930	199.43 230.20	324.14 375.42	155.91 194.05	43.53 36.15	168.24 181.37
9	-25.420 -39.763	14.343	230.20 380.81	375.42 626.43	194.05 380.81	36.15 0.00	181.37 245.62
10	-39.763 -41.480	1.717	380.81 398.83	626.43 656.47	380.81 403.16	0.00 0.00	245.62 253.31
11	-41.480 -44.470	2.990	536.18 572.25	1423.56 1555.85	498.66 544.90	37.52 27.35	924.89 1010.95
12	-44.470 -47.790	3.320	351.97 381.85	839.30 899.06	368.85 416.66	0.00 0.00	470.45 482.40
13	-47.790 -60.480	12.690	381.85 496.06	899.06 1127.48	416.66 530.87	0.00 0.00	482.40 596.61
14	-60.480 -67.450	6.970	765.11 848.61	2020.53 2344.54	830.49 921.70	0.00 0.00	1190.04 1422.84
15	-67.450 -69.100	1.650	843.19 863.71	2453.90 2553.00	915.05 937.88	0.00 0.00	1538.85 1615.12

perpendicular direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m^2)	passive side pressure (kN/m^2)	at rest side pressure (kN/m^2)	effective side pressure (kN/m^2)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -6.100	0.690	58.50 65.75	0.00 0.00	0.00 0.00	58.50 65.75	0.00 0.00
3	-6.100 -8.470	2.370	65.75 90.63	0.00 23.70	0.00 23.70	65.75 66.93	0.00 0.00
4	-8.470 -15.420	6.950	134.87 218.71	23.70 93.20	23.70 93.20	111.17 125.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	93.20 110.00	93.20 110.00	125.51 128.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	293.45 442.12	127.08 175.36	111.90 104.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	312.62 348.14	106.68 129.92	35.95 30.47	205.94 218.22
8	-22.490 -25.420	2.930	199.43 230.20	324.14 375.42	155.91 194.05	43.53 36.15	168.24 181.37
9	-25.420 -39.763	14.343	230.20 380.81	375.42 626.43	194.05 380.81	36.15 0.00	181.37 245.62
10	-39.763 -41.480	1.717	380.81 398.83	626.43 656.47	380.81 403.16	0.00 0.00	245.62 253.31
11	-41.480 -44.470	2.990	536.18 572.25	1423.56 1555.85	498.66 544.90	37.52 27.35	924.89 1010.95
12	-44.470 -47.790	3.320	351.97 381.85	839.30 899.06	368.85 416.66	0.00 0.00	470.45 482.40
13	-47.790 -60.480	12.690	381.85 496.06	899.06 1127.48	416.66 530.87	0.00 0.00	482.40 596.61
14	-60.480 -67.450	6.970	765.11 848.61	2020.53 2344.54	830.49 921.70	0.00 0.00	1190.04 1422.84
15	-67.450 -69.100	1.650	843.19 863.71	2453.90 2553.00	915.05 937.88	0.00 0.00	1538.85 1615.12

10)10 step

excavation area elevation = -17.100 (m)

landside water table elevation = -9.100 (m)

after footing concrete cast, before pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -8.470	3.060	58.50 90.63	0.00 0.00	0.00 0.00	58.50 90.63	0.00 0.00
3	-8.470 -9.100	0.630	134.87 142.47	0.00 0.00	0.00 0.00	134.87 142.47	0.00 0.00
4	-9.100 -15.420	6.320	142.47 218.71	0.00 63.20	0.00 63.20	142.47 155.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	63.20 80.00	63.20 80.00	155.51 158.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	263.45 412.12	97.08 145.36	141.90 134.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	282.62 318.14	91.68 114.92	50.95 45.47	190.94 203.22
8	-22.490 -25.420	2.930	199.43 230.20	294.14 345.42	137.91 176.05	61.53 54.15	156.24 169.37
9	-25.420 -41.480	16.060	230.20 398.83	345.42 626.47	176.05 385.16	54.15 13.67	169.37 241.31
10	-41.480 -44.470	2.990	536.18 572.25	1393.56 1525.85	468.66 514.90	67.52 57.35	924.89 1010.95
11	-44.470 -50.568	6.098	351.97 406.85	809.30 919.06	353.85 441.66	0.00 0.00	455.45 477.40
12	-50.568 -60.480	9.912	406.85 496.06	919.06 1097.48	441.66 530.87	0.00 0.00	477.40 566.61
13	-60.480 -67.450	6.970	765.11 848.61	1864.16 2188.17	830.49 921.70	0.00 0.00	1033.66 1266.47
14	-67.450 -69.100	1.650	843.19 863.71	2287.01 2386.12	915.05 937.88	0.00 0.00	1371.96 1448.24

perpendicular direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -8.470	3.060	58.50 90.63	0.00 0.00	0.00 0.00	58.50 90.63	0.00 0.00
3	-8.470 -9.100	0.630	134.87 142.47	0.00 0.00	0.00 0.00	134.87 142.47	0.00 0.00
4	-9.100 -15.420	6.320	142.47 218.71	0.00 63.20	0.00 63.20	142.47 155.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	63.20 80.00	63.20 80.00	155.51 158.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	263.45 412.12	97.08 145.36	141.90 134.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	282.62 318.14	91.68 114.92	50.95 45.47	190.94 203.22
8	-22.490 -25.420	2.930	199.43 230.20	294.14 345.42	137.91 176.05	61.53 54.15	156.24 169.37
9	-25.420 -41.480	16.060	230.20 398.83	345.42 626.47	176.05 385.16	54.15 13.67	169.37 241.31
10	-41.480 -44.470	2.990	536.18 572.25	1393.56 1525.85	468.66 514.90	67.52 57.35	924.89 1010.95
11	-44.470 -50.568	6.098	351.97 406.85	809.30 919.06	353.85 441.66	0.00 0.00	455.45 477.40
12	-50.568 -60.480	9.912	406.85 496.06	919.06 1097.48	441.66 530.87	0.00 0.00	477.40 566.61
13	-60.480 -67.450	6.970	765.11 848.61	1864.16 2188.17	830.49 921.70	0.00 0.00	1033.66 1266.47
14	-67.450 -69.100	1.650	843.19 863.71	2287.01 2386.12	915.05 937.88	0.00 0.00	1371.96 1448.24

11)11 step

excavation area elevation   = -17.100 (m)

landside water table elevation = -14.100 (m)

after footing concrete cast,   before pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -8.470	3.060	58.50 90.63	0.00 0.00	0.00 0.00	58.50 90.63	0.00 0.00
3	-8.470 -14.100	5.630	134.87 202.78	0.00 0.00	0.00 0.00	134.87 202.78	0.00 0.00
4	-14.100 -15.420	1.320	202.78 218.71	0.00 13.20	0.00 13.20	202.78 205.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	13.20 30.00	13.20 30.00	205.51 208.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	213.45 362.12	47.08 95.36	191.90 184.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	232.62 268.14	66.68 89.92	75.95 70.47	165.94 178.22
8	-22.490 -25.420	2.930	199.43 230.20	244.14 295.42	107.91 146.05	91.53 84.15	136.24 149.37
9	-25.420 -41.480	16.060	230.20 398.83	295.42 576.47	146.05 355.16	84.15 43.67	149.37 221.31
10	-41.480 -44.470	2.990	536.18 572.25	1343.56 1475.85	418.66 464.90	117.52 107.35	924.89 1010.95
11	-44.470 -48.751	4.281	351.97 390.50	759.30 836.36	328.85 390.50	23.12 0.00	430.45 445.86
12	-48.751 -55.197	6.446	390.50 448.52	836.36 952.39	390.50 483.33	0.00 0.00	445.86 469.07
13	-55.197 -60.480	5.283	448.52 496.06	952.39 1047.48	483.33 530.87	0.00 0.00	469.07 516.61
14	-60.480 -67.450	6.970	765.11 848.61	1603.53 1927.55	830.49 921.70	0.00 0.00	773.04 1005.85
15	-67.450 -69.100	1.650	843.19 863.71	2008.87 2107.98	915.05 937.88	0.00 0.00	1093.82 1170.10

perpendicular direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -8.470	3.060	58.50 90.63	0.00 0.00	0.00 0.00	58.50 90.63	0.00 0.00
3	-8.470 -14.100	5.630	134.87 202.78	0.00 0.00	0.00 0.00	134.87 202.78	0.00 0.00
4	-14.100 -15.420	1.320	202.78 218.71	0.00 13.20	0.00 13.20	202.78 205.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	13.20 30.00	13.20 30.00	205.51 208.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	213.45 362.12	47.08 95.36	191.90 184.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	232.62 268.14	66.68 89.92	75.95 70.47	165.94 178.22
8	-22.490 -25.420	2.930	199.43 230.20	244.14 295.42	107.91 146.05	91.53 84.15	136.24 149.37
9	-25.420 -41.480	16.060	230.20 398.83	295.42 576.47	146.05 355.16	84.15 43.67	149.37 221.31
10	-41.480 -44.470	2.990	536.18 572.25	1343.56 1475.85	418.66 464.90	117.52 107.35	924.89 1010.95
11	-44.470 -48.751	4.281	351.97 390.50	759.30 836.36	328.85 390.50	23.12 0.00	430.45 445.86
12	-48.751 -55.197	6.446	390.50 448.52	836.36 952.39	390.50 483.33	0.00 0.00	445.86 469.07
13	-55.197 -60.480	5.283	448.52 496.06	952.39 1047.48	483.33 530.87	0.00 0.00	469.07 516.61
14	-60.480 -67.450	6.970	765.11 848.61	1603.53 1927.55	830.49 921.70	0.00 0.00	773.04 1005.85
15	-67.450 -69.100	1.650	843.19 863.71	2008.87 2107.98	915.05 937.88	0.00 0.00	1093.82 1170.10

12)12 step

excavation area elevation = -17.100 (m)

landside water table elevation = -14.100 (m)

after footing concrete cast, after pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -8.470	3.060	58.50 90.63	0.00 0.00	0.00 0.00	58.50 90.63	0.00 0.00
3	-8.470 -14.100	5.630	134.87 202.78	0.00 0.00	0.00 0.00	134.87 202.78	0.00 0.00
4	-14.100 -15.420	1.320	202.78 218.71	0.00 13.20	0.00 13.20	202.78 205.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	13.20 30.00	13.20 30.00	205.51 208.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	213.45 362.12	47.08 95.36	191.90 184.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	232.62 268.14	66.68 89.92	75.95 70.47	165.94 178.22
8	-22.490 -25.420	2.930	199.43 230.20	244.14 295.42	107.91 146.05	91.53 84.15	136.24 149.37
9	-25.420 -41.480	16.060	230.20 398.83	295.42 576.47	146.05 355.16	84.15 43.67	149.37 221.31
10	-41.480 -44.470	2.990	536.18 572.25	1343.56 1475.85	418.66 464.90	117.52 107.35	924.89 1010.95
11	-44.470 -48.751	4.281	351.97 390.50	759.30 836.36	328.85 390.50	23.12 0.00	430.45 445.86
12	-48.751 -55.197	6.446	390.50 448.52	836.36 952.39	390.50 483.33	0.00 0.00	445.86 469.07
13	-55.197 -60.480	5.283	448.52 496.06	952.39 1047.48	483.33 530.87	0.00 0.00	469.07 516.61
14	-60.480 -67.450	6.970	765.11 848.61	1603.53 1927.55	830.49 921.70	0.00 0.00	773.04 1005.85
15	-67.450 -69.100	1.650	843.19 863.71	2008.87 2107.98	915.05 937.88	0.00 0.00	1093.82 1170.10

perpendicular direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -8.470	3.060	58.50 90.63	0.00 0.00	0.00 0.00	58.50 90.63	0.00 0.00
3	-8.470 -14.100	5.630	134.87 202.78	0.00 0.00	0.00 0.00	134.87 202.78	0.00 0.00
4	-14.100 -15.420	1.320	202.78 218.71	0.00 13.20	0.00 13.20	202.78 205.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	13.20 30.00	13.20 30.00	205.51 208.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	213.45 362.12	47.08 95.36	191.90 184.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	232.62 268.14	66.68 89.92	75.95 70.47	165.94 178.22
8	-22.490 -25.420	2.930	199.43 230.20	244.14 295.42	107.91 146.05	91.53 84.15	136.24 149.37
9	-25.420 -41.480	16.060	230.20 398.83	295.42 576.47	146.05 355.16	84.15 43.67	149.37 221.31
10	-41.480 -44.470	2.990	536.18 572.25	1343.56 1475.85	418.66 464.90	117.52 107.35	924.89 1010.95
11	-44.470 -48.751	4.281	351.97 390.50	759.30 836.36	328.85 390.50	23.12 0.00	430.45 445.86
12	-48.751 -55.197	6.446	390.50 448.52	836.36 952.39	390.50 483.33	0.00 0.00	445.86 469.07
13	-55.197 -60.480	5.283	448.52 496.06	952.39 1047.48	483.33 530.87	0.00 0.00	469.07 516.61
14	-60.480 -67.450	6.970	765.11 848.61	1603.53 1927.55	830.49 921.70	0.00 0.00	773.04 1005.85
15	-67.450 -69.100	1.650	843.19 863.71	2008.87 2107.98	915.05 937.88	0.00 0.00	1093.82 1170.10

13)13 step

excavation area elevation = -17.100 (m)

landside water table elevation = -14.100 (m)

after footing concrete cast, after pile cap cast

bridge axis direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m²)	passive side pressure (kN/m²)	at rest side pressure (kN/m²)	effective side pressure (kN/m²)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -8.470	3.060	58.50 90.63	0.00 0.00	0.00 0.00	58.50 90.63	0.00 0.00
3	-8.470 -14.100	5.630	134.87 202.78	0.00 0.00	0.00 0.00	134.87 202.78	0.00 0.00
4	-14.100 -15.420	1.320	202.78 218.71	0.00 13.20	0.00 13.20	202.78 205.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	13.20 30.00	13.20 30.00	205.51 208.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	213.45 362.12	47.08 95.36	191.90 184.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	232.62 268.14	66.68 89.92	75.95 70.47	165.94 178.22
8	-22.490 -25.420	2.930	199.43 230.20	244.14 295.42	107.91 146.05	91.53 84.15	136.24 149.37
9	-25.420 -41.480	16.060	230.20 398.83	295.42 576.47	146.05 355.16	84.15 43.67	149.37 221.31
10	-41.480 -44.470	2.990	536.18 572.25	1343.56 1475.85	418.66 464.90	117.52 107.35	924.89 1010.95
11	-44.470 -48.751	4.281	351.97 390.50	759.30 836.36	328.85 390.50	23.12 0.00	430.45 445.86
12	-48.751 -55.197	6.446	390.50 448.52	836.36 952.39	390.50 483.33	0.00 0.00	445.86 469.07
13	-55.197 -60.480	5.283	448.52 496.06	952.39 1047.48	483.33 530.87	0.00 0.00	469.07 516.61
14	-60.480 -67.450	6.970	765.11 848.61	1603.53 1927.55	830.49 921.70	0.00 0.00	773.04 1005.85
15	-67.450 -69.100	1.650	843.19 863.71	2008.87 2107.98	915.05 937.88	0.00 0.00	1093.82 1170.10

perpendicular direction

No	elevation (m)	layer thick (m)	active side pressure (kN/m^2)	passive side pressure (kN/m^2)	at rest side pressure (kN/m^2)	effective side pressure (kN/m^2)	
						active	passive
1	+4.340 -5.410	9.750	0.00 97.50	0.00 0.00	0.00 0.00	0.00 97.50	0.00 0.00
2	-5.410 -8.470	3.060	58.50 90.63	0.00 0.00	0.00 0.00	58.50 90.63	0.00 0.00
3	-8.470 -14.100	5.630	134.87 202.78	0.00 0.00	0.00 0.00	134.87 202.78	0.00 0.00
4	-14.100 -15.420	1.320	202.78 218.71	0.00 13.20	0.00 13.20	202.78 205.51	0.00 0.00
5	-15.420 -17.100	1.680	218.71 238.97	13.20 30.00	13.20 30.00	205.51 208.97	0.00 0.00
6	-17.100 -20.460	3.360	238.97 279.51	213.45 362.12	47.08 95.36	191.90 184.14	166.38 266.75
7	-20.460 -22.490	2.030	142.63 160.39	232.62 268.14	66.68 89.92	75.95 70.47	165.94 178.22
8	-22.490 -25.420	2.930	199.43 230.20	244.14 295.42	107.91 146.05	91.53 84.15	136.24 149.37
9	-25.420 -41.480	16.060	230.20 398.83	295.42 576.47	146.05 355.16	84.15 43.67	149.37 221.31
10	-41.480 -44.470	2.990	536.18 572.25	1343.56 1475.85	418.66 464.90	117.52 107.35	924.89 1010.95
11	-44.470 -48.751	4.281	351.97 390.50	759.30 836.36	328.85 390.50	23.12 0.00	430.45 445.86
12	-48.751 -55.197	6.446	390.50 448.52	836.36 952.39	390.50 483.33	0.00 0.00	445.86 469.07
13	-55.197 -60.480	5.283	448.52 496.06	952.39 1047.48	483.33 530.87	0.00 0.00	469.07 516.61
14	-60.480 -67.450	6.970	765.11 848.61	1603.53 1927.55	830.49 921.70	0.00 0.00	773.04 1005.85
15	-67.450 -69.100	1.650	843.19 863.71	2008.87 2107.98	915.05 937.88	0.00 0.00	1093.82 1170.10

3.2.8 side pressure detail output

(1)construction step [1]

No	soil	elevation (m)	layer thick (m)	Gam. (kN/m³)	c (kN/m²)	Phi. (angle)	N
1	-------	+4.340 -5.410	9.750	----	----	----	----
2	cohesv	-5.410 -8.470	3.060	17.5	10.0	0.00	1.0
3	sandy	-8.470 -15.420	6.950	17.0	0.0	33.00	13.0
4	sandy	-15.420 -20.460	5.040	17.0	0.0	33.00	13.0
5	cohesv	-20.460 -22.490	2.030	17.5	54.0	0.00	9.0
6	cohesv	-22.490 -25.420	2.930	17.5	42.0	0.00	7.0
7	cohesv	-25.420 -41.480	16.060	17.5	42.0	0.00	7.0
8	sandy	-41.480 -44.470	2.990	17.0	0.0	33.00	25.0
9	cohesv	-44.470 -60.480	16.010	18.0	108.0	0.00	18.0
10	sandy	-60.480 -67.450	6.970	17.0	0.0	34.00	30.0
11	sandy	-67.450 -69.100	1.650	19.0	0.0	35.00	50.0

1) active side pressure

No	soil	elevation (m)	layer thick (m)	Gam.*h+q (kN/m²)	Gam.*(h-H) (kN/m²)	pw1 (kN/m²)	Ka1	Ka2	Pa1 (kN/m²)	Pa (kN/m²)
1	----	+4.340 -5.410	9.750	0.00 0.00	-------- --------	0.00 97.50	------- -------	------- -------	0.00 0.00	0.00 97.50
2	cohesv	-5.410 -8.470	3.060	97.50 151.05	0.000 53.550	-------- --------	0.8000 0.8000	0.8000 0.8000	78.00 120.84	78.00 120.84
3	sandy	-8.470 -15.420	6.950	151.05 269.20	0.000 0.000	128.10 197.60	0.2948 0.2948	------- -------	6.77 21.11	134.87 218.71
4	sandy	-15.420 -20.460	5.040	269.20 354.88	0.000 0.000	197.60 248.00	0.2948 0.2948	------- -------	21.11 31.51	218.71 279.51
5	cohesv	-20.460 -22.490	2.030	354.88 390.40	257.380 292.905	-------- --------	0.5000 0.5000	0.5000 0.5000	177.44 195.20	177.44 195.20
6	cohesv	-22.490 -25.420	2.930	390.40 441.68	292.905 344.180	-------- --------	0.6000 0.6000	0.6000 0.6000	234.24 265.01	234.24 265.01
7	cohesv	-25.420 -41.480	16.060	441.68 722.73	344.180 625.230	-------- --------	0.6000 0.6000	0.6000 0.6000	265.01 433.64	265.01 433.64
8	sandy	-41.480 -44.470	2.990	722.73 773.56	0.000 0.000	458.20 488.10	0.2948 0.2948	------- -------	77.98 84.15	536.18 572.25
9	cohesv	-44.470 -60.480	16.010	773.56 1061.74	676.060 964.240	-------- --------	0.5000 0.5000	0.5000 0.5000	386.78 530.87	386.78 530.87
10	sandy	-60.480 -67.450	6.970	1061.74 1180.23	0.000 0.000	648.20 717.90	0.2827 0.2827	------- -------	116.91 130.71	765.11 848.61
11	sandy	-67.450 -69.100	1.650	1180.23 1211.58	0.000 0.000	717.90 734.40	0.2710 0.2710	------- -------	125.29 129.31	843.19 863.71

$$Pa1 = Ka1 * \left\{ Sum.\left((Gam.*h)\right) + q - pw1 \right\} - 2 * c * \sqrt{Ka1} \quad \text{(sand soil)}$$

$$Pa = Pa1 + pw1 \quad \text{(sand soil)}$$

$$Pa = Pa1 = Ka1 * \left\{ Sum.(Gam.*H) + q \right\} + Ka2 * \left\{ Sum.\left(Gam.(h - H)\right) \right\} \quad \text{(cohesive soil)}$$

2)passive side pressure

No	soil	elevation (m)	layer thick (m)	Gam.*h+q (kN/m²)	pw2 (kN/m²)	Kp	Pp1 (kN/m²)	Pp (kN/m²)
1	----	+4.340 -5.410	9.750	0.00 0.00	0.00 97.50	0.0000 0.0000	0.00 0.00	0.00 97.50
2	cohesv	-5.410 -8.470	3.060	97.50 151.05	--------- ---------	1.0000 1.0000	117.50 171.05	117.50 171.05
3	sandy	-8.470 -15.420	6.950	151.05 269.20	128.10 197.60	4.8921 4.8921	112.27 350.27	240.37 547.87
4	sandy	-15.420 -20.460	5.040	269.20 354.88	197.60 248.00	4.8921 4.8921	350.27 522.87	547.87 770.87
5	cohesv	-20.460 -22.490	2.030	354.88 390.40	--------- ---------	1.0000 1.0000	462.88 498.40	462.88 498.40
6	cohesv	-22.490 -25.420	2.930	390.40 441.68	--------- ---------	1.0000 1.0000	474.40 525.68	474.40 525.68

No	soil	elevation (m)	layer thick (m)	Gam.*h+q (kN/m²)	pw2 (kN/m²)	Kp	Pp1 (kN/m²)	Pp (kN/m²)
7	cohesv	-25.420 -41.480	16.060	441.68 722.73	--------- ---------	1.0000 1.0000	525.68 806.73	525.68 806.73
8	sandy	-41.480 -44.470	2.990	722.73 773.56	458.20 488.10	4.8921 4.8921	1294.11 1396.50	1752.31 1884.60
9	cohesv	-44.470 -60.480	16.010	773.56 1061.74	--------- ---------	1.0000 1.0000	989.56 1277.74	989.56 1277.74
10	sandy	-60.480 -67.450	6.970	1061.74 1180.23	648.20 717.90	5.2124 5.2124	2155.55 2409.86	2803.75 3127.76
11	sandy	-67.450 -69.100	1.650	1180.23 1211.58	717.90 734.40	5.5628 5.5628	2571.87 2654.48	3289.77 3388.88

$$Pp1 = Kp * \left\{ Sum.\left((Gam.*h)\right) + q - pw2 \right\} + 2*c*\sqrt{Kp} \quad (\text{ sand soil })$$

$$Pp = Pp1 + pw2 \quad (\text{ sand soil })$$

$$Pp = Pp1 - Kp*\left\{ Sum.\left((Gam.*h)\right) + q \right\} + 2*c*\sqrt{kp} \quad (\text{cohesive soil })$$

3)at rest side pressure (before excavation)

No	soil	elevation (m)	layer thick (m)	Gam.*h+q (kN/m²)	pw1 (kN/m²)	Ko	Po1 (kN/m²)	Po (kN/m²)
1	-------	+4.340 -5.410	9.750	0.00 0.00	0.00 97.50	0.0000 0.0000	0.00 0.00	0.00 97.50
2	cohesv	-5.410 -8.470	3.060	97.50 151.05	-------- --------	0.8000 0.8000	78.00 120.84	78.00 120.84
3	sandy	-8.470 -15.420	6.950	151.05 269.20	128.10 197.60	0.4554 0.4554	10.45 32.60	138.55 230.20
4	sandy	-15.420 -20.460	5.040	269.20 354.88	197.60 248.00	0.4554 0.4554	32.60 48.67	230.20 296.67
5	cohesv	-20.460 -22.490	2.030	354.88 390.40	-------- --------	0.5000 0.5000	177.44 195.20	177.44 195.20
6	cohesv	-22.490 -25.420	2.930	390.40 441.68	-------- --------	0.6000 0.6000	234.24 265.01	234.24 265.01
7	cohesv	-25.420 -41.480	16.060	441.68 722.73	-------- --------	0.6000 0.6000	265.01 433.64	265.01 433.64
8	sandy	-41.480 -44.470	2.990	722.73 773.56	458.20 488.10	0.4554 0.4554	120.46 129.99	578.66 618.09
9	cohesv	-44.470 -60.480	16.010	773.56 1061.74	-------- --------	0.5000 0.5000	386.78 530.87	386.78 530.87
No	soil	elevation (m)	layer thick (m)	Gam.*h+q (kN/m²)	pw1 (kN/m²)	Ko	Po1 (kN/m²)	Po (kN/m²)
10	sandy	-60.480 -67.450	6.970	1061.74 1180.23	648.20 717.90	0.4408 0.4408	182.29 203.80	830.49 921.70
11	sandy	-67.450 -69.100	1.650	1180.23 1211.58	717.90 734.40	0.4264 0.4264	197.15 203.48	915.05 937.88

$$Po1 = Ko * \{ Sum.(Gam.*h) + q - pw1 \} \quad (\text{sand soil})$$

$$Po = Po1 + pw1 \quad (\text{sand soil})$$

$$Po = Po1 = Ko * \{ Sum.(Gam.*h) + q \} \quad (\text{cohesive soil})$$

4)at rest side pressure (after excavation)

bridge axis direction

No	soil	elevation (m)	layer thick (m)	Gam.*h+q (kN/m²)	pw2 (kN/m²)	f (kN/m²)	f*h (kN.m)	ko	Po1' (kN/m²)	Po' (kN/m²)
1	-------	+4.340 -5.410	9.750	0.00 0.00	0.00 97.50	-------	-------- --------	0.0000 0.0000	0.00 0.00	0.00 97.50
2	cohesv	-5.410 -8.470	3.060	97.50 151.05	-------- --------	0.00	0.00 0.00	0.8000 0.8000	78.00 120.84	78.00 120.84
3	sandy	-8.470 -15.420	6.950	151.05 269.20	128.10 197.60	13.00	0.00 90.35	0.4554 0.4554	10.45 40.83	138.55 238.43
4	sandy	-15.420 -20.460	5.040	269.20 354.88	197.60 248.00	13.00	90.35 155.87	0.4554 0.4554	40.83 62.86	238.43 310.86
5	cohesv	-20.460 -22.490	2.030	354.88 390.40	-------- --------	27.00	155.87 210.68	0.5000 0.5000	193.03 216.27	193.03 216.27
6	cohesv	-22.490 -25.420	2.930	390.40 441.68	-------- --------	21.00	210.68 272.21	0.6000 0.6000	259.52 297.67	259.52 297.67
7	cohesv	-25.420 -41.480	16.060	441.68 722.73	-------- --------	21.00	272.21 609.47	0.6000 0.6000	297.67 506.77	297.67 506.77
8	sandy	-41.480 -44.470	2.990	722.73 773.56	458.20 488.10	25.00	609.47 684.22	0.4554 0.4554	175.96 192.30	634.16 680.40
9	cohesv	-44.470 -60.480	16.010	773.56 1061.74	-------- --------	54.00	684.22 1548.76	0.5000 0.5000	455.20 685.75	455.20 685.75
10	sandy	-60.480 -67.450	6.970	1061.74 1180.23	648.20 717.90	30.00	1548.76 1757.86	0.4408 0.4408	318.83 358.77	967.03 1076.67
11	sandy	-67.450 -69.100	1.650	1180.23 1211.58	717.90 734.40	50.00	1757.86 1840.36	0.4264 0.4264	347.07 360.44	1064.97 1094.84

friction force B7027influence range B = 5.000 (m)

Po1'= Ko * { Sum.(Gam.*h) + q - pw2 } + Ko * { Sum.(f*h)—B } (sand soil)

Po' = Po1'+ pw2 (sand soil)

Po' = Po1'= Ko * { Sum.(Gam.*h) + q }+ Ko * { Sum.(f*h)—B } (cohesive soil)

perpendicular direction

No	soil	elevation (m)	layer thick (m)	Gam.*h+q (kN/m²)	pw2 (kN/m²)	f (kN/m²)	f*h (kN.m)	ko	Po1' (kN/m²)	Po' (kN/m²)
1	-------	+4.340 -5.410	9.750	0.00 0.00	0.00 97.50	-------	-------- --------	0.0000 0.0000	0.00 0.00	0.00 97.50
2	cohesv	-5.410 -8.470	3.060	97.50 151.05	-------- --------	0.00	0.00 0.00	0.8000 0.8000	78.00 120.84	78.00 120.84
3	sandy	-8.470 -15.420	6.950	151.05 269.20	128.10 197.60	13.00	0.00 90.35	0.4554 0.4554	10.45 40.83	138.55 238.43
4	sandy	-15.420 -20.460	5.040	269.20 354.88	197.60 248.00	13.00	90.35 155.87	0.4554 0.4554	40.83 62.86	238.43 310.86
5	cohesv	-20.460 -22.490	2.030	354.88 390.40	-------- --------	27.00	155.87 210.68	0.5000 0.5000	193.03 216.27	193.03 216.27
6	cohesv	-22.490 -25.420	2.930	390.40 441.68	-------- --------	21.00	210.68 272.21	0.6000 0.6000	259.52 297.67	259.52 297.67
7	cohesv	-25.420 -41.480	16.060	441.68 722.73	-------- --------	21.00	272.21 609.47	0.6000 0.6000	297.67 506.77	297.67 506.77
8	sandy	-41.480 -44.470	2.990	722.73 773.56	458.20 488.10	25.00	609.47 684.22	0.4554 0.4554	175.96 192.30	634.16 680.40
9	cohesv	-44.470 -60.480	16.010	773.56 1061.74	-------- --------	54.00	684.22 1548.76	0.5000 0.5000	455.20 685.75	455.20 685.75
10	sandy	-60.480 -67.450	6.970	1061.74 1180.23	648.20 717.90	30.00	1548.76 1757.86	0.4408 0.4408	318.83 358.77	967.03 1076.67
11	sandy	-67.450 -69.100	1.650	1180.23 1211.58	717.90 734.40	50.00	1757.86 1840.36	0.4264 0.4264	347.07 360.44	1064.97 1094.84

friction force B7027influence range B = 5.000 (m)

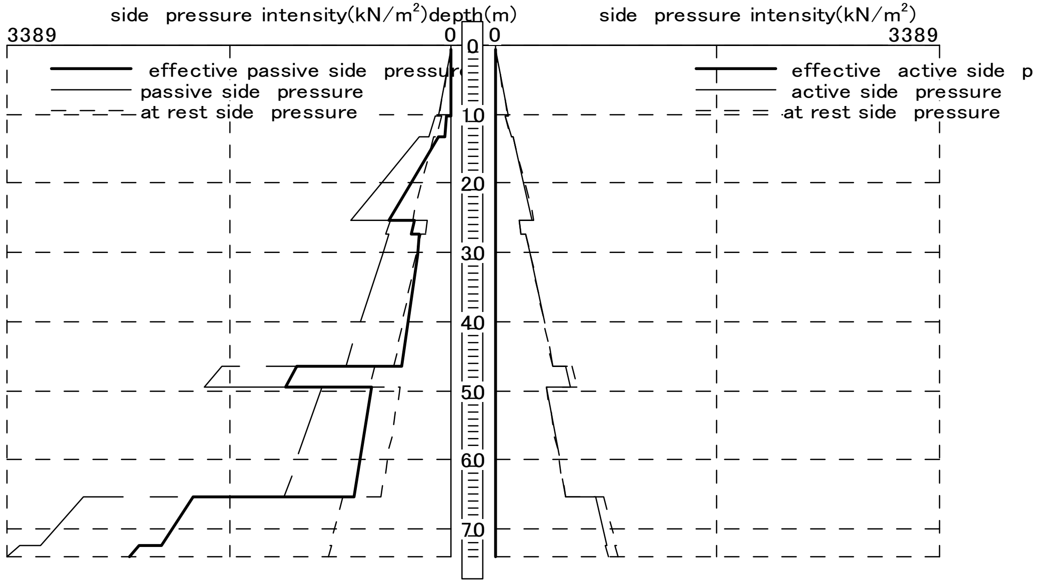
Po1'= Ko * { Sum.(Gam.*h) + q - pw2 } + Ko * { Sum.(f*h)—B } (sand soil)

Po' = Po1'+ pw2 (sand soil)

Po' = Po1'= Ko * { Sum.(Gam.*h) + q }+ Ko * { Sum.(f*h)—B } (cohesive soil)

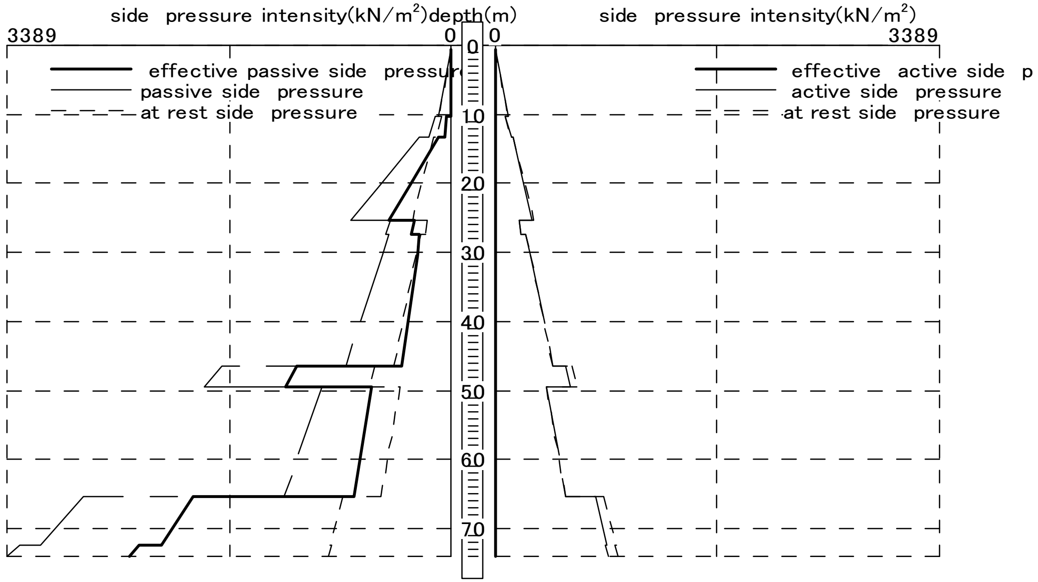
bridge axis direction

ve passive side pressure inte effective active side pressure intensity distribution d



perpendicular direction

ve passive side pressure inte effective active side pressure intensity distribution d



3.2.9 calculation result table

1)bridge axis direction

item			unit	the1step	the2step	the3step	the4step
displace ment	max displacement	Del.max	cm	0.154	0.154	1.575	1.575
	accrue location	Lm	m	+4.900	+4.900	-3.500	-3.500
displace coffer displace part	max bending moment	Mmax	kN.m	-14.0	-14.0	619.0	619.0
		Sig.	N/mm²	1.13	1.13	58.59	58.59
		Lm	m	-9.100	-9.100	-2.300	-2.300
	SKY400	M	kN.m	-5.0	-5.0	619.0	619.0
		Sig.max	N/mm²	0.51	0.51	58.59	58.59
		Lm	m	-2.600	-2.600	-2.300	-2.300
	SKY490	M	kN.m	-14.0	-14.0	617.0	617.0
		Sig.max	N/mm²	1.13	1.13	51.41	51.41
		Lm	m	-9.100	-9.100	-2.600	-2.600
displace celler displace part	max bending moment	Mmax	kN.m	-14.0	-14.0	-186.0	-186.0
		Sig.	N/mm²	1.13	1.13	15.50	15.50
		Lm	m	-9.500	-9.500	-15.350	-15.350
	SKY400	M	kN.m	0.0	0.0	7.0	7.0
		Sig.max	N/mm²	0.04	0.04	0.66	0.66
		Lm	m	-31.600	-31.600	-35.900	-35.900
	SKY490	M	kN.m	-14.0	-14.0	-186.0	-186.0
		Sig.max	N/mm²	1.13	1.13	15.50	15.50
		Lm	m	-9.500	-9.500	-15.350	-15.350
(SKY400)		Sig.a	N/mm²	210.00	210.00	210.00	210.00
(SKY490)		Sig.a	N/mm²	280.00	280.00	280.00	280.00

support point reaction force	timbering reaction	1st row	kN/m	------	0.0	153.3	153.3
		2nd row	kN/m	------	------	------	0.0
		3rd row	kN/m	------	------	------	------
		4th row	kN/m	------	------	------	------
		5th row	kN/m	------	------	------	------
		6th row	kN/m	------	------	------	------
		7th row	kN/m	------	------	------	------
		8th row	kN/m	------	------	------	------
		9th row	kN/m	------	------	------	------
		10th row	kN/m	------	------	------	------
	footing concrete reaction		kN/m	0.0	0.0	0.0	0.0

note)Lm shows elevation

item			unit	the5step	the6step	the7step	the8step
displa ce ment	max displacement	Del.max	cm	7.961	5.566	9.291	9.841
	accrue location	Lm	m	-9.500	-9.100	-9.100	-8.470
displa ce coffer displa ce part	max bending moment	Mmax	kN.m	1604.0	1263.0	2192.0	2530.0
		Sig.	N/mm²	133.59	105.15	182.58	210.72
		Lm	m	-9.100	-9.100	-8.470	-8.100
	SKY400	M	kN.m	1085.0	937.0	1680.0	1775.0
		Sig.max	N/mm²	102.75	88.69	159.11	168.08
		Lm	m	-2.600	-2.600	-2.600	-2.600
	SKY490	M	kN.m	1604.0	1263.0	2192.0	2530.0
		Sig.max	N/mm²	133.59	105.15	182.58	210.72
		Lm	m	-9.100	-9.100	-8.470	-8.100
displa ce celler displa ce part	max bending moment	Mmax	kN.m	1619.0	1264.0	2189.0	2497.0
		Sig.	N/mm²	134.79	105.24	182.29	207.99
		Lm	m	-10.700	-9.500	-9.100	-9.100
	SKY400	M	kN.m	-330.0	-134.0	-236.0	-219.0
		Sig.max	N/mm²	31.30	12.71	22.32	20.78
		Lm	m	-31.600	-31.600	-31.600	-31.600
	SKY490	M	kN.m	1619.0	1264.0	2189.0	2497.0
		Sig.max	N/mm²	134.79	105.24	182.29	207.99
		Lm	m	-10.700	-9.500	-9.100	-9.100
(SKY400)		Sig.a	N/mm²	210.00	210.00	210.00	210.00
(SKY490)		Sig.a	N/mm²	280.00	280.00	280.00	280.00

support point reaction force	timbering reaction	1st row	kN/m	0.0	0.0	0.0	0.0
		2nd row	kN/m	308.2	278.5	447.4	366.8
		3rd row	kN/m	------	------	------	201.2
		4th row	kN/m	------	------	------	------
		5th row	kN/m	------	------	------	------
		6th row	kN/m	------	------	------	------
		7th row	kN/m	------	------	------	------
		8th row	kN/m	------	------	------	------
		9th row	kN/m	------	------	------	------
		10th row	kN/m	------	------	------	------
	footing concrete reaction		kN/m	0.0	0.0	63.2	421.7

note)Lm shows elevation

item			unit	the9step	the10step	the11step	the12step
displace ment	max displacement	Del.max	cm	10.108	10.238	10.242	10.238
	accrue location	Lm	m	-8.470	-8.470	-8.470	-8.470
displace coffer displace part	max bending moment	Mmax	kN.m	2755.0	2883.0	2874.0	2927.0
		Sig.	N/mm²	229.42	240.12	239.38	243.74
		Lm	m	-8.300	-8.470	-8.470	-8.470
	SKY400	M	kN.m	1632.0	1562.0	1561.0	1560.0
		Sig.max	N/mm²	154.52	147.96	147.85	147.70
		Lm	m	-2.600	-2.600	-2.600	-2.600
	SKY490	M	kN.m	2755.0	2883.0	2874.0	2927.0
		Sig.max	N/mm²	229.42	240.12	239.38	243.74
		Lm	m	-8.300	-8.470	-8.470	-8.470
displace celler displace part	max bending moment	Mmax	kN.m	2720.0	2867.0	2859.0	2918.0
		Sig.	N/mm²	226.52	238.78	238.14	243.03
		Lm	m	-9.100	-9.100	-9.100	-9.100
	SKY400	M	kN.m	-170.0	-127.0	-160.0	-160.0
		Sig.max	N/mm²	16.08	12.06	15.15	15.14
		Lm	m	-31.600	-31.600	-47.900	-47.900
	SKY490	M	kN.m	2720.0	2867.0	2859.0	2918.0
		Sig.max	N/mm²	226.52	238.78	238.14	243.03
		Lm	m	-9.100	-9.100	-9.100	-9.100
(SKY400)		Sig.a	N/mm²	210.00	210.00	210.00	210.00
(SKY490)		Sig.a	N/mm²	280.00	280.00	280.00	280.00

support point reaction force	timbering reaction	1st row	kN/m	0.0	0.0	0.0	0.0
		2nd row	kN/m	329.8	317.9	318.0	316.8
		3rd row	kN/m	218.1	214.1	213.5	215.2
		4th row	kN/m	112.1	131.9	131.0	136.4
		5th row	kN/m	------	59.1	58.9	64.8
		6th row	kN/m	------	------	3.4	1.8
		7th row	kN/m	------	------	------	------
		8th row	kN/m	------	------	------	------
		9th row	kN/m	------	------	------	------
		10th row	kN/m	------	------	------	------
	footing concrete reaction		kN/m	724.4	1037.3	1448.6	1457.3

note)Lm shows elevation

item			unit	the13step
displace ment	max displacement	Del.max	cm	10.238
	accrue location	Lm	m	-8.470
displace coffer displace part	max bending moment	Mmax	kN.m	2927.0
		Sig.	N/mm^2	243.77
		Lm	m	-8.470
	SKY400	M	kN.m	1560.0
		Sig.max	N/mm^2	147.69
		Lm	m	-2.600
	SKY490	M	kN.m	2927.0
		Sig.max	N/mm^2	243.77
		Lm	m	-8.470
displace celler displace part	max bending moment	Mmax	kN.m	2918.0
		Sig.	N/mm^2	242.98
		Lm	m	-9.100
	SKY400	M	kN.m	-160.0
		Sig.max	N/mm^2	15.14
		Lm	m	-47.900
	SKY490	M	kN.m	2918.0
		Sig.max	N/mm^2	242.98
		Lm	m	-9.100
(SKY400)		Sig.a	N/mm^2	210.00
(SKY490)		Sig.a	N/mm^2	280.00

support point reaction force	timbering reaction	1st row	kN/m	0.0
		2nd row	kN/m	316.8
		3rd row	kN/m	215.2
		4th row	kN/m	136.5
		5th row	kN/m	65.0
		6th row	kN/m	------
		7th row	kN/m	------
		8th row	kN/m	------
		9th row	kN/m	------
		10th row	kN/m	------
	footing concrete reaction		kN/m	1457.3

note)Lm shows elevation

2)perpendicular direction

item			unit	the1step	the2step	the3step	the4step
displa ce ment	max displacement	Del.max	cm	0.154	0.154	1.591	1.591
	accrue location	Lm	m	+4.900	+4.900	-3.500	-3.500
displa ce coffer displa ce part	max bending moment	Mmax	kN.m	-14.0	-14.0	616.0	616.0
		Sig.	N/mm²	1.13	1.13	58.38	58.38
		Lm	m	-9.100	-9.100	-2.300	-2.300
	SKY400	M	kN.m	-5.0	-5.0	616.0	616.0
		Sig.max	N/mm²	0.51	0.51	58.38	58.38
		Lm	m	-2.600	-2.600	-2.300	-2.300
	SKY490	M	kN.m	-14.0	-14.0	615.0	615.0
		Sig.max	N/mm²	1.13	1.13	51.22	51.22
		Lm	m	-9.100	-9.100	-2.600	-2.600
displa ce celler displa ce part	max bending moment	Mmax	kN.m	-14.0	-14.0	-188.0	-188.0
		Sig.	N/mm²	1.13	1.13	15.64	15.64
		Lm	m	-9.500	-9.500	-15.350	-15.350
	SKY400	M	kN.m	0.0	0.0	7.0	7.0
		Sig.max	N/mm²	0.04	0.04	0.66	0.66
		Lm	m	-31.600	-31.600	-35.900	-35.900
	SKY490	M	kN.m	-14.0	-14.0	-188.0	-188.0
		Sig.max	N/mm²	1.13	1.13	15.64	15.64
		Lm	m	-9.500	-9.500	-15.350	-15.350
(SKY400)		Sig.a	N/mm²	210.00	210.00	210.00	210.00
(SKY490)		Sig.a	N/mm²	280.00	280.00	280.00	280.00

support point reaction force	timbering reaction	1st row	kN/m	------	0.0	153.0	153.0
		2nd row	kN/m	------	------	------	0.0
		3rd row	kN/m	------	------	------	------
		4th row	kN/m	------	------	------	------
		5th row	kN/m	------	------	------	------
		6th row	kN/m	------	------	------	------
		7th row	kN/m	------	------	------	------
		8th row	kN/m	------	------	------	------
		9th row	kN/m	------	------	------	------
		10th row	kN/m	------	------	------	------
	footing concrete reaction		kN/m	0.0	0.0	0.0	0.0

note)Lm shows elevation

item			unit	the5step	the6step	the7step	the8step
displace ment	max displacement	Del.max	cm	7.989	5.590	9.335	9.973
	accrue location	Lm	m	-9.500	-8.470	-8.470	-8.470
displace coffer displace part	max bending moment	Mmax	kN.m	1603.0	1261.0	2192.0	2550.0
		Sig.	N/mm²	133.47	104.98	182.57	212.33
		Lm	m	-9.100	-9.100	-8.470	-8.100
	SKY400	M	kN.m	1084.0	936.0	1680.0	1806.0
		Sig.max	N/mm²	102.69	88.61	159.10	171.03
		Lm	m	-2.600	-2.600	-2.600	-2.600
	SKY490	M	kN.m	1603.0	1261.0	2192.0	2550.0
		Sig.max	N/mm²	133.47	104.98	182.57	212.33
		Lm	m	-9.100	-9.100	-8.470	-8.100
displace celler displace part	max bending moment	Mmax	kN.m	1617.0	1262.0	2189.0	2515.0
		Sig.	N/mm²	134.66	105.07	182.28	209.41
		Lm	m	-10.700	-9.500	-9.100	-9.100
	SKY400	M	kN.m	-331.0	-134.0	-236.0	-222.0
		Sig.max	N/mm²	31.33	12.71	22.37	20.98
		Lm	m	-31.600	-31.600	-31.600	-31.600
	SKY490	M	kN.m	1617.0	1262.0	2189.0	2515.0
		Sig.max	N/mm²	134.66	105.07	182.28	209.41
		Lm	m	-10.700	-9.500	-9.100	-9.100
(SKY400)		Sig.a	N/mm²	210.00	210.00	210.00	210.00
(SKY490)		Sig.a	N/mm²	280.00	280.00	280.00	280.00

support point reaction force	timbering reaction	1st row	kN/m	0.0	0.0	0.0	0.0
		2nd row	kN/m	308.0	278.3	447.4	381.5
		3rd row	kN/m	------	------	------	184.4
		4th row	kN/m	------	------	------	------
		5th row	kN/m	------	------	------	------
		6th row	kN/m	------	------	------	------
		7th row	kN/m	------	------	------	------
		8th row	kN/m	------	------	------	------
		9th row	kN/m	------	------	------	------
		10th row	kN/m	------	------	------	------
	footing concrete reaction		kN/m	0.0	0.0	62.0	419.1

note)Lm shows elevation

item			unit	the9step	the10step	the11step	the12step
displace ment	max displacement	Del.max	cm	10.290	10.456	10.476	10.472
	accrue location	Lm	m	-8.470	-8.470	-8.470	-8.470
displace coffer displace part	max bending moment	Mmax	kN.m	2784.0	2919.0	2895.0	2946.0
		Sig.	N/mm²	231.89	243.13	241.07	245.37
		Lm	m	-8.100	-8.470	-8.470	-8.470
	SKY400	M	kN.m	1672.0	1594.0	1586.0	1586.0
		Sig.max	N/mm²	158.35	150.91	150.19	150.18
		Lm	m	-2.600	-2.600	-2.600	-2.600
	SKY490	M	kN.m	2784.0	2919.0	2895.0	2946.0
		Sig.max	N/mm²	231.89	243.13	241.07	245.37
		Lm	m	-8.100	-8.470	-8.470	-8.470
displace celler displace part	max bending moment	Mmax	kN.m	2748.0	2903.0	2884.0	2942.0
		Sig.	N/mm²	228.85	241.79	240.20	245.02
		Lm	m	-9.100	-9.100	-9.100	-9.100
	SKY400	M	kN.m	-174.0	-134.0	-159.0	-159.0
		Sig.max	N/mm²	16.47	12.67	15.08	15.08
		Lm	m	-31.600	-31.600	-47.900	-47.900
	SKY490	M	kN.m	2748.0	2903.0	2884.0	2942.0
		Sig.max	N/mm²	228.85	241.79	240.20	245.02
		Lm	m	-9.100	-9.100	-9.100	-9.100
(SKY400)		Sig.a	N/mm²	210.00	210.00	210.00	210.00
(SKY490)		Sig.a	N/mm²	280.00	280.00	280.00	280.00

support point reaction force	timbering reaction	1st row	kN/m	0.0	0.0	0.0	0.0
		2nd row	kN/m	342.9	327.7	327.1	326.1
		3rd row	kN/m	207.9	207.0	205.2	207.2
		4th row	kN/m	107.3	131.5	129.5	134.6
		5th row	kN/m	------	56.6	57.9	62.8
		6th row	kN/m	------	------	12.1	11.1
		7th row	kN/m	------	------	------	------
		8th row	kN/m	------	------	------	------
		9th row	kN/m	------	------	------	------
		10th row	kN/m	------	------	------	------
	footing concrete reaction		kN/m	717.4	1023.6	1422.9	1428.5

note)Lm shows elevation

item			unit	the13step
displace ment	max displacement	Del.max	cm	10.473
	accrue location	Lm	m	-8.470
displace coffer displace part	max bending moment	Mmax	kN.m	2948.0
		Sig.	N/mm²	245.51
		Lm	m	-8.470
	SKY400	M	kN.m	1585.0
		Sig.max	N/mm²	150.14
		Lm	m	-2.600
	SKY490	M	kN.m	2948.0
		Sig.max	N/mm²	245.51
		Lm	m	-8.470
displace celler displace part	max bending moment	Mmax	kN.m	2938.0
		Sig.	N/mm²	244.66
		Lm	m	-9.100
	SKY400	M	kN.m	-159.0
		Sig.max	N/mm²	15.08
		Lm	m	-47.900
	SKY490	M	kN.m	2938.0
		Sig.max	N/mm²	244.66
		Lm	m	-9.100
(SKY400)		Sig.a	N/mm²	210.00
(SKY490)		Sig.a	N/mm²	280.00

support point reaction force	timbering reaction	1st row	kN/m	0.0
		2nd row	kN/m	325.9
		3rd row	kN/m	207.3
		4th row	kN/m	135.2
		5th row	kN/m	63.7
		6th row	kN/m	------
		7th row	kN/m	------
		8th row	kN/m	------
		9th row	kN/m	------
		10th row	kN/m	------
	footing concrete reaction		kN/m	1428.5

note)Lm shows elevation

3.2.10 detail output

(1)bridge axis direction　1 step

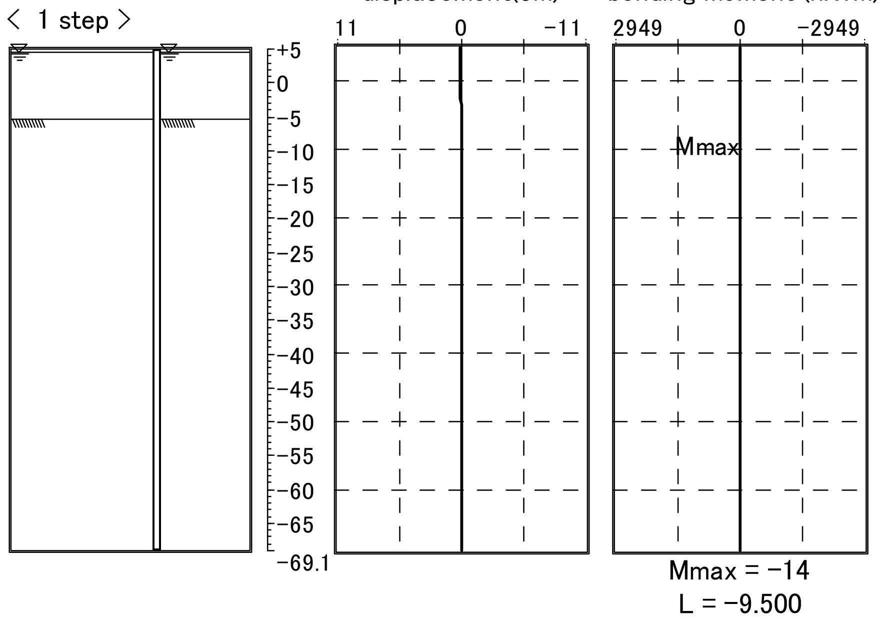
support point reaction (kN)	elevation (m)	active side pressure (kN/m)	Del. (cm)	Theta (d)	M (kN.m)	S (kN)	Sig. (N/mm^2)	subgrade reaction (kN/m^2)	passive earth pressure (kN/m^2)	plastic
	+4.900	0.0	0.154	-0.113	0.0	0.0	0.00	0.0	0.0	
	+4.400	0.0	0.148	-0.113	0.0	0.0	0.00	0.0	0.0	
	+4.340	0.3	0.148	-0.113	0.0	0.0	0.00	0.0	0.0	
	+3.700	0.3	0.140	-0.113	-0.1	-0.2	0.01	0.0	0.0	
	+2.500	0.2	0.127	-0.112	-0.4	-0.5	0.04	0.0	0.0	
	+2.400	0.2	0.126	-0.112	-0.5	-0.5	0.05	0.0	0.0	
	+1.300	0.2	0.113	-0.112	-1.2	-0.7	0.11	0.0	0.0	
	+0.100	0.2	0.100	-0.110	-2.2	-1.0	0.21	0.0	0.0	
	-0.100	0.2	0.098	-0.110	-2.4	-1.0	0.22	0.0	0.0	
	-1.100	0.2	0.087	-0.108	-3.5	-1.2	0.33	0.0	0.0	
	-2.300	0.1	0.074	-0.104	-5.0	-1.3	0.47	0.0	0.0	
	-2.600	0.1	0.071	-0.102	-5.4	-1.4	0.51	0.0	0.0	
	-2.600	0.1	0.071	-0.102	-5.4	-1.4	0.45	0.0	0.0	
	-3.500	0.1	0.062	-0.099	-6.7	-1.5	0.55	0.0	0.0	
	-4.700	0.1	0.051	-0.092	-8.5	-1.6	0.71	0.0	0.0	
	-5.100	0.1	0.047	-0.090	-9.2	-1.6	0.76	0.0	0.0	
	-5.410	0.0	0.044	-0.088	-9.7	-1.7	0.80	0.4	39.5	
	-5.900	0.0	0.040	-0.084	-10.4	-1.5	0.87	0.3	41.2	
	-7.100	0.0	0.031	-0.075	-12.0	-1.1	1.00	0.3	45.4	
	-8.100	0.0	0.024	-0.066	-13.0	-0.9	1.08	0.2	48.9	
	-8.300	0.0	0.022	-0.065	-13.1	-0.8	1.09	0.2	49.6	
	-8.470	0.0	0.021	-0.063	-13.3	-0.8	1.10	1.1	101.8	
	-9.100	0.0	0.017	-0.057	-13.6	-0.2	1.13	0.9	121.4	
	-9.500	0.0	0.015	-0.053	-13.6	0.1	1.13	0.8	133.8	
	-10.700	0.0	0.009	-0.042	-13.0	0.9	1.08	0.5	171.1	
	-11.900	0.0	0.005	-0.032	-11.7	1.3	0.97	0.2	208.3	
	-13.100	0.0	0.002	-0.023	-10.0	1.5	0.83	0.1	245.6	
	-14.100	0.0	0.000	-0.017	-8.5	1.5	0.71	0.0	276.7	
	-14.300	0.0	-0.001	-0.015	-8.2	1.5	0.68	0.0	282.9	
	-15.350	0.0	-0.002	-0.010	-6.6	1.4	0.55	0.0	315.5	
	-15.420	0.0	-0.002	-0.010	-6.5	1.4	0.54	0.0	317.7	
	-15.500	0.0	-0.002	-0.009	-6.4	1.4	0.54	0.0	320.2	
	-16.700	0.0	-0.003	-0.005	-4.8	1.3	0.40	0.0	357.4	
	-17.900	0.0	-0.003	-0.001	-3.4	1.1	0.28	0.0	394.7	

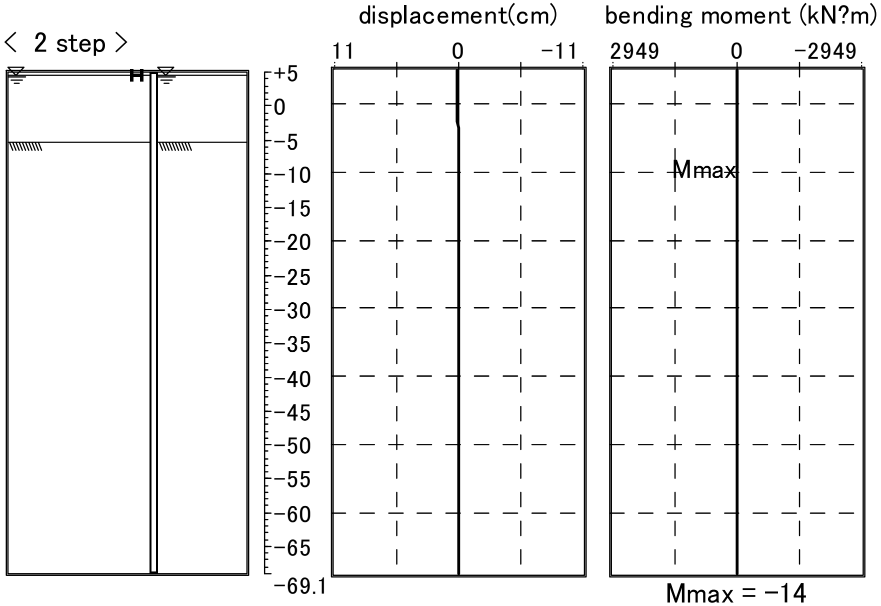
support point reaction (kN)	elevation (m)	active side pressure (kN/m)	Del. (cm)	Theta (d)	M (kN.m)	S (kN)	Sig. (N/mm^2)	subgrade reaction (kN/m^2)	passive earth pressure (kN/m^2)	plastic
	-19.100	0.0	-0.003	0.001	-2.2	0.9	0.19	0.0	432.0	
	-20.300	0.0	-0.003	0.003	-1.3	0.7	0.11	0.0	469.2	
	-20.460	0.0	-0.003	0.003	-1.2	0.7	0.10	0.0	285.4	
	-21.500	0.0	-0.003	0.003	-0.6	0.5	0.05	0.0	294.5	
	-22.490	0.0	-0.002	0.004	-0.2	0.3	0.01	0.0	240.2	
	-22.700	0.0	-0.002	0.004	-0.1	0.3	0.01	0.0	241.6	
	-23.900	0.0	-0.002	0.004	0.2	0.2	0.02	0.0	250.0	
	-25.100	0.0	-0.001	0.003	0.4	0.1	0.04	0.0	258.4	
	-25.420	0.0	-0.001	0.003	0.5	0.1	0.04	0.0	260.7	
	-26.300	0.0	-0.001	0.003	0.5	0.1	0.04	0.0	266.8	
	-27.500	0.0	-0.001	0.002	0.6	0.0	0.05	0.0	275.2	
	-28.700	0.0	0.000	0.002	0.5	0.0	0.05	0.0	283.6	
	-29.900	0.0	0.000	0.001	0.5	0.0	0.04	0.0	292.0	
	-31.100	0.0	0.000	0.001	0.4	-0.1	0.04	0.0	300.4	
	-31.600	0.0	0.000	0.001	0.4	-0.1	0.03	0.0	303.9	
	-31.600	0.0	0.000	0.001	0.4	-0.1	0.04	0.0	303.9	
	-32.300	0.0	0.000	0.001	0.4	-0.1	0.03	0.0	308.8	
	-33.500	0.0	0.000	0.000	0.3	-0.1	0.03	0.0	317.2	
	-34.700	0.0	0.000	0.000	0.2	-0.1	0.02	0.0	325.6	
	-35.900	0.0	0.000	0.000	0.2	0.0	0.01	0.0	334.0	
	-37.100	0.0	0.000	0.000	0.1	0.0	0.01	0.0	342.4	
	-38.300	0.0	0.000	0.000	0.1	0.0	0.01	0.0	350.8	
	-39.500	0.0	0.000	0.000	0.0	0.0	0.00	0.0	359.2	
	-40.700	0.0	0.000	0.000	0.0	0.0	0.00	0.0	367.6	
	-41.480	0.0	0.000	0.000	0.0	0.0	0.00	0.0	1173.7	
	-41.900	0.0	0.000	0.000	0.0	0.0	0.00	0.0	1186.7	
	-43.100	0.0	0.000	0.000	0.0	0.0	0.00	0.0	1224.0	
	-44.300	0.0	0.000	0.000	0.0	0.0	0.00	0.0	1261.2	
	-44.470	0.0	0.000	0.000	0.0	0.0	0.00	0.0	602.8	
	-45.500	0.0	0.000	0.000	0.0	0.0	0.00	0.0	612.1	
	-46.700	0.0	0.000	0.000	0.0	0.0	0.00	0.0	622.9	
	-47.900	0.0	0.000	0.000	0.0	0.0	0.00	0.0	633.7	
	-49.100	0.0	0.000	0.000	0.0	0.0	0.00	0.0	644.5	
	-50.300	0.0	0.000	0.000	0.0	0.0	0.00	0.0	655.3	
	-51.500	0.0	0.000	0.000	0.0	0.0	0.00	0.0	666.1	
	-52.700	0.0	0.000	0.000	0.0	0.0	0.00	0.0	676.9	
	-53.900	0.0	0.000	0.000	0.0	0.0	0.00	0.0	687.7	

support point reaction (kN)	elevation (m)	active side pressure (kN/m)	Del. (cm)	Theta (d)	M (kN.m)	S (kN)	Sig. (N/mm^2)	subgrade reaction (kN/m^2)	passive earth pressure (kN/m^2)	plastic
	-55.100	0.0	0.000	0.000	0.0	0.0	0.00	0.0	698.5	
	-56.300	0.0	0.000	0.000	0.0	0.0	0.00	0.0	709.3	
	-57.500	0.0	0.000	0.000	0.0	0.0	0.00	0.0	720.1	
	-58.700	0.0	0.000	0.000	0.0	0.0	0.00	0.0	730.9	
	-59.900	0.0	0.000	0.000	0.0	0.0	0.00	0.0	741.7	
	-60.480	0.0	0.000	0.000	0.0	0.0	0.00	0.0	1973.3	
	-61.100	0.0	0.000	0.000	0.0	0.0	0.00	0.0	1994.0	
	-62.300	0.0	0.000	0.000	0.0	0.0	0.00	0.0	2034.0	
	-63.500	0.0	0.000	0.000	0.0	0.0	0.00	0.0	2074.1	
	-64.700	0.0	0.000	0.000	0.0	0.0	0.00	0.0	2114.2	
	-65.900	0.0	0.000	0.000	0.0	0.0	0.00	0.0	2154.3	
	-67.100	0.0	0.000	0.000	0.0	0.0	0.00	0.0	2194.4	
	-67.450	0.0	0.000	0.000	0.0	0.0	0.00	0.0	2374.7	
	-68.300	0.0	0.000	0.000	0.0	0.0	0.00	0.0	2414.0	
	-69.100	0.0	0.000	0.000	0.0	0.0	0.00	0.0	2451.0	

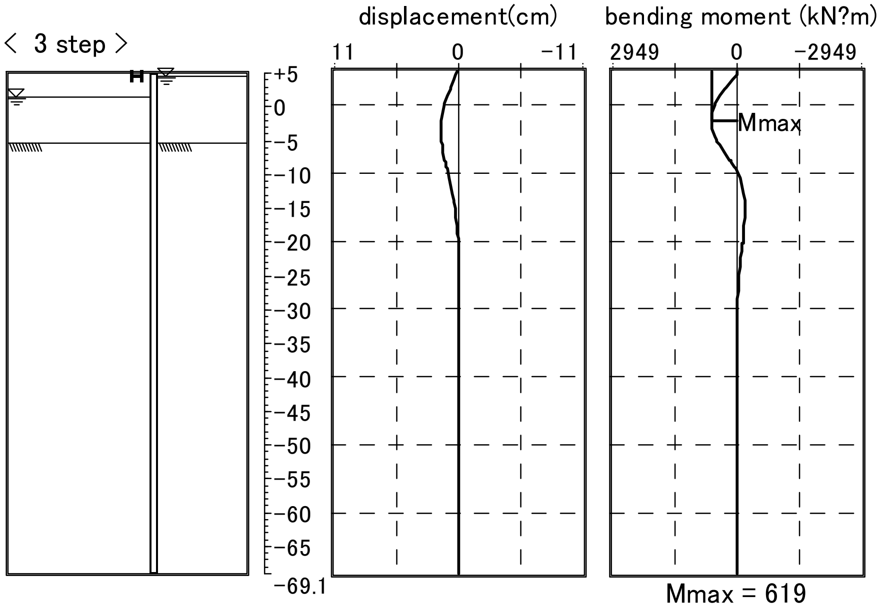
3.2.11 displacement / member force diagram

bridge axis direction



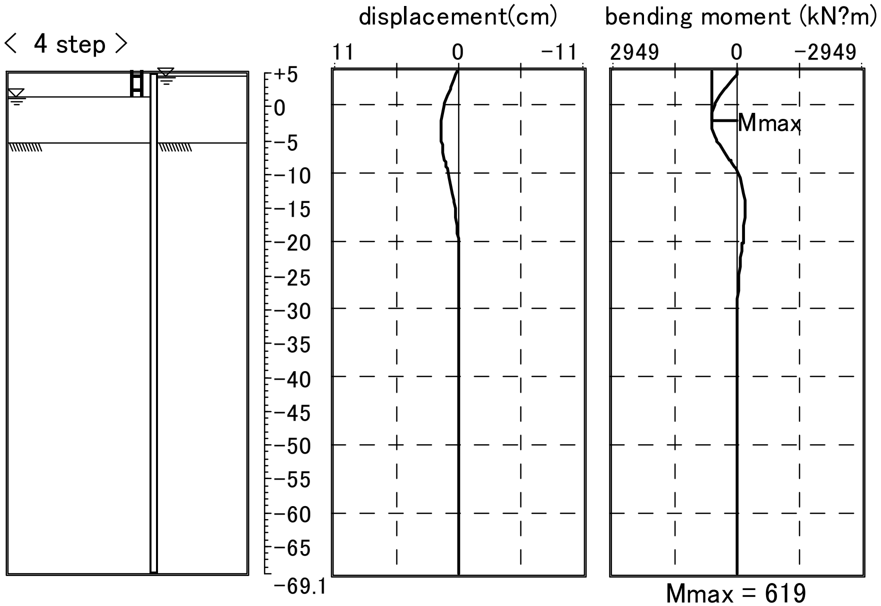


Mmax = -14
L = -9.500



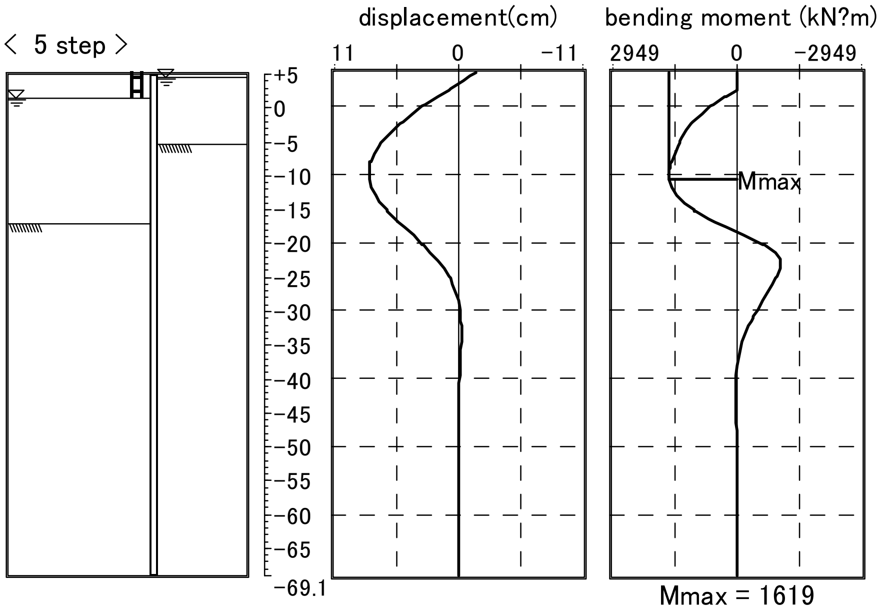
Mmax = 619
L = -2.300

< 4 step >



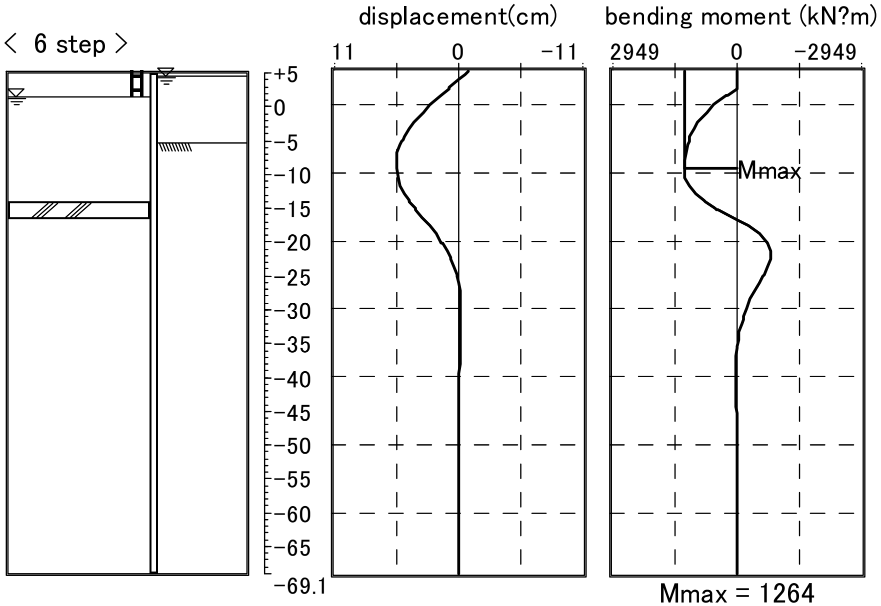
Mmax = 619
L = -2.300

< 5 step >



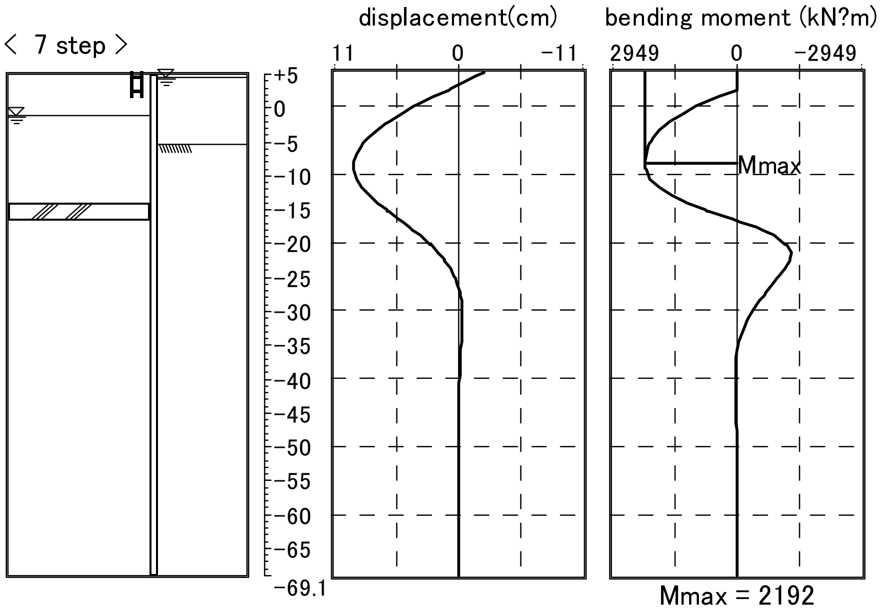
Mmax = 1619
L = -10.700

< 6 step >

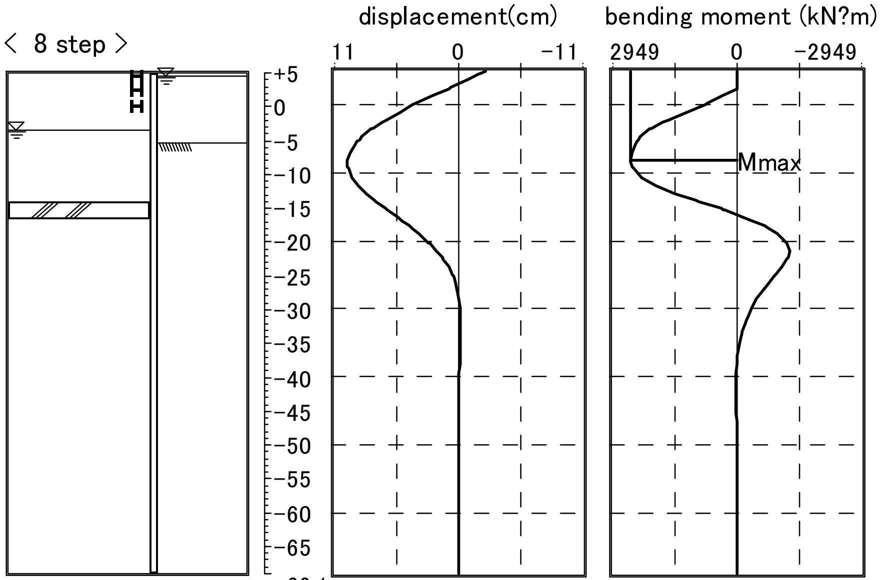


Mmax = 1264
L = -9.500

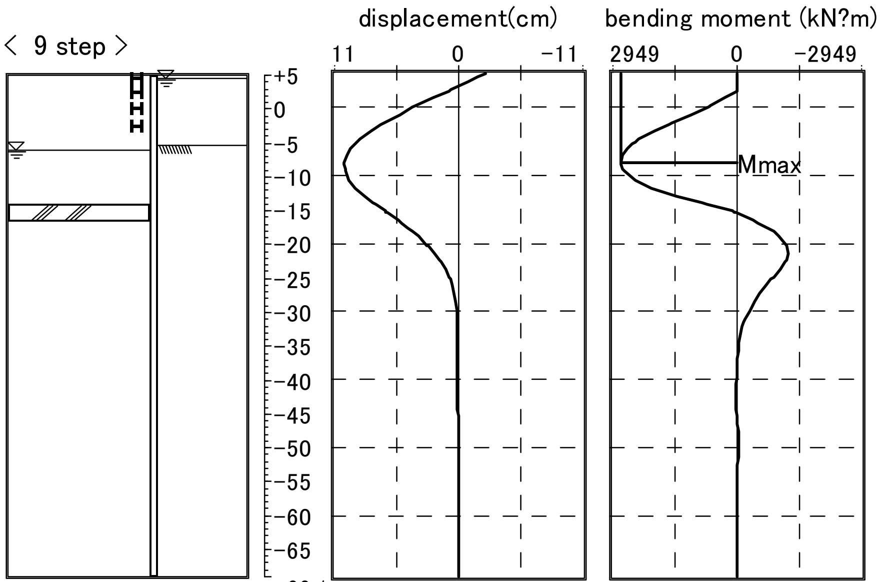
< 7 step >



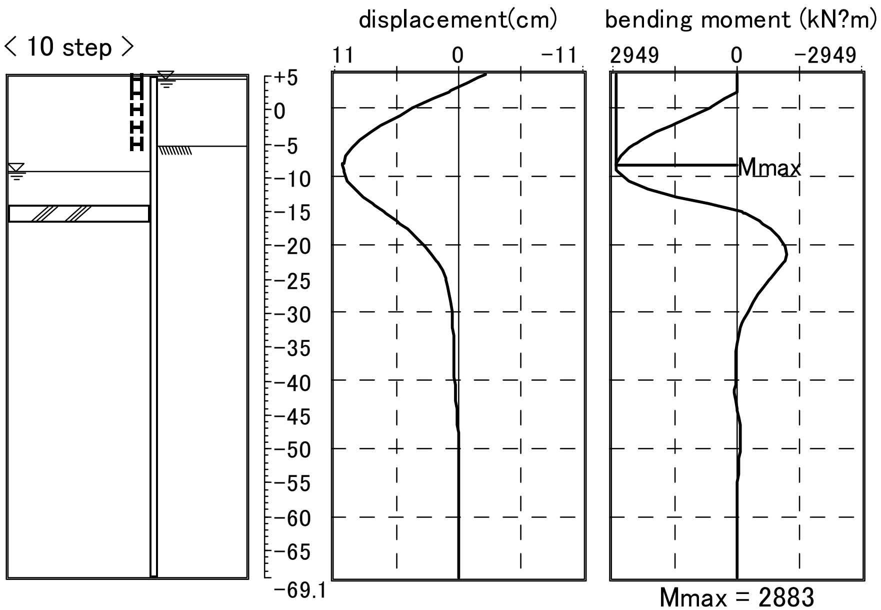
Mmax = 2192
L = -8.470



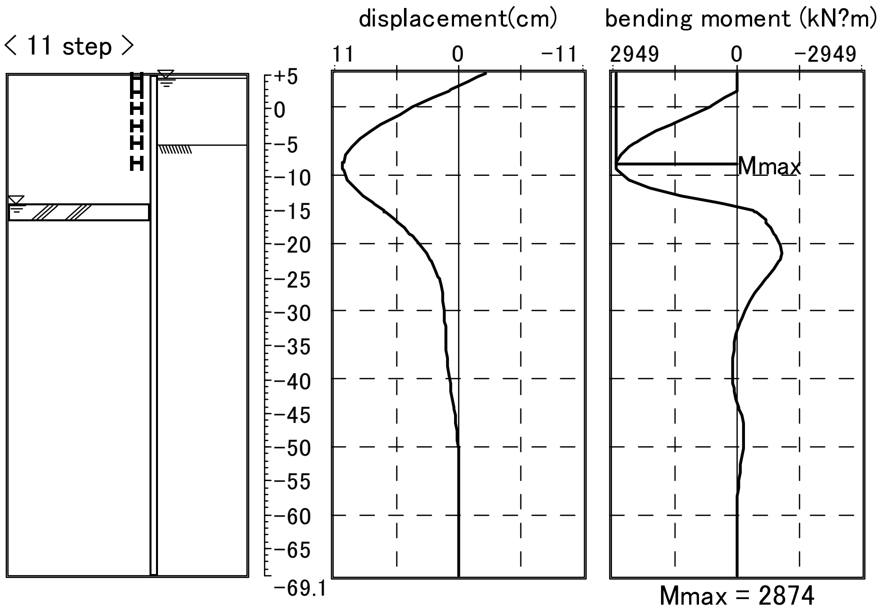
Mmax = 2530
L = -8.100



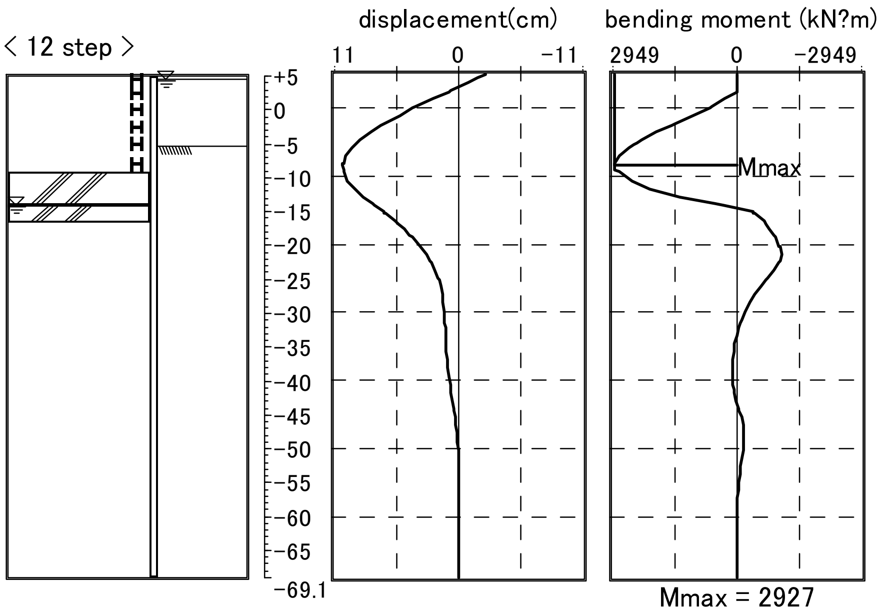
Mmax = 2755
L = -8.300



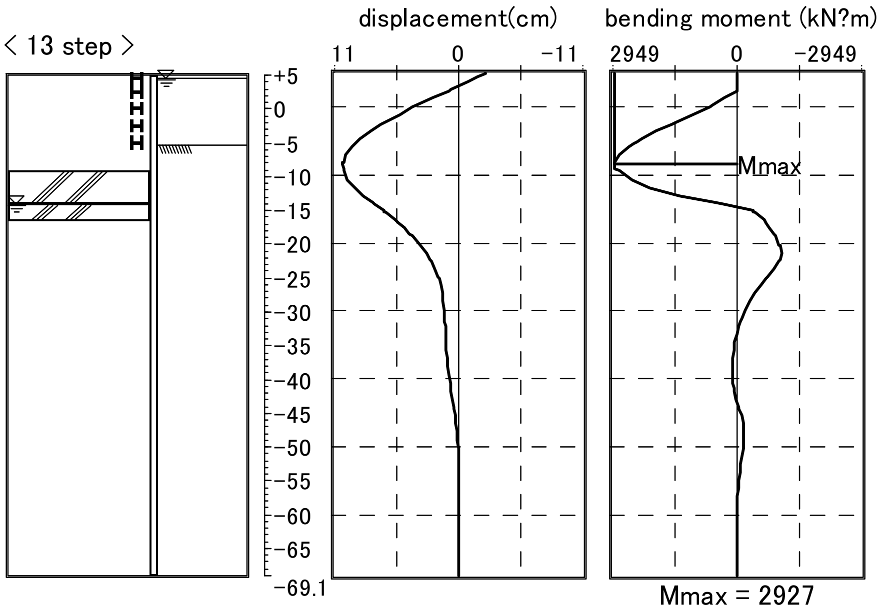
Mmax = 2883
L = -8.470



Mmax = 2874
L = -8.470

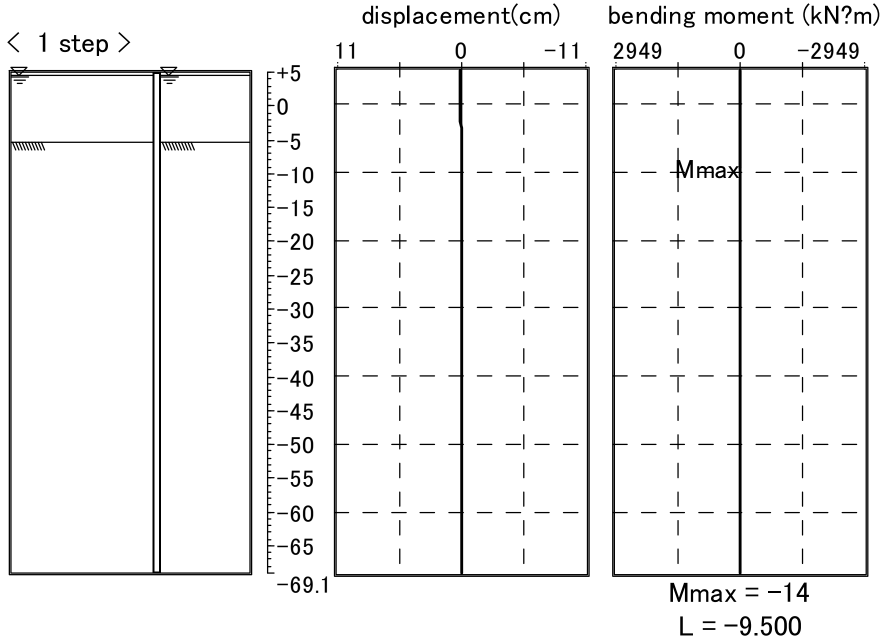


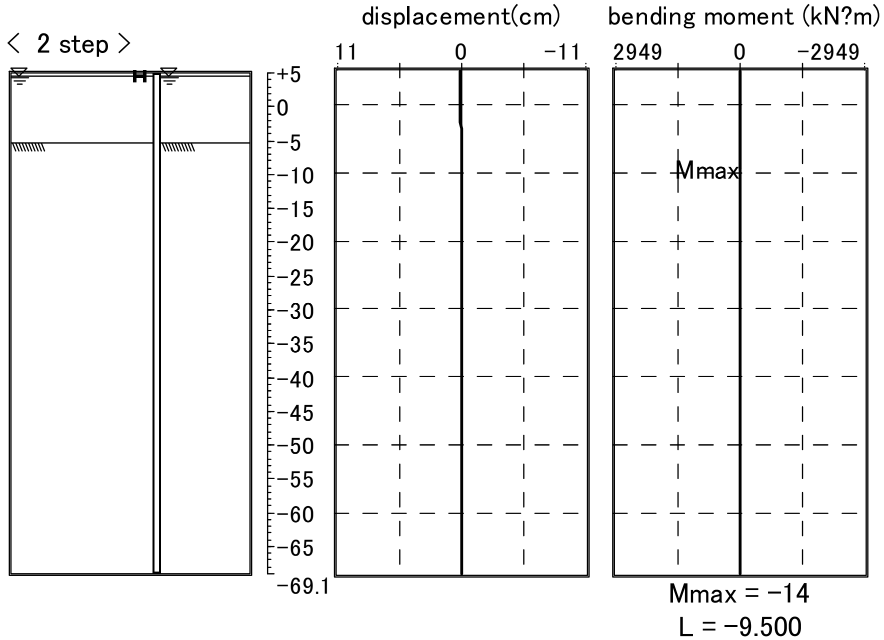
Mmax = 2927
L = -8.470

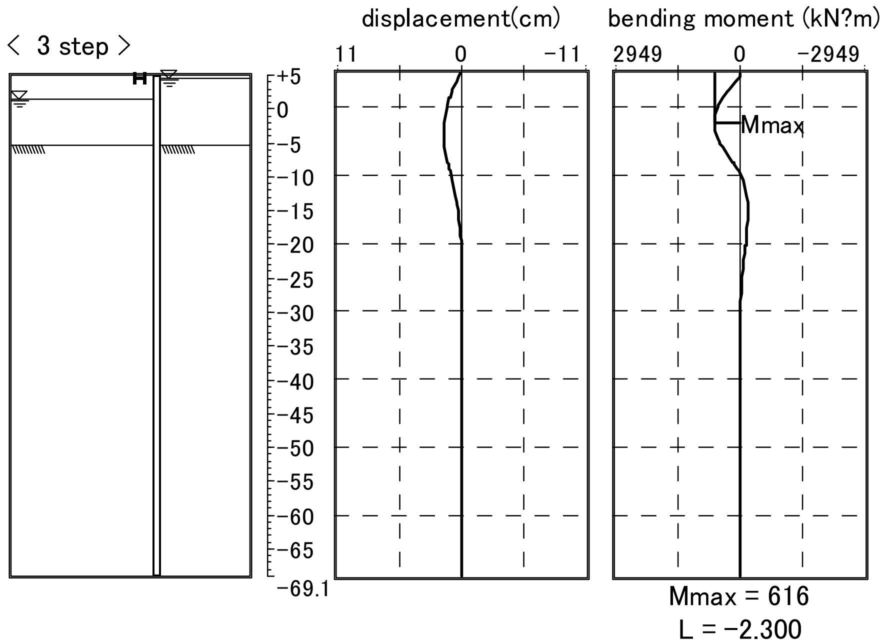


Mmax = 2927
L = -8.470

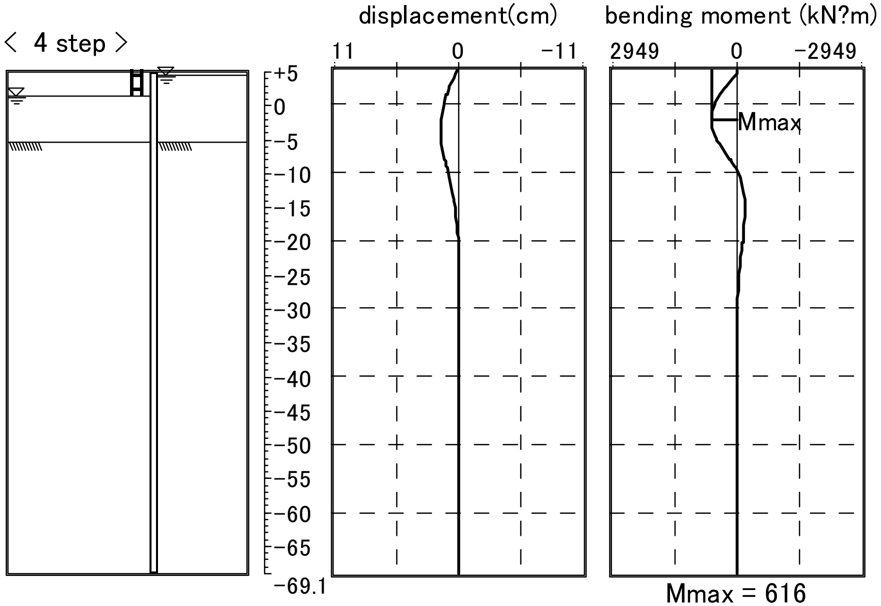
perpendicular direction




< 2 step >
displacement(cm)
11
0
-11
bending moment (kN?m)
2949
0
-2949
+5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-69.1
Mmax
Mmax = -14
L = -9.500

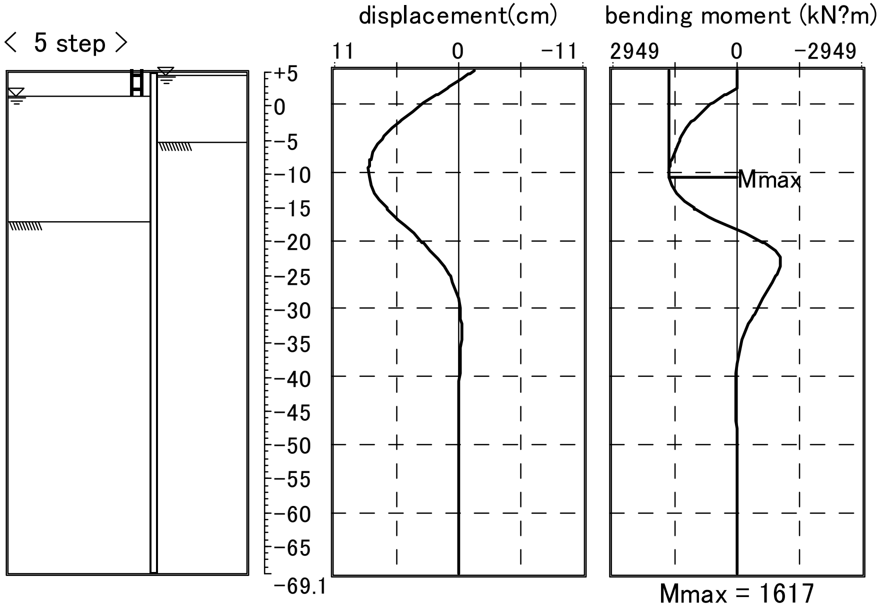

< 3 step >
displacement(cm)
11
0
-11
bending moment (kN?m)
2949
0
-2949
+5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-69.1
Mmax
Mmax = 616
L = -2.300

〈 4 step 〉

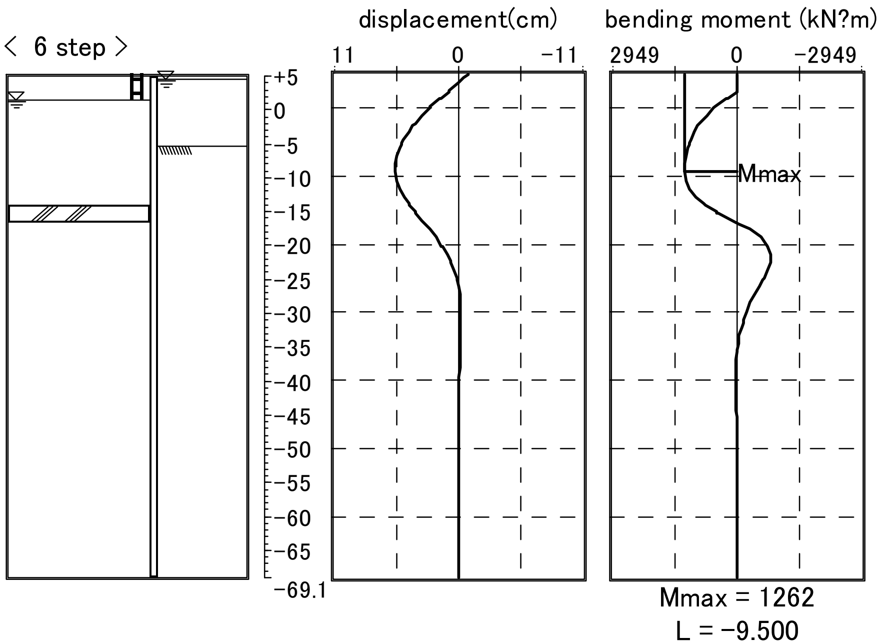


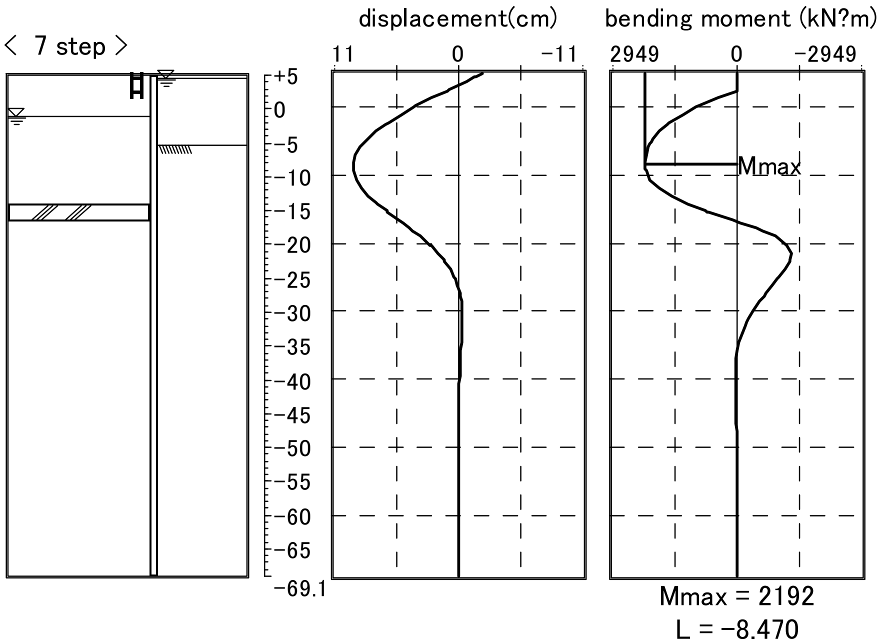
Mmax = 616
L = -2.300

〈 5 step 〉

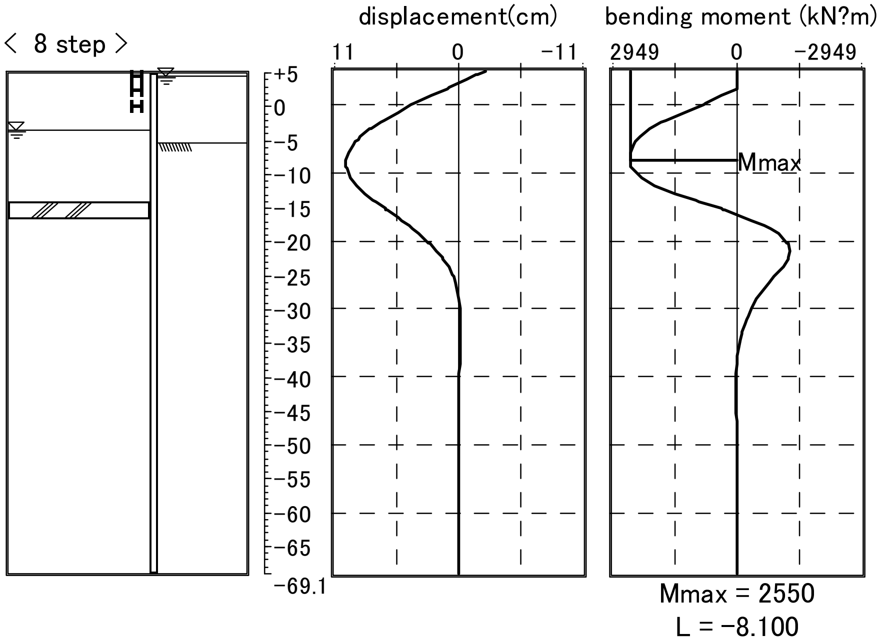


Mmax = 1617
L = -10.700


< 6 step >
displacement(cm)
11
0
-11
bending moment (kN?m)
2949
0
-2949
+5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-69.1
Mmax
Mmax = 1262
L = -9.500

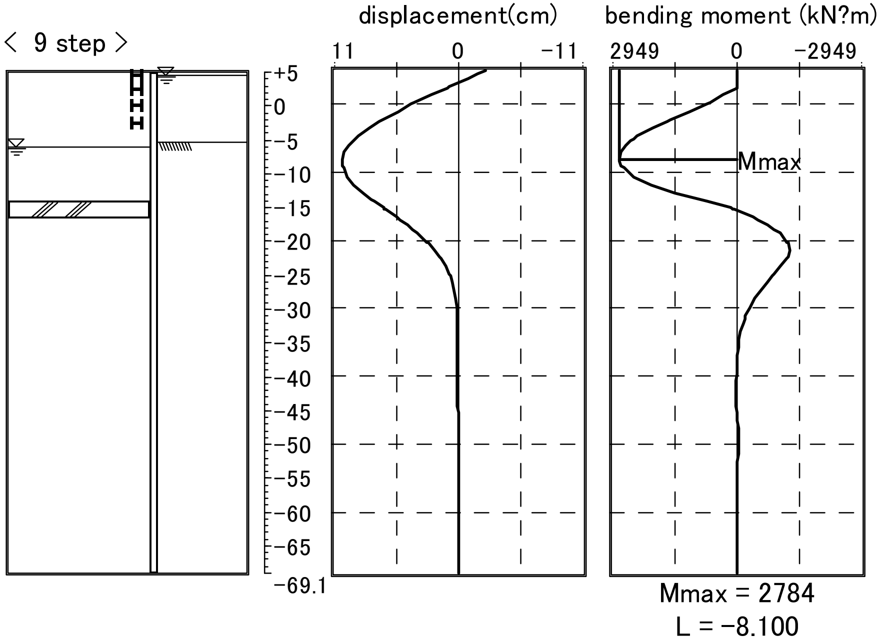

< 7 step >
displacement(cm)
11
0
-11
bending moment (kN?m)
2949
0
-2949
+5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-69.1
Mmax
Mmax = 2192
L = -8.470

< 8 step >



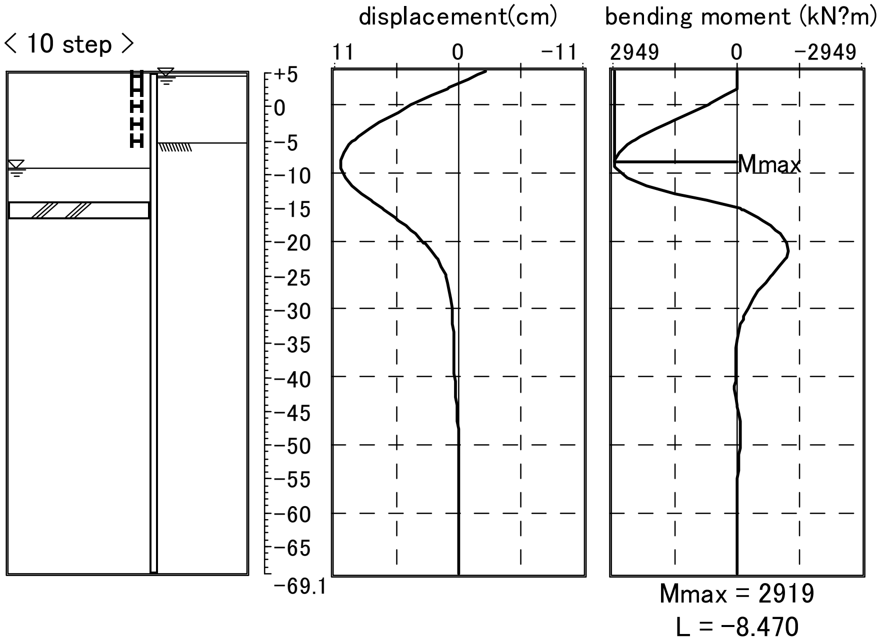
displacement(cm)
11 0 −11
bending moment (kN?m)
2949 0 −2949
+5
0
−5
−10
−15
−20
−25
−30
−35
−40
−45
−50
−55
−60
−65
−69.1
Mmax
Mmax = 2550
L = −8.100

< 9 step >

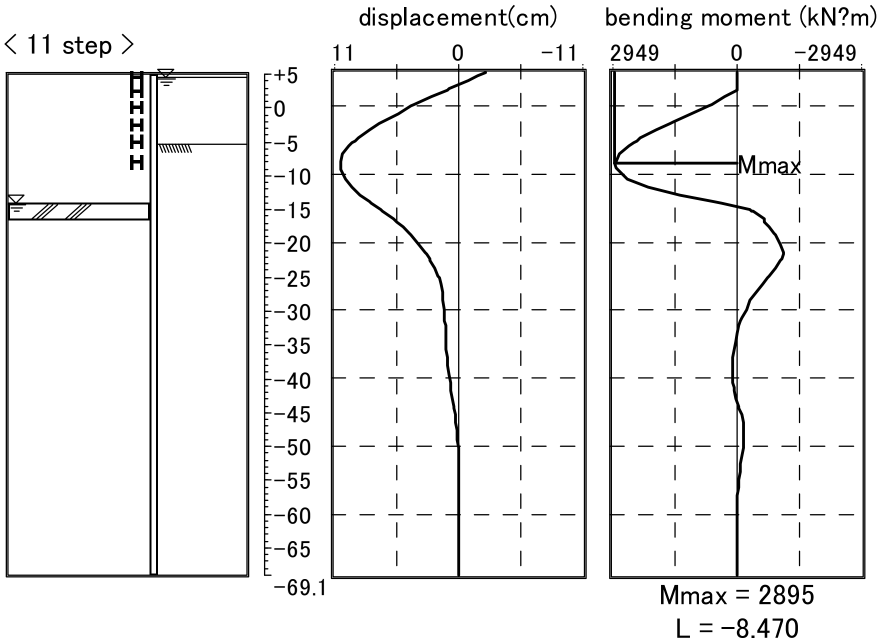


displacement(cm)
11 0 −11
bending moment (kN?m)
2949 0 −2949
+5
0
−5
−10
−15
−20
−25
−30
−35
−40
−45
−50
−55
−60
−65
−69.1
Mmax
Mmax = 2784
L = −8.100

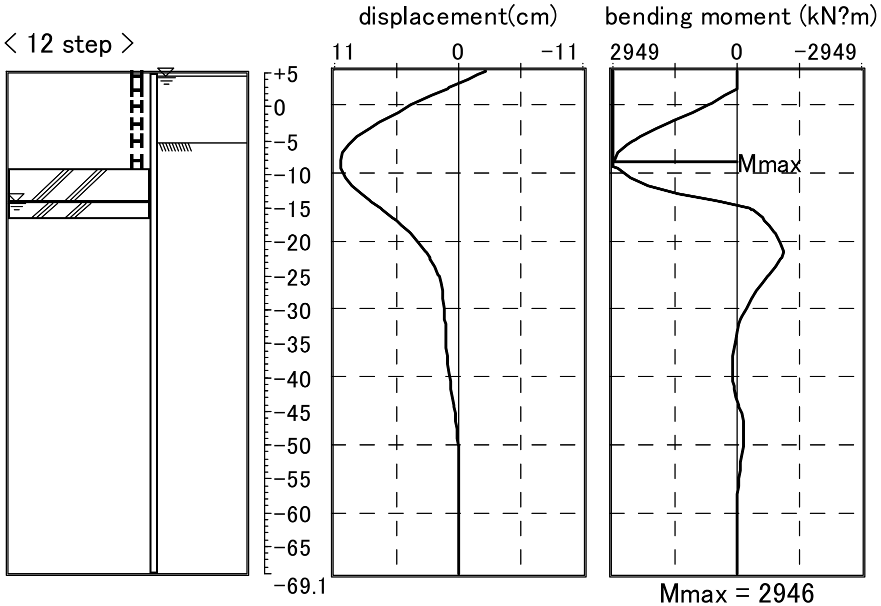
< 10 step >



< 11 step >

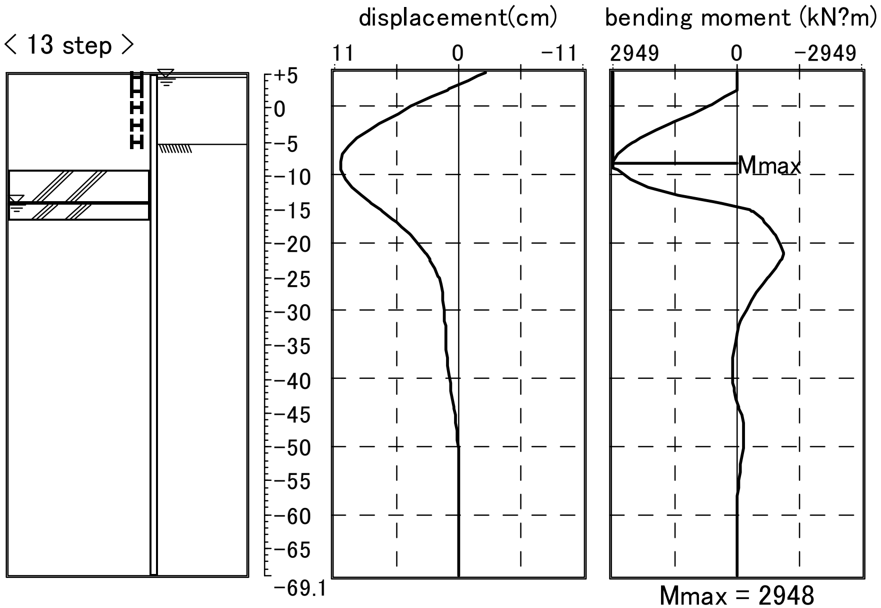


< 12 step >



Mmax = 2946
L = -8.470

< 13 step >



Mmax = 2948
L = -8.470

3.2.12 check timbering

(1) section performance

1)bridge axis direction (linear)

**wailing

row	H (cm)	B (cm)	A (cm^2)	Aw (cm^2)	Iy (cm^4)	Zy (cm^3)	ry (cm)	rz (cm)
1	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
2	40.0	40.0	218.70	46.54	66600	3330	17.50	10.10
3	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
4	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
5	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55
6	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55

**strut

row	H (cm)	B (cm)	A (cm^2)	Aw (cm^2)	Iy (cm^4)	Zy (cm^3)	ry (cm)	rz (cm)
1	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
2	40.0	40.0	218.70	46.54	66600	3330	17.50	10.10
3	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
4	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
5	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55
6	30.0	30.0	118.40	27.00	20200	1350	13.10	7.55

2)perpendicular direction (arc)

row	H (cm)	B (cm)	A (cm^2)	Aw (cm^2)	Iy (cm^4)	Zy (cm^3)	ry (cm)	rz (cm)
1	35.0	35.0	171.90	37.44	39800	2280	15.20	8.89
2	40.0	40.0	218.70	46.54	66600	3330	17.5	10.1

							0	0
3	35.0	35.0	171.90	37.44	39800	2280	15.2 0	8.89
4	35.0	35.0	171.90	37.44	39800	2280	15.2 0	8.89
5	30.0	30.0	118.40	27.00	20200	1350	13.1 0	7.55
6	30.0	30.0	118.40	27.00	20200	1350	13.1 0	7.55

(2) maximum timbering reaction Rmax (kN/m)

row	bridge axis direction (linear)		perpendicular direction(arc)	
	section	Rmax	section	Rmax
1	H-350*350*12*19	153.30	H-350*350*12*19	152.97
2	2H-400*400*13*21	223.70	2H-400*400*13*21	223.69
3	H-350*350*12*19	218.13	H-350*350*12*19	207.92
4	H-350*350*12*19	136.45	H-350*350*12*19	135.19
5	H-300*300*10*15	65.01	H-300*300*10*15	63.67
6	H-300*300*10*15	3.38	H-300*300*10*15	12.08

note)double timbering is 1/2 value

(3)arc part

1)check of ring buckling

about buckling of arc wailing, following equation to calculate allowable timbering reaction in considertaion of ring buckling safety is checked

$$Ra = \frac{2*E*Iy}{r^3} >= R1max$$

where, Ra : allowable timbering reaction (N/mm)

E : Young's modulus of wailing = 2.00 * 10^5(N/mm^2)

Iy : moment of inertia of wailing(mm^4)

r : radius of circular timbering (mm)

R1max : maximum timbering reaction (N/mm) ------ perpendicular direction(arc part)

row	section	r (cm)	Iy (cm^4)	Ra (kN/m)	R1max	judge
1	H-350*350*12*19	569.04	39800	863.98	152.97	OK
2	2H-400*400*13*21	566.54	66600	1464.98	223.69	OK
3	H-350*350*12*19	569.04	39800	863.98	207.92	OK
4	H-350*350*12*19	569.04	39800	863.98	135.19	OK
5	H-300*300*10*15	571.54	20200	432.77	63.67	OK
6	H-300*300*10*15	571.54	20200	432.77	12.08	OK

2)wailing stress check

arc wailing may be calculated as an axial compression member under uniformly distributed pressure

Acutually, irregular shape of timbering and precision to cast steel pipe sheet pile (actual observation, radius in oval part about 1 to 2%), because imbalanced pressure induced moment is observed,

for safety, following procedure is taken to consider influence of ovalization in principle

stress working at wailing is given by the following equation.

$$\text{Sig.s} = \frac{N}{A} + \frac{M1 + M2}{Z} \le \text{Sig.sa}$$

where, Sig.s : stress of wailing(N/mm^2)

Sig.sa : allowable stress of wailing (N/mm^2)

A : sectional area of wailing (mm^2)

Z : section coefficient of wailing (mm^3)

N : axial force (N) = R1max * r

R1max : maximum timbering reaction (N/mm)

r : radius of wailing (mm)

M1 : bending moment in consideration of ovalization (N.mm) = R1max * r^2 * Del.

Del. : ovalization rate, 2% wailing radius is supposed to be standard.

M2 : support point bending moment in linear part (N.mm) = (R2max.$L1^2$) / 12

R2max : maximum timbering reaction (N/mm) bridge axis direction(linear part)

L1 : effective span in linear part of wailing (mm)

row	section	A (cm^2)	Z	R1max	R2max	r (cm)
1	H-350*350*12*19	171.90	2280	152.97	153.30	569.04
2	2H-400*400*13*21	218.70	3330	223.69	223.70	566.54
3	H-350*350*12*19	171.90	2280	207.92	218.13	569.04
4	H-350*350*12*19	171.90	2280	135.19	136.45	569.04
5	H-300*300*10*15	118.40	1350	63.67	65.01	571.54
6	H-300*300*10*15	118.40	1350	12.08	3.38	571.54

row	L1 (m)	N (kN)	M1 (kN.m)	M2 (kN.m)	Sig.s (N/mm^2)	Sig.sa (N/mm^2)	judge
1	2.700	870.5	99.1	93.1	134.94	210.00	OK
2	2.700	1267.3	143.6	135.9	141.88	210.00	OK

row	L1 (m)	N (kN)	M1 (kN.m)	M2 (kN.m)	Sig.s (N/mm^2)	Sig.sa (N/mm^2)	judge
3	2.700	1183.2	134.7	132.5	186.01	210.00	OK
4	2.700	769.3	87.6	82.9	119.51	210.00	OK
5	2.700	363.9	41.6	39.5	90.80	210.00	OK
6	2.700	69.0	7.9	2.1	13.20	210.00	OK

(4)linear part

1)check of wailing

wailing in linear part is a member which receives both axial compressive force and bending moment together are supposed to be checked using the following equation

besides, as axial force, it is supposed to add temperature stress(Del.N = 150 kN)

$$\frac{Sig.c}{Sig.caz} + \frac{Sig.bcy}{Sig.bagy * \left(1 - \frac{Sig.c}{Sig.eay}\right)} <= 1.0 \quad \text{---} \quad \text{check1}$$

$$Sig.c + \frac{Sig.bcy}{1 - \frac{Sig.c}{Sig.eay}} <= Sig.cal \quad \text{---} \quad \text{check2}$$

where, Sig.c : compressive stress by axial force acting on check section (N/mm^2)

Sig.bcy : bending compressive stress by bending moment about strong axis (N/mm^2)

Sig.caz : about weak axis allowable axial direction compressive stress (N/mm^2)

$$\frac{L5}{rz} <= 18 : Sig.caz = 210.0$$

$$18 < \frac{L5}{rz} <= 92 : Sig.caz = 1.5*\left\{ 140.0 - 0.82\left(\frac{L5}{rz} - 18\right) \right\}$$

$$92 < \frac{L5}{rz} \quad : Sig.caz = \frac{1.5*1,200,000}{6700 + \left(\frac{L5}{rz}\right)^2}$$

L5 : about weak axis effective buckling length (mm)

rz : about weak axis section second radius (mm)

Sig.bagy : without considering local tbuckling, allowable bending compressive stress about strong axis (N/mm^2)

$$\frac{L2}{b} \leq 4.5 \qquad : Sig.bagy = 210.0$$

$$4.5 < \frac{L2}{b} \leq 30 \quad : Sig.bagy = 1.5*\left\{ 140.0 - 2.4\left(\frac{L2}{b} - 4.5 \right) \right\}$$

L2 : distance between fixed flange (mm)

b : compressive flange width (mm)

Sig.cal : allowable stress for local buckling of protrusion under compressive force (N/mm^2)

(= 210.0 (N/mm^2))

Sig.eay : Euler buckling stress about strong axis(N/mm^2) = $\dfrac{1,200,000}{\left(\dfrac{L4}{ry}\right)^2}$

L4 : effective buckling length about strong axis (mm)

ry : section second radius about strong axis (mm)

a)stability check1

$$\frac{Sig.c}{Sig.caz} + \frac{Sig.bcy}{Sig.bagy*\left(1 - \dfrac{Sig.c}{Sig.eay}\right)} \leq 1.0$$

$$N = R1max*r + Del.N$$

$$M = \frac{R2max*L1^2}{8}$$

$$sc = \frac{N}{A}, \qquad sbcy = \frac{M}{Z}$$

$$Alp. = \frac{Sig.c}{Sig.caz}, \qquad Beta = \frac{Sig.bcy}{Sig.bagy*\left(1 - \dfrac{Sig.c}{Sig.eay}\right)}$$

where, R1max : maximum timbering reaction (N/mm) perpendicular direction(arc part)

R2max : maximum timbering reaction (N/mm) bridge axis direction(linear part)

N : axial force (N)

L : maximum strut spacing (mm)

L' : brace setting length (mm)

L1 : effective buckling length (mm) = L - L'

L2 : distance between fixed flange (mm)

L4 : effective buckling length about strong axis (mm)

L5 : effective buckling length about weak axis (mm)

row	section	A (cm²)	Z (cm³)	r (cm)	L (m)	L' (m)	L1 (m)	L2 (m)	L4 (m)	L5 (m)
1	H-350*350*12*19	171.90	2280	569.04	4.000	1.300	2.700	2.700	2.700	2.700
2	2H-400*400*13*21	218.70	3330	566.54	4.000	1.300	2.700	2.700	2.700	2.700
3	H-350*350*12*19	171.90	2280	569.04	4.000	1.300	2.700	2.700	2.700	2.700
4	H-350*350*12*19	171.90	2280	569.04	4.000	1.300	2.700	2.700	2.700	2.700
5	H-300*300*10*15	118.40	1350	571.54	4.000	1.300	2.700	2.700	2.700	2.700
6	H-300*300*10*15	118.40	1350	571.54	4.000	1.300	2.700	2.700	2.700	2.700

row	L5/rz	Sig.caz (N/mm²)	L2/b	Sig.bagy (N/mm²)	L4/ry (m)	Sig.eay (N/mm²)
1	30.37	194.78	7.71	198.43	17.76	3803.13
2	26.73	199.26	6.75	201.90	15.43	5041.15
3	30.37	194.78	7.71	198.43	17.76	3803.13
4	30.37	194.78	7.71	198.43	17.76	3803.13
5	35.76	188.15	9.00	193.80	20.61	2824.86
6	35.76	188.15	9.00	193.80	20.61	2824.86

row	R1max (kN/m)	R2max (kN/m)	N (kN)	M (kN.m)	Sig.c (N/mm2)	Sig.bcy
1	152.97	153.30	1020.49	139.69	59.37	61.27
2	223.69	223.70	1417.29	203.84	64.81	61.21
3	207.92	218.13	1333.17	198.77	77.55	87.18
4	135.19	136.45	919.28	124.34	53.48	54.54
5	63.67	65.01	513.88	59.24	43.40	43.88
6	12.08	3.38	219.04	3.08	18.50	2.28

row	Alp.	Beta	Alp.+Beta	judgement
1	0.305	0.314	0.618	OK
2	0.325	0.307	0.632	OK
3	0.398	0.449	0.847	OK
4	0.275	0.279	0.553	OK
5	0.231	0.230	0.461	OK
6	0.098	0.012	0.110	OK

b)stability check2

$$Sig..c + \frac{Sig.bcy}{1 - \frac{Sig.c}{Sig.eay}} <= Sig.cal$$

$$Gam. = \frac{Sig.bcy}{1 - \frac{Sig.c}{Sig.eay}}$$

row	Sig.c (N/mm2	Sig.bcy (N/mm2	Sig.eay (N/mm2	Gam. (N/mm2)	Sig.c+Gam. (N/mm2)	Sig.cal	judgement
1	59.37	61.27	3803.13	62.24	121.61	210.00	OK
2	64.81	61.21	5041.15	62.01	126.82	210.00	OK
3	77.55	87.18	3803.13	89.00	166.55	210.00	OK
4	53.48	54.54	3803.13	55.31	108.79	210.00	OK
5	43.40	43.88	2824.86	44.56	87.97	210.00	OK
6	18.50	2.28	2824.86	2.30	20.80	210.00	OK

c) check of shear stress

$$Smax = \frac{R2max*L1}{2}$$

$$Tau.s = \frac{Smax}{Aw} <= Tau.sa$$

where, Smax : maximum shear force (N)

Aw : web sectional area (mm^2)

Tau.s : accrue shear stress (N/mm^2)

Tau.sa : allowable shear stress (N/mm^2)

row	R2max (kN/m)	L1 (m)	Smax (kN)	Aw (cm2)	Tau.s (N/mm2	Tau.sa (N/mm2	judgement
1	153.30	2.700	206.95	37.44	55.28	120.00	OK
2	223.70	2.700	301.99	46.54	64.89	120.00	OK

row	R2max (kN/m)	L1 (m)	Smax (kN)	Aw (cm2)	Tau.s (N/mm2	Tau.sa (N/mm2	judgement
3	218.13	2.700	294.48	37.44	78.65	120.00	OK
4	136.45	2.700	184.21	37.44	49.20	120.00	OK
5	65.01	2.700	87.76	27.00	32.50	120.00	OK
6	3.38	2.700	4.57	27.00	1.69	120.00	OK

2) check of strut

strut is a member which receives both axial compression force and bending moment with wailing likewise check. vertical load working at strut is sume of strut dead weight+surcharge load (w = 5.0 kN/m) as axial force, it is supposed to add temperature stress(Del.N = 150 kN)

a) stability check1

$$\frac{Sig.c}{Sig.caz} + \frac{Sig.bcy}{Sig.bagy*\left(1 - \frac{Sig.c}{Sig.eay}\right)} <= 1.0$$

$$N = R2max*L1 + Del.N$$

$$M = \frac{w*L3^2}{8}$$

$$Sig.c = \frac{N}{A}, \quad Sig.bcy = \frac{M}{Z}$$

$$Alp. = \frac{Sig.c}{Sig.caz}, \quad Beta = \frac{Sig.bcy}{Sig.bagy*\left(1 - \frac{Sig.c}{Sig.eay}\right)}$$

where, L1 : axial force sharing width of strut (mm)
L2 : distance between fixed flange (mm)
L3 : strut bending span (mm)
L4 : effective buckling length about strong axis (mm)
L5 : effective buckling length about weak axis (mm)

row	section	A (cm2)	Z (cm3)	L1 (m)	L2 (m)	L3 (m)	L4 (m)	L5 (m)
1	H-350*350*12*19	171.90	2280	4.000	8.431	11.031	11.031	8.431
2	2H-400*400*13*21	218.70	3330	4.000	8.331	10.931	10.931	8.331
3	H-350*350*12*19	171.90	2280	4.000	8.431	11.031	11.031	8.431
4	H-350*350*12*19	171.90	2280	4.000	8.431	11.031	11.031	8.431
5	H-300*300*10*15	118.40	1350	4.000	8.531	11.131	11.131	8.531
6	H-300*300*10*15	118.40	1350	4.000	8.531	11.131	11.131	8.531

row	L5/rz	Sig.caz	L2/b	Sig.bagy	L4/ry (m)	Sig.eay
1	94.84	114.69	24.09	139.48	72.57	227.84
2	82.49	130.68	20.83	151.22	62.46	307.57
3	94.84	114.69	24.09	139.48	72.57	227.84
4	94.84	114.69	24.09	139.48	72.57	227.84
5	112.99	92.46	28.44	123.83	84.97	166.21
6	112.99	92.46	28.44	123.83	84.97	166.21

row	R1max (kN/m)	R2max (kN/m)	N (kN)	M (kN.m)	Sig.c (N/mm2)	Sig.bcy
1	152.97	153.30	763.19	76.05	44.40	33.36
2	223.69	223.70	1044.78	74.68	47.77	22.43
3	207.92	218.13	1022.52	76.05	59.48	33.36
4	135.19	136.45	695.82	76.05	40.48	33.36
5	63.67	65.01	410.03	77.44	34.63	57.36
6	12.08	3.38	163.54	77.44	13.81	57.36

row	Alp.	Beta	Alp.+Beta	judgement
1	0.387	0.297	0.684	OK
2	0.366	0.176	0.541	OK
3	0.519	0.324	0.842	OK
4	0.353	0.291	0.644	OK
5	0.375	0.585	0.960	OK
6	0.149	0.505	0.655	OK

b)stability check2

$$\text{Sig..c} + \frac{\text{Sig.bcy}}{1 - \dfrac{\text{Sig.c}}{\text{Sig.eay}}} \leq \text{Sig.cal}$$

$$\text{Gam.} = \frac{\text{Sig.bcy}}{1 - \dfrac{\text{Sig.c}}{\text{Sig.eay}}}$$

row	Sig.c (N/mm2	Sig.bcy (N/mm2	Sig.eay (N/mm2	Gam. (N/mm2)	Sig.c+Gam. (N/mm2)	Sig.cal	judgement
1	44.40	33.36	227.84	41.43	85.83	210.00	OK
2	47.77	22.43	307.57	26.55	74.32	210.00	OK
3	59.48	33.36	227.84	45.14	104.62	210.00	OK
4	40.48	33.36	227.84	40.56	81.04	210.00	OK
5	34.63	57.36	166.21	72.46	107.09	210.00	OK
6	13.81	57.36	166.21	62.56	76.37	210.00	OK

c) check of shear stress

$$Smax = \frac{5.0*L3}{2}$$

$$Tau.s = \frac{Smax}{Aw} <= Tau.sa$$

row	L3 (m)	Smax (kN)	Aw (cm2)	Tau.s (N/mm2)	Tau.sa (N/mm2	judgement
1	11.031	27.58	37.44	7.37	120.00	OK
2	10.931	27.33	46.54	5.87	120.00	OK
3	11.031	27.58	37.44	7.37	120.00	OK
4	11.031	27.58	37.44	7.37	120.00	OK
5	11.131	27.83	27.00	10.31	120.00	OK
6	11.131	27.83	27.00	10.31	120.00	OK

3)check of brace beam

brace beam is a member which receives only axial compression force from wailing and use the following equation are supposed to be checked

$$Sig.c = \frac{N}{A} \leq Sig.caz$$

$$N = \frac{(L1 + L2)*R2max}{2*cosTheta}$$

where, L : brace length (mm)
L1 : brace setting length (mm)
L2 : strut spacing - 2 * brace span (mm)
Theta : brace setting angle (Deg.)

row	section	A (cm2)	Theta	L (m)	L1 (m)	L2 (m)
1	H-350*350*12*19	171.90	45.0	1.838	1.300	1.400
2	2H-400*400*13*21	218.70	45.0	1.838	1.300	1.400
3	H-350*350*12*19	171.90	45.0	1.838	1.300	1.400
4	H-350*350*12*19	171.90	45.0	1.838	1.300	1.400
5	H-300*300*10*15	118.40	45.0	1.838	1.300	1.400
6	H-300*300*10*15	118.40	45.0	1.838	1.300	1.400

row	L/rz	R2max	N (kN)	Sig.c (N/mm2)	Sig.caz	judgement
1	20.68	153.30	292.67	17.03	206.70	OK
2	18.20	223.70	427.08	19.53	209.75	OK
3	20.68	218.13	416.45	24.23	206.70	OK
4	20.68	136.45	260.52	15.16	206.70	OK
5	24.35	65.01	124.11	10.48	202.19	OK
6	24.35	3.38	6.46	0.55	202.19	OK

3.2.13 check of embedment length

current ground surface elevation -5.410 (m)
riverside water table elevation +4.340 (m)
steel pipe sheet pile length 74.000 (m)

(1)final excavation time (11 step)
observing strut elevation = -8.100 (m)
coffered landside excavation area elevation = -17.100 (m)
coffered landside water table elevation = -14.100 (m)

layer No	elevation (m)	layer thickness (m)	passive side pressure (kN/m2)	active side pressure (kN/m2)	water pressure (kN/m2)
1	-8.100 -8.470	0.370	------- -------	0.18 2.95	124.40 128.10
2	-8.470 -14.100	5.630	------- -------	6.77 20.04	128.10 184.40
3	-14.100 -15.420	1.320	------- -------	20.04 23.16	184.40 0.00
4	-15.420 -17.100	1.680	------- -------	23.16 27.12	0.00 0.00
5	-17.100 -20.460	3.360	0.00 91.18	27.12 35.04	0.00 0.00
6	-20.460 -22.490	2.030	134.88 150.10	10.87 26.10	0.00 0.00
7	-22.490 -25.420	2.930	126.10 148.08	50.10 72.07	0.00 0.00
8	-25.420 -41.480	16.060	148.08 268.53	72.07 192.52	0.00 0.00
9	-41.480 -41.699	0.219	625.95 631.88	81.52 82.03	0.00 0.00

active earth pressure /water pressure Pa = 6081.2 (kN/m)
ya = 17.098 (m)

Ma = 103978 (kN.m/m)

passive earth pressure Pp = 4327.0 (kN/m)

yp = 24.030 (m)

Mp = 103978 (kN.m/m)

balanced depth Z = 24.599 (m) (elevation = -41.699 (m))

embedment length D = 29.518 (m) (elevation = -46.618 (m))

required sheet pile length L = 51.518 (m)

(2)before installation of the lower strut (10 step)

observing strut elevation = -5.100 (m)

coffered landside excavation area elevation = -17.100 (m)

coffered landside water table elevation = -9.100 (m)

layer No	elevation (m)	layer thickness (m)	passive side pressure (kN/m2)	active side pressure (kN/m2)	water pressure (kN/m2)
1	-5.100 -5.410	0.310	------- -------	0.00 0.00	94.40 97.50
2	-5.410 -8.077	2.667	------- -------	0.00 0.00	97.50 124.17
3	-8.077 -8.470	0.393	------- -------	0.00 2.95	124.17 128.10
4	-8.470 -9.100	0.630	------- -------	6.77 8.25	128.10 134.40
5	-9.100 -15.420	6.320	------- -------	8.25 23.16	134.40 1.14
6	-15.420 -17.100	1.680	------- -------	23.16 27.12	1.14 1.01
7	-17.100 -20.460	3.360	0.00 91.18	27.12 35.04	1.01 0.77
8	-20.460 -22.490	2.030	134.88 150.10	10.87 26.10	0.77 0.62
9	-22.490 -25.420	2.930	126.10 148.08	50.10 72.07	0.62 0.41

10	-25.420 -30.975	5.555	148.08 189.74	72.07 113.73	0.41 0.00

active earth pressure /water pressure Pa = 2911.4 (kN/m)

ya = 12.466 (m)

Ma = 36292 (kN.m/m)

passive earth pressure Pp = 1782.4 (kN/m)

yp = 20.361 (m)

Mp = 36292 (kN.m/m)

balanced depth Z = 13.875 (m) (elevation = -30.975 (m))

embedment length D = 16.650 (m) (elevation = -33.750 (m))

required sheet pile length L = 38.650 (m)

3.2.14 check of boiling

check final excavation time(13 step)

current ground surfaceelevation -5.410 (m)

riverside water tableelevation +4.340 (m)

excavation areaelevation -17.100 (m)

steel pipe sheet pile length 74.000 (m)

$$d = \frac{\frac{10 \cdot Fs \cdot H}{Gam.'} - h}{2}$$

where, d : embedment length (m)

Fs : factor of safety = 1.5

Gam.': average submerged unit weight of soil = 7.86 (kN/m³)

H : distance from riverside water table to excavation area = 21.4400 (m)

h : distance from current ground surface to excavation area = 11.6900 (m)

d = 14.610 (m) (elevation = -31.710 (m))

required sheet pile length 36.610 (m)

3.2.15 check of heaving

check final excavation time(13 step)

excavation areaelevation -17.100 (m)

distance from excavation bottom to top end of impermeable layer h1 27.370 (m)

thickness of impermeable layer h2 16.010 (m)

suppression water head hw 64.820 (m)

$$U <= \frac{w}{1.1} + \frac{Sum((fli*hli))*L}{6}$$

where, U : uplifting force working at bottom of impermeable layer

U = Gam.w*hw*A = 137409.02 (kN)

Gam.w : unit weight of water = 10.00 (kN/m^3)

A : coffered area = 211.986 (m^2)

Gam.ti: wet weight of soil (kN/m^3)

hi : layer thickness (m)

Gam.c : unit weight of footing concrete = 23.00 (kN/m^3)

hc : footing concrete thickness = 2.50 (m)

Gam.t': unit weight of paving sand = 19.00 (kN/m^3)

ht' : thickness of paving sand = 0.50 (m)

w : celler internal soil upper than impermeable layer bottom and footing concrete ,weight of paving sand(kN)

weight of footing concretew1

w1 = Gam.c*hc*A = 12189.17 (kN)

weight of paving sandw2

w2 = Gam.t'*ht'*A = 2013.86 (kN)

weight of celler internal soil w3

No	elevation (m)	layer type	layer thickness (m)	unit weight Gam.ti(kN/m^3)	Gam.ti.hti.A (kN)
1	-17.100 -20.460	sandy	3.360	17.00	12108.61
2	-20.460 -22.490	cohesv	2.030	17.50	7530.79
3	-22.490 -25.420	cohesv	2.930	17.50	10869.56
4	-25.420 -41.480	cohesv	16.060	17.50	59578.53
5	-41.480 -44.470	sandy	2.990	17.00	10775.23

No	elevation (m)	layer type	layer thickness (m)	unit weight Gam.ti(kN/m³)	Gam.ti.hti.A (kN)
6	-44.470 -60.480	cohesv	16.010	18.00	61089.98
sum			43.380		161952.70

Sw = w1 + w2 + w3 = 176155.73 (kN)

L :celler internal perimeter = 75.289 (m)

fli :friction force (kN/m²)

about sand soil, friction force is not considered

hli :thickness to consider friction force (m)

No	elevation (m)	layer type	layer thick	N value	friction force fli	friction resistant force fli*hli (kN/m)
1	-17.100 -20.460	sandy	3.360	13.0	------	------
2	-20.460 -22.490	cohesv	2.030	9.0	90.00	182.70
3	-22.490 -25.420	cohesv	2.930	7.0	70.00	205.10
4	-25.420 -41.480	cohesv	16.060	7.0	70.00	1124.20
5	-41.480 -44.470	sandy	2.990	25.0	------	------
6	-44.470 -60.480	cohesv	16.010	18.0	150.00	2401.50
sum			43.380			3913.50

* 137409.016 (kN) <= 209248.844 (kN) OK

3.3 composite stress calculation

3.3.1 maximum stress table

(1)bridge axis direction

1) material :SKY400

Case	load name	accrue location(m)	Sig.1(N/mm²)	Sig.2(N/mm²)	Sig.max(N/mm²)	Sig.a(N/mm²)
1	RegularHWL[W]	-31.600	66.36	7.03	73.39	140.00
2	RegularLWL[W]	-47.900	62.29	15.15	77.43	140.00
3	Temp.HWL[W]	-31.600	78.44	7.03	85.47	161.00
4	Temp.LWL[W]	-31.600	79.38	7.03	86.41	161.00
5	Wind[W]	-47.900	54.18	15.15	69.33	175.00
6	Vessel Impact[W]	-31.600	75.87	7.03	82.90	210.00
7	Seismic[W]	-31.600	135.89	7.03	142.92	210.00
8	Seismic[dyn Smax]	-31.600	128.66	7.03	135.69	210.00
9	Seismic[dyn Mmax]	-31.600	127.77	7.03	134.80	210.00

2) material :SKY490

Case	load name	accrue location(m)	Sig.1(N/mm²)	Sig.2(N/mm²)	Sig.max(N/mm²)	Sig.a(N/mm²)
1	RegularHWL[W]	-21.500	64.39	88.43	152.82	185.00
2	RegularLWL[W]	-21.500	61.84	88.43	150.27	185.00
3	Temp.HWL[W]	-21.500	80.92	88.43	169.35	212.75
4	Temp.LWL[W]	-21.500	78.54	88.43	166.97	212.75
5	Wind[W]	-21.500	51.69	88.43	140.12	231.25
6	Vessel Impact[W]	-21.500	76.58	88.43	165.01	277.50
7	Seismic[W]	-21.500	155.64	88.43	244.07	277.50
8	Seismic[dyn Smax]	-21.500	148.36	88.43	236.79	277.50
9	Seismic[dyn Mmax]	-21.500	148.81	88.43	237.24	277.50

(2)perpendicular direction

1) material :SKY400

Case	load name	accrue location(m)	Sig.1(N/mm²)	Sig.2(N/mm²)	Sig.max(N/mm²)	Sig.a(N/mm²)
1	Reg HWL [W]	-47.900	54.88	15.08	69.96	140.00

Case	load name	accrue location(m)	Sig.1(N/mm²)	Sig.2(N/mm²)	Sig.max(N/mm²)	Sig.a(N/mm²)
2	Reg LWL[W]	-47.900	62.27	15.08	77.36	140.00
3	wind[W]	-47.900	57.65	15.08	72.74	175.00
4	vessel impact[W]	-31.600	81.97	8.18	90.15	210.00
5	seismic[W]	-31.600	148.25	8.18	156.43	210.00
6	Seismic[dyn Smax]	-31.600	118.98	8.18	127.17	210.00
7	Seismic[dyn Mmax]	-31.600	118.97	8.18	127.16	210.00

2) material :SKY490

Case	load name	accrue location(m)	Sig.1(N/mm²)	Sig.2(N/mm²)	Sig.max(N/mm²)	Sig.a(N/mm²)
1	Reg HWL [W]	-21.500	51.63	90.67	142.30	185.00
2	Reg LWL[W]	-21.500	58.13	90.67	148.80	185.00
3	wind[W]	-21.500	59.68	90.67	150.35	231.25
4	vessel impact[W]	-21.500	77.32	90.67	167.99	277.50
5	seismic[W]	-21.500	151.45	90.67	242.11	277.50
6	Seismic[dyn Smax]	-21.500	122.74	90.67	213.40	277.50
7	Seismic[dyn Mmax]	-21.500	122.76	90.67	213.43	277.50

occurence location shows elevation

Sig.1 : stress after completion by design external force

Sig.2 : resultant stress(11 step)

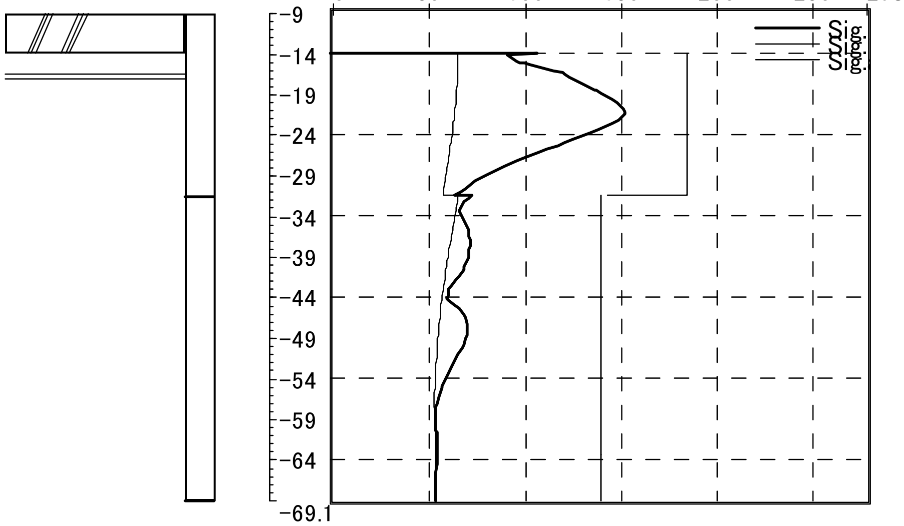
Sig.max: composite stress

Sig.a : allowabe stress of steel pipe sheet pile

3.3.2 stress distribution diagram

(1)bridge axis direction

<CASE-1 RegularHWL[W]>



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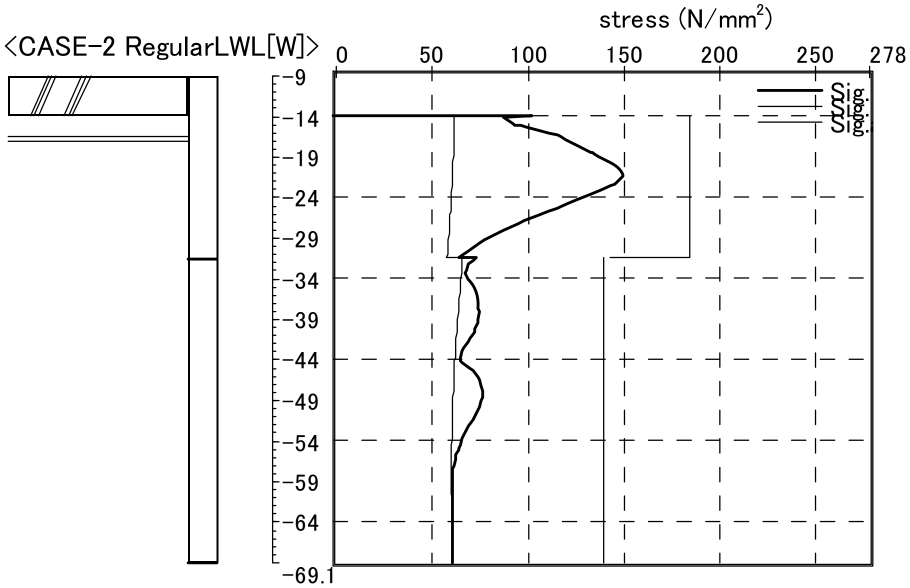
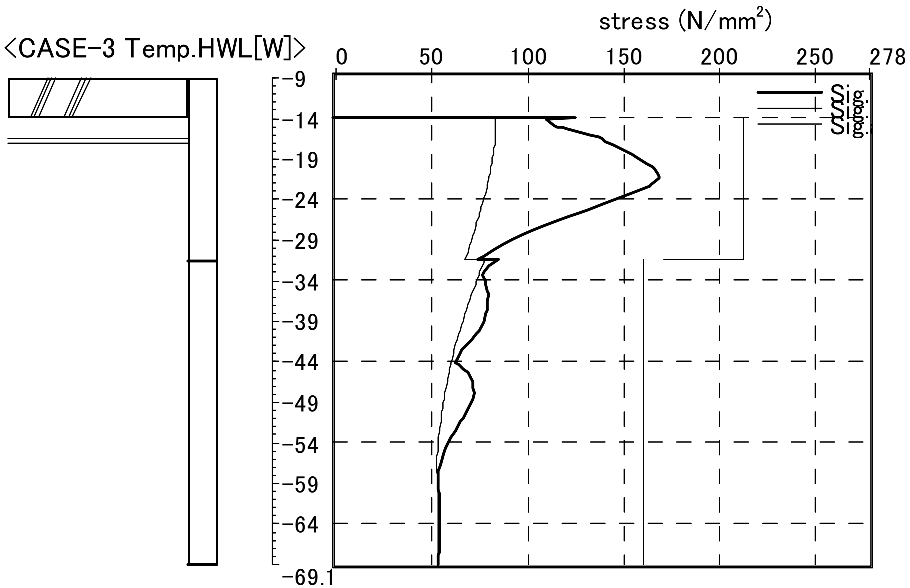
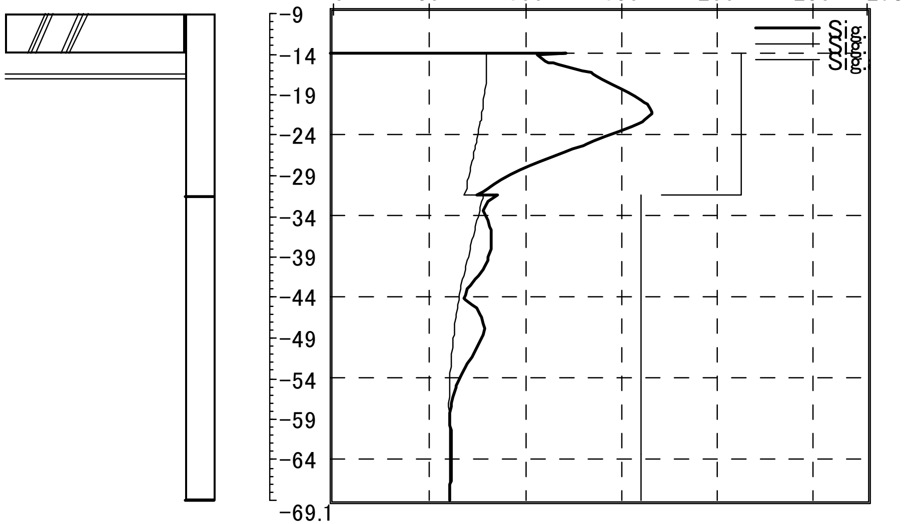


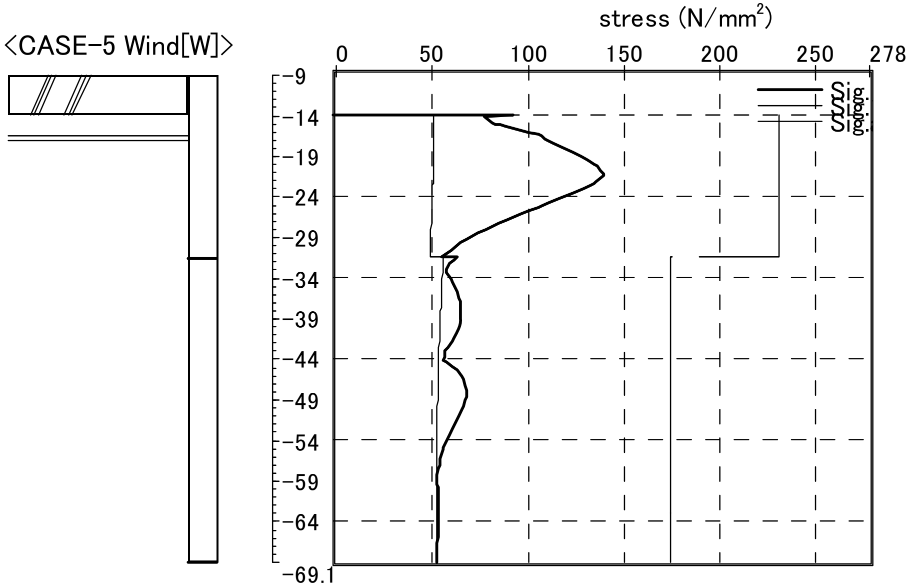
<CASE-3 Temp.HWL[W]>



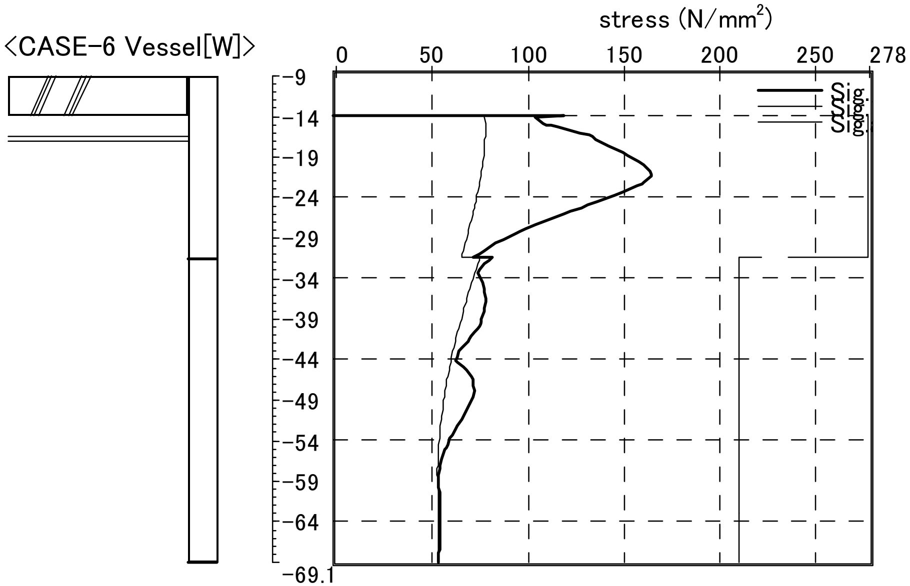
<CASE-4 Temp.LWL[W]>



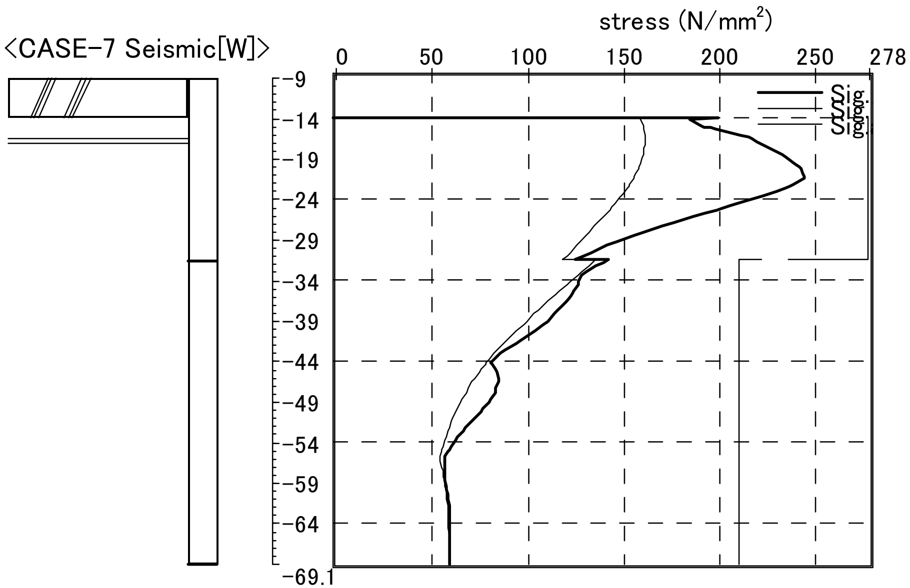
<CASE-5 Wind[W]>



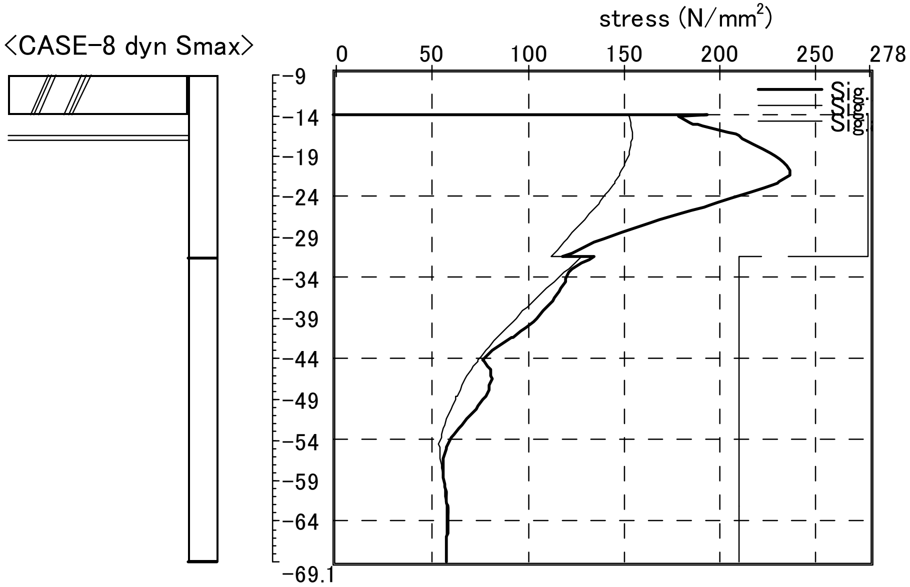
<CASE-6 Vessel[W]>



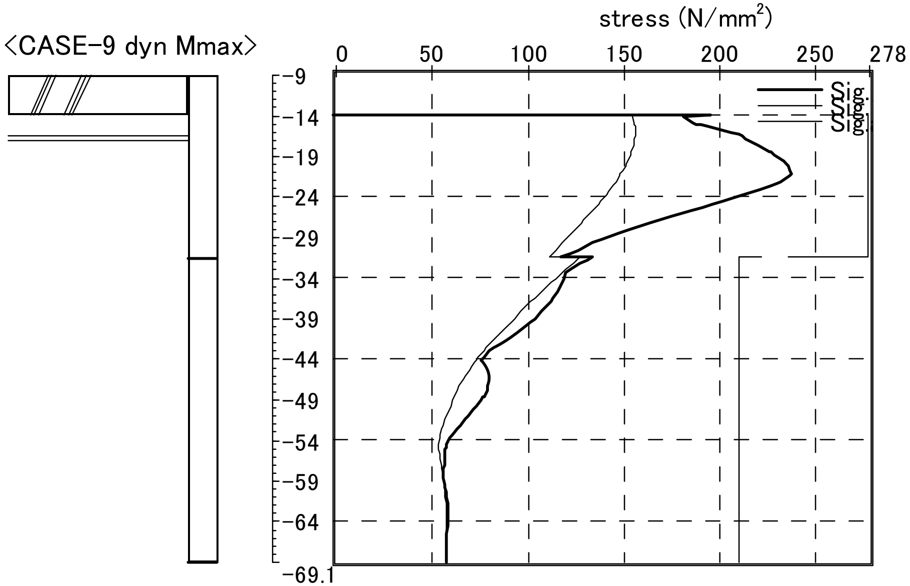
<CASE-7 Seismic[W]>



<CASE-8 dyn Smax>

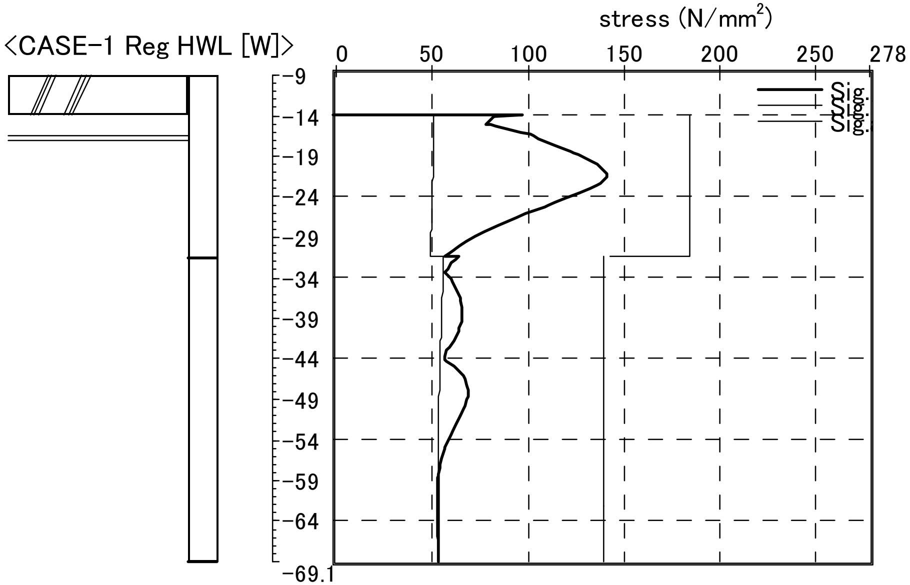


<CASE-9 dyn Mmax>

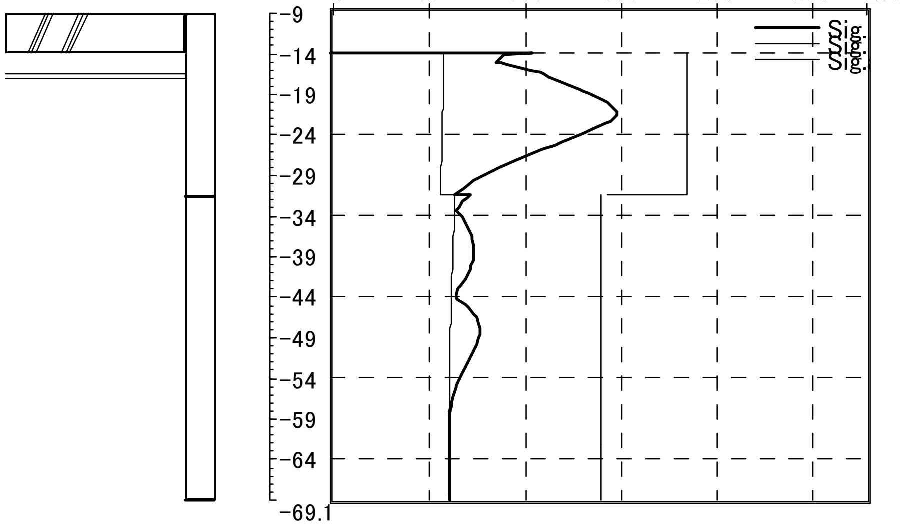


(2)perpendicular direction

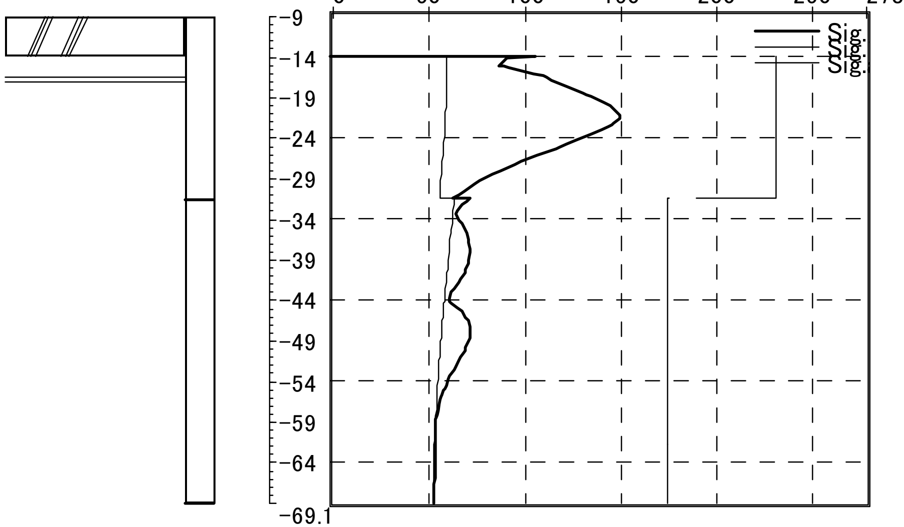
<CASE-1 Reg HWL [W]>



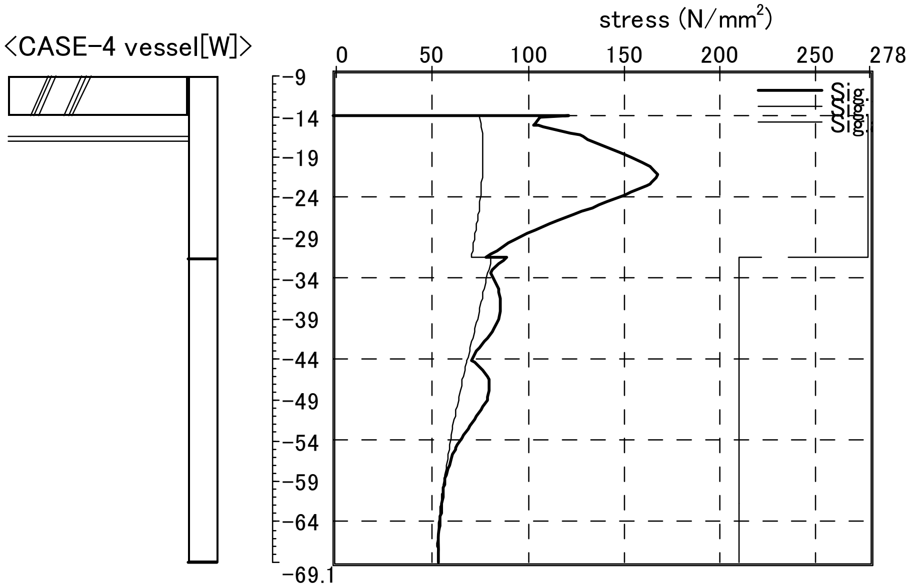
<CASE-2 Reg LWL [W]>



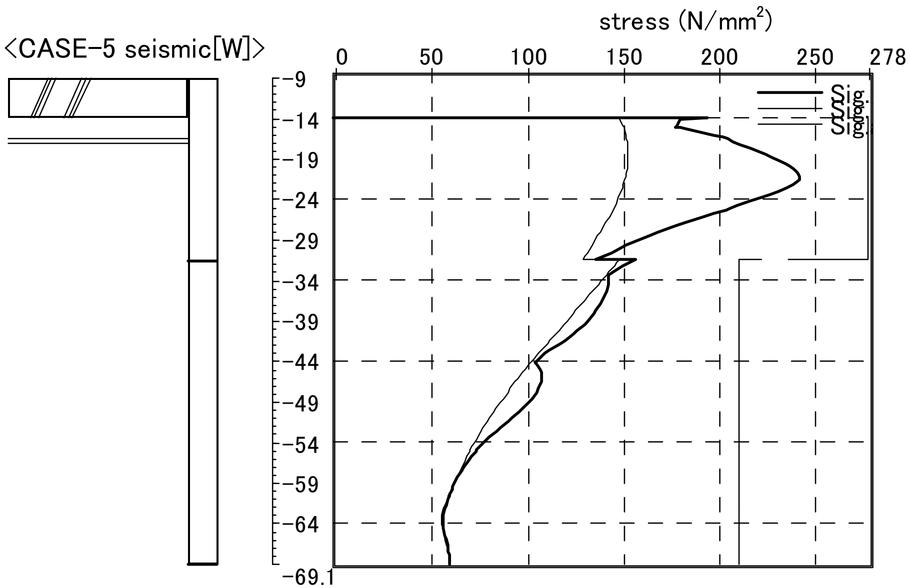
<CASE-3 wind[W]>



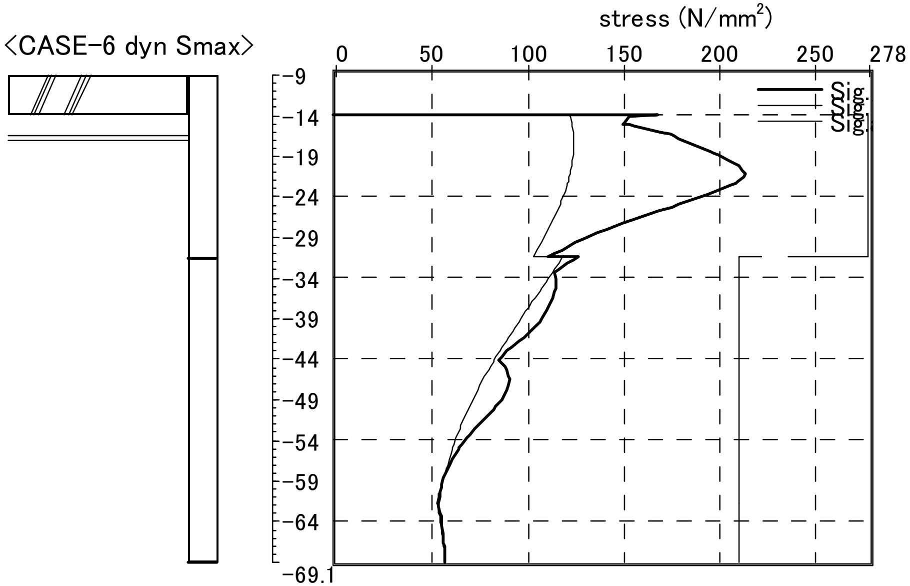
<CASE-4 vessel[W]>



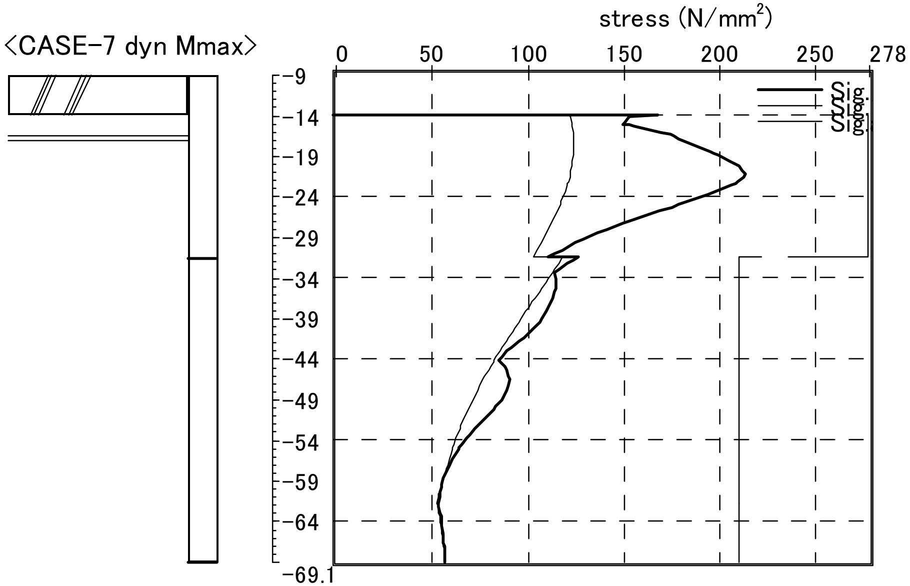
<CASE-5 seismic[W]>



<CASE-6 dyn Smax>



<CASE-7 dyn Mmax>



3.3.3 detail output

(1)bridge axis direction

1)RegularHWL[W]

elevation(m)	Sig.1(N/mm²)	Sig.2(N/mm²)	Sig.max(N/mm²)	
-14.100	66.12	40.71	106.84	
-14.300	66.13	25.84	91.97	
-15.100	66.15	30.33	96.48	
-15.350	66.14	31.74	97.87	
-15.420	66.14	34.35	100.49	
-15.500	66.13	37.15	103.28	
-16.300	66.05	49.42	115.47	
-16.600	66.01	54.02	120.03	
-16.700	65.99	55.56	121.55	
-17.100	65.92	57.49	123.41	
-17.500	65.83	61.05	126.88	
-17.900	65.72	64.60	130.32	
-18.700	65.51	71.67	137.18	
-18.731	65.50	71.94	137.44	
-19.100	65.38	74.84	140.22	
-19.900	65.09	80.62	145.71	
-20.300	64.93	83.51	148.44	
-20.460	64.86	84.71	149.57	
-21.100	64.59	87.00	151.58	
-21.500	64.39	88.43	152.82	◎
-21.543	64.37	88.40	152.77	
-22.300	64.00	84.91	148.92	
-22.490	63.91	84.04	147.95	
-22.700	63.79	82.31	146.11	
-23.500	63.36	74.86	138.22	
-23.900	63.13	71.13	134.26	
-24.700	62.67	62.92	125.59	
-25.100	62.43	58.82	121.25	
-25.420	62.24	55.50	117.74	
-25.900	61.95	50.61	112.56	
-26.300	61.70	46.53	108.23	
-27.100	61.20	38.88	100.08	
-27.500	60.94	35.05	95.99	
-28.300	60.43	28.23	88.66	

-28.700	60.17	24.82	84.99	
-29.500	59.65	18.97	78.62	
-29.900	59.39	16.05	75.43	
-30.700	58.86	11.20	70.06	
-31.100	58.60	8.78	67.38	
-31.600	58.27	6.18	64.45	
-31.600	66.36	7.03	73.39	**
-31.900	66.13	5.45	71.59	
-32.300	65.83	3.35	69.19	
-33.100	65.23	2.32	67.55	
-33.500	64.93	1.80	66.73	
-34.300	64.33	4.36	68.69	
-34.700	64.04	5.64	69.68	
-35.500	63.45	7.44	70.89	
-35.900	63.16	8.34	71.49	
-36.700	62.58	9.45	72.03	
-37.100	62.29	10.01	72.30	
-37.900	61.72	10.48	72.20	
-38.300	61.44	10.72	72.16	
-39.100	60.88	10.54	71.42	
-39.500	60.61	10.44	71.05	
-40.300	60.06	9.54	69.60	
-40.700	59.80	9.09	68.89	
-41.480	59.28	7.54	66.82	
-41.500	59.27	7.50	66.76	
-41.900	59.02	6.56	65.57	
-42.700	58.52	4.29	62.81	
-43.100	58.29	3.15	61.45	
-43.900	57.84	2.84	60.68	
-44.300	57.64	2.68	60.32	
-44.470	57.55	3.83	61.38	
-45.100	57.24	7.41	64.65	
-45.500	57.06	9.68	66.74	
-46.300	56.69	12.31	69.00	
-46.700	56.53	13.62	70.15	
-47.500	56.20	14.64	70.84	
-47.900	56.05	15.15	71.20	
-48.700	55.76	15.06	70.82	
-48.751	55.74	15.05	70.79	

-49.100	55.62	14.77	70.39	
-49.900	55.36	13.58	68.94	
-50.300	55.24	12.98	68.23	
-51.100	55.01	11.35	66.36	
-51.500	54.91	10.54	65.44	
-52.300	54.70	8.82	63.52	
-52.700	54.61	7.96	62.58	
-53.500	54.43	6.38	60.82	
-53.900	54.36	5.59	59.95	
-54.700	54.20	4.26	58.46	
-55.100	54.14	3.59	57.73	
-55.197	54.12	3.45	57.57	
-55.900	54.00	2.54	56.55	
-56.300	53.98	2.03	56.00	
-57.100	53.92	1.26	55.18	
-57.500	53.96	0.88	54.84	
-58.300	54.06	0.35	54.41	
-58.700	54.09	0.09	54.19	
-59.500	54.17	0.30	54.47	
-59.900	54.20	0.41	54.61	
-60.480	54.25	0.57	54.82	
-60.700	54.27	0.61	54.87	
-61.100	54.29	0.68	54.97	
-61.900	54.33	0.71	55.05	
-62.300	54.35	0.73	55.08	
-63.100	54.38	0.67	55.05	
-63.500	54.39	0.64	55.03	
-64.300	54.40	0.54	54.94	
-64.700	54.41	0.48	54.89	
-65.500	54.41	0.36	54.78	
-65.900	54.41	0.30	54.72	
-66.700	54.41	0.20	54.61	
-67.100	54.41	0.14	54.55	
-67.450	54.41	0.10	54.51	
-67.900	54.41	0.06	54.47	
-68.300	54.40	0.02	54.43	
-69.100	54.40	0.00	54.40	

* :location unable to weld in site

** :SKY400 maximum stress accrue location   *** :SKY490 maximum stress accrue location

(2)perpendicular direction

1)Reg HWL [W]

elevation(m)	Sig.1(N/mm²)	Sig.2(N/mm²)	Sig.max(N/mm²)	
-14.100	52.30	45.66	97.96	
-14.300	52.29	30.88	83.17	
-15.100	52.24	27.72	79.96	
-15.350	52.22	26.73	78.96	
-15.420	52.22	29.39	81.60	
-15.500	52.21	32.23	84.45	
-16.300	52.15	45.41	97.56	
-16.600	52.13	50.35	102.48	
-16.700	52.12	52.00	104.12	
-17.100	52.09	54.56	106.65	
-17.500	52.05	58.74	110.79	
-17.900	52.01	62.92	114.93	
-18.700	51.94	71.16	123.10	
-18.856	51.92	72.77	124.69	
-19.100	51.90	75.01	126.91	
-19.900	51.81	81.63	133.45	
-20.300	51.77	84.94	136.71	
-20.460	51.75	86.25	138.01	
-21.100	51.68	88.97	140.65	
-21.500	51.63	90.67	142.30	◎
-21.721	51.61	90.48	142.09	
-22.300	51.54	87.70	139.24	
-22.490	51.51	86.79	138.30	
-22.700	51.49	85.13	136.62	
-23.500	51.39	77.79	129.17	
-23.900	51.34	74.11	125.45	
-24.700	51.23	65.84	117.08	
-25.100	51.18	61.71	112.89	
-25.420	51.14	58.34	109.48	
-25.900	51.08	53.34	104.41	
-26.300	51.02	49.17	100.19	
-27.100	50.91	41.28	92.20	
-27.500	50.86	37.34	88.20	
-28.300	50.75	30.26	81.01	
-28.700	50.69	26.72	77.41	

-29.500	50.58	20.61	71.20	
-29.900	50.53	17.56	68.09	
-30.700	50.42	12.48	62.89	
-31.100	50.36	9.93	60.29	
-31.600	50.29	7.20	57.49	
-31.600	57.24	8.18	65.42	
-31.900	57.19	6.52	63.71	
-32.300	57.12	4.30	61.43	
-33.100	57.00	2.20	59.20	
-33.500	56.93	1.15	58.09	
-34.300	56.80	3.88	60.68	
-34.700	56.74	5.24	61.98	
-35.500	56.61	7.17	63.78	
-35.900	56.55	8.13	64.68	
-36.700	56.42	9.34	65.77	
-37.100	56.36	9.95	66.31	
-37.900	56.24	10.49	66.73	
-38.300	56.17	10.76	66.93	
-39.100	56.05	10.62	66.67	
-39.500	55.99	10.56	66.55	
-40.300	55.87	9.68	65.55	
-40.700	55.81	9.24	65.05	
-41.480	55.69	7.72	63.41	
-41.500	55.69	7.67	63.36	
-41.900	55.63	6.74	62.37	
-42.700	55.51	4.47	59.98	
-43.100	55.46	3.33	58.79	
-43.900	55.35	2.80	58.15	
-44.300	55.30	2.53	57.83	
-44.470	55.28	3.68	58.95	
-45.100	55.20	7.28	62.48	
-45.500	55.15	9.56	64.71	
-46.300	55.06	12.20	67.26	
-46.700	55.01	13.53	68.54	
-47.500	54.92	14.56	69.49	
-47.900	54.88	15.08	69.96	**
-48.700	54.79	15.01	69.81	
-48.751	54.79	15.01	69.80	
-49.100	54.75	14.73	69.48	

-49.900	54.67	13.55	68.23	
-50.300	54.64	12.96	67.60	
-51.100	54.56	11.34	65.90	
-51.500	54.53	10.53	65.06	
-52.300	54.46	8.82	63.28	
-52.700	54.43	7.96	62.39	
-53.500	54.36	6.39	60.75	
-53.900	54.33	5.60	59.93	
-54.700	54.27	4.27	58.54	
-55.100	54.24	3.60	57.85	
-55.197	54.24	3.46	57.70	
-55.900	54.19	2.55	56.74	
-56.300	54.16	2.04	56.20	
-57.100	54.11	1.27	55.38	
-57.500	54.09	0.89	54.97	
-58.300	54.04	0.36	54.40	
-58.700	54.02	0.10	54.12	
-59.500	53.98	0.30	54.28	
-59.900	53.96	0.40	54.36	
-60.480	53.93	0.56	54.49	
-60.700	53.92	0.60	54.52	
-61.100	53.91	0.68	54.58	
-61.900	53.89	0.71	54.60	
-62.300	53.91	0.73	54.64	
-63.100	53.94	0.67	54.61	
-63.500	53.95	0.64	54.59	
-64.300	53.97	0.54	54.51	
-64.700	53.99	0.48	54.47	
-65.500	54.01	0.36	54.37	
-65.900	54.02	0.30	54.32	
-66.700	54.03	0.19	54.23	
-67.100	54.04	0.14	54.18	
-67.450	54.05	0.10	54.15	
-67.900	54.06	0.06	54.12	
-68.300	54.06	0.02	54.09	
-69.100	54.07	0.00	54.07	

*   :location unable to weld in site

** :SKY400 maximum stress accrue location

*** :SKY490 maximum stress accrue location

3.4 member calculation

3.4.1 calculation of pile cap

3.4.1.1 design condition

(1) calculation method : cantilever

(2) concrete design standard strength : Sig.ck = 24 (N/mm^2)

(3) rebar in use : SD345(underwater member)

(4) shape dimension

pile cap thickness h = 5.000 (m)

center spacing of steel pipe sheet piles a = 1.4478 (m) (bridge axis direction)

1.4478 (m) (perpendicular direction)

(5) dead weight of pile cap and surcharge load

1)bridge axis direction

No	abbreviation	embankment height (m)	water table height (m)	w(kN/m^2)
1	RegularHWL[W]	-5.410	3.180	105.71
2	RegularLWL[W]	-5.410	-2.390	105.71
3	Temp.HWL[W]	-5.410	3.180	105.71
4	Temp.LWL[W]	-5.410	-2.390	105.71
5	Wind[W]	-5.410	4.990	105.71
6	Vessel[W]	-5.410	3.180	105.71
7	Seismic[W]	-5.410	0.290	105.71
8	dyn Smax	-5.410	0.290	105.71
9	dyn Mmax	-5.410	0.290	105.71

2)perpendicular direction

No	abbreviation	embankment height (m)	water table height (m)	w(kN/m^2)
1	Reg HWL [W]	-5.410	3.180	105.71
2	Reg LWL [W]	-5.410	-2.390	105.71
3	wind[W]	-5.410	4.990	105.71
4	vessel[W]	-5.410	3.180	105.71
5	seismic[W]	-5.410	0.290	105.71
6	dyn Smax	-5.410	0.290	105.71
7	dyn Mmax	-5.410	0.290	105.71

note: backfilling soil height , water table height is shown in elevation(crest of pile cap elevation = -9.100m)

3.4.1.2 external working force

pile cap is designed for external working force at bottom of pile cap

besides, in estimating vertical load, dead weight of pile cap upto celler part internal periphery and surcharge load are considered

(1) area of pile cap(let internal periphery sheet pile)

oval: $A1 = B^2 = PI/4 + B * (L-B)$

$= 11.731^2 * Pai/4 + 11.731 * (20.418 - 11.731) = 209.985\ (m^2)$

(2)area of backfilling soil

$A2 = A1 - Ap = 132.055\ (m^2)$

where, Ap:leg column cross sectional area = 77.93 (m^2)

(3)working force at leg column bottom

1)bridge axis direction y = 5.00 (m)

No	abbreviation	V(kN)	H(kN)	M(kN.m)	H*y(kN.m)	Sum.M(kN.m)
1	RegularHWL[W]	96841.2	4700.0	105750.0	23500.0	129250.0
2	RegularLWL[W]	108341.2	2200.0	49500.0	11000.0	60500.0
3	Temp.HWL[W]	96541.2	9300.0	209250.0	46500.0	255750.0
4	Temp.LWL[W]	108441.2	6800.0	153000.0	34000.0	187000.0
5	Wind[W]	97641.2	1285.4	28173.5	6427.0	34600.5
6	Vessel[W]	96841.2	9550.0	169285.0	47750.0	217035.0
7	Seismic[W]	97541.2	33957.8	585015.1	169789.0	754804.1
8	dyn Smax	95587.4	30839.6	564659.0	154198.0	718857.0
9	dyn Mmax	95256.4	28637.3	590183.0	143186.5	733369.5

2)perpendicular direction y = 5.00 (m)

No	abbreviation	V(kN)	H(kN)	M(kN.m)	H*y(kN.m)	Sum.M(kN.m)
1	Reg HWL [W]	96841.2	100.0	34250.0	500.0	34750.0
2	Reg LWL [W]	108341.2	100.0	34250.0	500.0	34750.0
3	wind[W]	97641.2	2253.6	83880.0	11268.0	95148.0
4	vessel[W]	96841.2	9800.0	161320.0	49000.0	210320.0
5	seismic[W]	97641.2	27972.5	577239.2	139862.5	717101.7
6	dyn Smax	94298.8	-20268.8	-439530.0	-101344.0	-540874.0
7	dyn Mmax	94298.8	-20217.6	-440242.0	-101088.0	-541330.0

(4) pile cap, backfilling soil

V1 = A1*{ h1*Gam.c + h2*(Gam.c - Gam.w) }

V2 = A2*{ h1'*Gam.t + h2'*(Gam.sat - Gam.w) }

V3 = Ap*hw*Gam.w

where, V1 : weight of pile cap (kN)
V2 : weight of backfilling soil (kN)
V3 : buoyancy working at column (kN)
h1 : pile cap thickness upper than water table(m)
h2 : pile cap thickness lower than water table(m)
h1' : backfilling soil thickness upper than water table(m)
h2' : backfilling soil thickness lower than water table(m)
Gam.c : pile cap concrete unit weight = 24.5 (kN/m^3)
Gam.w : unit weight of water =10.00 (kN/m^3)
Gam.t : unit weight of backfilling soil(wet) = 18.0 (kN/m^3)
Gam.sat: unit weight of backfilling soil(saturated) = 19.0 (kN/m^3)
hw : water table (m)(height from crest of pile cap)
h' : backfilling soil thickness (m)
H1 : pile cap and filling concrete inertia force (kN)
y : pile cap inertia force working gravity location height (m)

1)bridge axis direction

1.vertical force

No	abbreviation	hw(m)	h'(m)	V1(kN)	V2(kN)	V3(kN)	Sum.V(kN)
1	RegularHWL[W]	12.280	3.690	15223.94	4385.56	9569.80	10039.70
2	RegularLWL[W]	6.710	3.690	15223.94	4385.56	5229.10	14380.40
3	Temp.HWL[W]	12.280	3.690	15223.94	4385.56	9569.80	10039.70
4	Temp.LWL[W]	6.710	3.690	15223.94	4385.56	5229.10	14380.40
5	Wind[W]	14.090	3.690	15223.94	4385.56	10980.34	8629.17
6	Vessel[W]	12.280	3.690	15223.94	4385.56	9569.80	10039.70
7	Seismic[W]	9.390	3.690	15223.94	4385.56	7317.63	12291.88
8	dyn Smax	9.390	3.690	15223.94	4385.56	7317.63	12291.88
9	dyn Mmax	9.390	3.690	15223.94	4385.56	7317.63	12291.88

2.horizontal force

No	abbreviation	H1(kN)	y(m)	H1*y(kN.m)
1	RegularHWL[W]	0.00	0.000	0.00
2	RegularLWL[W]	0.00	0.000	0.00
3	Temp.HWL[W]	0.00	0.000	0.00
4	Temp.LWL[W]	0.00	0.000	0.00
5	Wind[W]	0.00	0.000	0.00
6	Vessel[W]	0.00	0.000	0.00
7	Seismic[W]	0.00	0.000	0.00
8	dyn Smax	0.00	0.000	0.00
9	dyn Mmax	0.00	0.000	0.00

2)perpendicular direction

1.vertical force

No	abbreviation	hw(m)	h'(m)	V1(kN)	V2(kN)	V3(kN)	Sum.V(kN)
1	Reg HWL [W]	12.280	3.690	15223.94	4385.56	9569.80	10039.70
2	Reg LWL [W]	6.710	3.690	15223.94	4385.56	5229.10	14380.40
3	wind[W]	14.090	3.690	15223.94	4385.56	10980.34	8629.17
4	vessel[W]	12.280	3.690	15223.94	4385.56	9569.80	10039.70
5	seismic[W]	9.390	3.690	15223.94	4385.56	7317.63	12291.88
6	dyn Smax	9.390	3.690	15223.94	4385.56	7317.63	12291.88
7	dyn Mmax	9.390	3.690	15223.94	4385.56	7317.63	12291.88

2.horizontal force

No	abbreviation	H1(kN)	y(m)	H1*y(kN.m)
1	Reg HWL [W]	0.00	0.000	0.00
2	Reg LWL [W]	0.00	0.000	0.00
3	wind[W]	0.00	0.000	0.00
4	vessel[W]	0.00	0.000	0.00
5	seismic[W]	0.00	0.000	0.00
6	dyn Smax	0.00	0.000	0.00
7	dyn Mmax	0.00	0.000	0.00

(5)external force sum up

Vo = V + V1 + V2 - V3 + V4

Ho = H + H1

Mo = M + H*y + H1*y = SumM + H1*y

where, V4: other load (kN)

1)bridge axis direction

No	abbreviation	V4(kN)	Vo(kN)	Ho(kN)	Mo(kN.m)
1	RegularHWL[W]	0.0	106880.9	4700.0	129250.0
2	RegularLWL[W]	0.0	122721.6	2200.0	60500.0
3	Temp.HWL[W]	0.0	106580.9	9300.0	255750.0
4	Temp.LWL[W]	0.0	122821.6	6800.0	187000.0
5	Wind[W]	0.0	106270.4	1285.4	34600.5
6	Vessel[W]	0.0	106880.9	9550.0	217035.0
7	Seismic[W]	0.0	109833.1	33957.8	754804.1
8	dyn Smax	0.0	107879.3	30839.6	718857.0
9	dyn Mmax	0.0	107548.3	28637.3	733369.5

2)perpendicular direction

No	abbreviation	V4(kN)	Vo(kN)	Ho(kN)	Mo(kN.m)
1	Reg HWL [W]	0.0	106880.9	100.0	34750.0
2	Reg LWL [W]	0.0	122721.6	100.0	34750.0
3	wind[W]	0.0	106270.4	2253.6	95148.0
4	vessel[W]	0.0	106880.9	9800.0	210320.0
5	seismic[W]	0.0	109933.1	27972.5	717101.7
6	dyn Smax	0.0	106590.7	-20268.8	-540874.0
7	dyn Mmax	0.0	106590.7	-20217.6	-541330.0

(6) reaction

$$Ri = \frac{Vo*Aoi}{\Sigma(ni*Aoi)} + \frac{Mo*Aoi}{\Sigma(IBi*Aoi)}*Xi$$

	number ni (num)	sectional area Aoi (m^2/num)	IBi (m^2)	
			bridge axis direction	perpendicular direction
periphery sheet pile(1)	40	0.05199	1086.85	2190.04
separation wall sheet pile(2)	8	0.04464	86.70	0.00
intermediate driven pile (3)	--	------	----------	----------

1)bridge axis direction

No	abbreviation	max reaction(kN/number)	min reaction(kN/number)	increment coefficient
1	RegularHWL[W]	3000	1561	1.00
2	RegularLWL[W]	2955	2282	1.00
3	Temp.HWL[W]	3698	850	1.15
4	Temp.LWL[W]	3662	1579	1.15
5	Wind[W]	2460	2075	1.25
6	Vessel[W]	3489	1072	1.50
7	Seismic[W]	6546	-1859	1.50
8	dyn Smax	6304	-1700	1.50
9	dyn Mmax	6378	-1788	1.50

2)perpendicular direction

No	abbreviation	max reaction(kN/number)	min reaction(kN/number)	increment coefficient
1	Reg HWL [W]	2452	2109	1.00

No	abbreviation	max reaction(kN/number)	min reaction(kN/number)	increment coefficient
2	Reg LWL [W]	2790	2447	1.00
3	wind[W]	2737	1798	1.25
4	vessel[W]	3318	1242	1.50
5	seismic[W]	5885	-1194	1.50
6	dyn Smax	4944	-395	1.50
7	dyn Mmax	4946	-397	1.50

3.4.1.3 calculation of member force

(1)section of leg column bottom external edge

pile cap shape : oval

pile cap dimension : external width By = 14.1309 (m) (bridge axis direction)

Bx = 22.8177 (m) (perpendicular direction)

periphery steel pipe pile body diameter Do = 1.2000 (m)

leg column shape : oval

leg column dimension : 7.500 (m) (bridge axis direction)

12.000 (m) (perpendicular direction)

(2) reaction

$$R_i = \frac{Vo*Aoi}{\Sigma(ni*Aoi)} + \frac{Mo*Aoi}{\Sigma(IBi*Aoi)}*Xi$$

where, Ri : vertical reaction of i-th steel pipe sheet pile and intermediate driven single pile (kN/number)
Vo : vertical load working at bottom of pile cap (kN)
Mo : moment working at bottom of pile cap (kN.m)
n1 : number of periphery steel pipe sheet pile = 40 (number)
n2 : number of separation wall steel pipe sheet pile = 8 (number)
n3 : number of intermediate driven single pile = 0 (number)
Ao1 : pure cross sectional area of periphery steel pipe sheet pile = 0.05199 (m^2/number)
Ao2 : pure cross sectional area of separation wall steel pipe sheet pile = 0.04464 (m^2/number)
Ao3 : pure cross sectional area of intermediate driven single pile = 0.00000 (m^2/number)
IBi : sum of squared distance from centroid of steel pipe sheet to neutral axis of horizontal section of celler (m^2)

		bridge axis direction	perpendicular direction
periphery steel pipe sheet pile	IB1	1086.85	2190.04
separation wall steel pipe sheet pile	IB2	86.70	0.00
intermediate driven single pile	IB3	0.00	0.00

1)bridge axis direction
1. check location
X1 = 6.4654 (m)
X2 = -6.4654 (m)

2. bottom of pile cap working force

No	load abbreviation	Vo (kN)	Mo (kN.m)	increment coefficient
1	RegularHWL[W]	106880.9	129250.0	1.00
2	RegularLWL[W]	122721.6	60500.0	1.00
3	Temp.HWL[W]	106580.9	255750.0	1.15
4	Temp.LWL[W]	122821.6	187000.0	1.15
5	Wind[W]	106270.4	34600.5	1.25
6	Vessel Impact[W]	106880.9	217035.0	1.50
7	Seismic[W]	109833.1	754804.1	1.50

No	load abbreviation	Vo (kN)	Mo (kN.m)	increment coefficient
8	Seismic[dyn Smax]	107879.3	718857.0	1.50
9	Seismic[dyn Mmax]	107548.3	733369.5	1.50

3.periphery steel pipe sheet pile reaction

No	at farthest sheet pile location Xi(m)	6.4654	-6.4654
	load abbreviation	R1 (kN/number)	R2 (kN/number)
1	RegularHWL[W]	3000.0	1560.8
2	RegularLWL[W]	2955.2	2281.6
3	Temp.HWL[W]	3697.9	850.2
4	Temp.LWL[W]	3661.7	1579.4
5	Wind[W]	2460.0	2074.8
6	Vessel Impact[W]	3488.8	1072.1
7	Seismic[W]	6545.8	-1858.9
8	Seismic[dyn Smax]	6303.9	-1700.5
9	Seismic[dyn Mmax]	6377.7	-1788.3

4.separation wall steel pipe sheet pile reaction

coordinated system of center of figure		
pile No	number	Xi (m)
1	1	5.0287

abbreviation	[1] RegularHWL[W]		[2] RegularLWL[W]		[3] Temp.HWL[W]		[4] Temp.LWL[W]	
pile No	R1	R2	R1	R2	R1	R2	R1	R2
1	2438.5	1477.4	2473.1	2023.2	2903.3	1001.6	2945.2	1554.7

abbreviation	[5] Wind[W]		[6] Vessel[W]		[7] Seismic[W]		[8] dyn Smax	
pile No	R1	R2	R1	R2	R1	R2	R1	R2
1	2075.4	1818.1	2764.9	1151.0	4818.4	-794.3	4648.9	-696.4

abbreviation	[9] dyn Mmax	
pile No	R1	R2
1	4696.8	-756.4

2)perpendicular direction

1. check location

Y1 = 10.8088 (m)

Y2 = -10.8088 (m)

2. bottom of pile cap working force

No	load abbreviation	Vo (kN)	Mo (kN.m)	increment coefficient
1	Reg HWL [W]	106880.9	34750.0	1.00
2	Reg LWL[W]	122721.6	34750.0	1.00
3	wind[W]	106270.4	95148.0	1.25
4	vessel impact[W]	106880.9	210320.0	1.50
5	seismic[W]	109933.1	717101.7	1.50
6	Seismic[dyn Smax]	106590.7	-540874.0	1.50
7	Seismic[dyn Mmax]	106590.7	-541330.0	1.50

3.periphery steel pipe sheet pile reaction

No	at farthest sheet pile location Xi(m)	10.8088	-10.8088
	load abbreviation	R1 (kN/number)	R2 (kN/number)
1	Reg HWL [W]	2451.9	2108.9
2	Reg LWL[W]	2789.9	2446.9
3	wind[W]	2737.0	1797.8
4	vessel impact[W]	3318.5	1242.4
5	seismic[W]	5884.8	-1193.7
6	Seismic[dyn Smax]	4943.7	-395.2
7	Seismic[dyn Mmax]	4945.9	-397.5

(3)section of leg column bottom external edge

calculate cantilever with leg column bottom external edge as fixed end

$$MA = \frac{Rmax}{Do'} * \left(L + \frac{Do}{2} \right) + \Sigma \left(Ri * \frac{Li}{ai} \right) - \frac{w*L^2}{2} \quad (kN.m/m)$$

$$MA' = \frac{Rmin}{Do'} * \left(L + \frac{Do}{2} \right) + \Sigma \left(Ri * \frac{Li}{ai} \right) - \frac{w*L^2}{2} \quad (kN.m/m)$$

where,

MA,MA': bending moment per unit width of external edge of leg column bottom (kN.m/m)

Rmaxi : maximum vertical reaction induced in single steel pipe sheet pile (kN/number)

Rmini : minimum vertical reaction induced in single steel pipe sheet pile(kN/number)

Ri : influence range of design cantilever at maximum or minimum vertical reaction of steel pipe sheet pile vertical reaction of separation wall steel pipe sheet pile, intermediate driven single pile (kN/number)

L : distance from external edge of body bottom to celler of internal celler periphery = 2.1154 (m)(bridge axis direction)
= 4.9588 (m)(perpendicular direction)

Li : distance from external edge of body bottom to center of separation wall steel pipe sheet pile, intermediate driven single pile within influence range(m)

w : dead weight of pile cap and surcharge load (kN/m²)

Do : external diameter = 1.2000 (m) (periphery steel pipe sheet pile)
: = 1.2000 (m) (separation wall steel pipe sheet pile)
: = --- (m) (intermediate driven single pile)

Do' :center spacing of periphery steel pipe sheet piles = 1.4478 (m) (bridge axis direction)
= 1.4478 (m) (perpendicular direction)

d : effective height of pile cap = 4.4600 (m) (bridge axis direction)
= 4.5274 (m) (perpendicular direction)

ai : Do + d

		bridge axis direction	perpendicular direction
separation wall steel pipe sheet pile	ai	5.6600	5.7274

(4)periphery steel pipe sheet pile front section

$$QB = \frac{Rmax}{Do'} \quad (kN/m)$$

$$QB1 = \frac{Rmax}{Do' + \frac{Ri}{ai} - w\left(L - \frac{h}{2}\right)} \quad (kN/m)$$

where, QB : shear force per unit width in periphery steel pipe sheet pile front (kN/m)
QB1: shear force at location where is 1/2 of thickness of pile cap apart from external edge of body bottom (kN/m)
h : pile cap thickness = 5.0000 (m)

(5)member force sum up table

1)bridge axis direction

No	load name	MA (kN.m/m)	MA' (kN.m/m)	QB (kN/m)	QB1 (kN/m)
1	RegularHWL[W]	5941	3025	2072	2072
2	RegularLWL[W]	5865	4500	2041	2041
3	Temp.HWL[W]	7355	1584	2554	2554
4	Temp.LWL[W]	7297	3077	2529	2529
5	Wind[W]	4846	4066	1699	1699
6	Vessel Impact[W]	6932	2034	2410	2410
7	Seismic[W]	13129	-3903	4521	4521
8	Seismic[dyn Smax]	12637	-3583	4354	4354
9	Seismic[dyn Mmax]	12786	-3762	4405	4405

2)perpendicular direction

No	load name	MA (kN.m/m)	MA' (kN.m/m)	QB (kN/m)	QB1 (kN/m)
1	Reg HWL [W]	8115	6798	1694	1434
2	Reg LWL[W]	9412	8095	1927	1667
3	wind[W]	9209	5603	1890	1631
4	vessel impact[W]	11442	3471	2292	2032
5	seismic[W]	21295	-5883	4065	3805
6	Seismic[dyn Smax]	17682	-2817	3415	3155
7	Seismic[dyn Mmax]	17690	-2826	3416	3156

3.4.1.4 stress calculation

(1)bridge axis direction

b = 100.0 (cm)   h = 500.0 (cm)

rebar in use

lower tensile (As = 212.622 (cm^2))

1 row	cover	340 (mm)	D51 @ 286
2 row	cover	540 (mm)	D51 @ 286
3 row	cover	740 (mm)	D51 @ 286

upper tensile (As = 79.720 (cm^2))

1 row	cover	150 (mm)	D38 @ 286
2 row	cover	300 (mm)	D38 @ 286

			unit	RegularHWL[W]	RegularLWL[W]	Temp.HWL[W]
bottom side tensile	bending moment	MA	kN.m	5941.0	5865.0	7355.0
	required rebar amount	Asr	cm^2	94.946	93.685	102.536
	neutral axis	x	cm	139.7	139.7	139.7
	stress	Sig.c	N/mm^2 N/mm^2	2.12 74.38	2.10 73.42	2.63 92.08
	tensile resultant force required rebar amount	T As	kN cm^2	2112.4	2085.3	2615.1
top side tensile	bending moment	MA'	kN.m	3025.0	4500.0	1584.0
	required rebar amount	Asr	cm^2	0.000	0.000	0.000
	neutral axis	x	cm	14.1	14.1	14.1
	stress	Sig.c	N/mm^2 N/mm^2	0.00 0.00	0.00 0.00	0.00 0.00
	tensile resultant force required rebar amount	T As	kN cm^2	0.0 0.000	0.0 0.000	0.0 0.000
allowable stress		Sig.ca Sig.s	N/mm^2 N/mm^2	8.00 160.00	8.00 160.00	9.20 184.00
average shear force		QB Tau.m Tau.a	kN N/mm^2 N/mm^2	2072.0 0.46 1.09	2041.0 0.46 1.09	2554.0 0.57 1.25
average shear force		S Tau.m Tau.a	kN N/mm^2 N/mm^2	2072.0 0.46 1.09	2041.0 0.46 1.09	2554.0 0.57 1.25
shear force to share by concrete		SC a	kN	4844.0	4844.0	5570.0
rebar	shear force to share	Sh'	kN	0.0	0.0	0.0
	member axial direction spacing	s	cm	150.0	150.0	150.0
	reduction coefficient	Cds	----	0.190	0.190	0.190
	allowable tensile stress	Sig.sa	N/mm^2	160.00	160.00	160.00
	amount of rebar in use	Aw	cm^2	2.581	2.581	2.581
	required rebar amount	Awreq	cm^2	0.000	0.000	0.000

increment of allowable shear stress Tau.a1' = Tau.a1 * Ce * Cpt * Cdc

1) correction coefficient about effective height Ce = 0.627 : effective height d = 446.00 (cm)

2) correction coefficient about tensile rebar percentage Cpt = 1.177 : tensile rebar percentage pt = 0.477 (%)

3) for shear span ratio increment coefficient Cdc = 6.400 : shear span a = 2.115 (m)

			unit	Temp.LWL[W]	Wind[W]	Vessel[W]
bottom side tensile	bending moment	MA	kN.m	7297.0	4846.0	6932.0
	required rebar amount	Asr	cm^2	101.682	60.931	57.998
	neutral axis	x	cm	139.7	139.7	139.7
	stress	Sig.c	N/mm^2 N/mm^2	2.61 91.35	1.73 60.67	2.48 86.78
	tensile resultant force required rebar amount	T As	kN cm^2	2594.3	1723.1	2464.5
top side tensile	bending moment	MA'	kN.m	3077.0	4066.0	2034.0
	required rebar amount	Asr	cm^2	0.000	0.000	0.000
	neutral axis	x	cm	14.1	14.1	14.1
	stress	Sig.c	N/mm^2 N/mm^2	0.00 0.00	0.00 0.00	0.00 0.00
	tensile resultant force required rebar amount	T As	kN cm^2	0.0 0.000	0.0 0.000	0.0 0.000
allowable stress		Sig.ca Sig.s	N/mm^2 N/mm^2	9.20 184.00	10.00	12.00
average shear force		QB Tau.m Tau.a	kN N/mm^2 N/mm^2	2529.0 0.57 1.25	1699.0 0.38 1.36	2410.0 0.54 1.65
average shear force		S Tau.m Tau.a	kN N/mm^2 N/mm^2	2529.0 0.57 1.25	1699.0 0.38 1.36	2410.0 0.54 1.65
shear force to share by concrete		SC a	kN	5570.0	6055.0	7371.0
rebar	shear force to share	Sh'	kN	0.0	0.0	0.0
	member axial direction spacing	s	cm	150.0	150.0	150.0
	reduction coefficient	Cds	----	0.190	0.190	0.190
	allowable tensile stress	Sig.sa	N/mm^2	160.00	160.00	200.00
	amount of rebar in use	Aw	cm^2	2.581	2.581	2.581
	required rebar amount	Awreq	cm^2	0.000	0.000	0.000

increment of allowable shear stress Tau.a1' = Tau.a1 * Ce * Cpt * Cdc

1) correction coefficient about effective height Ce = 0.627 : effective height d = 446.00 (cm)

2) correction coefficient about tensile rebar percentage Cpt = 1.177 : tensile rebar percentage pt = 0.477 (%)

3) for shear span ratio increment coefficient Cdc = 6.400 : shear span a = 2.115 (m)

			unit	Seismic[W]	dyn Smax	dyn Mmax
bottom side tensile	bending moment	MA	kN.m	13129.0	12637.0	12786.0
	required rebar amount	Asr	cm^2	112.740	108.323	109.665
	neutral axis	x	cm	139.7	139.7	139.7
	stress	Sig.c	N/mm^2 N/mm^2	4.69 164.36	4.52 158.21	4.57 160.07
	tensile resultant force required rebar amount	T As	kN cm^2	4668.1	4493.2	4546.2
top side tensile	bending moment	MA'	kN.m	-3903.0	-3583.0	-3762.0
	required rebar amount	Asr	cm^2	28.941	26.523	27.873
	neutral axis	x	cm	95.5	95.5	95.5
	stress	Sig.c	N/mm^2 N/mm^2	1.83 111.98	1.68 102.82	1.76 107.94
	tensile resultant force required rebar amount	T As	kN cm^2	1387.6	1274.0	1337.4
allowable stress		Sig.ca Sig.s	N/mm^2 N/mm^2	12.00	12.00	12.00
average shear force		QB Tau.m Tau.a	kN N/mm^2 N/mm^2	4521.0 1.01 1.65	4354.0 0.98 1.65	4405.0 0.99 1.65
average shear force		S Tau.m Tau.a	kN N/mm^2 N/mm^2	4521.0 1.01 1.65	4354.0 0.98 1.65	4405.0 0.99 1.65
shear force to share by concrete		SC a	kN	7371.0	7371.0	7371.0
rebar	shear force to share	Sh'	kN	0.0	0.0	0.0
	member axial direction spacing	s	cm	150.0	150.0	150.0
	reduction coefficient	Cds	----	0.190	0.190	0.190
	allowable tensile stress	Sig.sa	N/mm^2	200.00	200.00	200.00
	amount of rebar in use	Aw	cm^2	2.581	2.581	2.581
	required rebar amount	Awreq	cm^2	0.000	0.000	0.000

increment of allowable shear stress Tau.a1' = Tau.a1 * Ce * Cpt * Cdc

1) correction coefficient about effective height Ce = 0.627 : effective height d = 446.00 (cm)

2) correction coefficient about tensile rebar percentage Cpt = 1.177 : tensile rebar percentage pt = 0.477 (%)

3) for shear span ratio increment coefficient Cdc = 6.400 : shear span a = 2.115 (m)

(2)perpendicular direction

b = 100.0 (cm)   h = 500.0 (cm)

rebar in use

lower tensile (As = 265.636 (cm^2))

1 row	cover	270 (mm)	D51 @ 235
2 row	cover	470 (mm)	D51 @ 226
3 row	cover	670 (mm)	D51 @ 226

upper tensile (As = 100.885 (cm^2))

1 row	cover	116 (mm)	D38 @ 226
2 row	cover	266 (mm)	D38 @ 226

			unit	Reg HWL [W]	Reg LWL [W]	wind[W]
bottom side tensile	bending moment	MA	kN.m	8115.0	9412.0	9209.0
	required rebar amount	Asr	cm^2	129.408	151.268	116.944
	neutral axis	x	cm	154.2	154.2	154.2
	stress	Sig.c	N/mm^2 N/mm^2	2.62 81.10	3.03 94.07	2.97 92.04
	tensile resultant force required rebar amount	T As	kN cm^2	2885.2	3346.6	3274.3
top side tensile	bending moment	MA'	kN.m	6798.0	8095.0	5603.0
	required rebar amount	Asr	cm^2	0.000	0.000	0.000
	neutral axis	x	cm	13.2	13.2	13.2
	stress	Sig.c	N/mm^2 N/mm^2	0.00 0.00	0.00 0.00	0.00 0.00
	tensile resultant force required rebar amount	T As	kN cm^2	0.0 0.000	0.0 0.000	0.0 0.000
allowable stress		Sig.ca Sig.s	N/mm^2 N/mm^2	8.00 160.00	8.00 160.00	10.00
average shear force		QB Tau.m Tau.a	kN N/mm^2 N/mm^2	1694.0 0.37 0.67	1927.0 0.43 0.67	1890.0 0.42 0.83
average shear force		S Tau.m Tau.a	kN N/mm^2 N/mm^2	1434.0 0.32 0.67	1667.0 0.37 0.67	1631.0 0.36 0.83
shear force to share by concrete		SC a	kN	3020.0	3020.0	3775.0
rebar	shear force to share	Sh'	kN	0.0	0.0	0.0
	member axial direction spacing	s	cm	150.0	150.0	150.0
	reduction coefficient	Cds	----	0.438	0.438	0.438
	allowable tensile stress	Sig.sa	N/mm^2	160.00	160.00	160.00
	amount of rebar in use	Aw	cm^2	2.581	2.581	2.581
	required rebar amount	Awreq	cm^2	0.000	0.000	0.000

increment of allowable shear stress Tau.a1' = Tau.a1 * Ce * Cpt * Cdc

1) correction coefficient about effective height Ce = 0.624 : effective height d = 452.74 (cm)

2) correction coefficient about tensile rebar percentage Cpt = 1.252 : tensile rebar percentage pt = 0.587 (%)

3) for shear span ratio increment coefficient Cdc = 3.714 : shear span a = 4.959 (m)

			unit	vessel[W]	seismic[W]	dyn Smax
bottom side tensile	bending moment	MA	kN.m	11442.0	21295.0	17682.0
	required rebar amount	Asr	cm^2	96.052	184.455	151.564
	neutral axis	x	cm	154.2	154.2	154.2
	stress	Sig.c	N/mm^2 N/mm^2	3.69 114.35	6.87 212.84	5.70 176.72
	tensile resultant force required rebar amount	T As	kN cm^2	4068.1	7571.5	6286.8
top side tensile	bending moment	MA'	kN.m	3471.0	-5883.0	-2817.0
	required rebar amount	Asr	cm^2	0.000	43.733	20.598
	neutral axis	x	cm	13.2	106.5	106.5
	stress	Sig.c	N/mm^2 N/mm^2	0.00 0.00	2.48 133.48	1.19 63.92
	tensile resultant force required rebar amount	T As	kN cm^2	0.0 0.000	2091.7	1001.7
allowable stress		Sig.ca Sig.s	N/mm^2 N/mm^2	12.00	12.00	12.00
average shear force		QB Tau.m Tau.a	kN N/mm^2 N/mm^2	2292.0 0.51 1.02	4065.0 0.90 1.02	3415.0 0.75 1.02
average shear force		S Tau.m Tau.a	kN N/mm^2 N/mm^2	2032.0 0.45 1.02	3805.0 0.84 1.02	3155.0 0.70 1.02
shear force to share by concrete		SC a	kN	4595.0	4595.0	4595.0
rebar	shear force to share	Sh'	kN	0.0	0.0	0.0
	member axial direction spacing	s	cm	150.0	150.0	150.0
	reduction coefficient	Cds	----	0.438	0.438	0.438
	allowable tensile stress	Sig.sa	N/mm^2	200.00	200.00	200.00
	amount of rebar in use	Aw	cm^2	2.581	2.581	2.581
	required rebar amount	Awreq	cm^2	0.000	0.000	0.000

increment of allowable shear stress Tau.a1' = Tau.a1 * Ce * Cpt * Cdc

1) correction coefficient about effective height Ce = 0.624 : effective height d = 452.74 (cm)

2) correction coefficient about tensile rebar percentage Cpt = 1.252 : tensile rebar percentage pt = 0.587 (%)

3) for shear span ratio increment coefficient Cdc = 3.714 : shear span a = 4.959 (m)

			unit	dyn Mmax
bottom side tensile	bending moment	MA	kN.m	17690.0
	required rebar amount	Asr	cm²	151.656
	neutral axis	x	cm	154.2
	stress	Sig.c	N/mm² N/mm²	5.70 176.81
	tensile resultant force required rebar amount	T As	kN cm²	6289.9
top side tensile	bending moment	MA'	kN.m	-2826.0
	required rebar amount	Asr	cm²	20.663
	neutral axis	x	cm	106.5
	stress	Sig.c	N/mm² N/mm²	1.19 64.11
	tensile resultant force required rebar amount	T As	kN cm²	1004.7
allowable stress		Sig.ca Sig.s	N/mm² N/mm²	12.00
average shear force		QB Tau.m Tau.a	kN N/mm² N/mm²	3416.0 0.75 1.02
average shear force		S Tau.m Tau.a	kN N/mm² N/mm²	3156.0 0.70 1.02
shear force to share by concrete		SC a	kN	4595.0
rebar	shear force to share	Sh'	kN	0.0
	member axial direction spacing	s	cm	150.0
	reduction coefficient	Cds	----	0.438
	allowable tensile stress	Sig.sa	N/mm²	200.00
	amount of rebar in use	Aw	cm²	2.581
	required rebar amount	Awreq	cm²	0.000

increment of allowable shear stress Tau.a1' = Tau.a1 * Ce * Cpt * Cdc

1) correction coefficient about effective height Ce = 0.624 : effective height d = 452.74 (cm)

2) correction coefficient about tensile rebar percentage Cpt = 1.252 : tensile rebar percentage pt = 0.587 (%)

3) for shear span ratio increment coefficient Cdc = 3.714 : shear span a = 4.959 (m)

(3) required thickness of pile cap

$$h >= 1.94 * \sqrt[3]{\frac{kp*Lambda^4}{E}} = 2.399 \text{ (m)}$$

where, h : required thickness of pile cap(m)

kp : equivalent modulus of subgrade reaction (kN/m³)

$$kp = \frac{Kv1*n1 + Kv2*n2 + Kv3*n3}{A}$$

Kv : axial direction spring constant of steel pipe sheet pile or intermediate driven single pile (kN/m)

$$Kv = a * \frac{Ap*Ep}{L}$$

Ap : pure cross sectional area of steel pipe sheet pile or intermediate driven single pile (m^2)

Ep : Young's modulus of steel pipe sheet pile or 1 center pick single pile (kN/m^2)

L : pile length (m)

a : correction coefficient

a = 0.014*(L/D) + 0.72

Kv1(periphery steel pipe sheet pile) = 2.5741E+005

Kv2(separation wall steel pipe sheet pile) = 2.2101E+005

Kv3(intermediate driven single pile) = 0.0000E+000

n1 : number of periphery steel pipe sheet pile = 40

n2 : number of separation wall steel pipe sheet pile = 8

n3 : number of intermediate driven single pile = 0

A : area of pile cap (m^2) = 243.7

E : Young's modulus of pile cap (kN/m^2) = $2.50 * 10^7$

Lambda : protrusion length of pile cap (m) = 5.56

(4) minimum rebar amount check

		Mu(kN.m)	Mc(kN.m)	1.7M(kN.m)	As(mm^2/m)	judge
bridge axis direction	lower tensile	31361	7974	22319	21262	OK
	upper tensile	12942	7974	6634	7972	OK
perpendicular direction	lower tensile	39376	7974	36201	26564	OK
	upper tensile	16433	7974	10001	10088	OK

Note: 1)Mu>=Mc, 2)1.7M<=Mc, 3)As>=500(mm^2/m)

if either 1) or 2) and 3) are satisfied, it is OK

Note: 1.7M is the value against maximum moment in all cases.

3.4.2 calculation of pile cap / sheet pile joint part

3.4.2.1 design condition

(1) steel material in use :SS400,SM400
(2) rebar in use :SD345(underwater member)
(3) concrete design standard strength :Sig.ck = 24 (N/mm^2)
(4) material of steel pipe sheet pile :SKY490
(5) diameter of steel material main body :D = 1200.0 (mm)
(6) section coefficient of steel pipe pile body :Z = 15184.5 (cm^3)
(7) joint method :rebar stud welding method

3.4.2.2 reaction

(1)bridge axis direction

No	load name	vertical reaction (kN/number)	horizontal reaction (kN/number)	increment coefficient
1	RegularHWL[W]	3000	118	1.00
2	RegularLWL[W]	2863	55	1.00
3	Temp.HWL[W]	3698	233	1.15
4	Temp.LWL[W]	3569	170	1.15
5	Wind[W]	2490	32	1.25
6	Vessel Impact[W]	3489	239	1.50
7	Seismic[W]	6546	849	1.50
8	Seismic[dyn Smax]	6304	771	1.50
9	Seismic[dyn Mmax]	6378	716	1.50

(2)perpendicular direction

No	load name	vertical reaction (kN/number)	horizontal reaction (kN/number)	increment coefficient
1	Reg HWL [W]	2452	3	1.00
2	Reg LWL[W]	2697	3	1.00
3	wind[W]	2767	56	1.25
4	vessel impact[W]	3318	245	1.50
5	seismic[W]	5885	699	1.50

No	load name	vertical reaction (kN/number)	horizontal reaction (kN/number)	increment coefficient
6	Seismic[dyn Smax]	4944	507	1.50
7	Seismic[dyn Mmax]	4946	505	1.50

3.4.2.3 rebar stud welding method

(1) design bending moment

Me = Rp*e

MFix = Sig.sa * Zo

where, Me : moment by eccentricity of reaction(kN.m)

MFix : constraining moment (kN.m)

Rp : vertical reaction per single steel pipe sheet pile(kN)

e : eccentricity (m) = 0.6000

Sig.sa: allowable stress of steel pipe sheet pile (kN/m^2) = 185.00 (N/mm^2)

Zo : section coefficient of steel pipe pile body (m^3) = 15184.5 (cm^3)

select bigger of either Me or MFix

(2) moment rebar design

1) tensile stress by moment

$$T1 = \frac{M}{h}$$

$$Sig.s1 = \frac{T1}{nb*Ab}$$

where, T1 : tensile force working at moment rebar row (N)

M : design moment (N.mm)

h : center spacing of moment rebar row (mm) = 3400.00

Sig.s1: moment rebar tensile stress (N/mm^2)

nb : number of moment rebar (number/ row) = 20

Ab : cross sectional area of single moment rebar (mm^2) = 387.1 (D22)

2)tensile stress by horizontal force

$$T2 = \frac{Ho}{n1}$$

$$Sig.s2 = \frac{T2}{2*nb*Ab}$$

where, T2 : horizontal tensile force working at moment rebar row (N)
Ho : horizontal force working at bottom of pile cap(N)
n1 : number of periphery steel pipe sheet pile
Sig.s2: moment rebar tensile stress (N/mm^2)

3)composite

Sig.s = Sig.s1 + Sig.s2 <= Sig.sa

where, Sig.sa: moment rebar allowable tensile stress (N/mm^2)

4)required number of rebar

$$nba >= \frac{2*T1 + T2}{2*Sig.sa*Ab}$$

where, nba: required number of moment rebar (rebar/ row)

(3) shear rebar design

1) shear stress

$$Tau_s = \frac{Rp}{ns*As} <= Tau.sa$$

where, Tau.s : shear rebar shear stress (N/mm^2)
Rp : vertical reaction per single steel pipe sheet pile (N)
ns : number of shear rebar = 112
As : cross sectional area of single shear rebar (mm^2) = 387.1 (D22)
Tau.sa: shear rebar allowable shear stress (N/mm^2)

2)required number of rebar

$$nsa >= \frac{Rp}{Tau.sa*As}$$

where, nsa: required number of shear rebar (number) bridge axis direction

No	load name abbreviation	Rp (kN)	Me (kN.m)	MFix (kN.m)	M (kN.m)	T1 (kN)	T2 (kN)
1	RegularHWL[W]	3000.0	1800	2809	2809	826.2	118.0
2	RegularLWL[W]	2863.0	1718	2809	2809	826.2	55.0
3	Temp.HWL[W]	3698.0	2219	3231	3231	950.1	233.0
4	Temp.LWL[W]	3569.0	2141	3231	3231	950.1	170.0
5	Wind[W]	2490.0	1494	3511	3511	1032.8	32.0
6	Vessel[W]	3489.0	2093	4214	4214	1239.3	239.0
7	Seismic[W]	6546.0	3928	4214	4214	1239.3	849.0
8	dyn Smax	6304.0	3782	4214	4214	1239.3	771.0
9	dyn Mmax	6378.0	3827	4214	4214	1239.3	716.0

No	Sig.s1	Sig.s2	Sig.s (N/mm²)	Sig.sa	nb nba (rebar/row)	Tau.s (N/mm²)	Tau.sa	ns nsa (rebar)
1	106.72	7.62	114.34	160.00	20 >= 15	69.20	96.00	112 >= 81
2	106.72	3.55	110.27	160.00	20 >= 14	66.04	96.00	112 >= 78
3	122.73	15.05	137.77	184.00	20 >= 15	85.30	110.40	112 >= 87
4	122.73	10.98	133.71	184.00	20 >= 15	82.32	110.40	112 >= 84
5	133.40	2.07	135.46	200.00	20 >= 14	57.43	120.00	112 >= 54
6	160.08	15.44	175.51	300.00	20 >= 12	80.47	180.00	112 >= 51
7	160.08	54.83	214.91	300.00	20 >= 15	150.99	180.00	112 >= 94
8	160.08	49.79	209.87	300.00	20 >= 14	145.40	180.00	112 >= 91
9	160.08	46.24	206.32	300.00	20 >= 14	147.11	180.00	112 >= 92

perpendicular direction

No	load name abbreviation	Rp (kN)	Me (kN.m)	MFix (kN.m)	M (kN.m)	T1 (kN)	T2 (kN)
1	Reg HWL [W]	2452.0	1471	2809	2809	826.2	3.0
2	Reg LWL [W]	2697.0	1618	2809	2809	826.2	3.0
3	wind[W]	2767.0	1660	3511	3511	1032.8	56.0
4	vessel[W]	3318.0	1991	4214	4214	1239.3	245.0

No	load name abbreviation	Rp (kN)	Me (kN.m)	MFix (kN.m)	M (kN.m)	T1 (kN)	T2 (kN)
5	seismic[W]	5885.0	3531	4214	4214	1239.3	699.0
6	dyn Smax	4944.0	2966	4214	4214	1239.3	507.0
7	dyn Mmax	4946.0	2968	4214	4214	1239.3	505.0

No	Sig.s1	Sig.s2	Sig.s (N/mm^2)	Sig.sa	nb nba (rebar/row)	Tau.s (N/mm^2)	Tau.sa	ns nsa (rebar)
1	106.72	0.19	106.91	160.00	20 >= 14	56.56	96.00	112 >= 66
2	106.72	0.19	106.91	160.00	20 >= 14	62.21	96.00	112 >= 73
3	133.40	3.62	137.01	200.00	20 >= 14	63.82	120.00	112 >= 60
4	160.08	15.82	175.90	300.00	20 >= 12	76.53	180.00	112 >= 48
5	160.08	45.14	205.22	300.00	20 >= 14	135.74	180.00	112 >= 85
6	160.08	32.74	192.82	300.00	20 >= 13	114.03	180.00	112 >= 71
7	160.08	32.61	192.69	300.00	20 >= 13	114.08	180.00	112 >= 71

3.4.3 calculation of pile head joint part

3.4.3.1 design condition

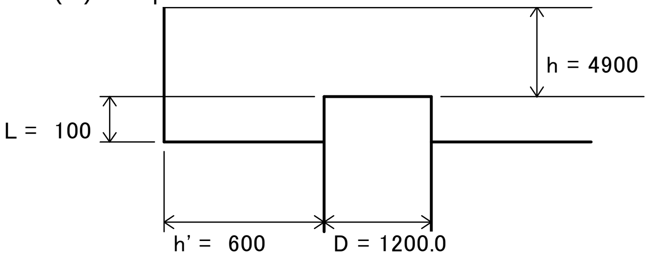
(1) design condition

1) joint method : method B

2) concrete design standard strength :Sig.ck = 24 (N/mm^2)

3) rebar in use :SD345(underwater member)

(2) shape dimension



(3) pile head working force

1)bridge axis direction

No	load name	increment coeff.	vertical	vertical	horizonta	moment (kN.m)
1	RegularHWL[W]	1.00	2439	1477	86	95
2	RegularLWL[W]	1.00	2473	2023	40	44
3	Temp.HWL[W]	1.15	2903	1002	171	188
4	Temp.LWL[W]	1.15	2945	1555	125	137
5	Wind[W]	1.25	2075	1818	24	25
6	Vessel Impact[W]	1.50	2765	1151	175	159
7	Seismic[W]	1.50	4818	-794	624	555
8	Seismic[dyn Smax]	1.50	4649	-696	567	528
9	Seismic[dyn Mmax]	1.50	4697	-756	526	539

2)perpendicular direction

No	load name	increment coeff.	vertical	vertical	horizonta	moment (kN.m)
1	Reg HWL [W]	1.00	1958	1958	2	26
2	Reg LWL[W]	1.00	2248	2248	2	26
3	wind[W]	1.25	1947	1947	41	70
4	vessel impact[W]	1.50	1958	1958	180	155
5	seismic[W]	1.50	2014	2014	514	527
6	Seismic[dyn Smax]	1.50	1953	1953	372	397
7	Seismic[dyn Mmax]	1.50	1953	1953	371	398

3.4.3.2 pile head joint part stress calculation

(1) pile cap concrete vertical bearing stress

$$Sig.cv = \frac{PNmax}{Pai*D^2/4} \le Sig.ca$$

where, PNmax : axial direction maximum compressive force (N)
D : pile external diameter (mm) = 120.00 (cm)
Sig.ca : concrete allowable bearing stress (N/mm²)

(2) punching shear stress at pile cap concrete

$$Tau_v = \frac{PNmax}{Pai*(D + h)*h} \le Tau_a$$

where, h : effective thickness of pile cap to resist vertical punching shear force (mm) = 490.0 (cm)
Tau.a: concrete allowable punching shear stress (N/mm^2)

1)bridge axis direction

No	load name	PNmax (kN)	Sig.cv (N/mm^2)	Sig.ca (N/mm^2)	Tau.v (N/mm^2)	Tau.a (N/mm^2)
1	RegularHWL[W]	2439	2.16	7.20	0.026	0.900
2	RegularLWL[W]	2473	2.19	7.20	0.026	0.900
3	Temp.HWL[W]	2903	2.57	8.28	0.031	0.900

No	load name	PNmax (kN)	Sig.cv (N/mm^2)	Sig.ca (N/mm^2)	Tau.v (N/mm^2)	Tau.a (N/mm^2)
4	Temp.LWL[W]	2945	2.60	8.28	0.031	0.900
5	Wind[W]	2075	1.83	9.00	0.022	0.900
6	Vessel Impact[W]	2765	2.44	10.80	0.029	0.900
7	Seismic[W]	4818	4.26	10.80	0.051	0.900
8	Seismic[dyn Smax]	4649	4.11	10.80	0.050	0.900
9	Seismic[dyn Mmax]	4697	4.15	10.80	0.050	0.900

2)perpendicular direction

No	load name	PNmax (kN)	Sig.cv (N/mm^2)	Sig.ca (N/mm^2)	Tau.v (N/mm^2)	Tau.a (N/mm^2)
1	Reg HWL [W]	1958	1.73	7.20	0.021	0.900
2	Reg LWL[W]	2248	1.99	7.20	0.024	0.900
3	wind[W]	1947	1.72	9.00	0.021	0.900
4	vessel impact[W]	1958	1.73	10.80	0.021	0.900
5	seismic[W]	2014	1.78	10.80	0.021	0.900
6	Seismic[dyn Smax]	1953	1.73	10.80	0.021	0.900
7	Seismic[dyn Mmax]	1953	1.73	10.80	0.021	0.900

(3) horizontal bearing stress at pile cap concrete

$$Sig.ch = \frac{PHmax}{D*I} \le Sig.ca$$

where, PHmax : axial orthogonal direction force (N)

I : pile embedment length (mm) = 10.0 (cm)

Sig.ca : concrete allowable bearing stress (N/mm^2)

1)bridge axis direction

No	load name	PHmax (kN)	Sig.ch (N/mm^2)	Sig.ca (N/mm^2)
1	RegularHWL[W]	86	0.717	7.200
2	RegularLWL[W]	40	0.333	7.200

No	load name	PHmax (kN)	Sig.ch (N/mm^2)	Sig.ca (N/mm^2)
3	Temp.HWL[W]	171	1.425	8.280
4	Temp.LWL[W]	125	1.042	8.280
5	Wind[W]	24	0.200	9.000
6	Vessel Impact[W]	175	1.458	10.800
7	Seismic[W]	624	5.200	10.800
8	Seismic[dyn Smax]	567	4.725	10.800
9	Seismic[dyn Mmax]	526	4.383	10.800

2)perpendicular direction

No	load name	PHmax (kN)	Sig.ch (N/mm^2)	Sig.ca (N/mm^2)
1	Reg HWL [W]	2	0.017	7.200
2	Reg LWL[W]	2	0.017	7.200
3	wind[W]	41	0.342	9.000
4	vessel impact[W]	180	1.500	10.800
5	seismic[W]	514	4.283	10.800
6	Seismic[dyn Smax]	372	3.100	10.800
7	Seismic[dyn Mmax]	371	3.092	10.800

3.4.3.3 pile head reinforcing rebar calculation

(1)calculation of imaginary rebar concrete section

sec	dia(cm)	cover(cm)	rebar	amount of used rebar(cm²)
1row	160.00	27.0	D32 - 12 (@278)	95.304

1)bridge axis direction

No	load name abbreviation	M (kN.m)	N (kN)	required rebar amount (cm²)	neutral axis (cm)	Sig.c (N/mm²)	Sig.ca (N/mm²)	Sig.s (N/mm²)	Sig.sa (N/mm²)
1	RegularHWL[W]	95.0	2439.0	0.000	487.45	1.35	8.00	-14.78	160.00
		95.0	1477.0	0.000	326.74	0.91	8.00	-8.08	160.00
2	RegularLWL[W]	44.0	2473.0	0.000	971.98	1.25	8.00	-16.20	160.00
		44.0	2023.0	0.000	809.67	1.04	8.00	-13.07	160.00
3	Temp.HWL[W]	188.0	2903.0	0.000	325.06	1.79	9.20	-15.85	184.00
		188.0	1002.0	0.000	164.58	0.91	9.20	-2.61	184.00
4	Temp.LWL[W]	137.0	2945.0	0.000	421.15	1.69	9.20	-17.33	184.00
		137.0	1555.0	0.000	260.13	1.04	9.20	-7.64	184.00
5	Wind[W]	25.0	2075.0	0.000	1397.23	1.02	10.00	-13.87	200.00
		25.0	1818.0	0.000	1234.08	0.90	10.00	-12.08	200.00
6	Vessel[W]	159.0	2765.0	0.000	355.98	1.66	12.00	-15.56	300.00
		159.0	1151.0	0.000	194.88	0.91	12.00	-4.32	300.00
7	Seismic[W]	555.0	4818.0	0.000	217.77	3.54	12.00	-20.65	300.00
		555.0	-794.0	76.200	26.70	4.06	12.00	242.27	300.00
8	dyn Smax	528.0	4649.0	0.000	219.74	3.39	12.00	-20.10	300.00
		528.0	-696.0	69.634	27.44	3.86	12.00	222.51	300.00
9	dyn Mmax	539.0	4697.0	0.000	218.30	3.44	12.00	-20.18	300.00
		539.0	-756.0	73.220	26.89	3.94	12.00	233.43	300.00

Shows upper step : Pmax, lower step : Pmin every load case.

2)perpendicular direction

No	load name abbreviation	M (kN.m)	N (kN)	required rebar amount (cm²)	neutral axis (cm)	Sig.c (N/mm²)	Sig.ca (N/mm²)	Sig.s (N/mm²)	Sig.sa (N/mm²)
1	Reg HWL [W]	26.0	1958.0	0.000	1275.15	0.97	8.00	-13.03	160.00
		26.0	1958.0	0.000	1275.15	0.97	8.00	-13.03	160.00
2	Reg LWL [W]	26.0	2248.0	0.000	1452.16	1.10	8.00	-15.05	160.00
		26.0	2248.0	0.000	1452.16	1.10	8.00	-15.05	160.00
3	wind[W]	70.0	1947.0	0.000	521.42	1.07	10.00	-11.93	200.00
		70.0	1947.0	0.000	521.42	1.07	10.00	-11.93	200.00
4	vessel[W]	155.0	1958.0	0.000	280.48	1.27	12.00	-10.03	300.00
		155.0	1958.0	0.000	280.48	1.27	12.00	-10.03	300.00
5	seismic[W]	527.0	2014.0	0.000	138.13	2.20	12.00	-1.22	300.00
		527.0	2014.0	0.000	138.13	2.20	12.00	-1.22	300.00
6	dyn Smax	397.0	1953.0	0.000	158.13	1.84	12.00	-4.37	300.00
		397.0	1953.0	0.000	158.13	1.84	12.00	-4.37	300.00
7	dyn Mmax	398.0	1953.0	0.000	157.81	1.84	12.00	-4.34	300.00
		398.0	1953.0	0.000	157.81	1.84	12.00	-4.34	300.00

Shows upper step : Pmax, lower step : Pmin every load case.

(2) pile head reinforcing rebar anchor length

$$Lo = \frac{Sig.sa}{4*Tau.oa} Phi = 1000 \text{ (mm)}$$

Lo : rebaranchor length (mm)

Sig.sa : rebar allowable tensile stress = 200.00 (N/mm²)

Tau.oa : allowable rebar bond stress = 1.600 (N/mm²)

Phi. : pile head reinforcing rebar diameter = 32 (mm)

embedment length L >= Lo + 10 * Phi. = 1320 (mm)

assure L from center of rebar in bottom of pile cap

(3) welding length of pile head supplemental rebar welding part by shear stress

$$Tau_s = \frac{Sig.sa*Ast}{1.4*Lambda*Ls} <= Tau.sa$$

$$Ls = \frac{Sig.s*Ast}{1.4*Lambda*Tau_{sa}}$$

where, Tau.sa: allowable shear stress of fillet welding = 72.00 (N/mm^2)

Sig.sa: rebar allowable tensile stress(to estimate anchor length) = 200.00 (N/mm^2)

Ast : sectional area of sigle pile head supplemental rebar = 7.942 (cm^2)

Lambda : fleg length of fillet welding (cm)

Ls : fillet welding length

welding leg length Lambda (cm)	0.6	0.7	0.8	0.9
welding length Ls (cm)	26.3	22.5	19.7	17.5

3.5 foundation spring calculation

subgrade reaction constant value used in calculation of natural period

It is calculated by the analysis model used in horizontal capacity method. But the upper limit of the subgrade reaction is not considered.

(1)Layer data

	type sand	thick(m) Layer	Nvalue	usual time	in quakes	calculation natural period	
				Alp.*Eo (kN/m²)	Alp.*Eo (kN/m²)	dyna.het.coef ED(kN/m)	dyna.pois.rate NyuD
1	sandy	6.320	13.0	20800	41600	117855	0.50
2	sandy	5.040	13.0	20800	41600	117855	0.50
3	clay	2.030	9.0	25200	50400	148348	0.50
4	clay	2.930	7.0	19600	39200	125458	0.50
5	clay	16.060	7.0	19600	39200	125458	0.50
6	sandy	2.990	25.0	70000	140000	182246	0.50
7	clay	16.010	18.0	50400	100800	242205	0.50
8	sandy	6.970	30.0	84000	168000	205805	0.50
9	sandy	1.650	50.0	140000	280000	323331	0.50

(2)modulus of subgrade reaction

1) foundation bottom spring

	vertical direction kv(kN/m³)	horizontal direction shear ks(kN/m³)
periphery sheet pile	381049	114315
separation wall sheet pile	381049	114315
intermediate driven pile	----------	----------

2) foundation front , side spring

usual time/ earthquake time $kHo = Alp.*Eo/0.3$

estimate natural period $kHo = ED/0.3$

foundation front horizontal direction $kh = Alp.k*kHo*(Be/0.3)^{(-3/4)}$ (kN/m^3)

foundation front vertical direction $kSVB = 0.3*Alp.k*kHo*(Be/0.3)^{(-3/4)}$ (kN/m^3)

foundation side horizontal direction $kSHD = 0.6*Alp.k*kHo*(De/0.3)^{(-3/4)}$ (kN/m^3)

foundation side vertical direction $kSVD = 0.3*Alp.k*kHo*(De/0.3)^{(-3/4)}$ (kN/m^3)

where Alp.k : modulus of subgrade reaction correction coefficient (= 1.50)

Alp. : modulus of elasticity in ground (kN/m^2)

Eo : dynamic modulus of elasticity in ground (kN/m^2)

ED : dynamic modulus of elasticity in ground (kN/m^2)

Nu.D: dynamic Poisson's ratio

Be : equivalent loading width in orthogonal direction to external force, foundation width (m)

De : equivalent loading width in external force direction, foundation width (m)

both Be,De are values which 0.2*D is deducted in case of circular and oval shape (D:circular diameter (m))

usual time

1.bridge axis direction(Be = 19.99151, De = 11.30471)

layer No	elevation(m)	front (kN/m^3)		side (kN/m^3)	
		kH	kSVB	kSHD	kSVD
1	-9.100 - -14.100	4459	1338	4103	2051
2	-14.100 - -15.420	4459	1338	4103	2051
3	-15.420 - -20.460	4459	1338	4103	2051
4	-20.460 - -22.490	5402	1621	4971	2485
5	-22.490 - -25.420	4202	1261	3866	1933
6	-25.420 - -41.480	4202	1261	3866	1933
7	-41.480 - -44.470	15006	4502	13808	6904
8	-44.470 - -59.491	10805	3241	9941	4971
9	-59.491 - -60.480	10805	6483	9941	9941
10	-60.480 - -67.450	18008	10805	16569	16569
11	-67.450 - -69.100	30013	18008	27615	27615

2.perpendicular direction(Be = 11.30471, De = 19.99151)

layer No	elevation(m)	front (kN/m^3)		side (kN/m^3)	
		kH	kSVB	kSHD	kSVD
1	-9.100 - -14.100	6838	2051	2675	1338
2	-14.100 - -15.420	6838	2051	2675	1338
3	-15.420 - -20.460	6838	2051	2675	1338
4	-20.460 - -22.490	8285	2485	3241	1621
5	-22.490 - -25.420	6444	1933	2521	1261
6	-25.420 - -41.480	6444	1933	2521	1261
7	-41.480 - -44.470	23013	6904	9004	4502
8	-44.470 - -59.491	16569	4971	6483	3241
9	-59.491 - -60.480	16569	9941	6483	6483
10	-60.480 - -67.450	27615	16569	10805	10805
11	-67.450 - -69.100	46025	27615	18008	18008

as for kSVB and kSVD, because resistance in internal periphery deeper than elevation -59.491(m) evaluated as sum of modulus of subgrade reaction both in external periphery and internal periphery

earthquake time

1.bridge axis direction(Be = 19.99151, De = 11.30471)

layer No	elevation(m)	front (kN/m^3)		side (kN/m^3)	
		kH	kSVB	kSHD	kSVD
1	-9.100 - -14.100	8918	2675	8206	4103
2	-14.100 - -15.420	8918	2675	8206	4103
3	-15.420 - -20.460	8918	2675	8206	4103
4	-20.460 - -22.490	10805	3241	9941	4971
5	-22.490 - -25.420	8404	2521	7732	3866
6	-25.420 - -41.480	8404	2521	7732	3866
7	-41.480 - -44.470	30013	9004	27615	13808
8	-44.470 - -59.491	21609	6483	19883	9941
9	-59.491 - -60.480	21609	12965	19883	19883
10	-60.480 - -67.450	36015	21609	33138	33138

layer No	elevation(m)	front (kN/m³)		side (kN/m³)	
		kH	kSVB	kSHD	kSVD
11	-67.450 - -69.100	60025	36015	55230	55230

2.perpendicular direction(Be = 11.30471, De = 19.99151)

layer No	elevation(m)	front (kN/m³)		side (kN/m³)	
		kH	kSVB	kSHD	kSVD
1	-9.100 - -14.100	13676	4103	5351	2675
2	-14.100 - -15.420	13676	4103	5351	2675
3	-15.420 - -20.460	13676	4103	5351	2675
4	-20.460 - -22.490	16569	4971	6483	3241
5	-22.490 - -25.420	12887	3866	5042	2521
6	-25.420 - -41.480	12887	3866	5042	2521
7	-41.480 - -44.470	46025	13808	18008	9004
8	-44.470 - -59.491	33138	9941	12965	6483
9	-59.491 - -60.480	33138	19883	12965	12965
10	-60.480 - -67.450	55230	33138	21609	21609
11	-67.450 - -69.100	92050	55230	36015	36015

as for kSVB and kSVD, because resistance in internal periphery deeper than elevation -59.491(m)
evaluated as sum of modulus of subgrade reaction both in external periphery and internal periphery

to estimate natural period

1.bridge axis direction(Be = 19.99151, De = 11.30471)

layer No	elevation(m)	front (kN/m³)		side (kN/m³)	
		kH	kSVB	kSHD	kSVD
1	-9.100 - -14.100	25265	7580	23247	11623
2	-14.100 - -15.420	25265	7580	23247	11623
3	-15.420 - -20.460	25265	7580	23247	11623
4	-20.460 - -22.490	31802	9541	29262	14631
5	-22.490 - -25.420	26895	8069	24747	12373

layer No	elevation(m)	front (kN/m³)		side (kN/m³)	
		kH	kSVB	kSHD	kSVD
6	-25.420 - -41.480	26895	8069	24747	12373
7	-41.480 - -44.470	39069	11721	35948	17974
8	-44.470 - -59.491	51923	15577	47775	23888
9	-59.491 - -60.480	51923	31154	47775	47775
10	-60.480 - -67.450	44120	26472	40595	40595
11	-67.450 - -69.100	69315	41589	63777	63777

2.perpendicular direction(Be = 11.30471, De = 19.99151)

layer No	elevation(m)	front (kN/m³)		side (kN/m³)	
		kH	kSVB	kSHD	kSVD
1	-9.100 - -14.100	38745	11623	15159	7580
2	-14.100 - -15.420	38745	11623	15159	7580
3	-15.420 - -20.460	38745	11623	15159	7580
4	-20.460 - -22.490	48769	14631	19081	9541
5	-22.490 - -25.420	41244	12373	16137	8069
6	-25.420 - -41.480	41244	12373	16137	8069
7	-41.480 - -44.470	59913	17974	23442	11721
8	-44.470 - -59.491	79625	23888	31154	15577
9	-59.491 - -60.480	79625	47775	31154	31154
10	-60.480 - -67.450	67658	40595	26472	26472
11	-67.450 - -69.100	106295	63777	41589	41589

as for kSVB and kSVD, because resistance in internal periphery deeper than elevation -59.491(m) evaluated as sum of modulus of subgrade reaction both in external periphery and internal periphery

(3)joint pipe external diameter ,shear resistance of joint

joint pipe external diameter

periphery :linear part = 0.1652 (m)

periphery :curve part = 0.1652 (m)

separation wall:Y direction = 0.1652 (m)

separation wall:X direction = 0.1652 (m) shear resistance of joint

shear rigidity Gj = 1200000 (kN/m^2)

shear capacity qju = 200 (kN/m)

(4) ground spring constant to estimate natural period

general equation

$$\begin{bmatrix} H \\ M \end{bmatrix} = \begin{bmatrix} Ass & Asr \\ Ars & Arr \end{bmatrix} \begin{bmatrix} Del. \\ Theta \end{bmatrix}$$

hence

$$\begin{bmatrix} Ho & O \\ O & Mo \end{bmatrix} = \begin{bmatrix} Ass & Asr \\ Ars & Arr \end{bmatrix} \begin{bmatrix} Del.oH & Del.oM \\ Theta.oH & Theta.oM \end{bmatrix}$$

$$\begin{bmatrix} Ass & Asr \\ Ars & Arr \end{bmatrix} = \begin{bmatrix} Ho & O \\ O & Mo \end{bmatrix} \begin{bmatrix} Del.oH & Del.oM \\ Theta.oH & Theta.oM \end{bmatrix}^{-1}$$

where Ho : unit horizontal force to apply at crest of foundation (kN)

Mo : unit moment to apply at crest of foundation (kN.m)

Del.oH : horizontal displacement at crest of foundation by Ho(m)

$Theta_{oH}$: rotational angle at crest of foundation by Ho (rad)

Del.oM : horizontal displacement at crest of foundation by Mo(m)

$Theta_{oM}$: rotational angle at crest of foundation by Mo (rad)

Ass : ground spring constant (kN/m)

Asr : ground spring constant (kN/rad)

Ars : ground spring constant (kN.m/m)

Arr : ground spring constant (kN.m/rad)

usual time

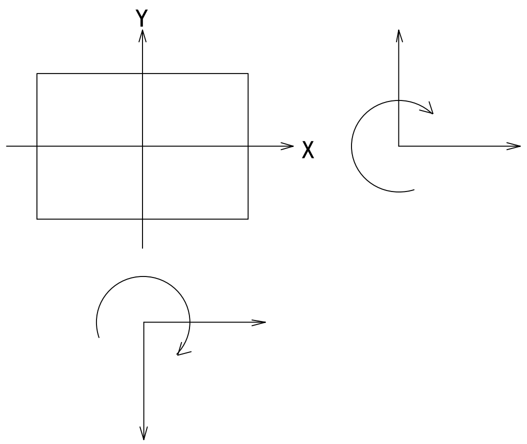
item	unit	bridge axis direction	perpendicular direction
Ho	kN		100.00
Mo	kN.m		1000.00
Del.oH	mm	5.1124E-002	4.2798E-002
ThetaoH	mrad	2.0158E-003	1.3146E-003
Del.oM	mm	2.0158E-002	1.3146E-002
ThetaoM	mrad	1.9356E-003	1.1878E-003
Ass	kN/m	3.3189E+006	3.5399E+006
Asr	kN/rad	-3.4564E+007	-3.9176E+007
Ars	kN.m/m	-3.4564E+007	-3.9176E+007
Arr	kN.m/rad	8.7659E+008	1.2754E+009

earthquake time

item	unit	bridge axis direction	perpendicular direction
Ho	kN		100.00
Mo	kN.m		1000.00
Del.oH	mm	3.0118E-002	2.5088E-002
ThetaoH	mrad	1.3969E-003	8.7023E-004
Del.oM	mm	1.3969E-002	8.7023E-003
ThetaoM	mrad	1.6459E-003	9.7860E-004
Ass	kN/m	5.4756E+006	5.7640E+006
Asr	kN/rad	-4.6471E+007	-5.1257E+007
Ars	kN.m/m	-4.6471E+007	-5.1257E+007
Arr	kN.m/rad	1.0020E+009	1.4777E+009

to estimate natural period

item	unit	bridge axis direction	perpendicular direction
Ho	kN		100.00
Mo	kN.m		1000.00
Del.oH	mm	1.2867E-002	1.0413E-002
ThetaoH	mrad	7.6383E-004	4.5789E-004
Del.oM	mm	7.6383E-003	4.5789E-003
ThetaoM	mrad	1.0541E-003	6.0614E-004
Ass	kN/m	1.3640E+007	1.4379E+007
Asr	kN/rad	-9.8838E+007	-1.0862E+008
Ars	kN.m/m	-9.8838E+007	-1.0862E+008
Arr	kN.m/rad	1.6649E+009	2.4703E+009



Y direction: bridge axis direction
X direction:perpendicular direction