

附錄二

RWDI風洞試驗

fax memo

RWDI

To: Mr. Shaw Shieh
Company: Evergreen Consulting Engineering
Fax #: 011-886-22-703-5848
Pages: 1 (including cover sheet)
From: Deborah Near
Re: Pedestrian Level Wind Study
Taipei Financial Center

Date: March 24, 1999
RWDI Reference #: 98-204

Message:

Dear Mr. Shieh:

We understand that the design change consists of an increase in building height from 428m to 448m, with this 20m increase occurring at the top of the tower where the building width is very narrow. It remains our opinion that the wind environment around the building will be substantially the same as per our report of November 25, 1997. Winds deflected by the tower top piece will be intercepted by the 92nd floor, and are not expected to affect the wind conditions at the base of the building.

Yours very truly;



Deborah Near, Associate
Project Manager

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**Table 1a: Structural Design Wind Loads at Ground Level
Scheme 1 with Heavy Tower Top Mass**

Natural Frequencies:

$N_1 = 0.1573$ Hz (x direction sway)

$N_2 = 0.1574$ Hz (y direction sway)

$N_3 = 0.2166$ Hz (z direction torsion)

Structural Damping Ratio:

$\zeta = 2.0\%$

Return Period	M_x (10^{10} N-m)	M_y (10^{10} N-m)	M_z (10^8 N-m)	F_x (10^8 N)	F_y (10^8 N)
50 years	2.421	2.613	5.572	1.019	0.961
100 years	2.796	2.772	7.129	1.136	1.112

**Table 1b: Structural Design Wind Loads at Ground Level
Scheme 1 with Light Tower Top Mass**

Natural Frequencies:

$N_1 = 0.1586$ Hz (x direction sway)

$N_2 = 0.1587$ Hz (y direction sway)

$N_3 = 0.2170$ Hz (z direction torsion)

Structural Damping Ratio:

$\zeta = 2.0\%$

Return Period	M_x (10^{10} N-m)	M_y (10^{10} N-m)	M_z (10^8 N-m)	F_x (10^8 N)	F_y (10^8 N)
50 years	2.446	2.657	5.569	1.033	0.971
100 years	2.813	2.797	7.125	1.148	1.123

**Table 2a: Effective Static Floor-by-Floor Loads for 100-Year Return Period
Scheme 1 with Heavy Tower Top Mass (Damping Ratio = 2%)**

Case	Floor No.	Height(m)	Fx(N)	Fy(N)	Mz(N-m)
Heavy T.T.	1	0.0	3.91E+05	3.03E+05	1.91E+06
Heavy T.T.	2	4.2	1.15E+06	8.98E+05	5.74E+06
Heavy T.T.	3	12.6	1.30E+06	1.03E+06	6.73E+06
Heavy T.T.	4	18.9	1.09E+06	8.75E+05	5.81E+06
Heavy T.T.	5	25.2	1.08E+06	8.74E+05	5.89E+06
Heavy T.T.	6	31.5	1.07E+06	8.88E+05	6.28E+06
Heavy T.T.	7	37.8	9.00E+05	7.59E+05	5.45E+06
Heavy T.T.	8	42.0	7.22E+05	6.13E+05	4.35E+06
Heavy T.T.	9	46.2	7.03E+05	5.95E+05	4.47E+06
Heavy T.T.	10	50.4	6.97E+05	5.92E+05	4.52E+06
Heavy T.T.	11	54.6	6.99E+05	5.98E+05	4.63E+06
Heavy T.T.	12	58.8	7.02E+05	6.04E+05	4.73E+06
Heavy T.T.	13	63.0	7.04E+05	6.11E+05	4.79E+06
Heavy T.T.	14	67.2	7.06E+05	6.19E+05	4.83E+06
Heavy T.T.	15	71.4	7.10E+05	6.26E+05	4.89E+06
Heavy T.T.	16	75.6	7.17E+05	6.37E+05	4.98E+06
Heavy T.T.	17	79.8	7.25E+05	6.47E+05	5.06E+06
Heavy T.T.	18	84.0	7.39E+05	6.63E+05	4.87E+06
Heavy T.T.	19	88.2	7.29E+05	6.55E+05	5.10E+06
Heavy T.T.	20	92.4	7.17E+05	6.46E+05	5.03E+06
Heavy T.T.	21	96.6	7.20E+05	6.51E+05	5.03E+06
Heavy T.T.	22	100.8	7.23E+05	6.57E+05	5.04E+06
Heavy T.T.	23	105.0	7.25E+05	6.63E+05	5.00E+06
Heavy T.T.	24	109.2	7.34E+05	6.76E+05	5.01E+06
Heavy T.T.	25	113.4	7.60E+05	7.04E+05	5.11E+06
Heavy T.T.	26	117.6	7.76E+05	7.21E+05	4.97E+06
Heavy T.T.	27	121.8	7.17E+05	6.65E+05	4.93E+06
Heavy T.T.	28	126.0	7.27E+05	6.77E+05	5.12E+06
Heavy T.T.	29	130.2	7.56E+05	7.08E+05	5.41E+06
Heavy T.T.	30	134.4	7.87E+05	7.42E+05	5.71E+06
Heavy T.T.	31	138.6	8.18E+05	7.76E+05	6.02E+06
Heavy T.T.	32	142.8	8.46E+05	8.08E+05	6.26E+06
Heavy T.T.	33	147.0	9.17E+05	8.81E+05	6.81E+06
Heavy T.T.	34	151.2	9.45E+05	9.10E+05	6.55E+06
Heavy T.T.	35	155.4	8.87E+05	8.55E+05	6.01E+06
Heavy T.T.	36	159.6	7.43E+05	7.17E+05	4.41E+06
Heavy T.T.	37	163.8	9.04E+05	8.73E+05	6.43E+06
Heavy T.T.	38	168.0	9.47E+05	9.16E+05	6.72E+06
Heavy T.T.	39	172.2	9.88E+05	9.58E+05	7.08E+06
Heavy T.T.	40	176.4	1.03E+06	1.00E+06	7.45E+06
Heavy T.T.	41	180.6	1.13E+06	1.10E+06	8.08E+06
Heavy T.T.	42	184.8	1.24E+06	1.21E+06	8.08E+06

Case	Floor No.	Height(m)	Fx(N)	Fy(N)	Mz(N-m)
Heavy T.T.	43	189.0	1.06E+06	1.04E+06	6.88E+06
Heavy T.T.	44	193.2	1.06E+06	1.04E+06	7.10E+06
Heavy T.T.	45	197.4	1.09E+06	1.06E+06	7.39E+06
Heavy T.T.	46	201.6	1.13E+06	1.11E+06	7.76E+06
Heavy T.T.	47	205.8	1.17E+06	1.15E+06	8.14E+06
Heavy T.T.	48	210.0	1.23E+06	1.21E+06	8.55E+06
Heavy T.T.	49	214.2	1.36E+06	1.34E+06	9.24E+06
Heavy T.T.	50	218.4	1.42E+06	1.39E+06	8.94E+06
Heavy T.T.	51	222.6	1.26E+06	1.24E+06	7.80E+06
Heavy T.T.	52	226.8	1.25E+06	1.23E+06	7.96E+06
Heavy T.T.	53	231.0	1.25E+06	1.24E+06	8.19E+06
Heavy T.T.	54	235.2	1.30E+06	1.29E+06	8.62E+06
Heavy T.T.	55	239.4	1.35E+06	1.34E+06	9.01E+06
Heavy T.T.	56	243.6	1.40E+06	1.39E+06	9.42E+06
Heavy T.T.	57	247.8	1.53E+06	1.52E+06	1.02E+07
Heavy T.T.	58	252.0	1.66E+06	1.63E+06	9.83E+06
Heavy T.T.	59	256.2	1.47E+06	1.45E+06	8.85E+06
Heavy T.T.	60	260.4	1.06E+06	1.07E+06	5.86E+06
Heavy T.T.	61	264.6	1.44E+06	1.43E+06	9.18E+06
Heavy T.T.	62	268.8	1.21E+06	1.22E+06	8.52E+06
Heavy T.T.	63	273.0	1.26E+06	1.27E+06	8.91E+06
Heavy T.T.	64	277.2	1.31E+06	1.32E+06	9.30E+06
Heavy T.T.	65	281.4	1.46E+06	1.46E+06	1.01E+07
Heavy T.T.	66	285.6	1.63E+06	1.62E+06	9.94E+06
Heavy T.T.	67	289.8	1.33E+06	1.34E+06	8.39E+06
Heavy T.T.	68	294.0	1.27E+06	1.29E+06	8.44E+06
Heavy T.T.	69	298.2	1.31E+06	1.32E+06	8.81E+06
Heavy T.T.	70	302.4	1.36E+06	1.37E+06	9.20E+06
Heavy T.T.	71	306.6	1.41E+06	1.42E+06	9.60E+06
Heavy T.T.	72	310.8	1.46E+06	1.48E+06	9.99E+06
Heavy T.T.	73	315.0	1.62E+06	1.64E+06	1.08E+07
Heavy T.T.	74	319.2	1.79E+06	1.78E+06	1.04E+07
Heavy T.T.	75	323.4	1.49E+06	1.50E+06	8.96E+06
Heavy T.T.	76	327.6	1.43E+06	1.45E+06	9.02E+06
Heavy T.T.	77	331.8	1.46E+06	1.48E+06	9.35E+06
Heavy T.T.	78	336.0	1.51E+06	1.54E+06	9.78E+06
Heavy T.T.	79	340.2	1.57E+06	1.60E+06	1.02E+07
Heavy T.T.	80	344.4	1.61E+06	1.64E+06	1.06E+07
Heavy T.T.	81	348.6	1.79E+06	1.81E+06	1.13E+07
Heavy T.T.	82	352.8	1.95E+06	1.95E+06	1.09E+07
Heavy T.T.	83	357.0	1.62E+06	1.64E+06	9.42E+06
Heavy T.T.	84	361.2	1.54E+06	1.57E+06	9.45E+06
Heavy T.T.	85	365.4	1.56E+06	1.60E+06	9.80E+06
Heavy T.T.	86	369.6	1.64E+06	1.67E+06	1.02E+07
Heavy T.T.	87	373.8	8.66E+05	9.62E+05	6.89E+06

Case	Floor No.	Height(m)	Fx(N)	Fy(N)	Mz(N-m)
Heavy T.T.	88	378.0	1.02E+06	1.11E+06	7.47E+06
Heavy T.T.	89	382.2	1.87E+06	1.90E+06	1.15E+07
Heavy T.T.	90	386.4	2.84E+06	2.79E+06	1.30E+07
Heavy T.T.	91	390.6	2.62E+06	2.57E+06	1.32E+07
Heavy T.T.	92	393.8	8.37E+05	9.02E+05	5.20E+06
Heavy T.T.	93	397.0	8.52E+05	9.00E+05	4.11E+06
Heavy T.T.	94	400.2	7.04E+05	7.46E+05	3.05E+06
Heavy T.T.	95	403.4	5.89E+05	6.16E+05	1.85E+06
Heavy T.T.	96	406.6	3.33E+05	3.80E+05	1.00E+06
Heavy T.T.	97	413.0	4.18E+05	4.94E+05	1.57E+06
Heavy T.T.	98	419.4	7.51E+05	8.14E+05	1.94E+06
Heavy T.T.	99	425.8	8.32E+05	9.03E+05	2.26E+06
Heavy T.T.	100	432.2	9.61E+05	1.04E+06	2.63E+06
Heavy T.T.	101	438.6	4.97E+05	6.54E+05	3.40E+06
Heavy T.T.	102	448.0	4.65E+05	6.54E+05	2.33E+06
Sum			1.136E+08	1.112E+08	7.129E+08

Note: (1) The loads presented in the table above must be combined with the recommended load combination factors given in Table 3.

Table 1: Structural Design Wind Loads at Ground Level

Return Period	M_x (10^{10} N-m)	M_y (10^{10} N-m)	M_z (10^8 N-m)	F_x (10^8 N)	F_y (10^8 N)
50 years	2.269	2.101	6.415	0.963	0.982
100 years	2.926	2.623	7.792	1.202	1.250

Note: The above predicted wind loads are based on the following structural dynamic properties.

Natural Frequencies:

$N_1 = 0.16907$ Hz (x direction sway)
 $N_2 = 0.16975$ Hz (y direction sway)
 $N_3 = 0.20756$ Hz (z direction torsion)

Structural Damping Ratio:

$\zeta = 1.5\%$ (for all modes)

Table 3: 100-Year Return Period Effective Static Floor-by-Floor Wind Loads
for 1.5% Damping (Based on Aeroelastic Model Tests)
(N1=0.16907 Hz; N2=0.16975 and N3=0.20756 Hz)

Structural Level	Elevation above Grade (m)	Fx (N)	Fy (N)	Mz (N-in)
2	0.0	6.632e+05	3.689e+05	1.475e+06
3	5.1	1.199e+06	6.649e+05	2.659e+06
4	9.3	1.079e+06	6.061e+05	3.175e+06
5	13.5	1.074e+06	6.108e+05	3.126e+06
6	17.7	1.070e+06	6.189e+05	3.827e+06
7	21.9	1.067e+06	6.302e+05	3.755e+06
8	26.1	1.063e+06	6.375e+05	4.386e+06
9	30.3	1.061e+06	6.522e+05	4.306e+06
10	34.5	1.059e+06	6.664e+05	4.284e+06
11	38.7	1.056e+06	6.768e+05	4.856e+06
12	42.9	1.053e+06	6.871e+05	4.632e+06
13	47.1	1.051e+06	7.027e+05	5.120e+06
14	51.3	1.048e+06	7.166e+05	4.977e+06
15	55.5	1.047e+06	7.341e+05	5.407e+06
16	59.7	1.046e+06	7.542e+05	5.803e+06
17	63.9	1.044e+06	7.705e+05	6.164e+06
18	68.1	1.043e+06	7.894e+05	5.993e+06
19	72.3	1.041e+06	8.062e+05	6.335e+06
20	76.5	1.042e+06	8.337e+05	6.276e+06
21	80.7	1.039e+06	8.471e+05	6.545e+06
22	84.9	1.012e+06	7.810e+05	5.687e+06
23	89.1	1.012e+06	8.010e+05	5.845e+06
24	93.3	1.010e+06	8.195e+05	5.977e+06
25	97.5	1.009e+06	8.416e+05	6.087e+06
26	101.7	1.000e+06	8.361e+05	5.894e+06
27	105.9	9.980e+05	8.540e+05	5.954e+06
28	110.1	9.948e+05	8.686e+05	5.996e+06
29	114.3	9.921e+05	8.850e+05	6.253e+06
30	118.5	9.969e+05	9.264e+05	6.388e+06
31	122.7	1.018e+06	9.531e+05	6.325e+06
32	126.9	1.028e+06	9.389e+05	6.274e+06
33	131.1	1.056e+06	9.816e+05	6.714e+06

34	135.3	1.084e+06	1.026e+06	7.172e+06
35	139.5	1.111e+06	1.074e+06	7.644e+06
36	143.7	1.141e+06	1.122e+06	8.138e+06
37	147.9	1.169e+06	1.169e+06	8.651e+06
38	152.1	1.101e+06	8.915e+05	6.112e+06
39	156.3	1.154e+06	1.344e+06	8.893e+06
40	160.5	1.135e+06	1.232e+06	8.155e+06
41	164.7	1.164e+06	1.280e+06	8.652e+06
42	168.9	1.185e+06	1.300e+06	8.924e+06
43	173.1	1.214e+06	1.350e+06	9.436e+06
44	177.3	1.244e+06	1.399e+06	9.965e+06
45	181.5	1.273e+06	1.446e+06	1.052e+07
46	185.7	1.163e+06	1.033e+06	7.125e+06
47	189.9	1.278e+06	1.694e+06	1.084e+07
48	194.1	1.239e+06	1.515e+06	9.564e+06
49	198.3	1.268e+06	1.562e+06	1.009e+07
50	202.5	1.284e+06	1.562e+06	1.028e+07
51	206.7	1.313e+06	1.612e+06	1.082e+07
52	210.9	1.342e+06	1.660e+06	1.138e+07
53	215.1	1.372e+06	1.707e+06	1.197e+07
54	219.3	1.218e+06	1.147e+06	7.783e+06
55	223.5	1.395e+06	2.022e+06	1.211e+07
56	227.7	1.332e+06	1.762e+06	1.072e+07
57	231.9	1.362e+06	1.810e+06	1.127e+07
58	236.1	1.377e+06	1.808e+06	1.148e+07
59	240.3	1.406e+06	1.857e+06	1.205e+07
60	244.5	1.436e+06	1.905e+06	1.264e+07
61	248.7	1.466e+06	1.951e+06	1.325e+07
62	252.9	1.265e+06	1.235e+06	8.234e+06
63	257.1	1.466e+06	2.196e+06	1.265e+07
64	261.3	1.426e+06	2.011e+06	1.186e+07
65	265.5	1.455e+06	2.055e+06	1.244e+07
66	269.7	1.331e+06	1.591e+06	9.738e+06
67	273.9	1.357e+06	1.628e+06	1.019e+07
68	278.1	1.384e+06	1.664e+06	1.064e+07
69	282.3	1.410e+06	1.699e+06	1.113e+07
70	286.5	1.160e+06	8.190e+05	5.186e+06

71	290.7	1.465e+06	2.132e+06	1.195e+07
72	294.9	1.360e+06	1.728e+06	9.924e+06
73	299.1	1.386e+06	1.764e+06	1.038e+07
74	303.3	1.404e+06	1.769e+06	1.053e+07
75	307.5	1.429e+06	1.804e+06	1.100e+07
76	311.7	1.456e+06	1.839e+06	1.148e+07
77	315.9	1.483e+06	1.873e+06	1.199e+07
78	320.1	1.187e+06	8.408e+05	5.356e+06
79	324.3	1.496e+06	2.172e+06	1.182e+07
80	328.5	1.430e+06	1.899e+06	1.065e+07
81	332.7	1.455e+06	1.930e+06	1.099e+07
82	336.9	1.474e+06	1.939e+06	1.134e+07
83	341.1	1.499e+06	1.969e+06	1.169e+07
84	345.3	1.525e+06	2.000e+06	1.220e+07
85	349.5	1.550e+06	2.029e+06	1.257e+07
86	353.7	1.213e+06	8.587e+05	5.483e+06
87	357.9	1.570e+06	2.358e+06	1.227e+07
88	362.1	1.079e+06	6.698e+05	3.804e+06
89	366.3	1.098e+06	6.793e+05	3.939e+06
90	370.5	1.536e+06	2.079e+06	1.176e+07
91	374.7	1.130e+06	6.773e+05	4.112e+06
92	378.9	1.150e+06	6.867e+05	4.253e+06
93	383.1	1.608e+06	2.156e+06	1.287e+07
94	387.3	1.238e+06	8.708e+05	5.560e+06
95	391.5	1.498e+06	2.391e+06	1.207e+07
96	394.7	2.489e+05	2.283e+05	1.938e+05
97	397.9	2.590e+05	2.331e+05	2.116e+05
98	401.1	2.692e+05	2.378e+05	2.302e+05
99	404.3	2.793e+05	2.427e+05	2.498e+05
100	407.5	2.895e+05	2.475e+05	2.702e+05
101	410.7	2.998e+05	2.523e+05	2.914e+05
102	413.9	3.100e+05	2.571e+05	3.135e+05
103	417.1	3.204e+05	2.619e+05	3.366e+05
104	420.3	3.307e+05	2.667e+05	3.605e+05
105	423.5	4.011e+05	2.959e+05	4.443e+05
106	428.0	1.984e+06	9.450e+05	2.097e+06
Total		1.202E+08	1.250E+08	7.792E+08