

**LOCHNER**

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: PRESTRESSED GIRDER ANALYSIS  
 BEAM REACTIONS

JMJ Jun-06  
 KBM Jun-06

HIGH LEVEL BENT 137

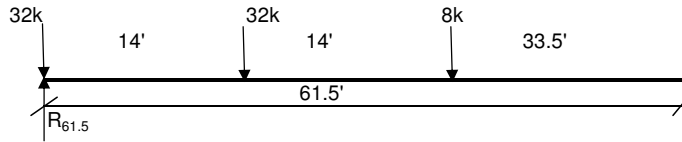
Beam No.	Self Wt.	Topping (Deck + Haunch)	DL - Precast	Interior Diaphragms	D.L.-Comp	Total D.L.
Exterior						
Span 137	17.40	23.30	0.70	1.00	3.30	45.70
Span 138	17.40	23.30	0.70	1.00	3.30	45.70
Totals	34.80	46.60	1.40	2.00	6.60	91.40
Interior						
Span 137	17.40	21.60	0.70	1.90	3.10	44.70
Span 138	17.40	21.60	0.70	1.90	3.10	44.70
Totals	34.80	43.20	1.40	3.80	6.20	89.40

PROJECT: **BONNER BRIDGE - OREGON INLET NORTH CAROLINA**  
 SUBJECT: **HIGH LEVEL BENT ANALYSIS**  
 HIGH LEVEL BENTS

JMJ Jun-06  
 WDB Jun-06

**LIVE LOAD** ( Bents 137, 142, 160)

**HS-20 AXLE LOAD**



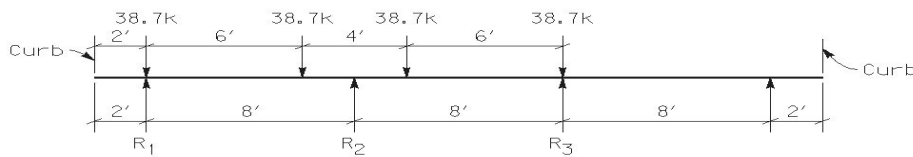
$$R_{61.5} = 32 + 32 * ( 47.5 / 61.5 ) + 8 * ( 33.5 / 61.5 ) = 61.1 \text{ k}$$

**HS-20 WHEEL LOAD**

$$W_{61.5} = R_{61.5} / 2 = 30.5 \text{ k}$$

$$w/\text{Impact} = 30.5 * ( \frac{50}{61.5 + 125} + 1 ) = 38.7 \text{ k}$$

**Max. NEGATIVE MOMENT**



w/ Impact

$$R_1 = 38.7 + 38.7 * ( 2 / 8 ) = 48.4 \text{ k} = R_3$$

$$R_2 = 38.7 * 2 * ( 6 / 8 ) = 58.1 \text{ k}$$

w/o Impact

$$R_1 = 30.5 + 30.5 * ( 2 / 8 ) = 38.1 \text{ k} = R_3$$

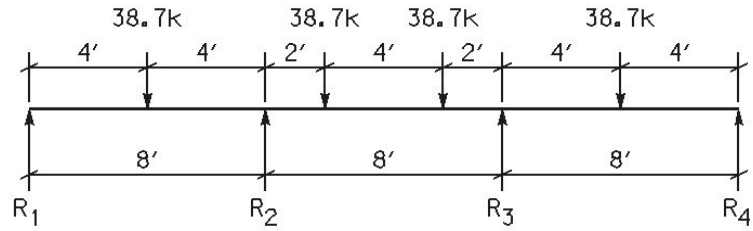
$$R_2 = ( 30.5 * 2 * ( 6 / 8 ) ) = 45.8 \text{ k}$$

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 SUBJECT: **HIGH LEVEL BENT ANALYSIS**  
 HIGH LEVEL BENTS

JMJ Jun-06  
 WDB Jun-06

**LIVE LOAD** ( Bents 137, 142, 160)

**MAX. POSITIVE MOMENT**



w/ Impact

$$R_1 = R_4 = 38.7 * ( 4 / 8 ) = 19.4 \text{ k}$$

$$R_2 = R_3 = 19.4 + 38.7 * ( 6 / 8 ) + ( 38.7 * ( 2 / 8 ) ) = 58.1 \text{ k}$$

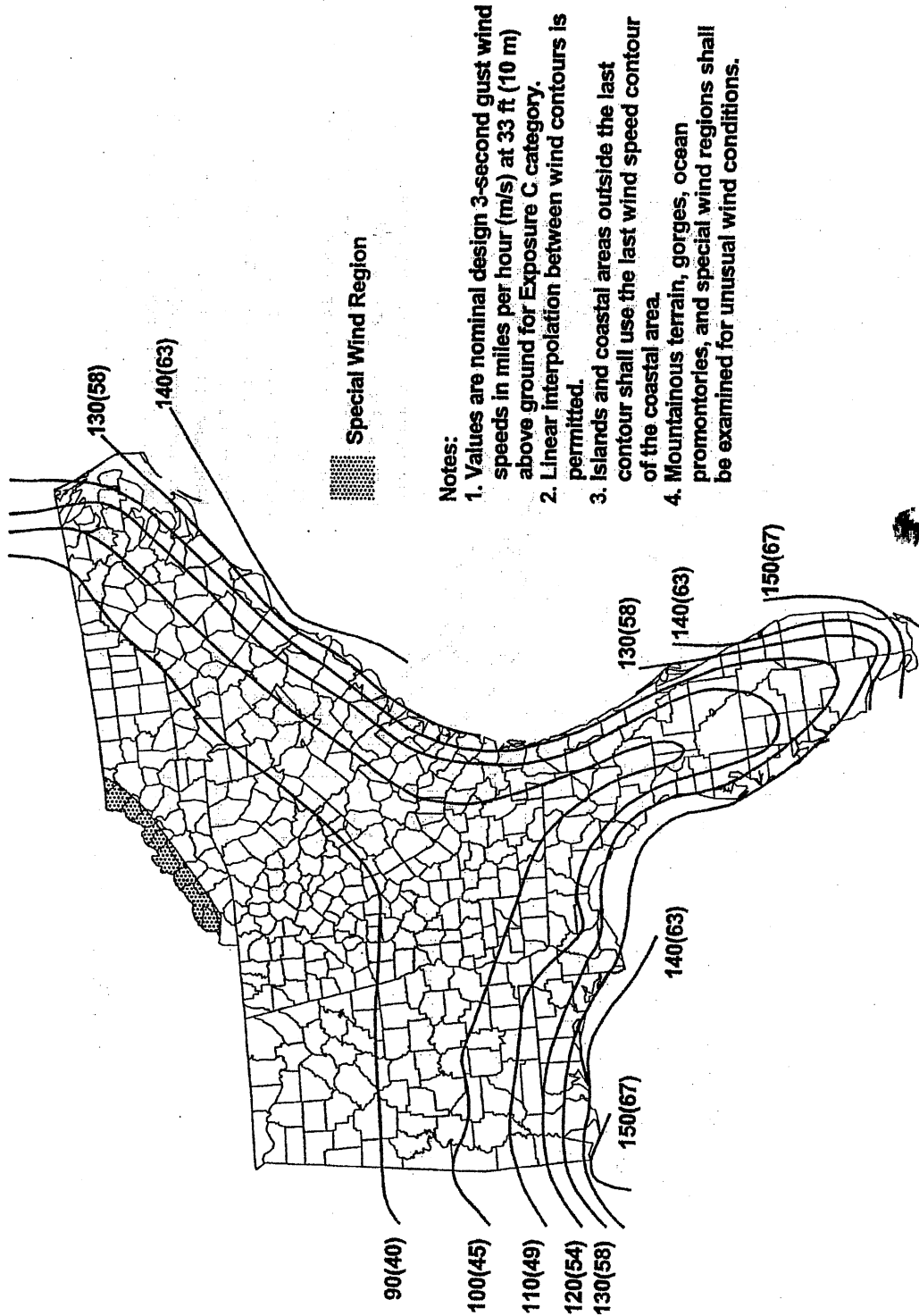


FIGURE 6-1b. Basic Wind Speed—Eastern Gulf of Mexico and Southeastern U.S. Hurricane Coastline

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 SUBJECT: **HIGH LEVEL BENT ANALYSIS**  
 H.L.B. #137

JMJ May-06  
 WDB Jun-06

**LOADING**

**Earth Loads**

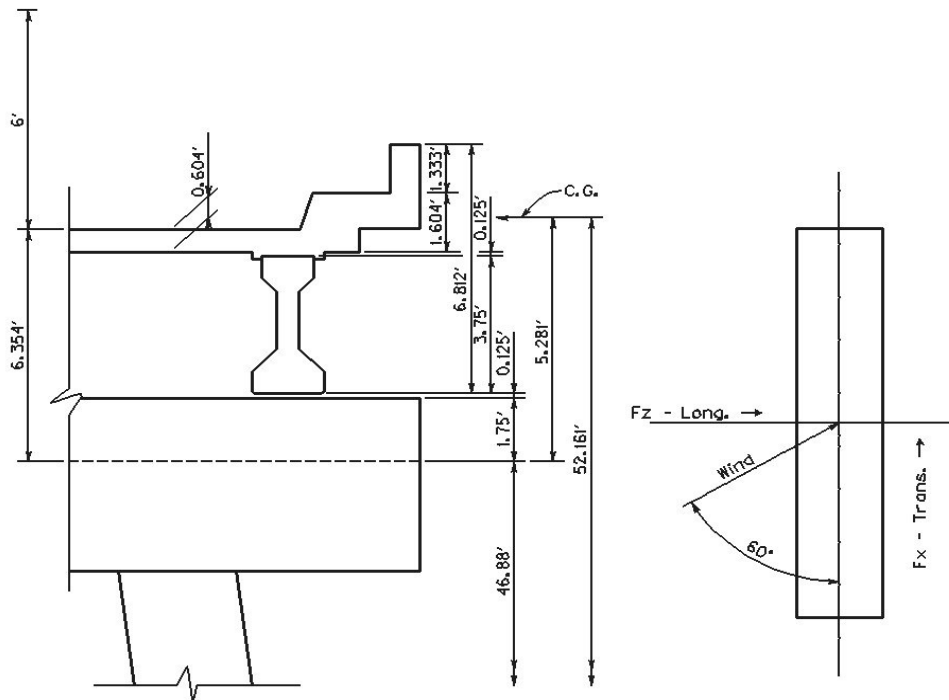
Assume No Earth Loading on Bents or Pile Cap.

**Wind Loads (AASHTO 3.15)**

Design Wind Speed = 130 MPH (Original Design Speed)

$$\text{Ratio} = (130)^2 / (100)^2 = 1.69$$

**Wind on Superstructure (AASHTO 3.15.2.1)**



Assume Wind @ 60° Skew

$$\begin{aligned} \text{Long.} &= (0.019 \text{ k/Ft}^2) (1.69 \text{ Ratio}) = 0.032 \text{ k/Ft}^2 \\ \text{Trans.} &= (0.017 \text{ k/Ft}^2) (1.69 \text{ Ratio}) = 0.029 \text{ k/Ft}^2 \end{aligned}$$

Assume Adjacent Bent Takes 1/2 Load

$$\text{Load Length} = 61.500 * 2 / 2 = 61.500 \text{ Ft.}$$

$$\begin{aligned} \text{Long. Force} &= (0.032 \text{ k/Ft}^2) (6.812 \text{ Ft.}) (61.500 \text{ Ft.}) = 13.406 \text{ k} \\ \text{Trans. Force} &= (0.029 \text{ k/Ft}^2) (6.812 \text{ Ft.}) (61.500 \text{ Ft.}) = 12.149 \text{ k} \end{aligned}$$

$$\text{Moment Factor } M_F = 52.161 / 46.88 = 1.113$$

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JMJ May-06  
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Modify & Apply to Jt. 2 & 3					
Long. Wind	= (	13.406 k)	* (	1.113 )/	2 = 7.460 k/Jt
Trans. Wind	= (	12.149 k)	* (	1.113 )/	2 = 6.761 k/Jt

**Wind on Live Load (AASHTO 3.15.2.1.2)**

Assume Wind @ 60° Skew & Apply @ 6' above Deck					
Long.	= (	0.038 k/Ft <sup>2</sup> )			
Trans.	= (	0.034 k/Ft <sup>2</sup> )			
Long. Force	= (	0.038 k/Ft <sup>2</sup> ) * (	61.500 Ft.)	=	2.337 k
Trans. Force	= (	0.034 k/Ft <sup>2</sup> ) * (	61.500 Ft.)	=	2.091 k
Moment Factor	= (	46.880 Ft. +	6.354 Ft. +	6.000 Ft. ) /	46.880 Ft. = 1.264
Modify & Apply to Jt. 2 & 3					
Long. Wind	= (	2.337 k)	* (	1.264 )/	2.000 = 1.477 k/Jt
Trans. Wind	= (	2.091 k)	* (	1.264 )/	2.000 = 1.322 k/Jt

**Wind on Superstructure**

Wind Pressure =	0.040 k/Ft <sup>2</sup>	*	1.690	=	0.068 k/Ft <sup>2</sup>
Long. =	0.068 k/Ft <sup>2</sup>	*	sin 60.000	=	0.059 k/Ft <sup>2</sup>
Trans. =	0.068 k/Ft <sup>2</sup>	*	cos 60.000	=	0.034 k/Ft <sup>2</sup>
Cap					
W <sub>z</sub> =	0.059 k/Ft <sup>2</sup>	*	3.500 Ft.	=	0.207 k/Ft <i>on members 1-3</i>
W <sub>x</sub> =	0.034 k/Ft <sup>2</sup>	*	3.500 Ft. * 3.000 Ft.	=	0.357 k/Ft <i>at Jt. 4</i>
Columns					
Members 4 & 5					
W <sub>z</sub> =	0.059 k/Ft <sup>2</sup>	*	3.000 Ft.	=	0.177 k/Ft
W <sub>x</sub> =	0.034 k/Ft <sup>2</sup>	*	3.039 Ft.	=	0.103 k/Ft
Members 7 & 8					
W <sub>z</sub> =	0.177 k/Ft				
W <sub>x</sub> =	0.034 k/Ft <sup>2</sup>	*	4.359 Ft.	=	0.148 k/Ft
Members 10 & 11					
W <sub>z</sub> =	0.177 k/Ft				
W <sub>x</sub> =	0.034 k/Ft <sup>2</sup>	*	5.176 Ft.	=	0.176 k/Ft
Struts					
Member 6					
W <sub>z</sub> =	0.177 k/Ft <sup>2</sup>				
Member 9					
W <sub>z</sub> =	5.000 Ft.	*	0.059 k/Ft <sup>2</sup>	=	0.295 k/Ft

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**Longitudinal Forces (AASHTO 3.9)**

Lane Loading

2 Lanes, HS20, No Reduction (AASHTO 3.12.1)

$$LF = [( 0.64 \text{ k/Ft} * 61.500 \text{ '}) + 18 \text{ k} ] * 2 \text{ Lanes} * 0.05 = 5.736 \text{ k}$$

Modify & Apply to Jts. 2 & 3

$$M_F = 1.264 \text{ from Wind on L.L.}$$

$$F_z = ( 5.736 \text{ k} * 1.264 ) / 2 = 3.625 \text{ k/Jt}$$

**Thermal Forces (AASHTO 3.16)**

Longitudinal - Structure Free to move at Brgs., No Long. Forces From  $\Delta T$   
 Transverse

Assume  $45^\circ \Delta T$

Thermal = 0.000006 (AASHTO 8.5.3)

Shrinkage = 0.0002 (AASHTO 8.5.4)

$$\text{Ratio} = \frac{S}{T * \Delta T} = \frac{0.0002}{0.000006 * 45} = 0.741 \text{ use } 1.741$$

**Stream Forces (AASHTO 3.18.1)**

Assume no Tidal, Stream, & Storm Surge Forces

**Seismic Loading (AASHTO 3.1)**

Since Acceleration = 4 % --> SPC = A --> No Seismic Analysis Required





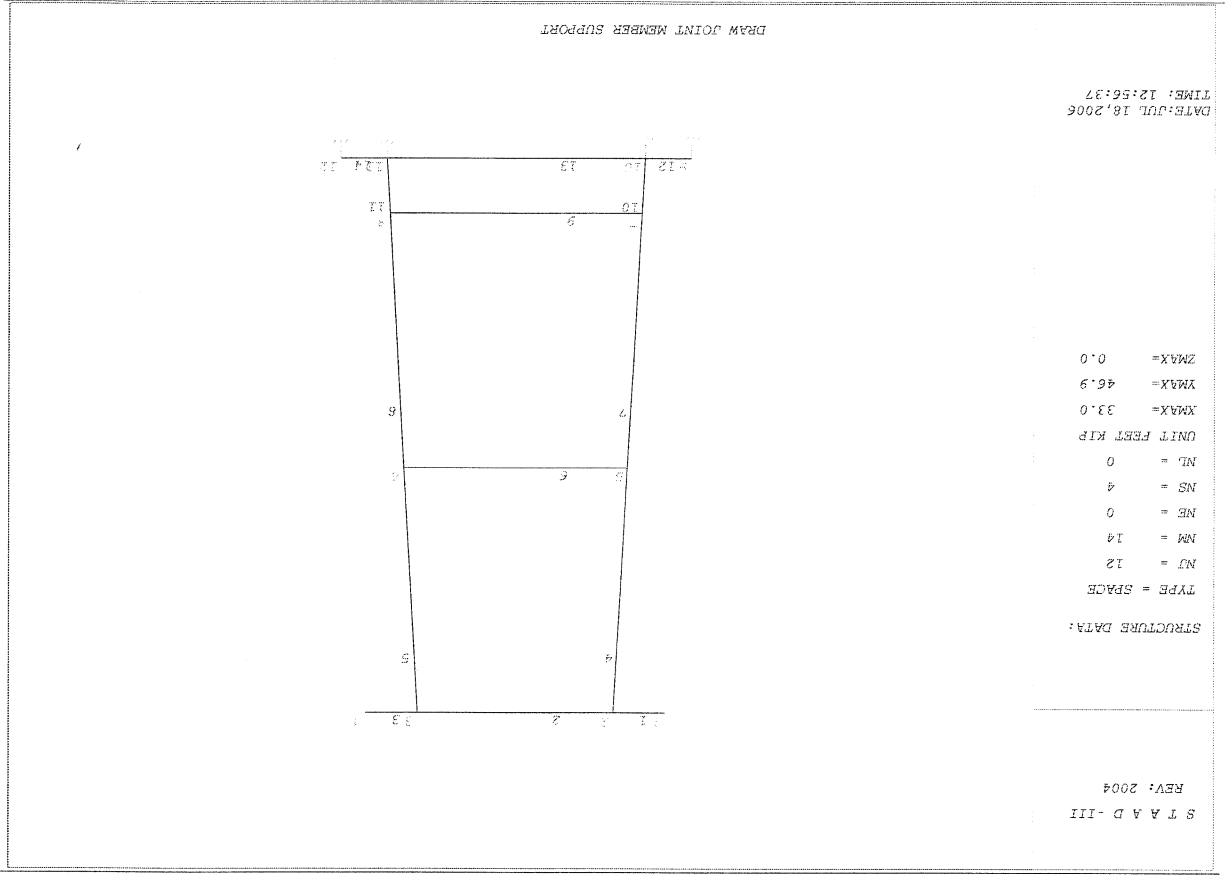
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*****
* STAAD.Pro
* Version 2004 Bid 1002.US
* Proprietary Program of
* Research Engineers, Intl.
* Date= JUL 18, 2006
* Time= 12:56:37
*
* USER ID: H.W. Lochner
*****
    
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*Jm > 7/6  
WOB 7/6*

1. STAAD SPACE BONNER BRIDGE, HLB137
- INPUT FILE: HLB137.STD
2. START JOB INFORMATION
3. JOB NAME BONNER BRIDGE
4. JOB CLIENT NORTH CAROLINA
5. ENGINEER NAME JMW
6. ENGINEER DATE MAY 2006
7. END JOB INFORMATION
8. INPUT WIDTH 72
9. PAGE LENGTH 62
10. UNIT FEET KIP
11. JOINT COORDINATES
12. 1 2.42 46.88 0; 2 7.28 46.88 0; 3 25.72 46.88 0; 4 30.58 46.88 0
13. 5 5.98 26.13 0; 6 27.02 26.13 0; 7 4.64 4.63 0; 8 28.37 4.63 0; 9 0 0 0
14. 10 4.35 0 0; 11 28.65 0 0; 12 33 0 0
15. MEMBER INCIDENCES
16. 1 1 2; 2 3; 3 4; 4 2 5; 5 3 6; 6 5 6; 7 5 7; 8 6 8; 9 7 8; 10 7 10
17. 11 8 11; 12 9 10; 13 10 11; 14 11 12
18. DEFINE MATERIAL START
19. ISOTROPIC CONCRETE
20. E 453600
21. POISSON 0.17
22. DENSITY 0.14999
23. ALPHA 5.5E-006
24. DAMP 0.05
25. END DEFINE MATERIAL
26. MEMBER PROPERTY AMERICAN
27. 1 TO 3 PRIS YD 3.5 ZD 3
28. 4 5 PRIS YD 2.994 ZD 3.039
29. 6 PRIS YD 3 ZD 2.5
30. 7 8 PRIS YD 2.994 ZD 4.359
31. 9 PRIS YD 5 ZD 1.5
32. 10 11 PRIS YD 2.994 ZD 5.176
33. 12 TO 14 PRIS YD 4.25 ZD 11
34. CONSTANTS
35. MATERIAL CONCRETE MEMB 1 TO 14
36. SUPPORTS
37. 9 TO 12 FIXED
38. DRAW JOINT MEMBER SUPPORT



DATE: JUL 18, 2006  
TIME: 12:56:37

STRUCTURE DATA:  
TYPE = SPACE  
NJ = 12  
NM = 10  
NE = 0  
NS = 4  
NL = 0  
UNIT FEET KIP  
XMAX = 33.0  
YMAX = 46.9  
ZMAX = 0.0

STAAD - III  
REV: 2004

DRAW JOINT MEMBER SUPPORT

39. \*\*  
40. \*\*DEAD LOAD  
41. \*\*  
42. LOAD 2 DEAD  
43. SELFWEIGHT Y -1  
44. MEMBER LOAD  
45. 1 CON GY -91.4 2.08  
46. 2 CON GY -89.4 5.22  
47. 2 CON GY -89.4 13.22  
48. 3 CON GY -91.4 2.78  
49. JOINT LOAD  
50. 2 3 5 6 FY -2.7  
51. \*\*  
52. \*\*MAXIMUM NEGATIVE MOMENT  
53. \*\*  
54. LOAD 11 LIVELoad + IMPACT FOR JT. 2 MEM. 1 AND 2  
55. MEMBER LOAD  
56. 1 CON Y -48.4 2.08  
57. 2 CON Y -58.1 5.22  
58. 2 CON Y -48.4 13.22  
59. LOAD 12 LIVELoad + IMPACT FOR JT. 3 MEM. 2 AND 3  
60. MEMBER LOAD  
61. 2 CON Y -48.4 5.22  
62. 2 CON Y -58.1 13.22  
63. 3 CON Y -48.4 2.78  
64. \*\*  
65. \*\*MAXIMUM POSITIVE MOMENT  
66. \*\*  
67. LOAD 13 LIVELoad + IMPACT MEM 2  
68. MEMBER LOAD  
69. 1 CON Y -19.4 2.08  
70. 2 CON Y -58.1 5.22  
71. 2 CON Y -58.1 13.22  
72. 3 CON Y -19.4 2.78  
73. \*\*  
74. \*\*LOADS ON FOOTINGS  
75. \*\*  
76. LOAD 14 LIVELoad NO IMPACT JT. 10  
77. MEMBER LOAD  
78. 1 CON Y -38.1 2.08  
79. 2 CON Y -45.8 5.22  
80. 2 CON Y -38.1 13.22  
81. LOAD 15 LIVELoad NO IMPACT FOR JT. 11  
82. MEMBER LOAD  
83. 2 CON Y -38.1 5.22  
84. 2 CON Y -45.8 13.22  
85. 3 CON Y -38.1 2.78  
86. \*\*  
87. \*\*WIND  
88. \*\*  
89. LOAD 4 WIND  
90. JOINT LOAD  
91. 2 3 FX -6.761 FZ -7.460  
92. 4 FX -0.357  
93. MEMBER LOAD  
94. 1 TO 3 UNI GZ -0.207  
95. 4 5 7 8 10 11 UNI GZ -0.177  
96. 4 5 UNI GX -0.103  
97. 7 8 UNI GX -0.148  
98. 10 11 UNI GX -0.176

PROBLEM STATISTICS

NUMBER OF JOINTS/MEMBER-ELEMENTS/SUPPORTS = 12/ 14/ 4  
ORIGINAL/FINAL BAND-WIDTH = 3/ 3/  
TOTAL PRIMARY LOAD CASES = 11, TOTAL DEGREES OF FREEDOM = 48  
SIZE OF STIFFNESS MATRIX = 2 DOUBLE KILO-WORDS  
REQD/AVAIL. DISK SPACE = 12.0/ 111479.3 MB

133. PRINT MEMBER FORCES LIST 2 4 5 6 7 8 10 11

MEMBER END FORCES STRUCTURE TYPE = SPACE  
 ALL UNITS ARE -- KIP FEET

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MON-Y	MON-Z
2	2	2	17.61	103.91	0.00	0.00	0.00	328.62
3	3	3	-17.61	103.91	0.00	0.00	0.00	-328.45
11	2	8	8.95	59.31	0.00	0.00	0.00	168.38
3	3	3	-8.95	47.15	0.00	0.00	0.00	-95.44
12	2	8	8.96	47.20	0.00	0.00	0.00	95.49
3	3	3	-8.96	59.30	0.00	0.00	0.00	-168.33
13	2	9	9.95	58.10	0.00	0.00	0.00	134.13
3	3	3	-9.95	58.10	0.00	0.00	0.00	-134.08
14	2	7	7.06	46.73	0.00	0.00	0.00	132.60
3	3	3	-7.06	37.17	0.00	0.00	0.00	-75.19
15	2	7	7.06	37.17	0.00	0.00	0.00	75.23
3	3	3	-7.06	46.73	0.00	0.00	0.00	-132.56
4	2	4	1.18	10.22	1.91	0.00	4.60	94.26
3	3	3	-1.18	-10.22	1.91	0.00	-4.60	-94.28
5	2	2	0.00	1.68	0.00	0.00	0.70	15.45
3	3	3	0.00	-1.68	0.00	0.00	-0.70	-15.45
6	2	2	0.00	0.00	0.00	0.00	1.72	0.00
3	3	3	0.00	0.00	0.00	0.00	-1.72	0.00
7	2	2	-1.12	0.00	0.00	0.00	0.00	-4.49
3	3	3	1.12	0.00	0.00	0.00	0.00	4.49
8	2	2	0.00	0.00	0.00	0.00	0.00	0.00
3	3	3	0.00	0.00	0.00	0.00	0.00	0.00
10	2	2	0.00	0.00	0.00	0.00	0.00	0.00
3	3	3	0.00	0.00	0.00	0.00	0.00	0.00
20	2	2	0.18	10.22	1.91	0.00	4.60	94.26
3	3	3	-0.18	-10.22	1.91	0.00	-4.60	-94.28
5	2	2	0.00	1.68	0.00	0.00	0.70	15.45
3	3	3	0.00	-1.68	0.00	0.00	-0.70	-15.45
6	2	2	0.00	0.00	0.00	0.00	1.72	0.00
3	3	3	0.00	0.00	0.00	0.00	-1.72	0.00
7	2	2	-1.12	0.00	0.00	0.00	0.00	-4.49
3	3	3	1.12	0.00	0.00	0.00	0.00	4.49
8	2	2	0.00	0.00	0.00	0.00	0.00	0.00
3	3	3	0.00	0.00	0.00	0.00	0.00	0.00
10	2	2	0.00	0.00	0.00	0.00	0.00	0.00
3	3	3	0.00	0.00	0.00	0.00	0.00	0.00
20	2	2	0.18	10.22	1.91	0.00	4.60	94.26
3	3	3	-0.18	-10.22	1.91	0.00	-4.60	-94.28
5	2	2	0.00	1.68	0.00	0.00	0.70	15.45
3	3	3	0.00	-1.68	0.00	0.00	-0.70	-15.45
6	2	2	0.00	0.00	0.00	0.00	1.72	0.00
3	3	3	0.00	0.00	0.00	0.00	-1.72	0.00
7	2	2	-1.12	0.00	0.00	0.00	0.00	-4.49
3	3	3	1.12	0.00	0.00	0.00	0.00	4.49
8	2	2	0.00	0.00	0.00	0.00	0.00	0.00
3	3	3	0.00	0.00	0.00	0.00	0.00	0.00
10	2	2	0.00	0.00	0.00	0.00	0.00	0.00
3	3	3	0.00	0.00	0.00	0.00	0.00	0.00
20	2	2	0.18	10.22	1.91	0.00	4.60	94.26
3	3	3	-0.18	-10.22	1.91	0.00	-4.60	-94.28

*Handwritten notes:*  
 - Max. Neg. MoM  
 - Max. Neg. Shear-Z

*Handwritten note:*  
 Val

MEMBER END FORCES STRUCTURE TYPE = SPACE  
 ALL UNITS ARE -- KIP FEET

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MON-Y	MON-Z
4	2	4	10.64	6.29	10.37	7.03	-0.45	94.26
5	2	5	-10.77	-8.42	-14.05	-7.03	-253.50	58.64
5	2	5	1.76	1.21	1.48	0.70	-0.04	15.45
5	2	5	-1.76	-1.21	-1.48	-0.70	-30.66	9.80
6	2	6	0.00	0.00	3.62	1.72	-0.11	0.00
5	2	5	0.00	0.00	-3.62	-1.72	-75.26	0.00
7	2	7	-0.07	-1.12	0.00	0.00	0.00	-4.49
5	2	5	0.07	1.12	0.00	0.00	0.00	-18.74
8	2	8	0.00	0.00	0.00	0.00	0.00	0.00
5	2	5	0.00	0.00	0.00	0.00	0.00	0.00
10	2	10	0.00	0.00	0.00	0.00	0.00	0.00
5	2	5	0.00	0.00	0.00	0.00	0.00	0.00
20	2	20	10.64	6.29	10.37	7.03	-0.45	94.26
5	2	5	-10.77	-8.42	-14.05	-7.03	-253.50	58.64
30	2	30	4.95	3.10	8.21	4.53	-0.29	43.73
5	2	5	-4.99	-3.74	-9.32	-4.53	-181.97	27.39
40	2	40	-0.12	-1.94	0.00	0.00	0.00	-7.81
5	2	5	0.12	1.94	0.00	0.00	0.00	32.61
50	2	50	10.52	4.34	10.37	7.03	-0.45	86.45
5	2	5	-10.65	-6.48	-14.05	-7.03	-253.50	26.03
60	2	60	4.82	1.16	8.21	4.53	-0.29	35.92
5	2	5	-4.86	-1.80	-9.32	-4.53	-181.97	-5.21
100	2	100	336.60	13.20	0.00	0.00	0.00	189.86
5	2	5	-364.91	-11.42	0.00	0.00	0.00	66.07
5	2	5	206.36	4.71	0.00	0.00	0.00	55.76
6	2	6	-234.68	-2.94	0.00	0.00	0.00	23.74
11	3	11	47.66	5.99	0.00	0.00	0.00	95.44
6	2	6	-47.66	-5.99	0.00	0.00	0.00	-29.03
12	3	12	108.05	2.20	0.00	0.00	0.00	33.78
6	2	6	-108.05	-2.20	0.00	0.00	0.00	12.03
13	3	13	77.97	5.08	0.00	0.00	0.00	80.15
6	2	6	-77.97	-5.08	0.00	0.00	0.00	-25.52
14	3	14	37.54	4.72	0.00	0.00	0.00	75.19
6	2	6	-37.54	-4.72	0.00	0.00	0.00	-22.88
15	3	15	85.10	1.74	0.00	0.00	0.00	26.64
6	2	6	-85.10	-1.74	0.00	0.00	0.00	-9.48
4	3	4	10.64	6.29	10.37	7.03	0.44	-94.28
6	2	6	-10.77	-8.42	-14.05	-7.03	253.51	-58.66
5	3	5	1.76	1.21	1.48	0.70	0.04	-15.45
6	2	6	-1.76	-1.21	-1.48	-0.70	30.66	-9.80
6	2	6	0.00	0.00	-3.63	-1.72	0.11	0.00
6	2	6	0.00	0.00	3.63	1.72	75.26	0.00
7	3	7	-0.07	-1.12	0.00	0.00	0.00	-4.49
6	2	6	0.07	1.12	0.00	0.00	0.00	-18.74
8	3	8	0.00	0.00	0.00	0.00	0.00	0.00
6	2	6	0.00	0.00	0.00	0.00	0.00	0.00
10	3	10	0.00	0.00	0.00	0.00	0.00	0.00
6	2	6	0.00	0.00	0.00	0.00	0.00	0.00
20	3	20	10.64	6.29	10.37	7.03	-0.45	94.26
6	2	6	-10.77	-8.42	-14.05	-7.03	-253.51	58.66

MEMBER END FORCES STRUCTURE TYPE = SPACE  
 ALL UNITS ARE -- KIP FEET

MEMBER END FORCES STRUCTURE TYPE = SPACE  
 ALL UNITS ARE -- KIP FEET

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
30	3		-4.95	-3.10	-8.21	-4.53	0.28	-43.74
4	3		4.99	3.74	9.32	4.53	181.98	-27.40
5	3		-0.12	-1.94	0.00	0.00	0.00	-7.81
6	3		0.12	1.94	0.00	0.00	0.00	-32.61
7	3		-10.76	-8.23	-10.37	-7.03	0.44	-102.09
8	3		10.89	10.37	14.05	7.03	253.51	-91.27
9	3		-5.07	-5.05	-8.21	-4.53	0.28	-51.55
10	3		5.11	5.69	9.32	4.53	181.98	-60.01
11	3		336.57	13.20	0.00	0.00	0.00	189.61
12	3		-364.89	-11.42	0.00	0.00	0.00	66.35
13	2		0.50	11.87	0.00	0.00	0.00	39.93
14	2		-0.50	-11.75	0.00	0.00	0.00	-39.09
15	2		-5.09	-2.34	0.00	0.00	0.00	-19.51
16	2		5.09	2.34	0.00	0.00	0.00	29.72
17	2		-5.08	2.36	0.00	0.00	0.00	-29.97
18	2		5.08	-2.36	0.00	0.00	0.00	19.76
19	2		-6.30	-0.01	0.00	0.00	0.00	6.52
20	2		6.30	0.01	0.00	0.00	0.00	-6.27
21	2		-4.01	-1.84	0.00	0.00	0.00	-15.37
22	2		4.01	1.84	0.00	0.00	0.00	23.42
23	2		-4.00	1.86	0.00	0.00	0.00	-23.61
24	2		4.00	-1.86	0.00	0.00	0.00	15.57
25	2		0.00	12.27	1.86	-0.01	0.60	129.13
26	2		0.00	-12.27	-1.86	0.00	-0.66	-129.13
27	2		0.00	1.72	0.00	0.00	0.33	18.10
28	2		0.00	-1.72	0.00	0.00	-0.34	-18.10
29	2		0.00	0.00	0.00	0.00	0.81	0.00
30	2		0.00	0.00	0.00	0.00	-0.82	0.00
31	2		10.77	0.00	0.00	0.00	0.00	9.58
32	2		-10.77	0.00	0.00	0.00	0.00	-9.60
33	2		0.00	0.00	0.00	0.00	0.00	0.00
34	2		0.00	0.00	0.00	0.00	0.00	0.00
35	2		0.00	0.00	0.00	0.00	0.00	0.00
36	2		0.00	0.00	0.00	0.00	0.00	0.00
37	2		0.00	0.00	0.00	0.00	0.00	0.00
38	2		0.00	0.00	0.00	0.00	0.00	0.00
39	2		0.00	0.00	0.00	0.00	0.00	0.00
40	2		0.00	0.00	0.00	0.00	0.00	0.00
41	2		0.00	0.00	0.00	0.00	0.00	0.00
42	2		0.00	0.00	0.00	0.00	0.00	0.00
43	2		0.00	0.00	0.00	0.00	0.00	0.00
44	2		0.00	0.00	0.00	0.00	0.00	0.00
45	2		0.00	0.00	0.00	0.00	0.00	0.00
46	2		0.00	0.00	0.00	0.00	0.00	0.00
47	2		0.00	0.00	0.00	0.00	0.00	0.00
48	2		0.00	0.00	0.00	0.00	0.00	0.00
49	2		0.00	0.00	0.00	0.00	0.00	0.00
50	2		0.00	0.00	0.00	0.00	0.00	0.00
51	2		0.00	0.00	0.00	0.00	0.00	0.00
52	2		0.00	0.00	0.00	0.00	0.00	0.00
53	2		0.00	0.00	0.00	0.00	0.00	0.00
54	2		0.00	0.00	0.00	0.00	0.00	0.00
55	2		0.00	0.00	0.00	0.00	0.00	0.00
56	2		0.00	0.00	0.00	0.00	0.00	0.00
57	2		0.00	0.00	0.00	0.00	0.00	0.00
58	2		0.00	0.00	0.00	0.00	0.00	0.00
59	2		0.00	0.00	0.00	0.00	0.00	0.00
60	2		0.00	0.00	0.00	0.00	0.00	0.00
61	2		0.00	0.00	0.00	0.00	0.00	0.00
62	2		0.00	0.00	0.00	0.00	0.00	0.00
63	2		0.00	0.00	0.00	0.00	0.00	0.00
64	2		0.00	0.00	0.00	0.00	0.00	0.00
65	2		0.00	0.00	0.00	0.00	0.00	0.00
66	2		0.00	0.00	0.00	0.00	0.00	0.00
67	2		0.00	0.00	0.00	0.00	0.00	0.00
68	2		0.00	0.00	0.00	0.00	0.00	0.00
69	2		0.00	0.00	0.00	0.00	0.00	0.00
70	2		0.00	0.00	0.00	0.00	0.00	0.00
71	2		0.00	0.00	0.00	0.00	0.00	0.00
72	2		0.00	0.00	0.00	0.00	0.00	0.00
73	2		0.00	0.00	0.00	0.00	0.00	0.00
74	2		0.00	0.00	0.00	0.00	0.00	0.00
75	2		0.00	0.00	0.00	0.00	0.00	0.00
76	2		0.00	0.00	0.00	0.00	0.00	0.00
77	2		0.00	0.00	0.00	0.00	0.00	0.00
78	2		0.00	0.00	0.00	0.00	0.00	0.00
79	2		0.00	0.00	0.00	0.00	0.00	0.00
80	2		0.00	0.00	0.00	0.00	0.00	0.00
81	2		0.00	0.00	0.00	0.00	0.00	0.00
82	2		0.00	0.00	0.00	0.00	0.00	0.00
83	2		0.00	0.00	0.00	0.00	0.00	0.00
84	2		0.00	0.00	0.00	0.00	0.00	0.00
85	2		0.00	0.00	0.00	0.00	0.00	0.00
86	2		0.00	0.00	0.00	0.00	0.00	0.00
87	2		0.00	0.00	0.00	0.00	0.00	0.00
88	2		0.00	0.00	0.00	0.00	0.00	0.00
89	2		0.00	0.00	0.00	0.00	0.00	0.00
90	2		0.00	0.00	0.00	0.00	0.00	0.00
91	2		0.00	0.00	0.00	0.00	0.00	0.00
92	2		0.00	0.00	0.00	0.00	0.00	0.00
93	2		0.00	0.00	0.00	0.00	0.00	0.00
94	2		0.00	0.00	0.00	0.00	0.00	0.00
95	2		0.00	0.00	0.00	0.00	0.00	0.00
96	2		0.00	0.00	0.00	0.00	0.00	0.00
97	2		0.00	0.00	0.00	0.00	0.00	0.00
98	2		0.00	0.00	0.00	0.00	0.00	0.00
99	2		0.00	0.00	0.00	0.00	0.00	0.00
100	2		0.00	0.00	0.00	0.00	0.00	0.00

Max. Neg. Mol  
 Max. Neg. Mol + Z

MEMBER END FORCES STRUCTURE TYPE = SPACE ALL UNITS ARE -- KIP FEET

Table with columns: MEMBER, LOAD, JT, AXIAL, SHEAR-Y, SHEAR-Z, TORSION, MOM-Y, MOM-Z. Contains force data for members 7 through 10.

MEMBER END FORCES STRUCTURE TYPE = SPACE ALL UNITS ARE -- KIP FEET

Table with columns: MEMBER, LOAD, JT, AXIAL, SHEAR-Y, SHEAR-Z, TORSION, MOM-Y, MOM-Z. Contains force data for members 6 through 15.

\*\*\*\*\* END OF LATEST ANALYSIS RESULT \*\*\*\*\*

134. SECTION 0.54 MEMB 10 11
135. PRINT MEMBER SECTION FORCES LIST 10 11



H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 4 JT. 2

JMJ Jun-06  
 Jun-06  
 WBE

**COLUMN LOADS**

				<b>PMAX</b>					
				HLB 137	MEMBER 4	JOINT 2			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	206.38	0.00	55.93		DL	206.38	0.00	55.93	
LL	108.06	0.00	33.83		LL	0.00	0.00	0.00	
GROUP 1	0.00	0.00	0.00		GROUP 2	10.64	-0.45	94.26	
SERVICE	314.44	0.00	89.76		SERVICE	217.02	-0.45	150.19	
STRENGTH	502.42	0.00	146.01		STRENGTH	282.13	-0.59	195.25	
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	206.38	0.00	55.93		DL	206.38	0.00	55.93	
LL	108.06	0.00	33.83		LL	108.06	0.00	33.83	
GROUP 3	4.95	-0.29	43.73		GROUP 4	-0.12	0.00	-7.81	
SERVICE	319.39	-0.29	133.49		SERVICE	314.32	0.00	81.95	
STRENGTH	415.21	-0.38	173.54		STRENGTH	408.62	0.00	106.54	
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	206.38	0.00	55.93		DL	206.38	0.00	55.93	
LL	0.00	0.00	0.00		LL	108.06	0.00	33.83	
GROUP 5	10.52	-0.45	86.45		GROUP 6	4.82	-0.29	35.92	
SERVICE	216.90	-0.45	142.38		SERVICE	319.26	-0.29	125.68	
STRENGTH	271.13	-0.56	177.98		STRENGTH	399.08	-0.36	157.10	

**SLENDERNESSE EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\Phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	10.94	In.	Depth of Rect. Col =	D =	36.468	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	11.5	Ft.	$K_y =$	2.0
			$L_z =$	19	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	145207	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	140939	In <sup>5</sup>		
$K_y L_y / r$	=	25.2	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	25.4	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 4 JT. 2

JMJ Jun-06  
 WPB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	*
MY	35.928	36.468	25.2	0.00	0.00	0.000	502	24989	1.030	1.030	71	*
MZ	35.928	36.468	25.4	146.01	72.71	0.498	502	16476	1.046	1.046	153	

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	*
MY	35.928	36.468	25.2	0.59	0.00	0.000	282	24989	1.016	1.016	40	*
MZ	35.928	36.468	25.4	195.25	72.71	0.372	282	17984	1.023	1.023	200	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	*
MY	35.928	36.468	25.2	0.38	0.00	0.000	415	24989	1.024	1.024	59	*
MZ	35.928	36.468	25.4	173.54	72.71	0.419	415	17394	1.035	1.035	180	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	*
MY	35.928	36.468	25.2	0.00	0.00	0.000	409	24989	1.024	1.024	58	*
MZ	35.928	36.468	25.4	106.54	72.71	0.682	409	14670	1.041	1.041	111	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	*
MY	35.928	36.468	25.2	0.56	0.00	0.000	271	24989	1.016	1.016	38	*
MZ	35.928	36.468	25.4	177.98	72.71	0.409	271	17523	1.023	1.023	182	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	*
MY	35.928	36.468	25.2	0.36	0.00	0.000	399	24989	1.023	1.023	56	*
MZ	35.928	36.468	25.4	157.10	72.71	0.463	399	16872	1.035	1.035	163	

\* MINIMUM MOMENT CONTROLS



PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 4 JT. 2

JMJ Jun-06  
 WLB Jun-06

**COLUMN LOADS**

				P MIN					
				HLB 137	MEMBER 4	JOINT 2			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	154.79	0.00	55.93	DL	154.79	0.00	55.93		
LL	47.66	0.00	95.49	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	10.64	-0.45	94.26		
SERVICE	202.45	0.00	151.42	SERVICE	165.43	-0.45	150.19		
STRENGTH	304.48	0.00	279.60	STRENGTH	215.05	-0.59	195.25		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	154.79	0.00	55.93	DL	154.79	0.00	55.93		
LL	47.66	0.00	95.49	LL	47.66	0.00	95.49		
GROUP 3	4.95	-0.29	43.73	GROUP 4	-0.12	0.00	-7.81		
SERVICE	207.40	-0.29	195.15	SERVICE	202.33	0.00	143.61		
STRENGTH	269.61	-0.38	253.70	STRENGTH	263.02	0.00	186.69		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	154.79	0.00	55.93	DL	154.79	0.00	55.93		
LL	0.00	0.00	0.00	LL	47.66	0.00	95.49		
GROUP 5	10.52	-0.45	86.45	GROUP 6	4.82	-0.29	35.92		
SERVICE	165.31	-0.45	142.38	SERVICE	207.27	-0.29	187.34		
STRENGTH	206.63	-0.56	177.98	STRENGTH	259.08	-0.36	234.18		

**SLENDERNESSE EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\Phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	10.94	In.	Depth of Rect. Col. =	D =	36.468	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	11.5	Ft.	$K_y =$	2.0
			$L_z =$	19	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	145207	$\text{In}^4$		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	140939	$\text{In}^5$		
$K_y L_y / r$	=	25.2	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	25.4	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 4 JT. 2

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	304	24989	1.018	1.018	43	*
MZ	35.928	36.468	25.4	279.60	72.71	0.260	304	19588	1.023	1.023	286	

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.59	0.00	0.000	215	24989	1.012	1.012	30	*
MZ	35.928	36.468	25.4	195.25	72.71	0.372	215	17984	1.017	1.017	199	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.38	0.00	0.000	270	24989	1.016	1.016	38	*
MZ	35.928	36.468	25.4	253.70	72.71	0.287	270	19183	1.020	1.020	259	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	263	24989	1.015	1.015	37	*
MZ	35.928	36.468	25.4	186.69	72.71	0.389	263	17763	1.022	1.022	191	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.56	0.00	0.000	207	24989	1.012	1.012	29	*
MZ	35.928	36.468	25.4	177.98	72.71	0.409	207	17523	1.017	1.017	181	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.36	0.00	0.000	259	24989	1.015	1.015	37	*
MZ	35.928	36.468	25.4	234.18	72.71	0.310	259	18834	1.020	1.020	239	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 4 JT. 5

JMJ Jun-06  
 WDE Jun-06

**COLUMN LOADS**

		HLB 137			P MEMBER 4			JOINT 5		
		<u>GROUP 1</u>				<u>GROUP 2</u>				
		P	MY	MZ		P	MY	MZ		
DL		-234.70	0.00	23.55	DL	-234.70	0.00	23.55		
LL		-108.06	0.00	11.96	LL	0.00	0.00	0.00		
GROUP 1		0.00	0.00	0.00	GROUP 2	-10.77	-253.50	58.64		
SERVICE		-342.76	0.00	35.51	SERVICE	-245.47	-253.50	82.19		
STRENGTH		-539.24	0.00	56.53	STRENGTH	-319.11	-329.55	106.85		
		<u>GROUP 3</u>				<u>GROUP 4</u>				
		P	MY	MZ		P	MY	MZ		
DL		-234.70	0.00	23.55	DL	-234.70	0.00	23.55		
LL		-108.06	0.00	11.96	LL	-108.06	0.00	11.96		
GROUP 3		-4.99	-181.97	27.39	GROUP 4	0.12	0.00	-32.61		
SERVICE		-347.75	-181.97	62.90	SERVICE	-342.64	0.00	2.90		
STRENGTH		-452.08	-236.56	81.77	STRENGTH	-445.43	0.00	3.77		
		<u>GROUP 5</u>				<u>GROUP 6</u>				
		P	MY	MZ		P	MY	MZ		
DL		-234.70	0.00	23.55	DL	-234.70	0.00	23.55		
LL		0.00	0.00	0.00	LL	-108.06	0.00	11.96		
GROUP 5		-10.65	-253.50	26.03	GROUP 6	-4.86	-181.97	-5.21		
SERVICE		-245.35	-253.50	49.58	SERVICE	-347.62	-181.97	30.30		
STRENGTH		-306.69	-316.88	61.98	STRENGTH	-434.53	-227.46	37.88		

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	10.94	In.	Depth of Rect. Col. =	D =	36.468	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	11.5	Ft.	$K_y =$	2.0
			$L_z =$	19	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	145207	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	140939	In <sup>5</sup>		
$K_y L_y / r$	=	25.2	>	22	CONSIDER SLENDERNESS		
$K_z L_z / r$	=	25.4	>	22	CONSIDER SLENDERNESS		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 4 JT. 5

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	539	24989	1.032	1.032	76	*
MZ	35.928	36.468	25.4	56.53	30.62	0.542	539	16010	1.051	1.051	75	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	329.55	0.00	0.000	319	24989	1.019	1.019	336	
MZ	35.928	36.468	25.4	106.85	30.62	0.287	319	19184	1.024	1.024	109	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	236.56	0.00	0.000	452	24989	1.027	1.027	243	
MZ	35.928	36.468	25.4	81.77	30.62	0.374	452	17958	1.037	1.037	85	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	445	24989	1.026	1.026	63	*
MZ	35.928	36.468	25.4	3.77	30.62	8.121	445	2706	1.307	1.307	62	*

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	316.88	0.00	0.000	307	24989	1.018	1.018	323	
MZ	35.928	36.468	25.4	61.98	30.62	0.494	307	16520	1.027	1.027	64	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	227.46	0.00	0.000	435	24989	1.025	1.025	233	
MZ	35.928	36.468	25.4	37.88	30.62	0.808	435	13649	1.048	1.048	61	*

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 4 JT. 5

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

	HLB 137			MEMBER 4			JOINT 5		
	<u>GROUP 1</u>			<u>GROUP 2</u>			<u>GROUP 2</u>		
	P	MY	MZ	P	MY	MZ	P	MY	MZ
DL	-176.03	0.00	23.55	DL	-176.03	0.00	DL	-176.03	23.55
LL	-47.66	0.00	28.98	LL	0.00	0.00	LL	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	-10.77	-253.50	GROUP 2	-10.77	58.64
SERVICE STRENGTH	-223.69	0.00	52.53	SERVICE STRENGTH	-186.80	-253.50	SERVICE STRENGTH	-186.80	82.19
	-332.10	0.00	93.41		-242.83	-329.55		-242.83	106.85
	<u>GROUP 3</u>			<u>GROUP 4</u>			<u>GROUP 4</u>		
	P	MY	MZ	P	MY	MZ	P	MY	MZ
DL	-176.03	0.00	23.55	DL	-176.03	0.00	DL	-176.03	23.55
LL	-47.66	0.00	28.98	LL	-47.66	0.00	LL	-47.66	28.98
GROUP 3	-4.99	-181.97	27.39	GROUP 4	0.12	0.00	GROUP 4	0.12	-32.61
SERVICE STRENGTH	-228.68	-181.97	79.92	SERVICE STRENGTH	-223.57	0.00	SERVICE STRENGTH	-223.57	19.92
	-297.28	-236.56	103.90		-290.63	0.00		-290.63	25.90
	<u>GROUP 5</u>			<u>GROUP 6</u>			<u>GROUP 6</u>		
	P	MY	MZ	P	MY	MZ	P	MY	MZ
DL	-176.03	0.00	23.55	DL	-176.03	0.00	DL	-176.03	23.55
LL	0.00	0.00	0.00	LL	-47.66	0.00	LL	-47.66	28.98
GROUP 5	-10.65	-253.50	26.03	GROUP 6	-4.86	-181.97	GROUP 6	-4.86	-5.21
SERVICE STRENGTH	-186.68	-253.50	49.58	SERVICE STRENGTH	-228.55	-181.97	SERVICE STRENGTH	-228.55	47.32
	-233.34	-316.88	61.98		-285.68	-227.46		-285.68	59.15

**SLENDERNESSE EFFECTS IN COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	10.94	In.	Depth of Rect. Col. =	D =	36.468	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	11.5	Ft.	$K_y =$	2.0
			$L_z =$	19	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	145207	$\text{In}^4$		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	140939	$\text{In}^5$		
$K_y L_y / r$	=	25.2	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	25.4	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 4 JT. 5

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	332	24989	1.019	1.019	47	*
MZ	35.928	36.468	25.4	93.41	30.62	0.328	332	18589	1.026	1.026	96	

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	329.55	0.00	0.000	243	24989	1.014	1.014	334	
MZ	35.928	36.468	25.4	106.85	30.62	0.287	243	19184	1.018	1.018	109	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	236.56	0.00	0.000	297	24989	1.017	1.017	241	
MZ	35.928	36.468	25.4	103.90	30.62	0.295	297	19064	1.023	1.023	106	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	291	24989	1.017	1.017	41	*
MZ	35.928	36.468	25.4	25.90	30.62	1.182	291	11310	1.038	1.038	41	*

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	316.88	0.00	0.000	233	24989	1.014	1.014	321	
MZ	35.928	36.468	25.4	61.98	30.62	0.494	233	16520	1.021	1.021	63	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	227.46	0.00	0.000	286	24989	1.017	1.017	231	
MZ	35.928	36.468	25.4	59.15	30.62	0.518	286	16264	1.026	1.026	61	

\* MINIMUM MOMENT CONTROLS

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JMS 7/06  
WDB 7/06

=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
=====

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*BASED ON PLANS*

General Information:

=====

File Name: S:\DGN-ST\NORTH-C~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M4PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====

f'c = 3 ksi fy = 40 ksi  
 Ec = 3122.02 ksi Es = 29000 ksi  
 fc = 2.55 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.85

Section:

=====

Rectangular: Width = 36 in Depth = 36.5 in  
 Gross section area, Ag = 1314 in<sup>2</sup>  
 Ix = 145881 in<sup>4</sup> Iy = 141912 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====

Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular

Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)

Total steel area, As = 28.08 in<sup>2</sup> at 2.14%

18 #11 Cover = 5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

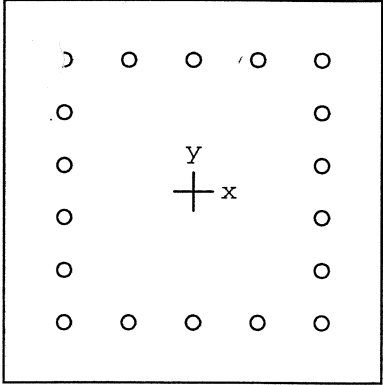
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No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	502.0	71.0	153.0	515.1	1106.0	7.233
2	282.0	40.0	200.0	238.0	1189.6	5.948
3	415.0	59.0	180.0	372.0	1132.5	6.293
4	409.0	58.0	111.0	540.8	1038.0	9.346
5	271.0	38.0	182.0	247.9	1186.6	6.520
6	399.0	56.0	163.0	385.0	1116.3	6.851
7	304.0	43.0	286.0	181.5	1205.5	4.215
8	215.0	30.0	199.0	181.7	1199.6	6.029
9	270.0	38.0	259.0	176.0	1208.0	4.663
10	263.0	37.0	191.0	231.1	1191.7	6.239
11	207.0	29.0	181.0	192.6	1196.2	6.610
12	259.0	37.0	239.0	185.7	1205.0	5.041
13	539.0	76.0	75.0	851.0	838.4	11.188
14	319.0	339.0	109.0	1137.9	366.0	3.357
15	452.0	243.0	85.0	1130.0	393.6	4.648



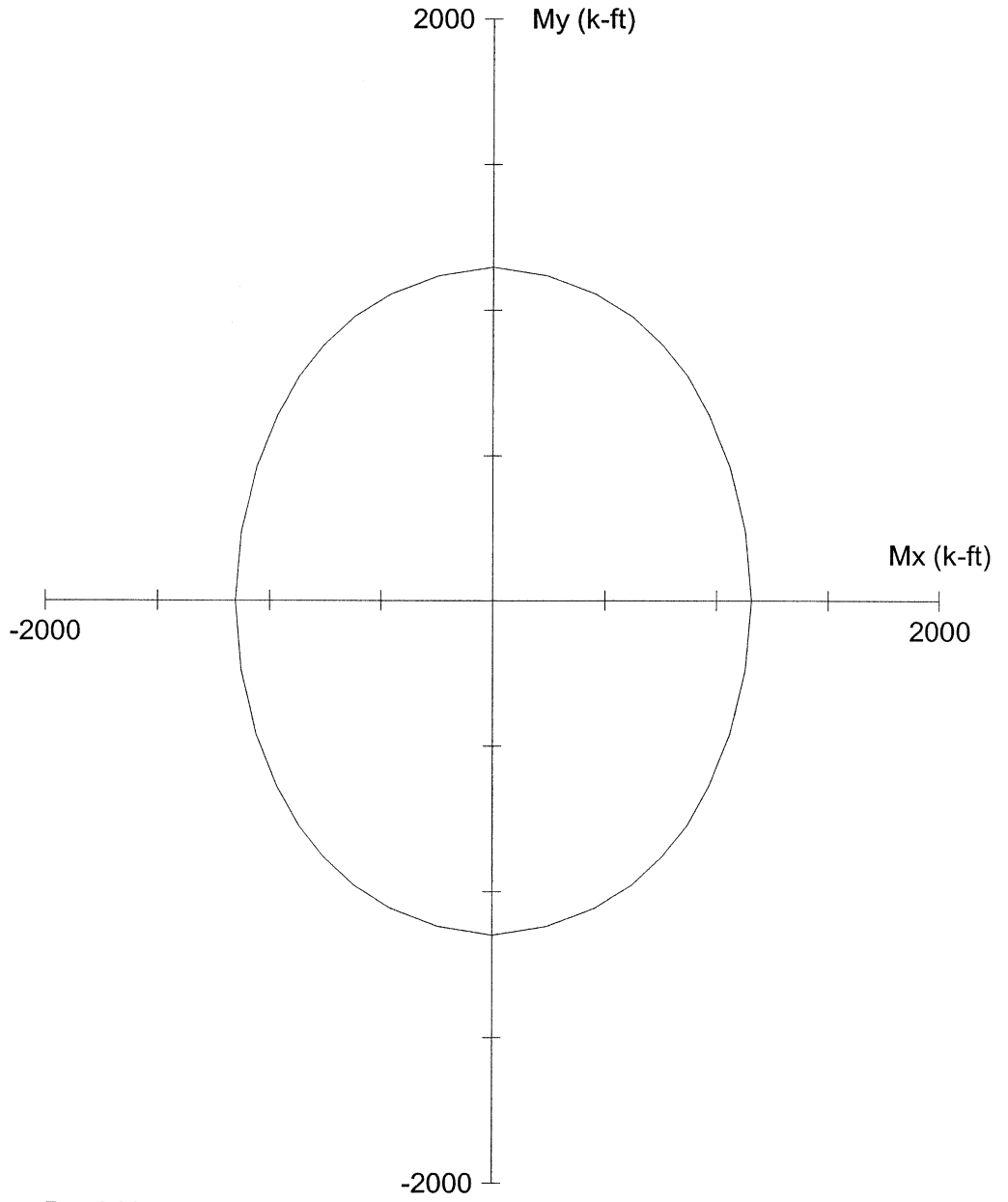
16	445.0	63.0	62.0	828.1	813.7	13.134
17	307.0	323.0	64.0	1188.7	234.2	3.679
18	435.0	233.0	61.0	1161.4	304.6	4.985
19	332.0	47.0	96.0	518.7	1064.0	11.075
20	243.0	334.0	109.0	1139.4	371.5	3.411
21	297.0	241.0	106.0	1088.8	480.1	4.520
22	291.0	41.0	41.0	831.6	831.7	20.284
23	233.0	321.0	63.0	1185.3	234.2	3.693
24	286.0	231.0	61.0	1163.8	307.8	5.039

\*\*\* Program completed as requested! \*\*\*



36 x 36.5 in

Code: ACI 318-95  
 Units: English  
 Run axis: Biaxial  
 Run option: Investigation  
 Slenderness: Not considered  
 Column type: Structural  
 Bars: User-defined  
 Date: 07/19/06  
 Time: 15:13:24



P = 0 kip

PCACOL V3.00 (PCA 1999) - Licensed to: Licensee name not yet specified.

File: S:\DGN-ST\NORTHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M4PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 1314$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 2.14%

$f_c = 2.55$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 145881$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 141912$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 3.61 in

Clear cover = 5.00 in

Confinement: Tied

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

```
0000000  00000  00000  00000  00000  00
00  00  00  00  00  00  00  00  00  00  00
00  00  00  00  00  00  00  00  00  00  00
00  00  00  00  00  00  00  00  00  00  00
00  00  00  0000000  00  00  00  00
0000000  00  00  00  00  00  00  00  00  00  00
00  00  00  00  00  00  00  00  00  00  00
00  00000  00  00  00000  00000  00000  (TM)
```

JM) 7/06  
WDB 7/06

=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
=====

Licensee stated above acknowledges that Portland Cement Association (PCA) is not and cannot be responsible for either the accuracy or adequacy of the material supplied as input for processing by the PCACOL(tm) computer program. Furthermore, PCA neither makes any warranty expressed nor implied with respect to the correctness of the output prepared by the PCACOL(tm) program. Although PCA has endeavored to produce PCACOL(tm) error free, the program is not and can't be certified infallible. The final and only responsibility for analysis, design and engineering documents is the licensees. Accordingly, PCA disclaims all responsibility in contract, negligence or other tort for any analysis, design or engineering documents prepared in connection with the use of the PCACOL(tm) program.

50% COVER LOSS  
f<sub>c</sub> = 4400 PSI

General Information:

=====

File Name: S:\DGN-ST\NORTH~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M4ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====

f'c = 4.4 ksi fy = 40 ksi  
 Ec = 3780.96 ksi Es = 29000 ksi  
 fc = 3.74 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.83

Section:

=====

Rectangular: Width = 31 in Depth = 31.5 in  
 Gross section area, Ag = 976.5 in<sup>2</sup>  
 Ix = 80744.3 in<sup>4</sup> Iy = 78201.4 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====

Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular

Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)

Total steel area, As = 28.08 in<sup>2</sup> at 2.88%

18 #11 Cover = 2.5 in

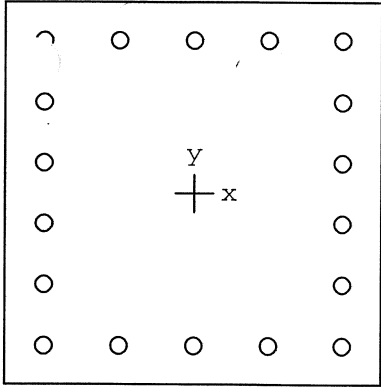
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	502.0	71.0	153.0	488.7	1048.3	6.857
2	282.0	40.0	200.0	227.0	1136.2	5.681
3	415.0	59.0	180.0	354.3	1081.4	6.008
4	409.0	58.0	111.0	521.3	995.4	8.972
5	271.0	38.0	182.0	238.0	1132.1	6.222
6	399.0	56.0	163.0	371.0	1078.0	6.615
7	304.0	43.0	286.0	171.6	1153.9	4.034
8	215.0	30.0	199.0	172.0	1140.4	5.730
9	270.0	38.0	259.0	168.2	1150.7	4.443
10	263.0	37.0	191.0	220.1	1137.3	5.954
11	207.0	29.0	181.0	182.3	1136.6	6.280
12	259.0	37.0	239.0	177.2	1147.2	4.800
13	539.0	76.0	75.0	809.7	797.0	10.640
14	319.0	339.0	109.0	1087.5	350.7	3.209
15	452.0	243.0	85.0	1071.0	376.1	4.409

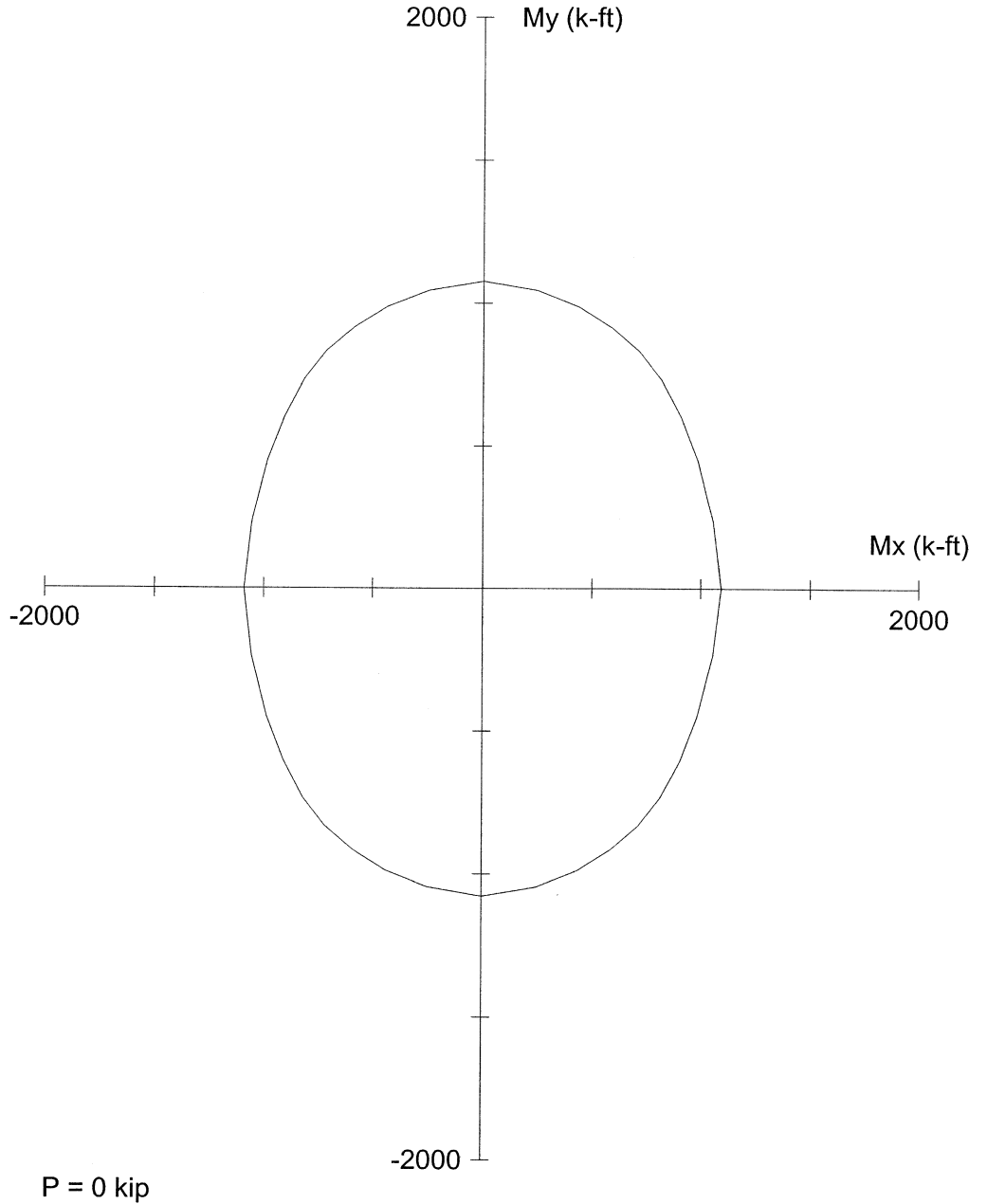
16	445.0	63.0	62.0	786.0	771.2	12.458
17	307.0	323.0	64.0	1131.6	224.2	3.503
18	435.0	233.0	61.0	1096.8	287.7	4.708
19	332.0	47.0	96.0	501.1	1022.6	10.654
20	243.0	334.0	109.0	1083.8	353.0	3.244
21	297.0	241.0	106.0	1041.3	455.9	4.318
22	291.0	41.0	41.0	799.0	799.9	19.498
23	233.0	321.0	63.0	1123.7	220.2	3.500
24	286.0	231.0	61.0	1110.3	293.1	4.807

\*\*\* Program completed as requested! \*\*\*



31 x 31.5 in

Code: ACI 318-95  
 Units: English  
 Run axis: Biaxial  
 Run option: Investigation  
 Slenderness: Not considered  
 Column type: Structural  
 Bars: User-defined  
 Date: 07/25/06  
 Time: 12:36:01



PCACOL V3.00 (PCA 1999) - Licensed to: Licensee name not yet specified.

File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M4ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 976.5$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 2.88%

$f_c = 3.74$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 80744.3$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 78201.4$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 3.61 in

Clear cover = 2.50 in

Confinement: Tied

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 5 JT. 3

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				<b>P MAX</b>					
				HLB 137	MEMBER 5	JOINT 3			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		
DL	206.36	0.00	55.76	DL	206.36	0.00	55.76		
LL	108.05	0.00	33.78	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	-10.64	0.44	-94.28		
SERVICE	314.41	0.00	89.54	SERVICE	195.72	0.44	-38.52		
STRENGTH	502.38	0.00	145.68	STRENGTH	254.44	0.57	-50.08		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		
DL	206.36	0.00	55.76	DL	206.36	0.00	55.76		
LL	108.05	0.00	33.78	LL	108.05	0.00	33.78		
GROUP 3	-4.95	0.28	-43.74	GROUP 4	-0.12	0.00	-7.81		
SERVICE	309.46	0.28	45.80	SERVICE	314.29	0.00	81.73		
STRENGTH	402.30	0.36	59.54	STRENGTH	408.58	0.00	106.25		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		
DL	206.36	0.00	55.76	DL	206.36	0.00	55.76		
LL	0.00	0.00	0.00	LL	108.05	0.00	33.78		
GROUP 5	-10.76	0.44	-102.09	GROUP 6	-5.07	0.28	-51.55		
SERVICE	195.60	0.44	-46.33	SERVICE	309.34	0.28	37.99		
STRENGTH	244.50	0.55	-57.91	STRENGTH	386.68	0.35	47.49		

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	36.468	In.	
$r_y = 0.30 * D =$	10.94	In.	$L_y =$	11.5	Ft.	$K_y =$	2.0
$r_z = 0.30 * B =$	10.78	In.	$L_z =$	19	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	145207	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	140939	In <sup>5</sup>		
$K_y L_y / r$	=	25.2	>	22	CONSIDER SLENDERNESS		
$K_z L_z / r$	=	25.4	>	22	CONSIDER SLENDERNESS		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 5 JT. 3

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	502	24989	1.030	1.030	71	*
MZ	35.928	36.468	25.4	145.68	72.49	0.498	502	16481	1.046	1.046	152	

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.57	0.00	0.000	254	24989	1.015	1.015	36	*
MZ	35.928	36.468	25.4	50.08	72.49	1.448	254	10084	1.037	1.037	52	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.36	0.00	0.000	402	24989	1.024	1.024	57	*
MZ	35.928	36.468	25.4	59.54	72.49	1.217	402	11130	1.054	1.054	63	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	409	24989	1.024	1.024	58	*
MZ	35.928	36.468	25.4	106.25	72.49	0.682	409	14672	1.041	1.041	111	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.55	0.00	0.000	245	24989	1.014	1.014	35	*
MZ	35.928	36.468	25.4	57.91	72.49	1.252	245	10961	1.033	1.033	60	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.35	0.00	0.000	387	24989	1.023	1.023	55	*
MZ	35.928	36.468	25.4	47.49	72.49	1.526	387	9769	1.060	1.060	54	*

\* MINIMUM MOMENT CONTROLS



PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 5 JT. 3

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 137				PMIN MEMBER 5				JOINT 3					
<u>GROUP 1</u>								<u>GROUP 2</u>					
	P	MY	MZ		P	MY	MZ		P	MY	MZ		
DL	154.77	0.00	55.76		DL	154.77	0.00	55.76		DL	154.77	0.00	55.76
LL	47.66	0.00	95.44		LL	0.00	0.00	0.00		LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00		GROUP 2	-10.64	0.44	-94.28		GROUP 2	-10.64	0.44	-94.28
SERVICE STRENGTH	202.43	0.00	151.20		SERVICE STRENGTH	144.13	0.44	-38.52		SERVICE STRENGTH	187.37	0.57	-50.08
	304.46	0.00	279.27										
<u>GROUP 3</u>								<u>GROUP 4</u>					
	P	MY	MZ		P	MY	MZ		P	MY	MZ		
DL	154.77	0.00	55.76		DL	154.77	0.00	55.76		DL	154.77	0.00	55.76
LL	47.66	0.00	95.44		LL	47.66	0.00	95.44		LL	47.66	0.00	95.44
GROUP 3	-4.95	0.28	-43.74		GROUP 4	-0.12	0.00	-7.81		GROUP 4	-0.12	0.00	-7.81
SERVICE STRENGTH	197.48	0.28	107.46		SERVICE STRENGTH	202.31	0.00	143.39		SERVICE STRENGTH	263.00	0.00	186.41
	256.72	0.36	139.70										
<u>GROUP 5</u>								<u>GROUP 6</u>					
	P	MY	MZ		P	MY	MZ		P	MY	MZ		
DL	154.77	0.00	55.76		DL	154.77	0.00	55.76		DL	154.77	0.00	55.76
LL	0.00	0.00	0.00		LL	47.66	0.00	95.44		LL	47.66	0.00	95.44
GROUP 5	-10.76	0.44	-102.09		GROUP 6	-5.07	0.28	-51.55		GROUP 6	-5.07	0.28	-51.55
SERVICE STRENGTH	144.01	0.44	-46.33		SERVICE STRENGTH	197.36	0.28	99.65		SERVICE STRENGTH	246.70	0.35	124.56
	180.01	0.55	-57.91										

**SLENDERNESS EFFECTS IN COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	36.468	In.	
$r_y = 0.30 * D =$	10.94	In.	$L_y =$	11.5	Ft.	$K_y =$	2.0
$r_z = 0.30 * B =$	10.78	In.	$L_z =$	19	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	145207	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	140939	In <sup>5</sup>		
$K_y L_y / r$	=	25.2	>	22	CONSIDER SLENDERNESS		
$K_z L_z / r$	=	25.4	>	22	CONSIDER SLENDERNESS		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 5 JT. 3

JMJ Jun-06  
 WDE Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	304	24989	1.018	1.018	43	*
MZ	35.928	36.468	25.4	279.27	72.49	0.260	304	19595	1.023	1.023	286	

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.57	0.00	0.000	187	24989	1.011	1.011	26	*
MZ	35.928	36.468	25.4	50.08	72.49	1.448	187	10084	1.027	1.027	51	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.36	0.00	0.000	257	24989	1.015	1.015	36	*
MZ	35.928	36.468	25.4	139.70	72.49	0.519	257	16250	1.023	1.023	143	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	263	24989	1.015	1.015	37	*
MZ	35.928	36.468	25.4	186.41	72.49	0.389	263	17771	1.022	1.022	190	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.55	0.00	0.000	180	24989	1.010	1.010	25	*
MZ	35.928	36.468	25.4	57.91	72.49	1.252	180	10961	1.024	1.024	59	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.35	0.00	0.000	247	24989	1.014	1.014	35	*
MZ	35.928	36.468	25.4	124.56	72.49	0.582	247	15602	1.023	1.023	127	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 5 JT. 6

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				<b>P MAX</b>					
				HLB 137	MEMBER 5	JOINT 6			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	-234.68	0.00	23.74	DL	-234.68	0.00	23.74		
LL	-108.05	0.00	12.03	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	10.77	253.51	-58.66		
SERVICE	-342.73	0.00	35.77	SERVICE	-223.91	253.51	-34.92		
STRENGTH	-539.19	0.00	56.93	STRENGTH	-291.08	329.56	-45.40		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	-234.68	0.00	23.74	DL	-234.68	0.00	23.74		
LL	-108.05	0.00	12.03	LL	-108.05	0.00	12.03		
GROUP 3	4.99	181.98	-27.40	GROUP 4	0.12	0.00	-32.61		
SERVICE	-337.74	181.98	8.37	SERVICE	-342.61	0.00	3.16		
STRENGTH	-439.06	236.57	10.88	STRENGTH	-445.39	0.00	4.11		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	-234.68	0.00	23.74	DL	-234.68	0.00	23.74		
LL	0.00	0.00	0.00	LL	-108.05	0.00	12.03		
GROUP 5	10.89	253.51	-91.27	GROUP 6	5.11	181.98	-60.01		
SERVICE	-223.79	253.51	-67.53	SERVICE	-337.62	181.98	-24.24		
STRENGTH	-279.74	316.89	-84.41	STRENGTH	-422.03	227.48	-30.30		

**SLENDERNESSE EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

f <sub>c</sub> =	3000	psi	PHI =	0.70	W <sub>c</sub> =	150	PCF
E <sub>c</sub> = W <sub>c</sub> <sup>1.5</sup> * 33 * f <sub>c</sub> <sup>0.5</sup> =	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col =	D =	36.468	In.	
r <sub>y</sub> = 0.30 * D =	10.94	In.	L <sub>y</sub> =	11.5	Ft.	K <sub>y</sub> =	2.0
r <sub>z</sub> = 0.30 * B =	10.78	In.	L <sub>z</sub> =	19	Ft.	K <sub>z</sub> =	1.2
I <sub>yy</sub> =	B * D <sup>3</sup> / 12		I <sub>yy</sub> =	145207	In <sup>4</sup>		
I <sub>zz</sub> =	D * B <sup>3</sup> / 12		I <sub>zz</sub> =	140939	In <sup>5</sup>		
K <sub>y</sub> L <sub>y</sub> /r	=	25.2	>	22	CONSIDER SLENDERNESSE		
K <sub>z</sub> L <sub>z</sub> /r	=	25.4	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 5 JT. 6

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	539	24989	1.032	1.032	76	*
MZ	35.928	36.468	25.4	56.93	30.86	0.542	539	16005	1.051	1.051	75	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	329.56	0.00	0.000	291	24989	1.017	1.017	335	
MZ	35.928	36.468	25.4	45.40	30.86	0.680	291	14693	1.029	1.029	47	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	236.57	0.00	0.000	439	24989	1.026	1.026	243	
MZ	35.928	36.468	25.4	10.88	30.86	2.836	439	6434	1.108	1.108	61	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	445	24989	1.026	1.026	63	*
MZ	35.928	36.468	25.4	4.11	30.86	7.513	445	2899	1.281	1.281	62	*

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	316.89	0.00	0.000	280	24989	1.016	1.016	322	
MZ	35.928	36.468	25.4	84.41	30.86	0.366	280	18074	1.023	1.023	86	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	227.48	0.00	0.000	422	24989	1.025	1.025	233	
MZ	35.928	36.468	25.4	30.30	30.86	1.019	422	12227	1.052	1.052	59	*

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 5 JT. 6

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 137			MEMBER 5			JOINT 6			
		<u>GROUP 1</u>						<u>GROUP 2</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-176.01	0.00	23.74	DL	-176.01	0.00	23.74	DL	-176.01	0.00	23.74
LL	-47.66	0.00	29.03	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	10.77	253.51	-58.66	GROUP 2	10.77	253.51	-58.66
SERVICE	-223.67	0.00	52.77	SERVICE	-165.24	253.51	-34.92	SERVICE	-165.24	253.51	-34.92
STRENGTH	-332.08	0.00	93.76	STRENGTH	-214.81	329.56	-45.40	STRENGTH	-214.81	329.56	-45.40
		<u>GROUP 3</u>						<u>GROUP 4</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-176.01	0.00	23.74	DL	-176.01	0.00	23.74	DL	-176.01	0.00	23.74
LL	-47.66	0.00	29.03	LL	-47.66	0.00	29.03	LL	-47.66	0.00	29.03
GROUP 3	4.99	181.98	-27.40	GROUP 4	0.12	0.00	-32.61	GROUP 4	0.12	0.00	-32.61
SERVICE	-218.68	181.98	25.37	SERVICE	-223.55	0.00	20.16	SERVICE	-223.55	0.00	20.16
STRENGTH	-284.28	236.57	32.98	STRENGTH	-290.62	0.00	26.21	STRENGTH	-290.62	0.00	26.21
		<u>GROUP 5</u>						<u>GROUP 6</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-176.01	0.00	23.74	DL	-176.01	0.00	23.74	DL	-176.01	0.00	23.74
LL	0.00	0.00	0.00	LL	-47.66	0.00	29.03	LL	-47.66	0.00	29.03
GROUP 5	10.89	253.51	-91.27	GROUP 6	5.11	181.98	-60.01	GROUP 6	5.11	181.98	-60.01
SERVICE	-165.12	253.51	-67.53	SERVICE	-218.56	181.98	-7.24	SERVICE	-218.56	181.98	-7.24
STRENGTH	-206.40	316.89	-84.41	STRENGTH	-273.20	227.48	-9.05	STRENGTH	-273.20	227.48	-9.05

**SLENDERNESSE EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\Phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	10.94	In.	Depth of Rect. Col. =	D =	36.468	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	11.5	Ft.	$K_y =$	2.0
			$L_z =$	19	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	145207	$\text{In}^4$		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	140939	$\text{In}^4$		
$K_y L_y / r$	=	25.2	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	25.4	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 5 JT. 6

JMJ Jun-06  
 WDB : Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	332	24989	1.019	1.019	47	*
MZ	35.928	36.468	25.4	93.76	30.86	0.329	332	18569	1.026	1.026	96	

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	329.56	0.00	0.000	215	24989	1.012	1.012	334	
MZ	35.928	36.468	25.4	45.40	30.86	0.680	215	14693	1.021	1.021	46	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	236.57	0.00	0.000	284	24989	1.017	1.017	240	
MZ	35.928	36.468	25.4	32.98	30.86	0.936	284	12750	1.033	1.033	40	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	0.00	0.00	0.000	291	24989	1.017	1.017	41	*
MZ	35.928	36.468	25.4	26.21	30.86	1.178	291	11334	1.038	1.038	41	*

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	316.89	0.00	0.000	206	24989	1.012	1.012	321	
MZ	35.928	36.468	25.4	84.41	30.86	0.366	206	18074	1.017	1.017	86	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	36.468	25.2	227.48	0.00	0.000	273	24989	1.016	1.016	231	
MZ	35.928	36.468	25.4	9.05	30.86	3.410	273	5596	1.075	1.075	38	*

\* MINIMUM MOMENT CONTROLS

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JMJ 7/06  
WDB 7/06

=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
=====

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*BASED ON PLANS.*

General Information:

=====

File Name: S:\DGN-ST\NORTH-C-1\BONNER-1\ANALYSIS\PIERS\HLB137\PCACOL-1\M5PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====

f'c = 3 ksi fy = 40 ksi  
 Ec = 3122.02 ksi Es = 29000 ksi  
 fc = 2.55 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.85

Section:

=====

Rectangular: Width = 36 in Depth = 36.5 in  
 Gross section area, Ag = 1314 in<sup>2</sup>  
 Ix = 145881 in<sup>4</sup> Iy = 141912 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====

Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular

Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)

Total steel area, As = 28.08 in<sup>2</sup> at 2.14%

18 #11 Cover = 5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

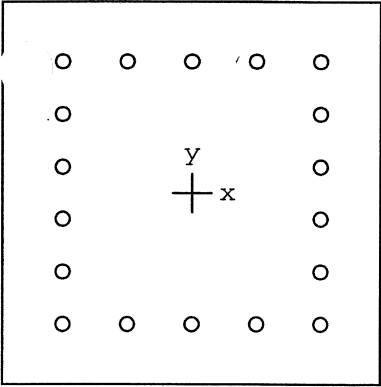
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No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	502.0	71.0	152.0	514.9	1106.2	7.273
2	254.0	36.0	52.0	676.9	979.4	18.824
3	402.0	57.0	63.0	767.3	846.8	13.450
4	409.0	58.0	111.0	540.8	1038.0	9.346
5	245.0	35.0	60.0	600.5	1028.6	17.147
6	387.0	55.0	54.0	816.2	800.1	14.828
7	304.0	43.0	286.0	181.5	1205.5	4.215
8	187.0	26.0	51.0	541.1	1064.7	20.864
9	257.0	36.0	143.0	294.9	1171.4	8.191
10	263.0	37.0	190.0	232.2	1191.3	6.270
11	180.0	25.0	59.0	465.4	1100.6	18.649
12	247.0	35.0	127.0	318.4	1163.1	9.154
13	539.0	76.0	75.0	851.0	838.4	11.188
14	291.0	335.0	47.0	1204.6	168.8	3.596
15	439.0	243.0	61.0	1167.7	293.6	4.806



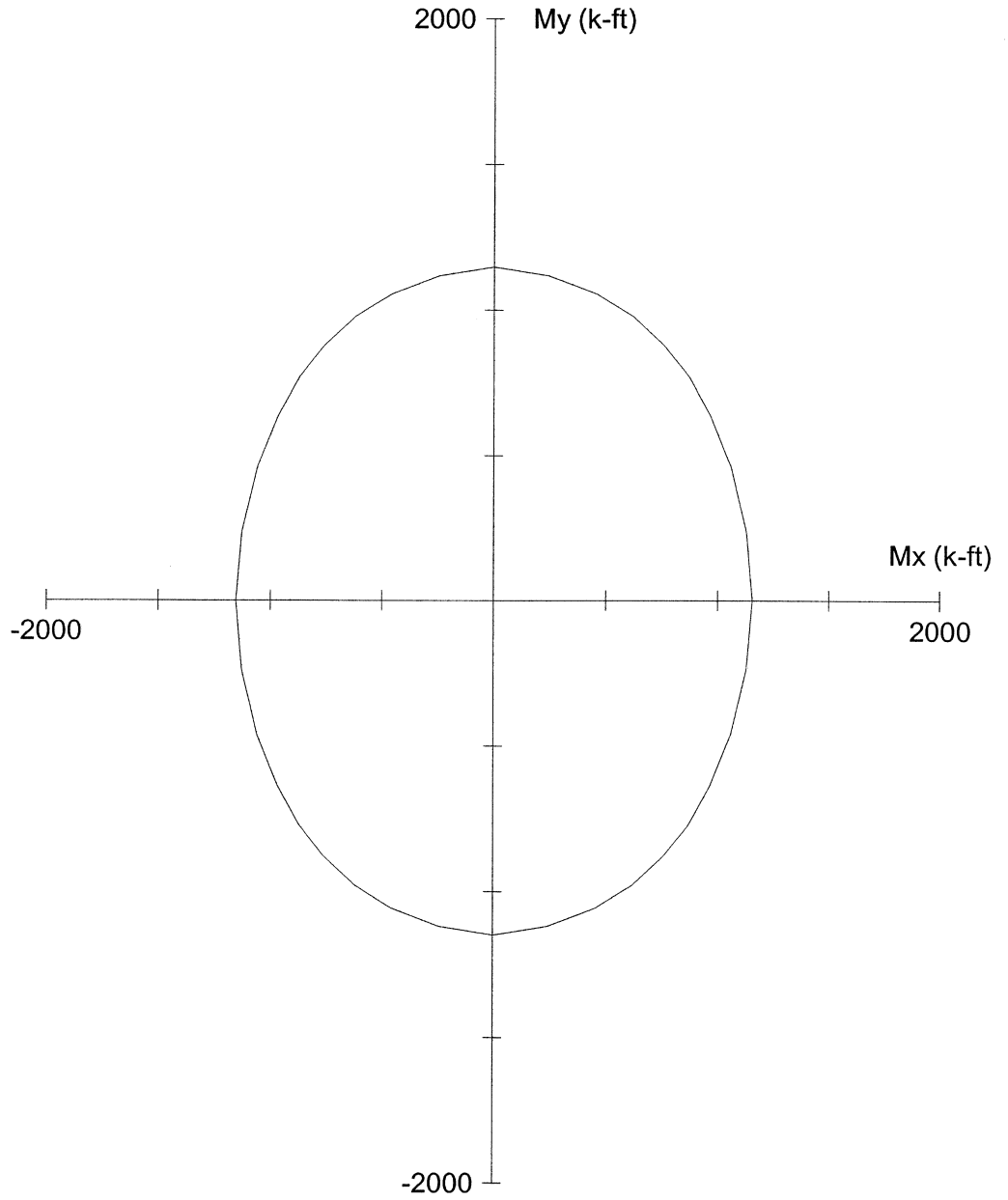
16	445.0	63.0	62.0	828.1	813.7	13.134
17	280.0	322.0	86.0	1162.9	311.1	3.612
18	422.0	233.0	59.0	1157.7	294.3	4.970
19	332.0	47.0	96.0	518.7	1064.0	11.075
20	215.0	334.0	46.0	1199.8	165.1	3.592
21	284.0	240.0	40.0	1197.4	199.2	4.989
22	291.0	41.0	41.0	831.6	831.7	20.284
23	206.0	321.0	86.0	1160.8	311.2	3.616
24	273.0	231.0	38.0	1197.6	196.8	5.184

\*\*\* Program completed as requested! \*\*\*



36 x 36.5 in

Code: ACI 318-95  
 Units: English  
 Run axis: Biaxial  
 Run option: Investigation  
 Slenderness: Not considered  
 umn type: Structural  
 Bars: User-defined  
 Date: 07/19/06  
 Time: 15:14:00



P = 0 kip

PCACOL V3.00 (PCA 1999) - Licensed to: Licensee name not yet specified.

File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M5PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 1314$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 2.14%

$f_c = 2.55$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 145881$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 141912$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 3.61 in

Clear cover = 5.00 in

Confinement: Tied

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

JMS 7/06  
WDB 7/06

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00 00000 00 00 00000 00000 00000 (TM)

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=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
=====

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50% COVER LOSS  
 $f'_c = 4400 \text{ PSI}$

General Information:

=====

File Name: S:\DGN-ST\NORTH~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M5ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====

f'c = 4.4 ksi fy = 40 ksi  
 Ec = 3780.96 ksi Es = 29000 ksi  
 fc = 3.74 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.83

Section:

=====

Rectangular: Width = 31 in Depth = 31.5 in  
 Gross section area, Ag = 976.5 in<sup>2</sup>  
 Ix = 80744.3 in<sup>4</sup> Iy = 78201.4 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====

Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular  
 Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)  
 Total steel area, As = 28.08 in<sup>2</sup> at 2.88%  
 18 #11 Cover = 2.5 in

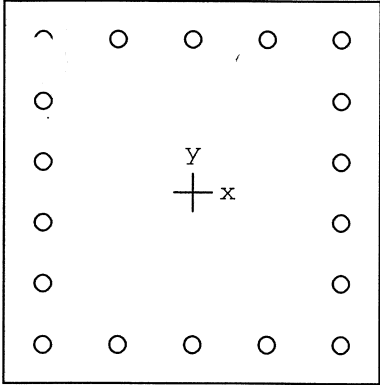
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	502.0	71.0	152.0	488.1	1048.6	6.895
2	254.0	36.0	52.0	648.0	935.1	17.988
3	402.0	57.0	63.0	743.7	822.5	13.052
4	409.0	58.0	111.0	521.3	995.4	8.972
5	245.0	35.0	60.0	573.8	983.4	16.391
6	387.0	55.0	54.0	793.3	778.0	14.415
7	304.0	43.0	286.0	171.6	1153.9	4.034
8	187.0	26.0	51.0	515.4	1011.9	19.838
9	257.0	36.0	143.0	281.0	1116.7	7.809
10	263.0	37.0	190.0	221.1	1137.0	5.984
11	180.0	25.0	59.0	442.4	1043.8	17.692
12	247.0	35.0	127.0	304.4	1107.4	8.718
13	539.0	76.0	75.0	809.7	797.0	10.640
14	291.0	335.0	47.0	1145.7	161.6	3.420
15	439.0	243.0	61.0	1102.6	277.4	4.538

16	445.0	63.0	62.0	786.0	771.2	12.458
17	280.0	322.0	86.0	1108.8	296.1	3.443
18	422.0	233.0	59.0	1099.5	279.5	4.720
19	332.0	47.0	96.0	501.1	1022.6	10.654
20	215.0	334.0	46.0	1136.8	157.2	3.404
21	284.0	240.0	40.0	1138.2	190.2	4.743
22	291.0	41.0	41.0	799.0	799.9	19.498
23	206.0	321.0	86.0	1098.1	293.0	3.420
24	273.0	231.0	38.0	1137.7	187.7	4.926

\*\*\* Program completed as requested! \*\*\*



31 x 31.5 in

Code: ACI 318-95

Units: English

Run axis: Biaxial

Run option: Investigation

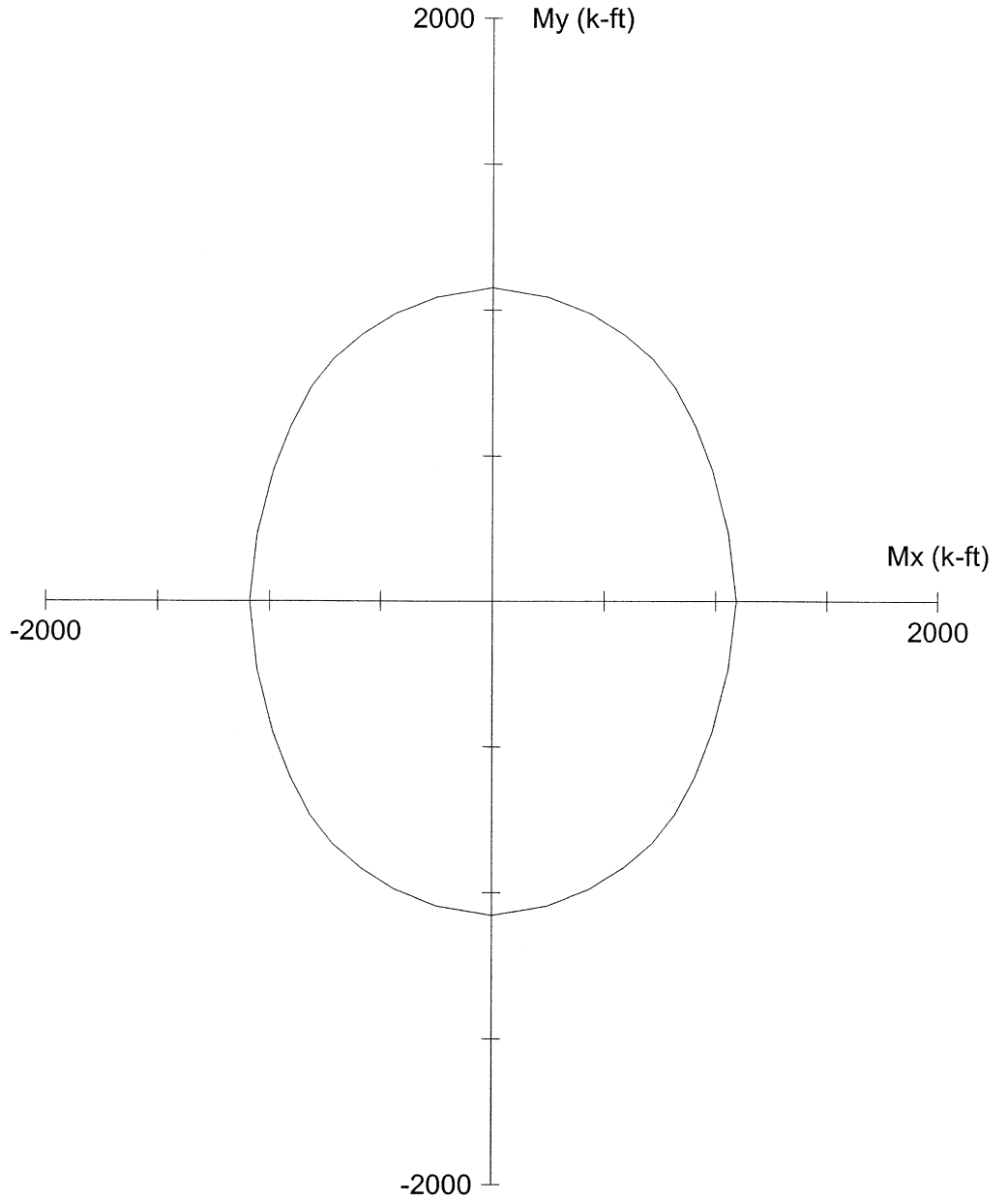
Slenderness: Not considered

mn type: Structural

Bars: User-defined

Date: 07/25/06

Time: 12:36:23



P = 0 kip

PCACOL V3.00 (PCA 1999) - Licensed to: Licensee name not yet specified.

File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M5ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f'_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 976.5$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 2.88%

$f_c = 3.74$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 80744.3$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 78201.4$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 3.61 in

Clear cover = 2.50 in

Confinement: Tied

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 7 JT. 5

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 137				P MEMBER 7				JOINT 5															
GROUP 1				GROUP 2				GROUP 3				GROUP 4				GROUP 5				GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ		P	MY	MZ		P	MY	MZ				
DL	249.28	0.00	16.38	DL	249.28	0.00	16.38	DL	249.28	0.00	16.38	DL	249.28	0.00	16.38	DL	249.28	0.00	16.38				
LL	105.41	0.00	-31.47	LL	0.00	0.00	0.00	LL	105.41	0.00	-31.47	LL	105.41	0.00	-31.47	LL	0.00	0.00	0.00				
GROUP 1	0.00	0.00	0.00	GROUP 2	23.02	253.46	70.49	GROUP 3	10.38	181.89	29.45	GROUP 4	1.04	0.00	49.28	GROUP 5	24.06	253.46	119.77				
SERVICE STRENGTH	354.69	0.00	-15.09	SERVICE STRENGTH	272.30	253.46	86.87	SERVICE STRENGTH	365.07	181.89	14.36	SERVICE STRENGTH	355.73	0.00	34.19	SERVICE STRENGTH	273.34	253.46	136.15				
	552.45	0.00	-46.89		353.99	329.50	112.93		474.59	236.46	18.67		462.45	0.00	44.45		341.68	316.83	170.19				

**SLENDERNESSE EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	52.308	In.	
$r_y = 0.30 * D =$	15.69	In.	$L_y =$	17.5	Ft.	$K_y =$	2.0
$r_z = 0.30 * B =$	10.78	In.	$L_z =$	21.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	428505	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	202156	In <sup>5</sup>		
$K_y L_y / r$	=	26.8	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	28.7	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 7 JT. 5

JMJ Jun-06  
 WOP Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	552	31844	1.025	1.025	100	*
MZ	35.928	52.308	28.7	46.89	21.29	0.454	552	19013	1.043	1.043	77	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	329.50	0.00	0.000	354	31844	1.016	1.016	335	
MZ	35.928	52.308	28.7	112.93	21.29	0.189	354	23261	1.022	1.022	115	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	236.46	0.00	0.000	475	31844	1.022	1.022	242	
MZ	35.928	52.308	28.7	18.67	21.29	1.141	475	12915	1.055	1.055	66	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	462	31844	1.021	1.021	84	*
MZ	35.928	52.308	28.7	44.45	21.29	0.479	462	18692	1.037	1.037	65	*

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	316.83	0.00	0.000	342	31844	1.016	1.016	322	
MZ	35.928	52.308	28.7	170.19	21.29	0.125	342	24573	1.020	1.020	174	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	227.36	0.00	0.000	458	31844	1.021	1.021	232	
MZ	35.928	52.308	28.7	79.55	21.29	0.268	458	21809	1.031	1.031	82	

\* MINIMUM MOMENT CONTROLS





H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 7 JT. 5

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	351	31844	1.016	1.016	63	*
MZ	35.928	52.308	28.7	23.44	21.29	0.908	351	14487	1.036	1.036	49	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	329.50	0.00	0.000	273	31844	1.012	1.012	334	
MZ	35.928	52.308	28.7	112.93	21.29	0.189	273	23261	1.017	1.017	115	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	236.46	0.00	0.000	321	31844	1.015	1.015	240	
MZ	35.928	52.308	28.7	60.87	21.29	0.350	321	20482	1.023	1.023	62	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	309	31844	1.014	1.014	56	*
MZ	35.928	52.308	28.7	86.65	21.29	0.246	309	22193	1.020	1.020	88	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	316.83	0.00	0.000	264	31844	1.012	1.012	321	
MZ	35.928	52.308	28.7	170.19	21.29	0.125	264	24573	1.016	1.016	173	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	227.36	0.00	0.000	310	31844	1.014	1.014	231	
MZ	35.928	52.308	28.7	120.13	21.29	0.177	310	23484	1.019	1.019	122	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 7 JT. 7

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				P MAX							
				HLB 137		MEMBER 7		JOINT 7			
				GROUP 1			GROUP 2				
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-291.36	0.00	11.52	DL	-291.36	0.00	11.52	DL	-291.36	0.00	11.52
LL	-105.41	0.00	-26.57	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	-23.22	-637.45	128.78	GROUP 2	-23.22	-637.45	128.78
SERVICE	-396.77	0.00	-15.05	SERVICE	-314.58	-637.45	140.30	SERVICE	-314.58	-637.45	140.30
STRENGTH	-607.16	0.00	-42.59	STRENGTH	-408.95	-828.69	182.39	STRENGTH	-408.95	-828.69	182.39
				GROUP 3			GROUP 4				
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-291.36	0.00	11.52	DL	-291.36	0.00	11.52	DL	-291.36	0.00	11.52
LL	-105.41	0.00	-26.57	LL	-105.41	0.00	-26.57	LL	-105.41	0.00	-26.57
GROUP 3	-10.44	-407.00	54.19	GROUP 4	-1.04	0.00	311.57	GROUP 4	-1.04	0.00	311.57
SERVICE	-407.21	-407.00	39.14	SERVICE	-397.81	0.00	296.52	SERVICE	-397.81	0.00	296.52
STRENGTH	-529.37	-529.10	50.88	STRENGTH	-517.15	0.00	385.48	STRENGTH	-517.15	0.00	385.48
				GROUP 5			GROUP 6				
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-291.36	0.00	11.52	DL	-291.36	0.00	11.52	DL	-291.36	0.00	11.52
LL	0.00	0.00	0.00	LL	-105.41	0.00	-26.57	LL	-105.41	0.00	-26.57
GROUP 5	-24.26	-637.45	440.35	GROUP 6	-11.48	-407.00	365.76	GROUP 6	-11.48	-407.00	365.76
SERVICE	-315.62	-637.45	451.87	SERVICE	-408.25	-407.00	350.71	SERVICE	-408.25	-407.00	350.71
STRENGTH	-394.53	-796.81	564.84	STRENGTH	-510.31	-508.75	438.39	STRENGTH	-510.31	-508.75	438.39

**SLENDERNESSE EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	52.308	In.	
$r_y = 0.30 * D =$	15.69	In.	$L_y =$	17.5	Ft.	$K_y =$	2.0
$r_z = 0.30 * B =$	10.78	In.	$L_z =$	21.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	428505	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	202156	In <sup>5</sup>		
$K_y L_y / r$	=	26.8	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	28.7	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 7 JT. 7

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	607	31844	1.028	1.028	110	*
MZ	35.928	52.308	28.7	42.59	14.98	0.352	607	20455	1.044	1.044	85	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	828.69	0.00	0.000	409	31844	1.019	1.019	844	
MZ	35.928	52.308	28.7	182.39	14.98	0.082	409	25550	1.023	1.023	187	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	529.10	0.00	0.000	529	31844	1.024	1.024	542	
MZ	35.928	52.308	28.7	50.88	14.98	0.294	529	21360	1.037	1.037	74	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	517	31844	1.024	1.024	93	*
MZ	35.928	52.308	28.7	385.48	14.98	0.039	517	26614	1.029	1.029	396	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	796.81	0.00	0.000	395	31844	1.018	1.018	811	
MZ	35.928	52.308	28.7	564.84	14.98	0.027	395	26933	1.021	1.021	577	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	508.75	0.00	0.000	510	31844	1.023	1.023	521	
MZ	35.928	52.308	28.7	438.39	14.98	0.034	510	26734	1.028	1.028	451	

\* MINIMUM MOMENT CONTROLS



H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 7 JT. 7

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	392	31844	1.018	1.018	71	*
MZ	35.928	52.308	28.7	49.62	14.98	0.302	392	21238	1.027	1.027	55	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	828.69	0.00	0.000	314	31844	1.014	1.014	841	
MZ	35.928	52.308	28.7	182.39	14.98	0.082	314	25550	1.018	1.018	186	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	529.10	0.00	0.000	362	31844	1.017	1.017	538	
MZ	35.928	52.308	28.7	106.21	14.98	0.141	362	24231	1.022	1.022	109	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	350	31844	1.016	1.016	63	*
MZ	35.928	52.308	28.7	440.80	14.98	0.034	350	26739	1.019	1.019	449	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	796.81	0.00	0.000	303	31844	1.014	1.014	808	
MZ	35.928	52.308	28.7	564.84	14.98	0.027	303	26933	1.016	1.016	574	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	508.75	0.00	0.000	350	31844	1.016	1.016	517	
MZ	35.928	52.308	28.7	491.59	14.98	0.030	350	26830	1.019	1.019	501	

\* MINIMUM MOMENT CONTROLS

*JMS 7/06*  
*WDB 7/06*

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Computer program for the Strength Design of Reinforced Concrete Sections
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*BASED ON PLANS.*

General Information:

File Name: S:\DGN-ST\NORTH-1\BONNER-1\ANALYSIS\PIERS\HLB137\PCACOL-1\M7PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 40 ksi  
 Ec = 3122.02 ksi Es = 29000 ksi  
 fc = 2.55 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.85

Section:

Rectangular: Width = 36 in Depth = 52.3 in  
 Gross section area, Ag = 1882.8 in<sup>2</sup>  
 Ix = 429167 in<sup>4</sup> Iy = 203342 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular  
 Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)  
 Total steel area, As = 28.08 in<sup>2</sup> at 1.49%  
 18 #11 Cover = 5 in

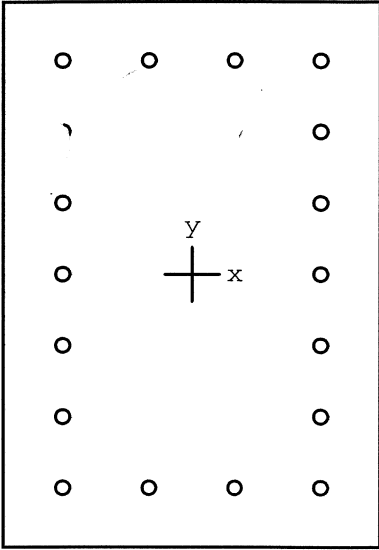
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	552.0	100.0	77.0	1362.2	1052.2	13.638
2	354.0	335.0	115.0	1834.6	626.9	5.474
3	475.0	242.0	66.0	1929.1	524.9	7.970
4	462.0	84.0	65.0	1374.7	1060.0	16.344
5	342.0	322.0	174.0	1612.1	869.1	5.004
6	458.0	232.0	82.0	1840.9	647.3	7.930
7	351.0	63.0	49.0	1360.2	1059.7	21.605
8	273.0	334.0	115.0	1802.7	619.3	5.396
9	321.0	240.0	62.0	1905.9	490.6	7.939
10	309.0	56.0	88.0	813.1	1277.8	14.520
11	264.0	321.0	173.0	1595.0	858.3	4.967
12	310.0	231.0	122.0	1617.5	855.8	7.005
13	607.0	110.0	85.0	1383.4	1065.6	12.562
14	409.0	844.0	187.0	1970.0	438.6	2.335
15	529.0	542.0	74.0	2057.3	277.3	3.795



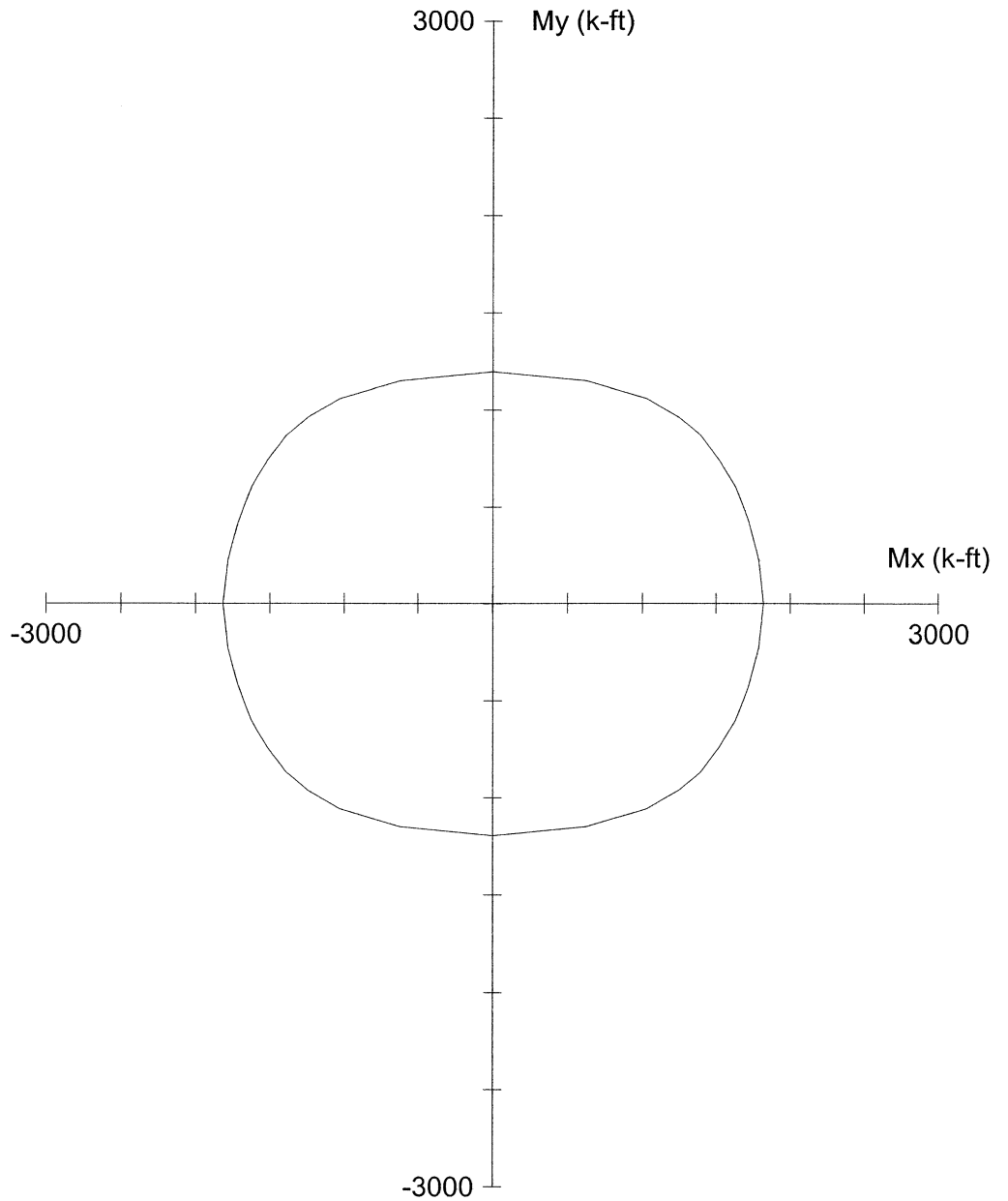
16	517.0	93.0	396.0	338.6	1436.7	3.629
17	395.0	811.0	577.0	1435.9	1020.9	1.770
18	510.0	521.0	451.0	1287.3	1111.3	2.468
19	392.0	71.0	55.0	1368.8	1060.9	19.283
20	314.0	841.0	186.0	1936.0	429.6	2.302
21	362.0	538.0	109.0	1974.0	397.6	3.668
22	350.0	63.0	449.0	196.2	1400.8	3.120
23	303.0	808.0	574.0	1420.3	1010.7	1.759
24	350.0	517.0	501.0	1186.6	1151.0	2.296

\*\*\* Program completed as requested! \*\*\*



36 x 52.3 in

Code: ACI 318-95  
 Units: English  
 Run axis: Biaxial  
 Run option: Investigation  
 Slenderness: Not considered  
 mn type: Structural  
 Bars: User-defined  
 Date: 07/20/06  
 Time: 09:33:28



P = 0 kip

PCACOL V3.00 (PCA 1999) - Licensed to: Licensee name not yet specified.

File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M7PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f'_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 1882.8$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 1.49%

$f_c = 2.55$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 429167$  in<sup>4</sup>

$J = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 203342$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 5.41 in

Clear cover = 5.00 in

Confinement: Tied  
 Appendix F.2

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

LMJ 7/06  
WDB 7/06

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00  00000  00  00  00000  00000  00000  (TM)

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Computer program for the Strength Design of Reinforced Concrete Sections
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Licensee stated above acknowledges that Portland Cement Association (PCA) is not and cannot be responsible for either the accuracy or adequacy of the material supplied as input for processing by the PCACOL(tm) computer program. Furthermore, PCA neither makes any warranty expressed nor implied with respect to the correctness of the output prepared by the PCACOL(tm) program. Although PCA has endeavored to produce PCACOL(tm) error free, the program is not and can't be certified infallible. The final and only responsibility for analysis, design and engineering documents is the licensees. Accordingly, PCA disclaims all responsibility in contract, negligence or other tort for any analysis, design or engineering documents prepared in connection with the use of the PCACOL(tm) program.

50% COVER LOSS  
S<sub>c</sub> = 4400 PSI

General Information:

=====  
 File Name: S:\DGN-ST\NORTH-C-1\BONNER-1\ANALYSIS\PIERS\HLB137\PCACOL~1\M7ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====  
 f'c = 4.4 ksi fy = 40 ksi  
 Ec = 3780.96 ksi Es = 29000 ksi  
 fc = 3.74 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.83

Section:

=====  
 Rectangular: Width = 31 in Depth = 47.3 in  
 Gross section area, Ag = 1466.3 in<sup>2</sup>  
 Ix = 273378 in<sup>4</sup> Iy = 117426 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====  
 Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular  
 Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)  
 Total steel area, As = 28.08 in<sup>2</sup> at 1.92%  
 18 #11 Cover = 2.5 in

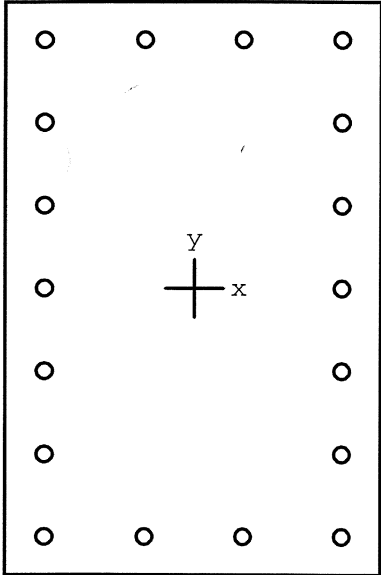
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====  
 =====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	552.0	100.0	77.0	1358.9	1047.9	13.597
2	354.0	335.0	115.0	1789.9	616.9	5.345
3	475.0	242.0	66.0	1906.5	523.1	7.881
4	462.0	84.0	65.0	1347.7	1043.8	16.050
5	342.0	322.0	174.0	1575.1	853.2	4.894
6	458.0	232.0	82.0	1814.0	641.5	7.820
7	351.0	63.0	49.0	1323.1	1029.8	21.007
8	273.0	334.0	115.0	1750.0	602.8	5.240
9	321.0	240.0	62.0	1855.8	478.2	7.731
10	309.0	56.0	88.0	772.5	1215.7	13.809
11	264.0	321.0	173.0	1544.5	835.0	4.815
12	310.0	231.0	122.0	1575.7	834.3	6.825
13	607.0	110.0	85.0	1356.7	1047.7	12.331
14	409.0	844.0	187.0	1930.9	427.5	2.288
15	529.0	542.0	74.0	2048.4	280.9	3.780

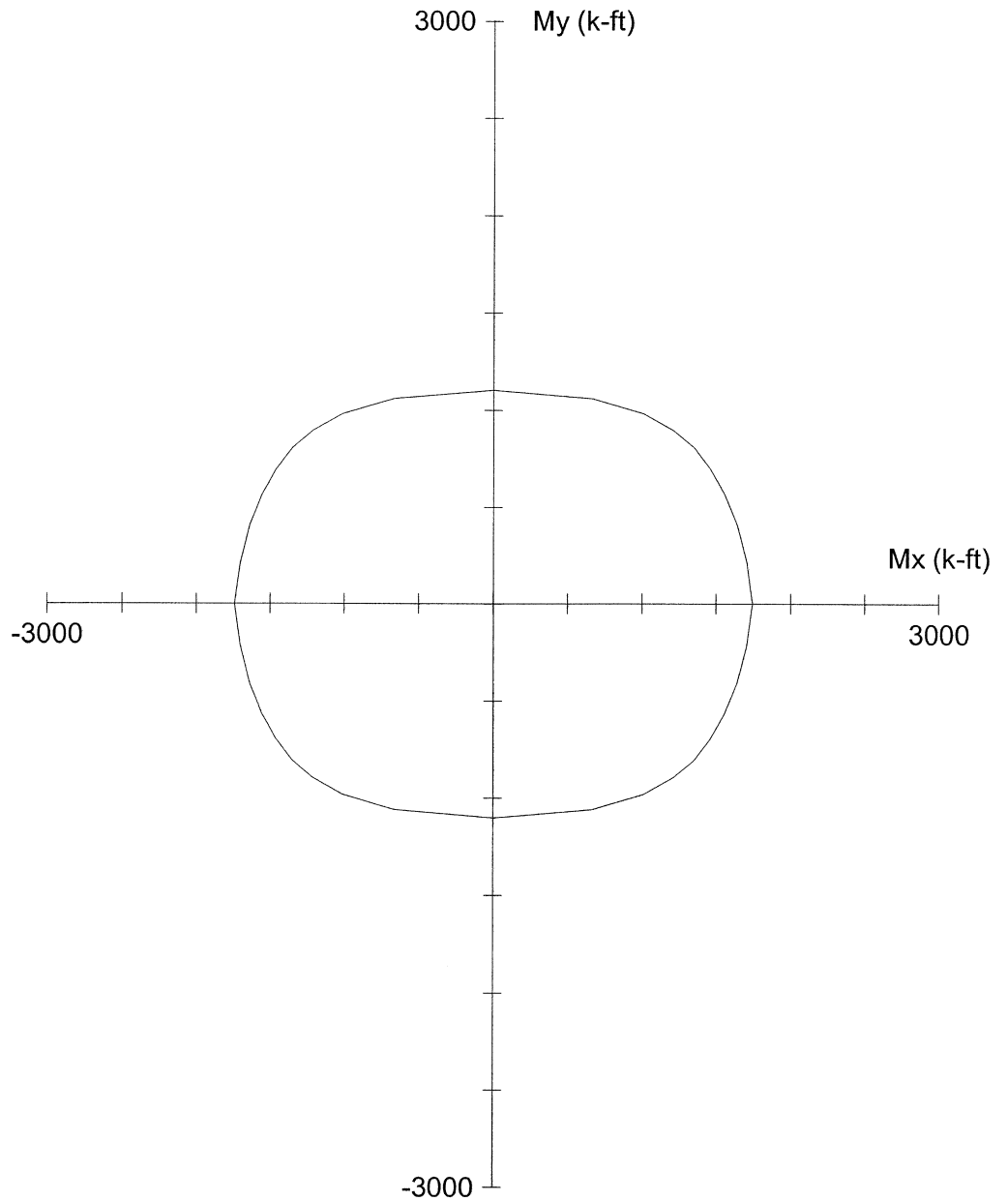
16	517.0	93.0	396.0	326.4	1384.8	3.498
17	395.0	811.0	577.0	1403.7	996.0	1.729
18	510.0	521.0	451.0	1267.3	1096.0	2.431
19	392.0	71.0	55.0	1335.6	1034.7	18.812
20	314.0	841.0	186.0	1886.8	413.9	2.243
21	362.0	538.0	109.0	1926.8	389.0	3.581
22	350.0	63.0	449.0	188.5	1331.9	2.967
23	303.0	808.0	574.0	1376.8	979.2	1.705
24	350.0	517.0	501.0	1141.5	1108.7	2.210

\*\*\* Program completed as requested! \*\*\*



31 x 47.3 in

Code: ACI 318-95  
 Units: English  
 Run axis: Biaxial  
 Run option: Investigation  
 Slenderness: Not considered  
 Column type: Structural  
 Bars: User-defined  
 Date: 07/25/06  
 Time: 12:36:53



P = 0 kip

PCACOL V3.00 (PCA 1999) - Licensed to: Licensee name not yet specified.

File: S:\DGN-ST\NORTHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M7ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 1466.3$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 1.92%

$f_c = 3.74$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 273378$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 117426$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 5.41 in

Clear cover = 2.50 in

Confinement: Tied  
 Appendix F.2

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 8 JT. 6

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 137			P MEMBER 8			JOINT 6			
		<u>GROUP 1</u>						<u>GROUP 2</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	249.18	0.00	15.35	DL	249.18	0.00	15.35	DL	249.18	0.00	15.35
LL	105.38	0.00	-31.79	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	-23.02	-253.48	-70.47	GROUP 2	-23.02	-253.48	-70.47
SERVICE STRENGTH	354.56	0.00	-16.44	SERVICE STRENGTH	226.16	-253.48	-55.12	SERVICE STRENGTH	226.16	-253.48	-55.12
	552.26	0.00	-48.92		294.01	-329.52	-71.66		294.01	-329.52	-71.66
		<u>GROUP 3</u>						<u>GROUP 4</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	249.18	0.00	15.35	DL	249.18	0.00	15.35	DL	249.18	0.00	15.35
LL	105.38	0.00	-31.79	LL	105.38	0.00	-31.79	LL	105.38	0.00	-31.79
GROUP 3	-10.38	-181.90	-29.44	GROUP 4	1.05	0.00	49.31	GROUP 4	1.05	0.00	49.31
SERVICE STRENGTH	344.18	-181.90	-45.88	SERVICE STRENGTH	355.61	0.00	32.87	SERVICE STRENGTH	355.61	0.00	32.87
	447.43	-236.47	-59.64		462.29	0.00	42.73		462.29	0.00	42.73
		<u>GROUP 5</u>						<u>GROUP 6</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	249.18	0.00	15.35	DL	249.18	0.00	15.35	DL	249.18	0.00	15.35
LL	0.00	0.00	0.00	LL	105.38	0.00	-31.79	LL	105.38	0.00	-31.79
GROUP 5	-21.97	-253.48	-21.17	GROUP 6	-9.33	-181.90	19.86	GROUP 6	-9.33	-181.90	19.86
SERVICE STRENGTH	227.21	-253.48	-5.82	SERVICE STRENGTH	345.23	-181.90	3.42	SERVICE STRENGTH	345.23	-181.90	3.42
	284.01	-316.85	-7.28		431.54	-227.38	4.28		431.54	-227.38	4.28

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\Phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	15.69	In.	Depth of Rect. Col. =	D =	52.308	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	17.5	Ft.	$K_y =$	2.0
			$L_z =$	21.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	428505	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	202156	In <sup>5</sup>		
$K_y L_y / r$	=	26.8	>	22	CONSIDER SLENDERNESS		
$K_z L_z / r$	=	28.7	>	22	CONSIDER SLENDERNESS		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 8 JT. 6

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	552	31844	1.025	1.025	100	*
MZ	35.928	52.308	28.7	48.92	19.96	0.408	552	19638	1.042	1.042	77	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	329.52	0.00	0.000	294	31844	1.013	1.013	334	
MZ	35.928	52.308	28.7	71.66	19.96	0.278	294	21625	1.020	1.020	73	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	236.47	0.00	0.000	447	31844	1.020	1.020	241	
MZ	35.928	52.308	28.7	59.64	19.96	0.335	447	20716	1.032	1.032	63	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	462	31844	1.021	1.021	84	*
MZ	35.928	52.308	28.7	42.73	19.96	0.467	462	18846	1.036	1.036	65	*

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	316.85	0.00	0.000	284	31844	1.013	1.013	321	
MZ	35.928	52.308	28.7	7.28	19.96	2.743	284	7387	1.058	1.058	40	*

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	227.38	0.00	0.000	432	31844	1.020	1.020	232	
MZ	35.928	52.308	28.7	4.28	19.96	4.668	432	4878	1.145	1.145	60	*

\* MINIMUM MOMENT CONTROLS



H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 8 JT. 6

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				PMIN							
				MEMBER 8				JOINT 6			
				HLB 137							
				GROUP 1				GROUP 2			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	186.89	0.00	15.35	DL	186.89	0.00	15.35	DL	186.89	0.00	15.35
LL	49.68	0.00	0.69	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	-23.02	-253.48	-70.47	GROUP 2	-23.02	-253.48	-70.47
SERVICE	236.57	0.00	16.04	SERVICE	163.87	-253.48	-55.12	SERVICE	163.87	-253.48	-55.12
STRENGTH	350.59	0.00	21.45	STRENGTH	213.02	-329.52	-71.66	STRENGTH	213.02	-329.52	-71.66

				GROUP 3				GROUP 4			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	186.89	0.00	15.35	DL	186.89	0.00	15.35	DL	186.89	0.00	15.35
LL	49.68	0.00	0.69	LL	49.68	0.00	0.69	LL	49.68	0.00	0.69
GROUP 3	-10.38	-181.90	-29.44	GROUP 4	1.05	0.00	49.31	GROUP 4	1.05	0.00	49.31
SERVICE	226.19	-181.90	-13.40	SERVICE	237.62	0.00	65.35	SERVICE	237.62	0.00	65.35
STRENGTH	294.04	-236.47	-17.42	STRENGTH	308.90	0.00	84.96	STRENGTH	308.90	0.00	84.96

				GROUP 5				GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	186.89	0.00	15.35	DL	186.89	0.00	15.35	DL	186.89	0.00	15.35
LL	0.00	0.00	0.00	LL	49.68	0.00	0.69	LL	49.68	0.00	0.69
GROUP 5	-21.97	-253.48	-21.17	GROUP 6	-9.33	-181.90	19.86	GROUP 6	-9.33	-181.90	19.86
SERVICE	164.92	-253.48	-5.82	SERVICE	227.24	-181.90	35.90	SERVICE	227.24	-181.90	35.90
STRENGTH	206.14	-316.85	-7.28	STRENGTH	284.04	-227.38	44.88	STRENGTH	284.04	-227.38	44.88

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	15.69	In.	Depth of Rect. Col. =	D =	52.308	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	17.5	Ft.	$K_y =$	2.0
			$L_z =$	21.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	428505	$\text{In}^4$		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	202156	$\text{In}^5$		
$K_y L_y / r$	=	26.8	>	22	CONSIDER SLENDERNESS		
$K_z L_z / r$	=	28.7	>	22	CONSIDER SLENDERNESS		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 8 JT. 6

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESSE EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	351	31844	1.016	1.016	63	*
MZ	35.928	52.308	28.7	21.45	19.96	0.930	351	14323	1.036	1.036	49	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	329.52	0.00	0.000	213	31844	1.010	1.010	333	
MZ	35.928	52.308	28.7	71.66	19.96	0.278	213	21625	1.014	1.014	73	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	236.47	0.00	0.000	294	31844	1.013	1.013	240	
MZ	35.928	52.308	28.7	17.42	19.96	1.146	294	12886	1.034	1.034	41	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	309	31844	1.014	1.014	56	*
MZ	35.928	52.308	28.7	84.96	19.96	0.235	309	22389	1.020	1.020	87	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	316.85	0.00	0.000	206	31844	1.009	1.009	320	
MZ	35.928	52.308	28.7	7.28	19.96	2.743	206	7387	1.042	1.042	29	*

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	227.38	0.00	0.000	284	31844	1.013	1.013	230	
MZ	35.928	52.308	28.7	44.88	19.96	0.445	284	19137	1.022	1.022	46	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 8 JT. 8

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 137				P MEMBER 8				JOINT 8			
GROUP 1				GROUP 2							
	P	MY	MZ		P	MY	MZ				
DL	-291.27	0.00	9.98	DL	-291.27	0.00	9.98				
LL	-105.38	0.00	-27.03	LL	0.00	0.00	0.00				
GROUP 1	0.00	0.00	0.00	GROUP 2	23.22	637.37	-128.75				
SERVICE STRENGTH	-396.65 -606.97	0.00 0.00	-17.05 -45.59	SERVICE STRENGTH	-268.05 -348.47	637.37 828.58	-118.77 -154.40				
GROUP 3				GROUP 4							
	P	MY	MZ		P	MY	MZ				
DL	-291.27	0.00	9.98	DL	-291.27	0.00	9.98				
LL	-105.38	0.00	-27.03	LL	-105.38	0.00	-27.03				
GROUP 3	10.44	406.96	-54.18	GROUP 4	-1.05	0.00	311.54				
SERVICE STRENGTH	-386.21 -502.07	406.96 529.05	-71.23 -92.60	SERVICE STRENGTH	-397.70 -517.01	0.00 0.00	294.49 382.84				
GROUP 5				GROUP 6							
	P	MY	MZ		P	MY	MZ				
DL	-291.27	0.00	9.98	DL	-291.27	0.00	9.98				
LL	0.00	0.00	0.00	LL	-105.38	0.00	-27.03				
GROUP 5	22.17	637.37	182.79	GROUP 6	9.39	406.96	257.36				
SERVICE STRENGTH	-269.10 -336.38	637.37 796.71	192.77 240.96	SERVICE STRENGTH	-387.26 -484.08	406.96 508.70	240.31 300.39				

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	52.308	In.	
$r_y = 0.30 * D =$	15.69	In.	$L_y =$	17.5	Ft.	$K_y =$	2.0
$r_z = 0.30 * B =$	10.78	In.	$L_z =$	21.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	428505	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	202156	In <sup>5</sup>		
$K_y L_y / r$	=	26.8	>	22	CONSIDER SLENDERNESS		
$K_z L_z / r$	=	28.7	>	22	CONSIDER SLENDERNESS		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 8 JT. 8

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESSE EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	607	31844	1.028	1.028	110	*
MZ	35.928	52.308	28.7	45.59	12.97	0.285	607	21523	1.042	1.042	85	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	828.58	0.00	0.000	348	31844	1.016	1.016	842	
MZ	35.928	52.308	28.7	154.40	12.97	0.084	348	25504	1.020	1.020	157	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	529.05	0.00	0.000	502	31844	1.023	1.023	541	
MZ	35.928	52.308	28.7	92.60	12.97	0.140	502	24250	1.030	1.030	95	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	517	31844	1.024	1.024	93	*
MZ	35.928	52.308	28.7	382.84	12.97	0.034	517	26741	1.028	1.028	394	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	796.71	0.00	0.000	336	31844	1.015	1.015	809	
MZ	35.928	52.308	28.7	240.96	12.97	0.054	336	26235	1.019	1.019	245	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	508.70	0.00	0.000	484	31844	1.022	1.022	520	
MZ	35.928	52.308	28.7	300.39	12.97	0.043	484	26503	1.027	1.027	308	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 8 JT. 8

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				PMIN					
				HLB 137	MEMBER 8	JOINT 8			
				GROUP 1			GROUP 2		
	P	MY	MZ		P	MY	MZ		
DL	-218.45	0.00	9.98	DL	-218.45	0.00	9.98		
LL	-49.68	0.00	15.59	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	23.22	637.37	-128.75		
SERVICE	-268.13	0.00	25.57	SERVICE	-195.23	637.37	-118.77		
STRENGTH	-391.63	0.00	46.75	STRENGTH	-253.80	828.58	-154.40		
				GROUP 3			GROUP 4		
	P	MY	MZ		P	MY	MZ		
DL	-218.45	0.00	9.98	DL	-218.45	0.00	9.98		
LL	-49.68	0.00	15.59	LL	-49.68	0.00	15.59		
GROUP 3	10.44	406.96	-54.18	GROUP 4	-1.05	0.00	311.54		
SERVICE	-257.69	406.96	-28.61	SERVICE	-269.18	0.00	337.11		
STRENGTH	-335.00	529.05	-37.19	STRENGTH	-349.94	0.00	438.24		
				GROUP 5			GROUP 6		
	P	MY	MZ		P	MY	MZ		
DL	-218.45	0.00	9.98	DL	-218.45	0.00	9.98		
LL	0.00	0.00	0.00	LL	-49.68	0.00	15.59		
GROUP 5	22.17	637.37	182.79	GROUP 6	9.39	406.96	257.36		
SERVICE	-196.28	637.37	192.77	SERVICE	-258.74	406.96	282.93		
STRENGTH	-245.35	796.71	240.96	STRENGTH	-323.43	508.70	353.66		

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	52.308	In.	
$r_y = 0.30 * D =$	15.69	In.	$L_y =$	17.5	Ft.	$K_y =$	2.0
$r_z = 0.30 * B =$	10.78	In.	$L_z =$	21.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	428505	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	202156	In <sup>5</sup>		
$K_y L_y / r$	=	26.8	>	22	CONSIDER SLENDERNESS		
$K_z L_z / r$	=	28.7	>	22	CONSIDER SLENDERNESS		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 8 JT. 8

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	392	31844	1.018	1.018	71	*
MZ	35.928	52.308	28.7	46.75	12.97	0.278	392	21642	1.027	1.027	55	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	828.58	0.00	0.000	254	31844	1.012	1.012	838	
MZ	35.928	52.308	28.7	154.40	12.97	0.084	254	25504	1.014	1.014	157	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	529.05	0.00	0.000	335	31844	1.015	1.015	537	
MZ	35.928	52.308	28.7	37.19	12.97	0.349	335	20497	1.024	1.024	47	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	0.00	0.00	0.000	350	31844	1.016	1.016	63	*
MZ	35.928	52.308	28.7	438.24	12.97	0.030	350	26853	1.019	1.019	447	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	796.71	0.00	0.000	245	31844	1.011	1.011	806	
MZ	35.928	52.308	28.7	240.96	12.97	0.054	245	26235	1.014	1.014	244	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	52.308	26.8	508.70	0.00	0.000	323	31844	1.015	1.015	516	
MZ	35.928	52.308	28.7	353.66	12.97	0.037	323	26669	1.018	1.018	360	

\* MINIMUM MOMENT CONTROLS

```
0000000 00000 00000 00000 00000 00
00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00
00 00 00 0000000 00 00 00 00
0000000 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00
00 00000 00 00 00000 00000 00000 (TM)
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*JMS 7/06*  
*WDB 7/06*

=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
=====

Licensee stated above acknowledges that Portland Cement Association (PCA) is not and cannot be responsible for either the accuracy or adequacy of the material supplied as input for processing by the PCACOL(tm) computer program. Furthermore, PCA neither makes any warranty expressed nor implied with respect to the correctness of the output prepared by the PCACOL(tm) program. Although PCA has endeavored to produce PCACOL(tm) error free, the program is not and can't be certified infallible. The final and only responsibility for analysis, design and engineering documents is the licensees. Accordingly, PCA disclaims all responsibility in contract, negligence or other tort for any analysis, design or engineering documents prepared in connection with the use of the PCACOL(tm) program.

*BASED ON PLANS.*

General Information:

=====

File Name: S:\DGN-ST\NORTH~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M8PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====

f'c = 3 ksi fy = 40 ksi  
 Ec = 3122.02 ksi Es = 29000 ksi  
 fc = 2.55 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.85

Section:

=====

Rectangular: Width = 36 in Depth = 52.3 in  
 Gross section area, Ag = 1882.8 in<sup>2</sup>  
 Ix = 429167 in<sup>4</sup> Iy = 203342 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====

Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular  
 Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)  
 Total steel area, As = 28.08 in<sup>2</sup> at 1.49%  
 18 #11 Cover = 5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

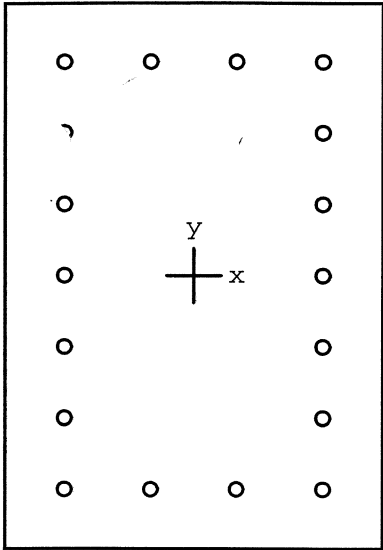
=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	552.0	100.0	77.0	1362.2	1052.2	13.638
2	294.0	334.0	73.0	1931.9	418.9	5.782
3	447.0	241.0	63.0	1938.8	510.3	8.048
4	462.0	84.0	65.0	1374.7	1060.0	16.344
5	284.0	321.0	40.0	1992.5	251.4	6.208
6	432.0	232.0	60.0	1940.7	503.1	8.366
7	351.0	63.0	49.0	1360.2	1059.7	21.605
8	213.0	333.0	73.0	1887.9	411.6	5.668
9	294.0	240.0	41.0	1968.3	338.5	8.203
10	309.0	56.0	87.0	823.2	1275.2	14.670
11	206.0	320.0	29.0	1964.6	180.2	6.140
12	284.0	230.0	46.0	1943.0	387.8	8.447
13	607.0	110.0	85.0	1383.4	1065.6	12.562
14	348.0	842.0	157.0	1981.3	371.4	2.354
15	502.0	541.0	95.0	2024.6	352.5	3.741



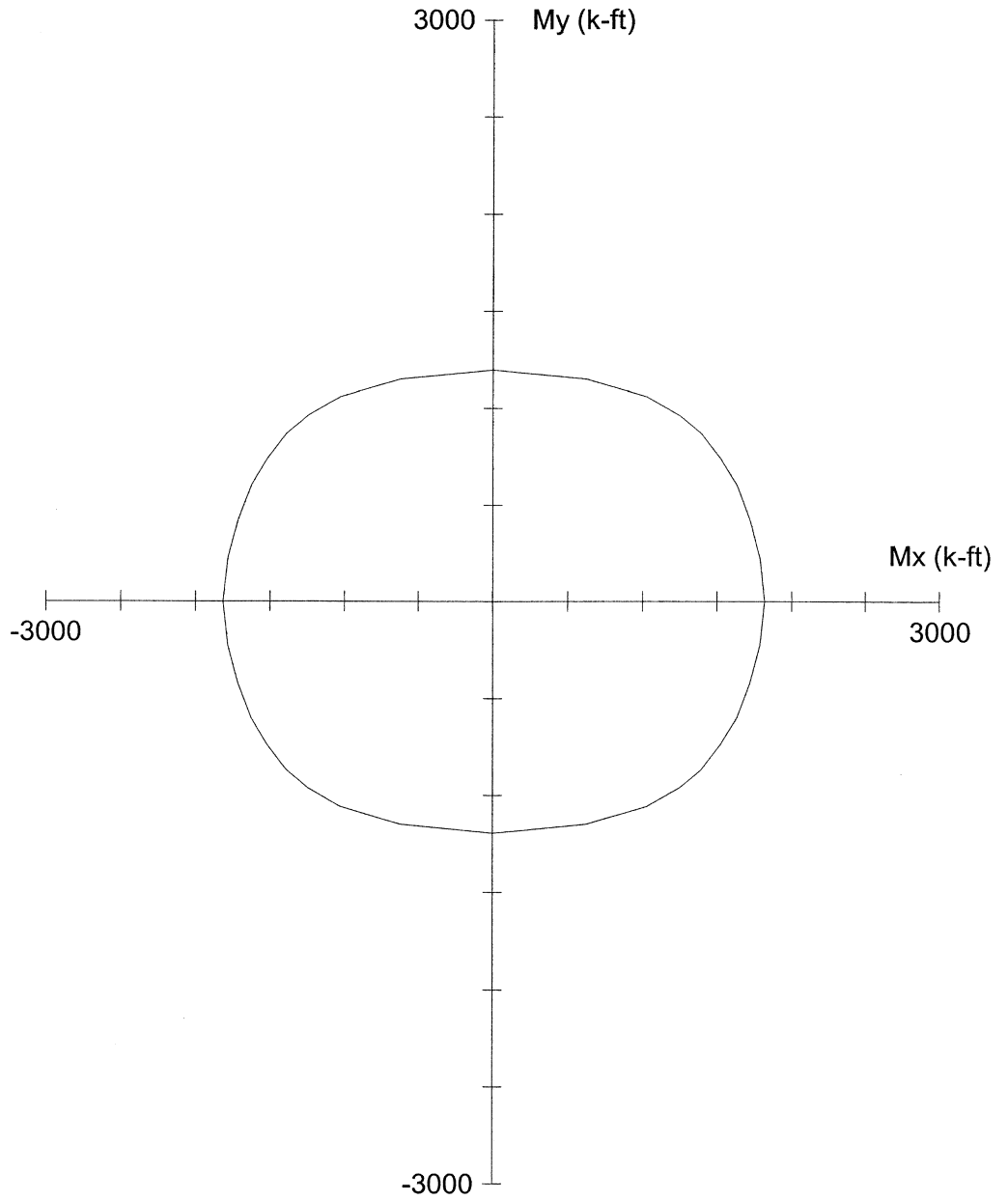
16	517.0	93.0	394.0	338.8	1436.7	3.646
17	336.0	809.0	245.0	1868.7	566.0	2.310
18	484.0	520.0	308.0	1561.3	926.5	3.004
19	392.0	71.0	55.0	1368.8	1060.9	19.283
20	254.0	838.0	157.0	1935.3	360.6	2.309
21	335.0	537.0	47.0	2042.0	179.1	3.803
22	350.0	63.0	447.0	196.1	1400.8	3.133
23	245.0	806.0	244.0	1829.6	553.0	2.270
24	323.0	516.0	360.0	1438.6	1004.2	2.789

\*\*\* Program completed as requested! \*\*\*



36 x 52.3 in

Code: ACI 318-95  
 Units: English  
 Run axis: Biaxial  
 Run option: Investigation  
 Slenderness: Not considered  
 mn type: Structural  
 Bars: User-defined  
 Date: 07/19/06  
 Time: 15:14:56



P = 0 kip

PCACOL V3.00 (PCA 1999) - Licensed to: Licensee name not yet specified.

File: S:\DGN-ST\NORTHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M8PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 1882.8$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 1.49%

$f_c = 2.55$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 429167$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 203342$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 5.41 in

Clear cover = 5.00 in

Confinement: Tied

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

1ms 7/06  
WAB 7/06

```

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00 00 00 00 00 00 00 00 00 00 00
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0000000 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00
00 00000 00 00 00000 00000 00000 (TM)

```

=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
=====

Licensee stated above acknowledges that Portland Cement Association (PCA) is not and cannot be responsible for either the accuracy or adequacy of the material supplied as input for processing by the PCACOL(tm) computer program. Furthermore, PCA neither makes any warranty expressed nor implied with respect to the correctness of the output prepared by the PCACOL(tm) program. Although PCA has endeavored to produce PCACOL(tm) error free, the program is not and can't be certified infallible. The final and only responsibility for analysis, design and engineering documents is the licensees. Accordingly, PCA disclaims all responsibility in contract, negligence or other tort for any analysis, design or engineering documents prepared in connection with the use of the PCACOL(tm) program.

50% COVER LOSS  
 $f_c = 4400 \text{ psi}$

General Information:

=====  
 File Name: S:\DGN-ST\NORTHCH~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M8ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English  
  
 Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====  
 f'c = 4.4 ksi fy = 40 ksi  
 Ec = 3780.96 ksi Es = 29000 ksi  
 fc = 3.74 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.83

Section:

=====  
 Rectangular: Width = 31 in Depth = 47.3 in  
  
 Gross section area, Ag = 1466.3 in<sup>2</sup>  
 Ix = 273378 in<sup>4</sup> Iy = 117426 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====  
 Rebar Database: User-defined  

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular  
 Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)  
 Total steel area, As = 28.08 in<sup>2</sup> at 1.92%  
 18 #11 Cover = 2.5 in

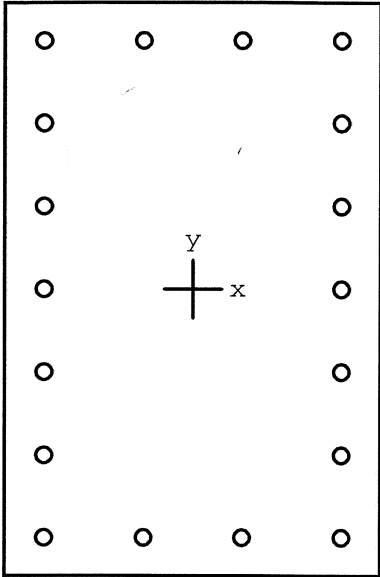
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====  

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	552.0	100.0	77.0	1358.9	1047.9	13.597
2	294.0	334.0	73.0	1875.1	411.4	5.615
3	447.0	241.0	63.0	1907.4	501.5	7.917
4	462.0	84.0	65.0	1347.7	1043.8	16.050
5	284.0	321.0	40.0	1932.5	239.4	6.020
6	432.0	232.0	60.0	1906.8	490.7	8.217
7	351.0	63.0	49.0	1323.1	1029.8	21.007
8	213.0	333.0	73.0	1820.7	401.7	5.469
9	294.0	240.0	41.0	1909.8	323.9	7.956
10	309.0	56.0	87.0	783.2	1213.2	13.957
11	206.0	320.0	29.0	1898.0	168.9	5.930
12	284.0	230.0	46.0	1883.7	373.8	8.187
13	607.0	110.0	85.0	1356.7	1047.7	12.331
14	348.0	842.0	157.0	1932.4	358.5	2.295
15	502.0	541.0	95.0	2007.3	355.0	3.711

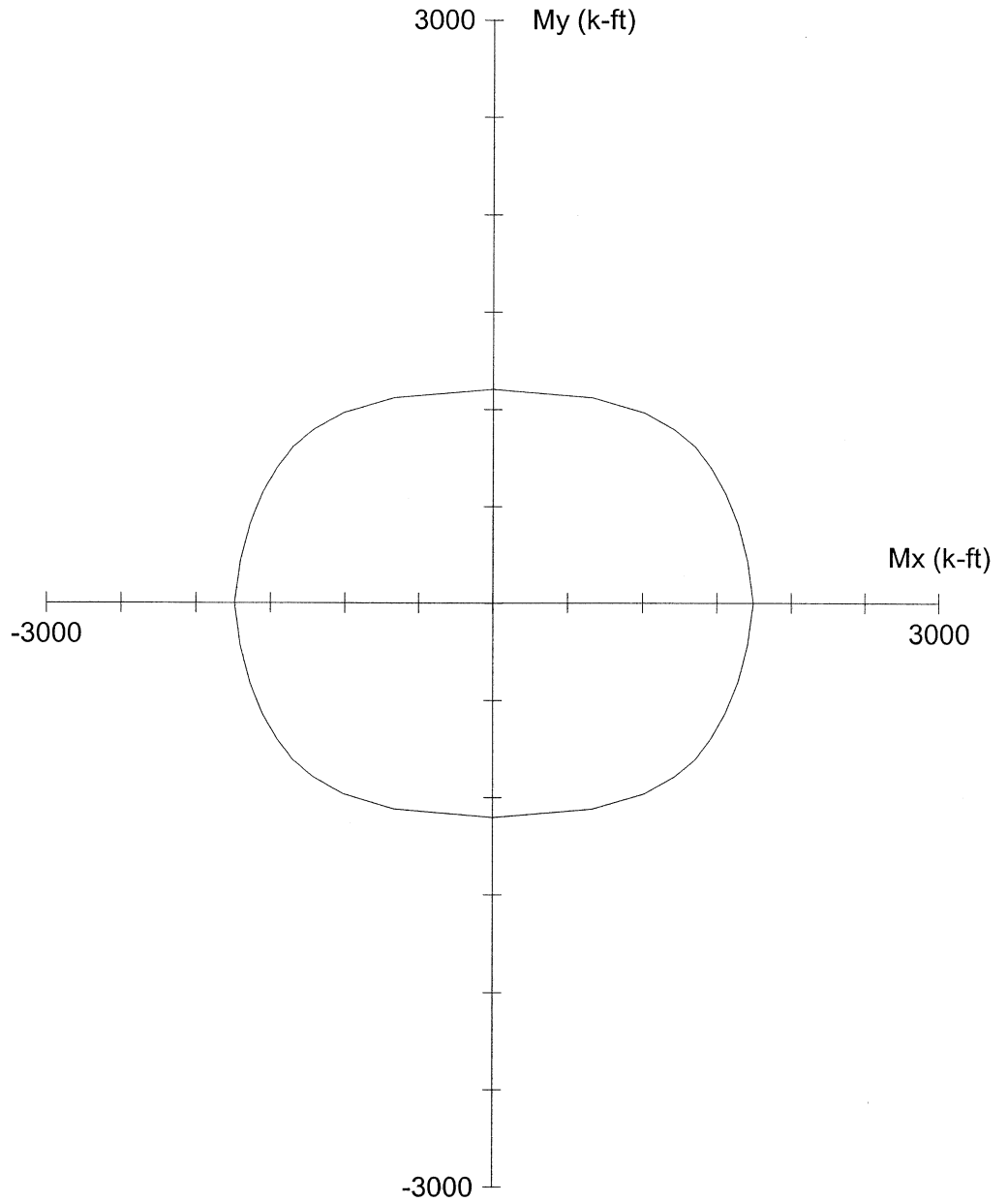
16	517.0	93.0	394.0	326.8	1384.8	3.515
17	336.0	809.0	245.0	1822.9	548.7	2.252
18	484.0	520.0	308.0	1543.6	916.2	2.970
19	392.0	71.0	55.0	1335.6	1034.7	18.812
20	254.0	838.0	157.0	1871.0	352.0	2.233
21	335.0	537.0	47.0	1986.2	174.5	3.699
22	350.0	63.0	447.0	187.6	1332.0	2.980
23	245.0	806.0	244.0	1772.9	539.2	2.200
24	323.0	516.0	360.0	1397.7	973.1	2.707

\*\*\* Program completed as requested! \*\*\*



31 x 47.3 in

Code: ACI 318-95  
 Units: English  
 Run axis: Biaxial  
 Run option: Investigation  
 Slenderness: Not considered  
 Column type: Structural  
 Bars: User-defined  
 Date: 07/25/06  
 Time: 12:37:22



P = 0 kip

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File: S:\DGN-ST\NORTHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M8ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 1466.3$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 1.92%

$f_c = 3.74$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 273378$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 117426$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 5.41 in

Clear cover = 2.50 in

Confinement: Tied  
 Appendix F.2

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 10 JT. 7

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				P MAX							
				HLB 137		MEMBER 10		JOINT 7			
				GROUP 1			GROUP 2				
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	304.99	0.00	30.04	DL	304.99	0.00	30.04	DL	304.99	0.00	30.04
LL	104.15	0.00	9.02	LL	0.00	0.00	0.00	LL	104.15	0.00	9.02
GROUP 1	0.00	0.00	0.00	GROUP 2	30.73	638.26	-39.51	GROUP 2	30.73	638.26	-39.51
SERVICE STRENGTH	409.14	0.00	39.06	SERVICE STRENGTH	335.72	638.26	-9.47	SERVICE STRENGTH	436.44	829.74	-12.31
				GROUP 3			GROUP 4				
DL	304.99	0.00	30.04	DL	304.99	0.00	30.04	DL	304.99	0.00	30.04
LL	104.15	0.00	9.02	LL	104.15	0.00	9.02	LL	104.15	0.00	9.02
GROUP 3	13.57	407.24	-16.97	GROUP 4	-35.05	0.00	-652.24	GROUP 4	-35.05	0.00	-652.24
SERVICE STRENGTH	422.71	407.24	22.09	SERVICE STRENGTH	374.09	0.00	-613.18	SERVICE STRENGTH	486.32	0.00	-797.13
				GROUP 5			GROUP 6				
DL	304.99	0.00	30.04	DL	304.99	0.00	30.04	DL	304.99	0.00	30.04
LL	0.00	0.00	0.00	LL	104.15	0.00	9.02	LL	104.15	0.00	9.02
GROUP 5	-4.31	638.26	-691.75	GROUP 6	-21.48	407.24	-669.21	GROUP 6	-21.48	407.24	-669.21
SERVICE STRENGTH	300.68	638.26	-661.71	SERVICE STRENGTH	387.66	407.24	-630.15	SERVICE STRENGTH	484.58	509.05	-787.69

**SLENDERNESS EFFECTS IN COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	18.63	In.	Depth of Rect. Col. =	D =	62.112	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	0	Ft.	$K_y =$	2.0
			$L_z =$	2.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	717428	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	240045	In <sup>5</sup>		
$K_y L_y / r$	=	0.0	<	22	NO SLENDERNESS EFFECT		
$K_z L_z / r$	=	3.3	<	22	NO SLENDERNESS EFFECT		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 10 JT. 7

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	622	0	1.000	1.000	128	*
MZ	35.928	62.112	3.3	58.60	39.05	0.666	622	0	1.000	1.000	87	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	829.74	0.00	0.000	436	0	1.000	1.000	830	
MZ	35.928	62.112	3.3	12.31	39.05	3.172	436	0	1.000	1.000	61	*

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	529.41	0.00	0.000	550	0	1.000	1.000	529	
MZ	35.928	62.112	3.3	28.72	39.05	1.360	550	0	1.000	1.000	77	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	486	0	1.000	1.000	100	*
MZ	35.928	62.112	3.3	797.13	39.05	0.049	486	0	1.000	1.000	797	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	797.83	0.00	0.000	376	0	1.000	1.000	798	
MZ	35.928	62.112	3.3	827.14	39.05	0.047	376	0	1.000	1.000	827	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	509.05	0.00	0.000	485	0	1.000	1.000	509	
MZ	35.928	62.112	3.3	787.69	39.05	0.050	485	0	1.000	1.000	788	

\* MINIMUM MOMENT CONTROLS



H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 'HLB 137 MEM. 10 JT. 7

JMJ Jun-06  
 WJB Jun-06

**COLUMN LOADS**

HLB 137				PMIN MEMBER 10				JOINT 7			
GROUP 1				GROUP 2							
	P	MY	MZ		P	MY	MZ				
DL	228.74	0.00	30.04	DL	228.74	0.00	30.04				
LL	51.09	0.00	-2.05	LL	0.00	0.00	0.00				
GROUP 1	0.00	0.00	0.00	GROUP 2	30.73	638.26	-39.51				
SERVICE STRENGTH	279.83 408.06	0.00 0.00	27.99 34.61	SERVICE STRENGTH	259.47 337.31	638.26 829.74	-9.47 -12.31				
GROUP 3				GROUP 4							
	P	MY	MZ		P	MY	MZ				
DL	228.74	0.00	30.04	DL	228.74	0.00	30.04				
LL	51.09	0.00	-2.05	LL	51.09	0.00	-2.05				
GROUP 3	13.57	407.24	-16.97	GROUP 4	-35.05	0.00	-652.24				
SERVICE STRENGTH	293.40 381.42	407.24 529.41	11.02 14.33	SERVICE STRENGTH	244.78 318.22	0.00 0.00	-624.25 -811.53				
GROUP 5				GROUP 6							
	P	MY	MZ		P	MY	MZ				
DL	228.74	0.00	30.04	DL	228.74	0.00	30.04				
LL	0.00	0.00	0.00	LL	51.09	0.00	-2.05				
GROUP 5	-4.31	638.26	-691.75	GROUP 6	-21.48	407.24	-669.21				
SERVICE STRENGTH	224.43 280.54	638.26 797.83	-661.71 -827.14	SERVICE STRENGTH	258.35 322.94	407.24 509.05	-641.22 -801.53				

**SLENDERNESS EFFECTS IN COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	18.63	In.	Depth of Rect. Col. =	D =	62.112	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	0	Ft.	$K_y =$	2.0
			$L_z =$	2.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	717428	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	240045	In <sup>5</sup>		
$K_y L_y / r$	=	0.0	<	22	NO SLENDERNESS EFFECT		
$K_z L_z / r$	=	3.3	<	22	NO SLENDERNESS EFFECT		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 10 JT. 7

JMJ Jun-06  
 W P B Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	408	0	1.000	1.000	84	*
MZ	35.928	62.112	3.3	34.61	39.05	1.128	408	0	1.000	1.000	57	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	829.74	0.00	0.000	337	0	1.000	1.000	830	
MZ	35.928	62.112	3.3	12.31	39.05	3.172	337	0	1.000	1.000	47	*

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	529.41	0.00	0.000	381	0	1.000	1.000	529	
MZ	35.928	62.112	3.3	14.33	39.05	2.726	381	0	1.000	1.000	53	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	318	0	1.000	1.000	65	*
MZ	35.928	62.112	3.3	811.53	39.05	0.048	318	0	1.000	1.000	812	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	797.83	0.00	0.000	281	0	1.000	1.000	798	
MZ	35.928	62.112	3.3	827.14	39.05	0.047	281	0	1.000	1.000	827	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	509.05	0.00	0.000	323	0	1.000	1.000	509	
MZ	35.928	62.112	3.3	801.53	39.05	0.049	323	0	1.000	1.000	802	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 137				P MEMBER 10				JOINT FOOTING			
GROUP 1				GROUP 2							
	P	MY	MZ		P	MY	MZ				
DL	310.80	0.00	20.45	DL	310.80	0.00	20.45				
LL	104.15	0.00	13.09	LL	0.00	0.00	0.00				
GROUP 1	0.00	0.00	0.00	GROUP 2	30.76	697.02	-66.07				
SERVICE STRENGTH	414.95 629.70	0.00 0.00	33.54 54.95	SERVICE STRENGTH	341.56 444.02	697.02 906.13	-45.62 -59.31				
GROUP 3				GROUP 4							
	P	MY	MZ		P	MY	MZ				
DL	310.80	0.00	20.45	DL	310.80	0.00	20.45				
LL	104.15	0.00	13.09	LL	104.15	0.00	13.09				
GROUP 3	13.58	437.66	-27.58	GROUP 4	-35.05	0.00	748.81				
SERVICE STRENGTH	428.53 557.09	437.66 568.96	5.96 7.75	SERVICE STRENGTH	379.90 493.87	0.00 0.00	782.35 1017.06				
GROUP 5				GROUP 6							
	P	MY	MZ		P	MY	MZ				
DL	310.80	0.00	20.45	DL	310.80	0.00	20.45				
LL	0.00	0.00	0.00	LL	104.15	0.00	13.09				
GROUP 5	-4.28	697.02	682.74	GROUP 6	-21.47	437.66	721.23				
SERVICE STRENGTH	306.53 383.16	697.02 871.28	703.19 878.99	SERVICE STRENGTH	393.48 491.85	437.66 547.08	754.77 943.46				

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	18.63	In.	Depth of Rect. Col. =	D =	62.112	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	0	Ft.	$K_y =$	2.0
			$L_z =$	2.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	717428	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	240045	In <sup>5</sup>		
$K_y L_y / r$	=	0.0	<	22	NO SLENDERNESS EFFECT		
$K_z L_z / r$	=	3.3	<	22	NO SLENDERNESS EFFECT		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	630	0	1.000	1.000	129	*
MZ	35.928	62.112	3.3	54.95	26.59	0.484	630	0	1.000	1.000	88	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	906.13	0.00	0.000	444	0	1.000	1.000	906	
MZ	35.928	62.112	3.3	59.31	26.59	0.448	444	0	1.000	1.000	62	*

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	568.96	0.00	0.000	557	0	1.000	1.000	569	
MZ	35.928	62.112	3.3	7.75	26.59	3.431	557	0	1.000	1.000	78	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	494	0	1.000	1.000	101	*
MZ	35.928	62.112	3.3	1017.06	26.59	0.026	494	0	1.000	1.000	1017	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	871.28	0.00	0.000	383	0	1.000	1.000	871	
MZ	35.928	62.112	3.3	878.99	26.59	0.030	383	0	1.000	1.000	879	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	547.08	0.00	0.000	492	0	1.000	1.000	547	
MZ	35.928	62.112	3.3	943.46	26.59	0.028	492	0	1.000	1.000	943	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 'HLB 137 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 137				PMIN MEMBER 10				JOINT FOOTING			
GROUP 1				GROUP 2							
	P	MY	MZ		P	MY	MZ				
DL	233.10	0.00	20.45	DL	233.10	0.00	20.45				
LL	51.09	0.00	-6.25	LL	0.00	0.00	0.00				
GROUP 1	0.00	0.00	0.00	GROUP 2	30.76	697.02	-66.07				
SERVICE STRENGTH	284.19 413.73	0.00 0.00	14.20 13.04	SERVICE STRENGTH	263.86 343.01	697.02 906.13	-45.62 -59.31				
GROUP 3				GROUP 4							
	P	MY	MZ		P	MY	MZ				
DL	233.10	0.00	20.45	DL	233.10	0.00	20.45				
LL	51.09	0.00	-6.25	LL	51.09	0.00	-6.25				
GROUP 3	13.58	437.66	-27.58	GROUP 4	-35.05	0.00	748.81				
SERVICE STRENGTH	297.77 387.10	437.66 568.96	-13.38 -17.39	SERVICE STRENGTH	249.14 323.88	0.00 0.00	763.01 991.91				
GROUP 5				GROUP 6							
	P	MY	MZ		P	MY	MZ				
DL	233.10	0.00	20.45	DL	233.10	0.00	20.45				
LL	0.00	0.00	0.00	LL	51.09	0.00	-6.25				
GROUP 5	-4.28	697.02	682.74	GROUP 6	-21.47	437.66	721.23				
SERVICE STRENGTH	228.83 286.03	697.02 871.28	703.19 878.99	SERVICE STRENGTH	262.72 328.40	437.66 547.08	735.43 919.29				

**SLENDERNESSE EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\Phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	62.112	In.	
$r_y = 0.30 * D =$	18.63	In.	$L_y =$	0	Ft.	$K_y =$	2.0
$r_z = 0.30 * B =$	10.78	In.	$L_z =$	2.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	717428	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	240045	In <sup>5</sup>		
$K_y L_y / r$	=	0.0	<	22		NO SLENDERNESS EFFECT	
$K_z L_z / r$	=	3.3	<	22		NO SLENDERNESS EFFECT	

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	414	0	1.000	1.000	85	*
MZ	35.928	62.112	3.3	13.04	26.59	2.038	414	0	1.000	1.000	58	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	906.13	0.00	0.000	343	0	1.000	1.000	906	
MZ	35.928	62.112	3.3	59.31	26.59	0.448	343	0	1.000	1.000	59	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	568.96	0.00	0.000	387	0	1.000	1.000	569	
MZ	35.928	62.112	3.3	17.39	26.59	1.528	387	0	1.000	1.000	54	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	324	0	1.000	1.000	66	*
MZ	35.928	62.112	3.3	991.91	26.59	0.027	324	0	1.000	1.000	992	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	871.28	0.00	0.000	286	0	1.000	1.000	871	
MZ	35.928	62.112	3.3	878.99	26.59	0.030	286	0	1.000	1.000	879	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	547.08	0.00	0.000	328	0	1.000	1.000	547	
MZ	35.928	62.112	3.3	919.29	26.59	0.029	328	0	1.000	1.000	919	

\* MINIMUM MOMENT CONTROLS

*Jms 7/06  
WDB 7/06*

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=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
=====

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*BASED ON PLANS.*

General Information:

```

=====
File Name: S:\DGN-ST\NORTH-C\BONNER-1\ANALYSIS\PIERS\HLB137\PCACOL~1\M10PLAN.COL
Project:  BONNER BRIDGE - OREGON INLET
Column:   HLB #137                      Engineer:  JMJ
Code:     ACI 318-95                    Units:   English

Run Option: Investigation                Slenderness: Not considered
Run Axis:   Biaxial                      Column Type: Structural
    
```

Material Properties:

```

=====
f'c   = 3 ksi                fy   = 40 ksi
Ec    = 3122.02 ksi         Es   = 29000 ksi
fc    = 2.55 ksi           Rupture strain = Infinity
Ultimate strain = 0.003 in/in
Beta1 = 0.85
    
```

Section:

```

=====
Rectangular: Width = 36 in                Depth = 62.1 in

Gross section area, Ag = 2235.6 in^2
Ix = 718449 in^4                        Iy = 241445 in^4
Xo = 0 in                                Yo = 0 in
    
```

Reinforcement:

```

=====
Rebar Database: User-defined
Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
-----
# 1      0.00      0.00   # 3      0.38      0.11   # 4      0.50      0.20
# 5      0.63      0.31   # 6      0.75      0.44   # 7      0.88      0.60
# 8      1.00      0.79   # 9      1.13      1.00   # 10     1.27      1.27
# 11     1.41      1.56   # 14     1.69      2.25   # 18     2.26      4.00
    
```

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular  
 Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)  
 Total steel area, As = 28.08 in^2 at 1.26%  
 18 #11 Cover = 5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

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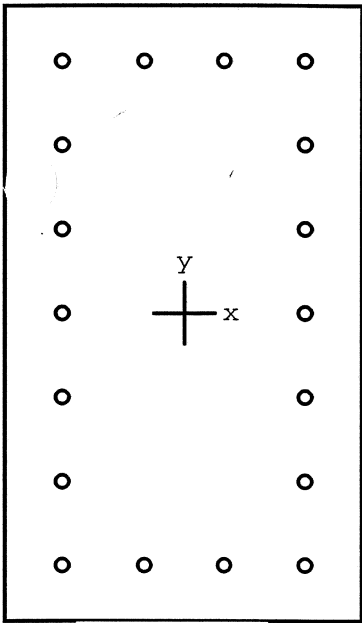
```

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	622.0	128.0	87.0	1758.4	1193.6	13.732
2	436.0	830.0	61.0	2665.8	194.3	3.212
3	550.0	529.0	77.0	2654.3	386.0	5.017
4	486.0	100.0	797.0	192.0	1537.4	1.929
5	376.0	798.0	827.0	1274.2	1316.0	1.594
6	485.0	509.0	788.0	933.0	1445.6	1.834
7	408.0	84.0	57.0	1725.9	1173.6	20.561
8	337.0	830.0	47.0	2601.1	148.0	3.134
9	381.0	529.0	53.0	2600.3	259.5	4.915
10	318.0	65.0	812.0	114.9	1443.3	1.777
11	281.0	798.0	827.0	1235.3	1281.2	1.549
12	323.0	509.0	802.0	875.3	1375.3	1.716
13	630.0	129.0	88.0	1755.4	1194.5	13.597
14	444.0	906.0	62.0	2674.7	184.9	2.952
15	557.0	569.0	78.0	2669.2	362.7	4.690



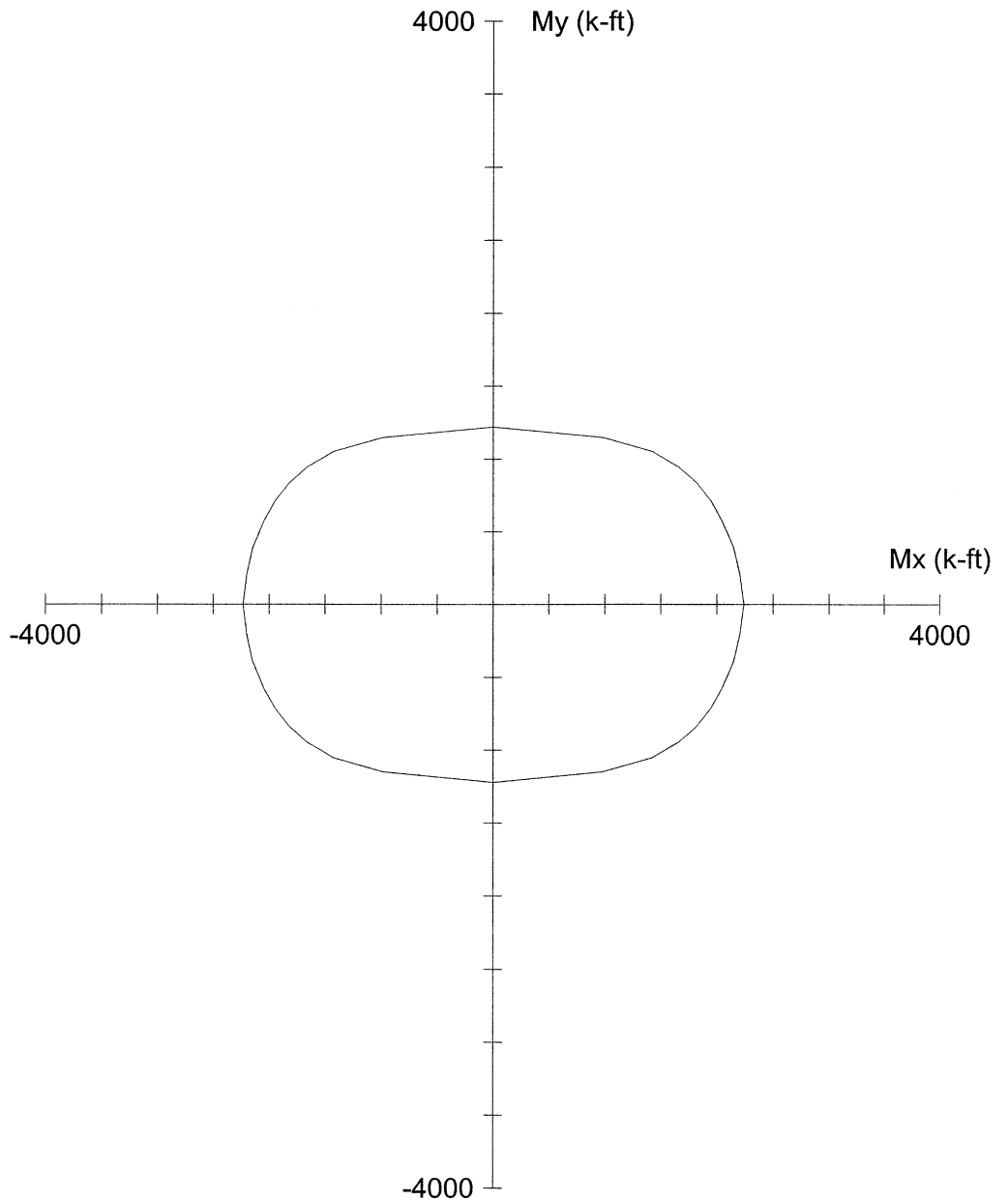
16	494.0	101.0	1017.0	153.0	1542.4	1.517
17	383.0	871.0	879.0	1300.0	1311.2	1.492
18	492.0	547.0	943.0	850.8	1462.7	1.552
19	414.0	85.0	58.0	1722.1	1177.3	20.272
20	343.0	906.0	59.0	2601.0	167.3	2.871
21	387.0	569.0	54.0	2610.8	244.1	4.588
22	324.0	66.0	992.0	97.7	1447.3	1.459
23	286.0	871.0	879.0	1268.6	1276.1	1.454
24	328.0	547.0	919.0	823.3	1386.6	1.508

\*\*\* Program completed as requested! \*\*\*



36 x 62.1 in

Code: ACI 318-95  
 Units: English  
 Run axis: Biaxial  
 Run option: Investigation  
 Slenderness: Not considered  
 Column type: Structural  
 Bars: User-defined  
 Date: 07/19/06  
 Time: 15:37:49



P = 0 kip

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File: S:\DGN-ST\NORTH-C~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M10PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f'_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 2235.6$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 1.26%

$f_c = 2.55$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 718449$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 241445$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 6.79 in

Clear cover = 5.00 in

Confinement: Tied  
 Appendix F.2

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

*Jms 7/06*  
*WOB 7/06*

```

0000000 00000 00000 00000 00000 00
00 00 00 00 00 00 00 00 00 00 00
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00 00 00 00 00 00 00 00 00 00 00
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00 00 00 00 00 00 00 00 00 00
00 00000 00 00 00000 00000 00000 (TM)

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=====
Computer program for the Strength Design of Reinforced Concrete Sections
=====

```

Licensee stated above acknowledges that Portland Cement Association (PCA) is not and cannot be responsible for either the accuracy or adequacy of the material supplied as input for processing by the PCACOL(tm) computer program. Furthermore, PCA neither makes any warranty expressed nor implied with respect to the correctness of the output prepared by the PCACOL(tm) program. Although PCA has endeavored to produce PCACOL(tm) error free, the program is not and can't be certified infallible. The final and only responsibility for analysis, design and engineering documents is the licensees. Accordingly, PCA disclaims all responsibility in contract, negligence or other tort for any analysis, design or engineering documents prepared in connection with the use of the PCACOL(tm) program.

*50% COVER LOSS*  
*f'c = 4400 PSI*

General Information:

=====  
 File Name: S:\DGN-ST\NORTH-1\BONNER-1\ANALYSIS\PIERS\HLB137\PCACOL-1\M10ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====  
 f'c = 4.4 ksi fy = 40 ksi  
 Ec = 3780.96 ksi Es = 29000 ksi  
 fc = 3.74 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.83

Section:

=====  
 Rectangular: Width = 31 in Depth = 57.1 in  
  
 Gross section area, Ag = 1770.1 in<sup>2</sup>  
 Ix = 480938 in<sup>4</sup> Iy = 141756 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====  
 Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular  
 Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)  
 Total steel area, As = 28.08 in<sup>2</sup> at 1.59%  
 18 #11 Cover = 2.5 in

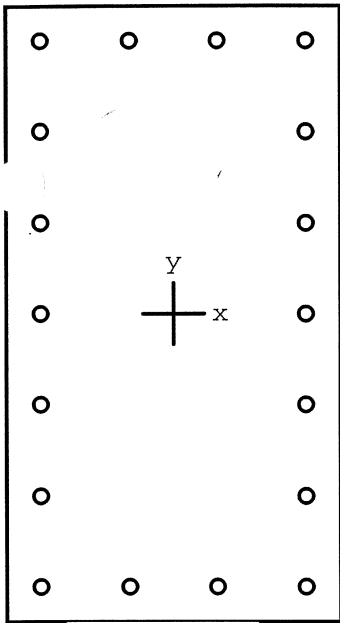
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====  
 =====

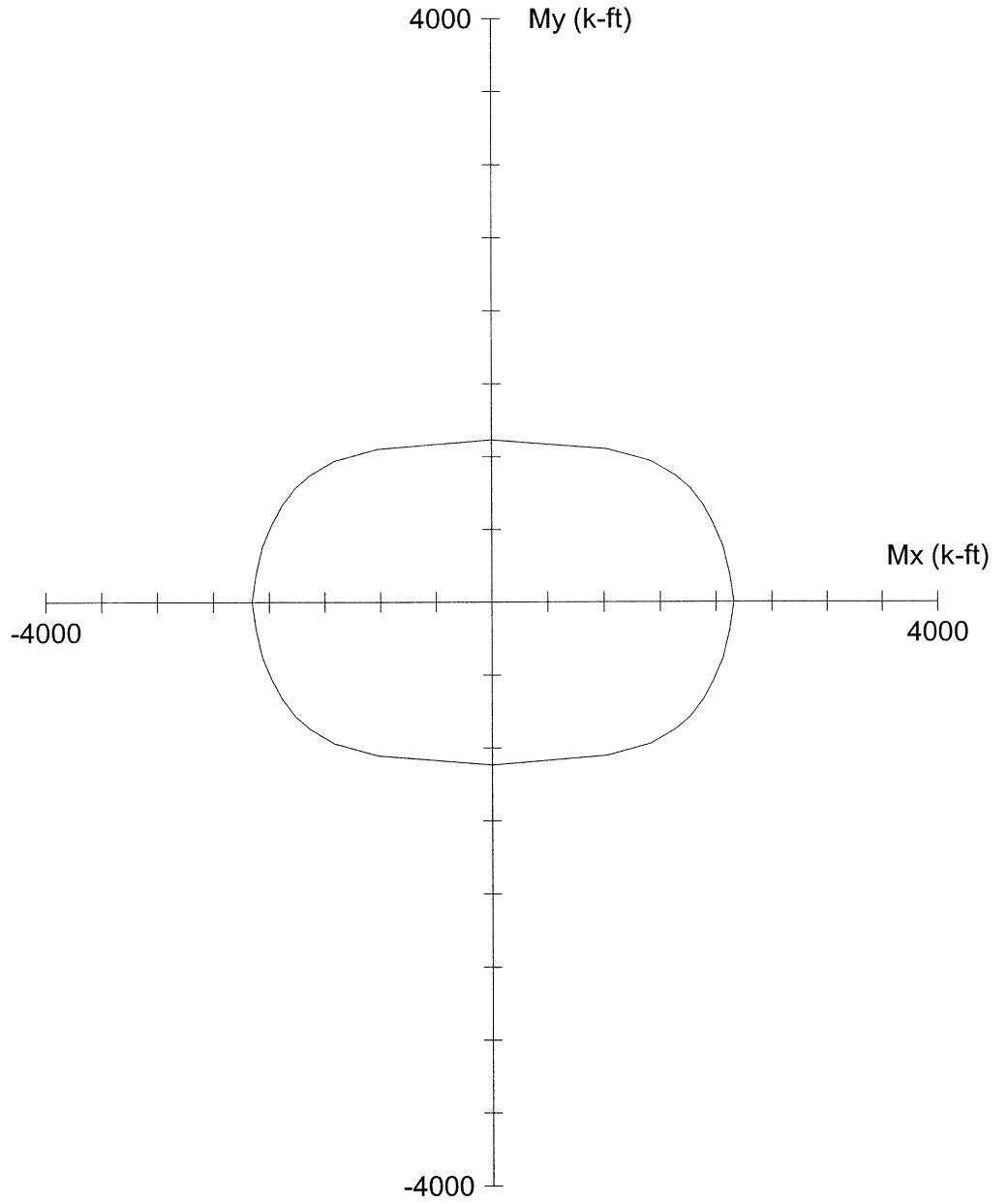
No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	622.0	128.0	87.0	1745.7	1188.6	13.646
2	436.0	830.0	61.0	2627.4	189.2	3.165
3	550.0	529.0	77.0	2647.1	381.6	5.003
4	486.0	100.0	797.0	185.3	1463.0	1.836
5	376.0	798.0	827.0	1212.8	1261.2	1.523
6	485.0	509.0	788.0	891.2	1380.2	1.751
7	408.0	84.0	57.0	1675.8	1135.2	19.940
8	337.0	830.0	47.0	2544.3	142.2	3.065
9	381.0	529.0	53.0	2552.2	257.5	4.825
10	318.0	65.0	812.0	109.5	1354.8	1.669
11	281.0	798.0	827.0	1170.0	1214.3	1.467
12	323.0	509.0	802.0	824.4	1300.9	1.621
13	630.0	129.0	88.0	1745.6	1190.4	13.531
14	444.0	906.0	62.0	2637.7	179.0	2.911
15	557.0	569.0	78.0	2659.9	366.2	4.675

16	494.0	101.0	1017.0	147.5	1469.1	1.445
17	383.0	871.0	879.0	1249.5	1257.0	1.432
18	492.0	547.0	943.0	811.4	1396.6	1.482
19	414.0	85.0	58.0	1671.9	1139.4	19.662
20	343.0	906.0	59.0	2545.8	165.6	2.810
21	387.0	569.0	54.0	2564.4	241.1	4.506
22	324.0	66.0	992.0	88.1	1359.2	1.370
23	286.0	871.0	879.0	1200.5	1212.0	1.379
24	328.0	547.0	919.0	778.3	1310.9	1.425

\*\*\* Program completed as requested! \*\*\*



31 x 57.1 in



Code: ACI 318-95

Units: English

Run axis: Biaxial

Run option: Investigation

Slenderness: Not considered

mn type: Structural

Bars: User-defined

Date: 07/25/06

Time: 12:38:02

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File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M10ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 1770.1$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

$Rho = 1.59\%$

$f_c = 3.74$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 480938$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 141756$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 6.79 in

Clear cover = 2.50 in

Confinement: Tied  
Appendix F.2

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 11 JT. 8

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				P MAX					
				HLB 137	MEMBER 11	JOINT 8			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		
DL	304.89	0.00	31.60	DL	304.89	0.00	31.60		
LL	104.12	0.00	9.48	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	-30.71	-638.17	39.46		
SERVICE STRENGTH	409.01	0.00	41.08	SERVICE STRENGTH	274.18	-638.17	71.06		
	621.95	0.00	61.62		356.43	-829.62	92.38		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		
DL	304.89	0.00	31.60	DL	304.89	0.00	31.60		
LL	104.12	0.00	9.48	LL	104.12	0.00	9.48		
GROUP 3	-13.56	-407.20	16.95	GROUP 4	-33.81	0.00	-651.84		
SERVICE STRENGTH	395.45	-407.20	58.03	SERVICE STRENGTH	375.20	0.00	-610.76		
	514.09	-529.36	75.44		487.76	0.00	-793.99		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		
DL	304.89	0.00	31.60	DL	304.89	0.00	31.60		
LL	0.00	0.00	0.00	LL	104.12	0.00	9.48		
GROUP 5	-64.52	-638.17	-612.38	GROUP 6	-47.37	-407.20	-634.89		
SERVICE STRENGTH	240.37	-638.17	-580.78	SERVICE STRENGTH	361.64	-407.20	-593.81		
	300.46	-797.71	-725.98		452.05	-509.00	-742.26		

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\Phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	18.63	In.	Depth of Rect. Col. =	D =	62.112	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	0	Ft.	$K_y =$	2.0
			$L_z =$	2.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	717428	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	240045	In <sup>5</sup>		
$K_y L_y / r$	=	0.0	<	22	NO SLENDERNESS EFFECT		
$K_z L_z / r$	=	3.3	<	22	NO SLENDERNESS EFFECT		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 11 JT. 8

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	622	0	1.000	1.000	128	*
MZ	35.928	62.112	3.3	61.62	41.08	0.667	622	0	1.000	1.000	87	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	829.62	0.00	0.000	356	0	1.000	1.000	830	
MZ	35.928	62.112	3.3	92.38	41.08	0.445	356	0	1.000	1.000	92	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	529.36	0.00	0.000	514	0	1.000	1.000	529	
MZ	35.928	62.112	3.3	75.44	41.08	0.545	514	0	1.000	1.000	75	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	488	0	1.000	1.000	100	*
MZ	35.928	62.112	3.3	793.99	41.08	0.052	488	0	1.000	1.000	794	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	797.71	0.00	0.000	300	0	1.000	1.000	798	
MZ	35.928	62.112	3.3	725.98	41.08	0.057	300	0	1.000	1.000	726	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	509.00	0.00	0.000	452	0	1.000	1.000	509	
MZ	35.928	62.112	3.3	742.26	41.08	0.055	452	0	1.000	1.000	742	

\* MINIMUM MOMENT CONTROLS



H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 'HLB 137 MEM. 11 JT. 8

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				PMIN					
				HLB 137	MEMBER 11	JOINT 8			
				GROUP 1			GROUP 2		
	P	MY	MZ		P	MY	MZ		
DL	228.67	0.00	31.60	DL	228.67	0.00	31.60		
LL	51.06	0.00	-1.68	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	-30.71	-638.17	39.46		
SERVICE STRENGTH	279.73 407.90	0.00 0.00	29.92 37.44	SERVICE STRENGTH	197.96 257.34	-638.17 -829.62	71.06 92.38		
				GROUP 3			GROUP 4		
	P	MY	MZ		P	MY	MZ		
DL	228.67	0.00	31.60	DL	228.67	0.00	31.60		
LL	51.06	0.00	-1.68	LL	51.06	0.00	-1.68		
GROUP 3	-13.56	-407.20	16.95	GROUP 4	-33.81	0.00	-651.84		
SERVICE STRENGTH	266.17 346.02	-407.20 -529.36	46.87 60.93	SERVICE STRENGTH	245.92 319.69	0.00 0.00	-621.92 -808.50		
				GROUP 5			GROUP 6		
	P	MY	MZ		P	MY	MZ		
DL	228.67	0.00	31.60	DL	228.67	0.00	31.60		
LL	0.00	0.00	0.00	LL	51.06	0.00	-1.68		
GROUP 5	-64.52	-638.17	-612.38	GROUP 6	-47.37	-407.20	-634.89		
SERVICE STRENGTH	164.15 205.18	-638.17 -797.71	-580.78 -725.98	SERVICE STRENGTH	232.36 290.45	-407.20 -509.00	-604.97 -756.21		

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	18.63	In.	Depth of Rect. Col. =	D =	62.112	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	0	Ft.	$K_y =$	2.0
			$L_z =$	2.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	717428	$\text{In}^4$		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	240045	$\text{In}^5$		
$K_y L_y / r$	=	0.0	<	22	NO SLENDERNESS EFFECT		
$K_z L_z / r$	=	3.3	<	22	NO SLENDERNESS EFFECT		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 11 JT. 8

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	408	0	1.000	1.000	84	*
MZ	35.928	62.112	3.3	37.44	41.08	1.097	408	0	1.000	1.000	57	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	829.62	0.00	0.000	257	0	1.000	1.000	830	
MZ	35.928	62.112	3.3	92.38	41.08	0.445	257	0	1.000	1.000	92	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	529.36	0.00	0.000	346	0	1.000	1.000	529	
MZ	35.928	62.112	3.3	60.93	41.08	0.674	346	0	1.000	1.000	61	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	320	0	1.000	1.000	66	*
MZ	35.928	62.112	3.3	808.50	41.08	0.051	320	0	1.000	1.000	808	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	797.71	0.00	0.000	205	0	1.000	1.000	798	
MZ	35.928	62.112	3.3	725.98	41.08	0.057	205	0	1.000	1.000	726	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	509.00	0.00	0.000	290	0	1.000	1.000	509	
MZ	35.928	62.112	3.3	756.21	41.08	0.054	290	0	1.000	1.000	756	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 11 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 137			P MEMBER 11			JOINT FOOTING			
		<u>GROUP 1</u>						<u>GROUP 2</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	310.70	0.00	20.34	DL	310.70	0.00	20.34	DL	310.70	0.00	20.34
LL	104.12	0.00	13.04	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	-30.74	-696.89	66.11	GROUP 2	-30.74	-696.89	66.11
SERVICE STRENGTH	414.82 629.50	0.00 0.00	33.38 54.70	SERVICE STRENGTH	279.97 363.96	-696.89 -905.96	86.45 112.39	SERVICE STRENGTH	279.97 363.96	-696.89 -905.96	86.45 112.39
		<u>GROUP 3</u>						<u>GROUP 4</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	310.70	0.00	20.34	DL	310.70	0.00	20.34	DL	310.70	0.00	20.34
LL	104.12	0.00	13.04	LL	104.12	0.00	13.04	LL	104.12	0.00	13.04
GROUP 3	-13.57	-437.59	27.60	GROUP 4	-33.81	0.00	749.21	GROUP 4	-33.81	0.00	749.21
SERVICE STRENGTH	401.25 521.63	-437.59 -568.87	60.98 79.27	SERVICE STRENGTH	381.01 495.31	0.00 0.00	782.59 1017.37	SERVICE STRENGTH	381.01 495.31	0.00 0.00	782.59 1017.37
		<u>GROUP 5</u>						<u>GROUP 6</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	310.70	0.00	20.34	DL	310.70	0.00	20.34	DL	310.70	0.00	20.34
LL	0.00	0.00	0.00	LL	104.12	0.00	13.04	LL	104.12	0.00	13.04
GROUP 5	-64.55	-696.89	815.32	GROUP 6	-47.38	-437.59	776.81	GROUP 6	-47.38	-437.59	776.81
SERVICE STRENGTH	246.16 307.69	-696.89 -871.11	835.66 1044.58	SERVICE STRENGTH	367.44 459.30	-437.59 -546.99	810.19 1012.74	SERVICE STRENGTH	367.44 459.30	-437.59 -546.99	810.19 1012.74

**SLENDERNESS EFFECTS IN  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	18.63	In.	Depth of Rect. Col. =	D =	62.112	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	0	Ft.	$K_y =$	2.0
			$L_z =$	2.5	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	717428	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	240045	In <sup>5</sup>		
$K_y L_y / r$	=	0.0	<	22	NO SLENDERNESS EFFECT		
$K_z L_z / r$	=	3.3	<	22	NO SLENDERNESS EFFECT		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 11 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	630	0	1.000	1.000	129	*
MZ	35.928	62.112	3.3	54.70	26.44	0.483	630	0	1.000	1.000	88	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	905.96	0.00	0.000	364	0	1.000	1.000	906	
MZ	35.928	62.112	3.3	112.39	26.44	0.235	364	0	1.000	1.000	112	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	568.87	0.00	0.000	522	0	1.000	1.000	569	
MZ	35.928	62.112	3.3	79.27	26.44	0.334	522	0	1.000	1.000	79	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	495	0	1.000	1.000	102	*
MZ	35.928	62.112	3.3	1017.37	26.44	0.026	495	0	1.000	1.000	1017	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	871.11	0.00	0.000	308	0	1.000	1.000	871	
MZ	35.928	62.112	3.3	1044.58	26.44	0.025	308	0	1.000	1.000	1045	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	546.99	0.00	0.000	459	0	1.000	1.000	547	
MZ	35.928	62.112	3.3	1012.74	26.44	0.026	459	0	1.000	1.000	1013	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 'HLB 137 MEM. 11 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 137				PMIN MEMBER 11				JOINT FOOTING															
GROUP 1				GROUP 2				GROUP 3				GROUP 4				GROUP 5				GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ		P	MY	MZ		P	MY	MZ				
DL	233.03	0.00	20.34	DL	233.03	0.00	20.34	DL	233.03	0.00	20.34	DL	233.03	0.00	20.34	DL	233.03	0.00	20.34				
LL	51.06	0.00	-6.22	LL	0.00	0.00	0.00	LL	51.06	0.00	-6.22	LL	51.06	0.00	-6.22	LL	0.00	0.00	0.00				
GROUP 1	0.00	0.00	0.00	GROUP 2	-30.74	-696.89	66.11	GROUP 3	-13.57	-437.59	27.60	GROUP 4	-33.81	0.00	749.21	GROUP 5	-64.55	-696.89	815.32				
SERVICE STRENGTH	284.09	0.00	14.12	SERVICE STRENGTH	202.29	-696.89	86.45	SERVICE STRENGTH	270.52	-437.59	41.72	SERVICE STRENGTH	250.28	0.00	763.33	SERVICE STRENGTH	168.48	-696.89	835.66				
	413.56	0.00	12.97		262.98	-905.96	112.39		351.67	-568.87	54.24		325.36	0.00	992.33		210.60	-871.11	1044.58				

**SLENDERNESSE EFFECTS IN COMPRESSION MEMBERS (AASHTO 8.16.5)**

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	18.63	In.	Depth of Rect. Col. =	D =	62.112	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	0	Ft.	$K_y =$	2.0
$I_{yy} =$	$B * D^3 / 12$		$L_z =$	2.5	Ft.	$K_z =$	1.2
$I_{zz} =$	$D * B^3 / 12$		$I_{yy} =$	717428	In <sup>4</sup>		
			$I_{zz} =$	240045	In <sup>5</sup>		
$K_y L_y / r$	=	0.0	<	22		NO SLENDERNESS EFFECT	
$K_z L_z / r$	=	3.3	<	22		NO SLENDERNESS EFFECT	

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 11 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**SLENDERNESS EFFECTS IN RECTANGULAR  
 COMPRESSION MEMBERS (AASHTO 8.16.5)**

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	414	0	1.000	1.000	85	*
MZ	35.928	62.112	3.3	12.97	26.44	2.039	414	0	1.000	1.000	58	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	905.96	0.00	0.000	263	0	1.000	1.000	906	
MZ	35.928	62.112	3.3	112.39	26.44	0.235	263	0	1.000	1.000	112	

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	568.87	0.00	0.000	352	0	1.000	1.000	569	
MZ	35.928	62.112	3.3	54.24	26.44	0.488	352	0	1.000	1.000	54	

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	0.00	0.00	0.000	325	0	1.000	1.000	67	*
MZ	35.928	62.112	3.3	992.33	26.44	0.027	325	0	1.000	1.000	992	

**GROUP 5**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	871.11	0.00	0.000	211	0	1.000	1.000	871	
MZ	35.928	62.112	3.3	1044.58	26.44	0.025	211	0	1.000	1.000	1045	

**GROUP 6**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	62.112	0.0	546.99	0.00	0.000	296	0	1.000	1.000	547	
MZ	35.928	62.112	3.3	988.66	26.44	0.027	296	0	1.000	1.000	989	

\* MINIMUM MOMENT CONTROLS

JMJ 7/06  
WOB 7/06

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0000000  00000  00000  00000  00000  00
00  00  00  00  00  00  00  00  00  00  00
00  00  00  00  00  00  00  00  00  00  00
00  00  00  00  00  00  00  00  00  00  00
00  00  00  00  0000000  00  00  00  00
0000000  00  00  00  00  00  00  00  00  00
00  00  00  00  00  00  00  00  00  00  00
00  00000  00  00  00000  00000  00000  (TM)
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=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
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*BASED ON PLANS.*

General Information:

=====

File Name: S:\DGN-ST\NORTH-C\BONNER-1\ANALYSIS\PIERS\HLB137\PCACOL~1\M11PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====

f'c = 3 ksi fy = 40 ksi  
 Ec = 3122.02 ksi Es = 29000 ksi  
 fc = 2.55 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.85

Section:

=====

Rectangular: Width = 36 in Depth = 62.1 in  
 Gross section area, Ag = 2235.6 in<sup>2</sup>  
 Ix = 718449 in<sup>4</sup> Iy = 241445 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====

Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular

Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)

Total steel area, As = 28.08 in<sup>2</sup> at 1.26%

18 #11 Cover = 5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

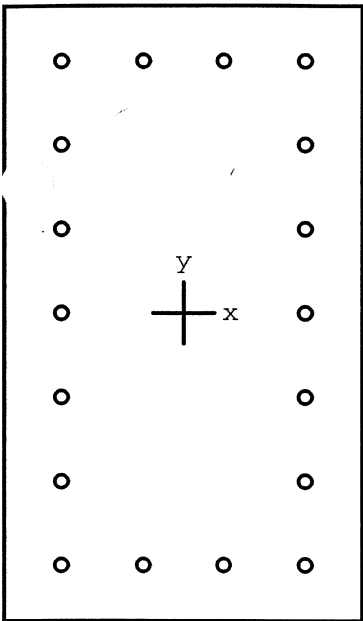
=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	622.0	128.0	87.0	1758.4	1193.6	13.732
2	356.0	830.0	92.0	2569.9	284.9	3.096
3	514.0	529.0	75.0	2643.1	376.9	4.997
4	488.0	100.0	794.0	192.7	1538.4	1.937
5	300.0	798.0	726.0	1375.7	1249.8	1.723
6	452.0	509.0	742.0	976.2	1422.6	1.918
7	408.0	84.0	57.0	1725.9	1173.6	20.561
8	257.0	830.0	92.0	2485.1	272.2	2.994
9	346.0	529.0	61.0	2558.2	293.1	4.835
10	320.0	66.0	808.0	119.8	1444.5	1.788
11	205.0	798.0	726.0	1335.6	1213.8	1.673
12	290.0	509.0	756.0	910.0	1350.8	1.787
13	630.0	129.0	88.0	1755.4	1194.5	13.597
14	364.0	906.0	112.0	2563.6	317.9	2.830
15	522.0	569.0	79.0	2650.3	371.0	4.659

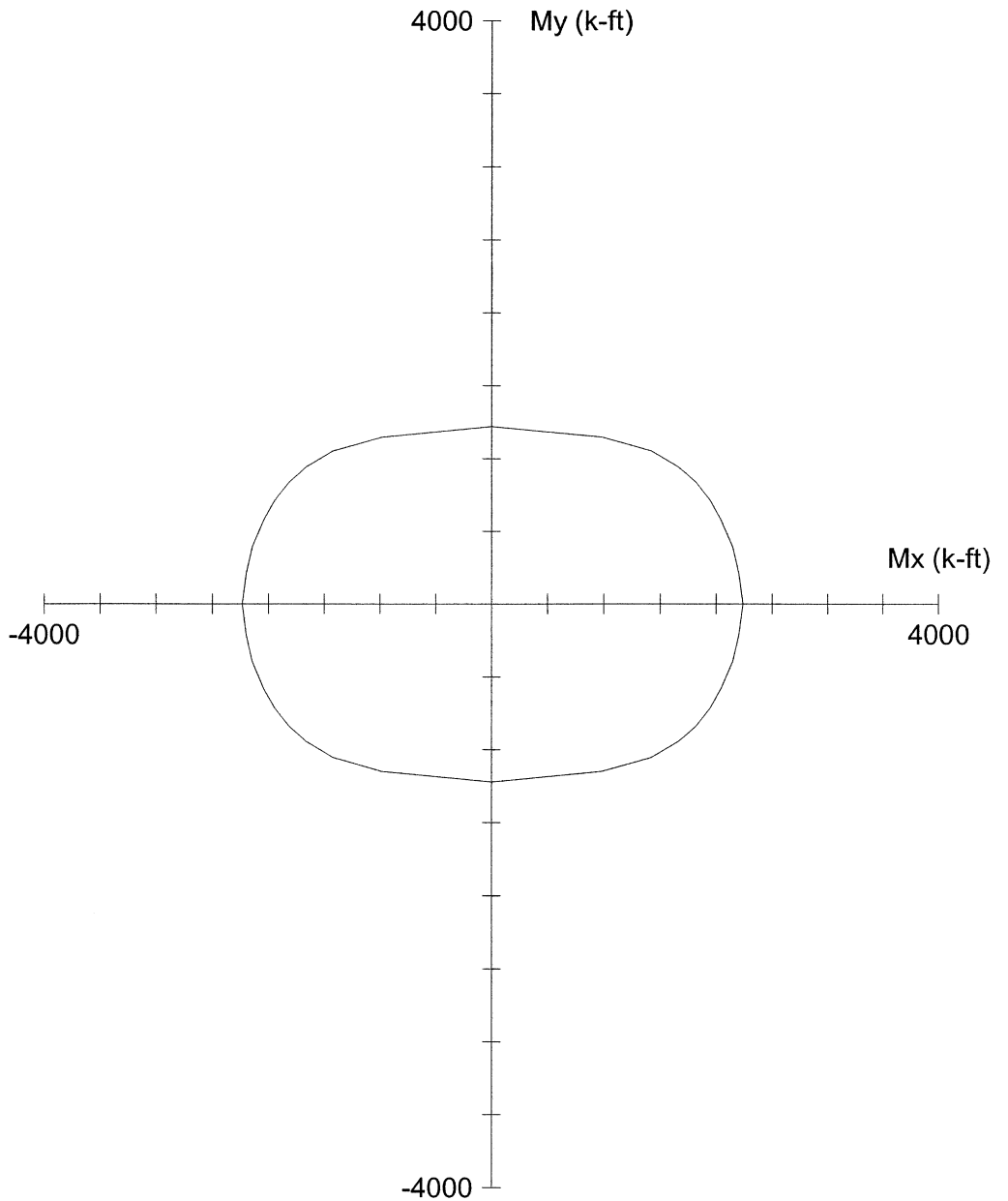


16	495.0	102.0	1017.0	152.9	1542.9	1.517
17	308.0	871.0	1045.0	1102.4	1324.6	1.267
18	459.0	547.0	1013.0	787.3	1458.9	1.440
19	414.0	85.0	58.0	1722.1	1177.3	20.272
20	263.0	906.0	112.0	2476.2	308.4	2.733
21	352.0	569.0	54.0	2582.3	242.8	4.538
22	325.0	67.0	992.0	99.4	1447.9	1.460
23	211.0	871.0	1045.0	1061.8	1275.8	1.220
24	296.0	547.0	989.0	762.9	1377.7	1.393

\*\*\* Program completed as requested! \*\*\*



36 x 62.1 in



Code: ACI 318-95

Units: English

Run axis: Biaxial

Run option: Investigation

Slenderness: Not considered

imn type: Structural

Bars: User-defined

Date: 07/19/06

Time: 16:00:23

PCACOL V3.00 (PCA 1999) - Licensed to: Licensee name not yet specified.

File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M11PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 2235.6$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 1.26%

$f_c = 2.55$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 718449$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 241445$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 6.79 in

Clear cover = 5.00 in

Confinement: Tied  
Appendix F.2

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

JMJ 7/06  
WDB 7/06

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0000000  00000  00000  00000  00000  00
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00  00  00  00  00  00  00  00  00  00  00
00  00  00  00  00  00  00  00  00  00  00
00  00  00  0000000  00  00  00  00  00
0000000  00  00  00  00  00  00  00  00  00
00  00  00  00  00  00  00  00  00  00  00
00  00000  00  00  00000  00000  00000  (TM)

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=====
Computer program for the Strength Design of Reinforced Concrete Sections
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50% COVER LOSS  
 $f'_c = 4400 \text{ PSI}$

General Information:

=====

File Name: S:\DGN-ST\NORTH-1\BONNER-1\ANALYSIS\PIERS\HLB137\PCACOL-1\M11ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #137 Engineer: JMJ  
 Code: ACI 318-95 Units: English

Run Option: Investigation Slenderness: Not considered  
 Run Axis: Biaxial Column Type: Structural

Material Properties:

=====

f'c = 4.4 ksi fy = 40 ksi  
 Ec = 3780.96 ksi Es = 29000 ksi  
 fc = 3.74 ksi Rupture strain = Infinity  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.83

Section:

=====

Rectangular: Width = 31 in Depth = 57.1 in  
 Gross section area, Ag = 1770.1 in<sup>2</sup>  
 Ix = 480938 in<sup>4</sup> Iy = 141756 in<sup>4</sup>  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====

Rebar Database: User-defined

Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )	Size	Diam (in)	Area (in <sup>2</sup> )
# 1	0.00	0.00	# 3	0.38	0.11	# 4	0.50	0.20
# 5	0.63	0.31	# 6	0.75	0.44	# 7	0.88	0.60
# 8	1.00	0.79	# 9	1.13	1.00	# 10	1.27	1.27
# 11	1.41	1.56	# 14	1.69	2.25	# 18	2.26	4.00

Confinement: Tied; #1 ties with #9 bars, #1 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.7

Layout: Rectangular

Pattern: Equal Bar Spacing (Cover to longitudinal reinforcement)

Total steel area, As = 28.08 in<sup>2</sup> at 1.59%

18 #11 Cover = 2.5 in

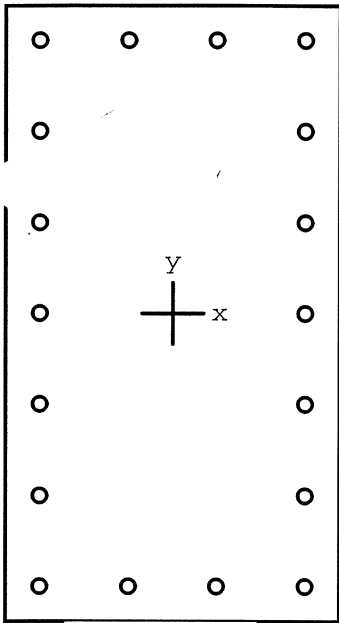
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====

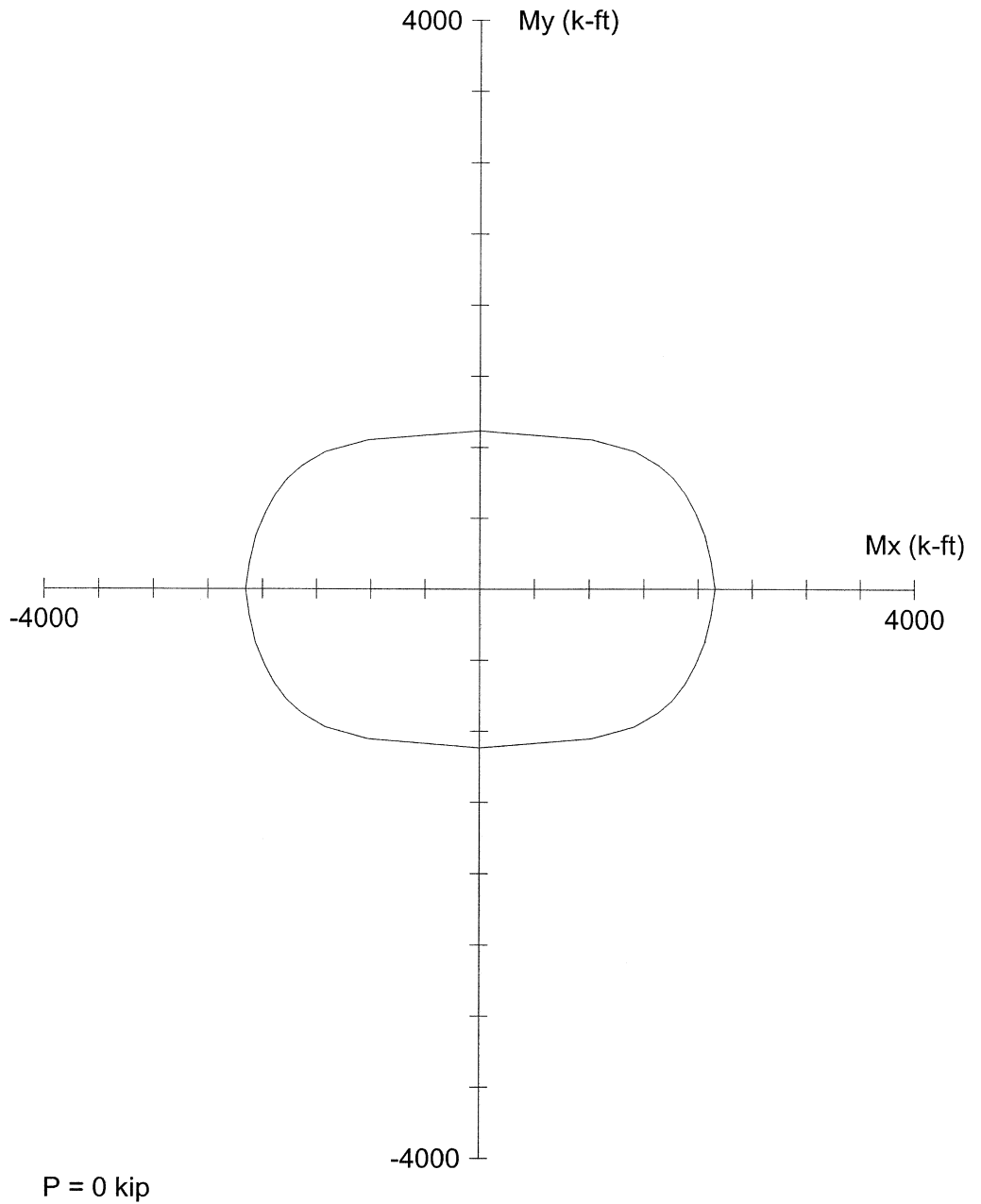
No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	622.0	128.0	87.0	1745.7	1188.6	13.646
2	356.0	830.0	92.0	2519.4	278.4	3.035
3	514.0	529.0	75.0	2624.0	370.0	4.960
4	488.0	100.0	794.0	184.9	1464.2	1.844
5	300.0	798.0	726.0	1311.7	1196.2	1.645
6	452.0	509.0	742.0	928.1	1356.9	1.827
7	408.0	84.0	57.0	1675.8	1135.2	19.940
8	257.0	830.0	92.0	2420.7	272.3	2.917
9	346.0	529.0	61.0	2503.6	292.8	4.734
10	320.0	66.0	808.0	112.8	1356.1	1.679
11	205.0	798.0	726.0	1260.8	1149.4	1.581
12	290.0	509.0	756.0	859.0	1275.0	1.687
13	630.0	129.0	88.0	1745.6	1190.4	13.531
14	364.0	906.0	112.0	2515.4	307.1	2.776
15	522.0	569.0	79.0	2633.4	363.8	4.628

16	495.0	102.0	1017.0	148.9	1469.6	1.445
17	308.0	871.0	1045.0	1045.1	1254.4	1.200
18	459.0	547.0	1013.0	747.6	1389.2	1.370
19	414.0	85.0	58.0	1671.9	1139.4	19.662
20	263.0	906.0	112.0	2417.1	295.7	2.667
21	352.0	569.0	54.0	2529.9	242.4	4.447
22	325.0	67.0	992.0	93.3	1359.8	1.371
23	211.0	871.0	1045.0	1001.7	1201.9	1.150
24	296.0	547.0	989.0	720.6	1300.0	1.315

\*\*\* Program completed as requested! \*\*\*



31 x 57.1 in



Code: ACI 318-95

Units: English

Run axis: Biaxial

Run option: Investigation

Slenderness: Not considered

mn type: Structural

Bars: User-defined

Date: 07/25/06

Time: 12:38:25

PCACOL V3.00 (PCA 1999) - Licensed to: Licensee name not yet specified.

File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB137\PCACOL~1\M11ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #137

Engineer: JMJ

$f'_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 1770.1$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

$A_s = 28.08$  in<sup>2</sup>

Rho = 1.59%

$f_c = 3.74$  ksi

$e_{rup} = \text{Infinity}$

$X_o = 0.00$  in

$I_x = 480938$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 141756$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 6.79 in

Clear cover = 2.50 in

Confinement: Tied  
Appendix F.2

$\phi(a) = 0.8, \phi(b) = 0.9, \phi(c) = 0.7$

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #137  
 SUBJECT: TOP OF CAP - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 KBM Jun-06

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	328.620	Ft. Kips	Working Stress Mom.	497.000	Ft. Kips
Live Load Moment	168.380	Ft. Kips	Load Factor Mom.	792.759	Ft. Kips
Avg. Bar Clearance	3.625	In.	Z For Steel Dist.	170	
Cover	3.000	In.	fc	=	3.000 Ksi
Width of Member (b)	36.000	In.	fy	=	40.000 Ksi
Depth of Member (h)	42.000	In.			

**AREA OF STEEL**

Bar Size	11		dc =	4.330	In.
No. Bars	7		dc' =	2.705	In.
As	10.93	Sq. In.	d =	37.670	In.

**RESULTS**

A	=	2.00 x 4.56 x 2.705	=	24.68	
f <sub>s</sub> Allow	=	170.00 / (24.68 x 2.705) <sup>.33</sup>	=	41.91 Ksi	36.00 Max
a	=	(10.93 x 40.00) / 0.85 x 3.00 x 36.00	=	4.763	In.
jd	=	37.670 - 4.76 / 2.00	=	35.29	
f <sub>s</sub> Act	=	(497.00 x 12.00) / 10.93 x 35.29	=	15.46	Ksi
θM <sub>N</sub>	=	0.90 x 10.93 x 40.00 x 35.29 / 12	=	1157.13	Ft. Kips

AASHTO 8.17.1	Min. Reinforcement	φM <sub>n</sub> > 1.2Mcr	Mcr = fr Ig/yt
fr =	7.5 (fc) <sup>1/2</sup>		= 0.411 Ksi
Ig =	1/12 * b * h <sup>3</sup>	yt = h/2	= 21.00 In.
Mcr =	0.411 x 222264 / 21.00 / 12		= 362.32 Ft. Kips

AASHTO 8.17.1      φM<sub>n</sub> = 1157.13      >      1.2 Mcr = 434.78      **OK**

f<sub>s</sub> Act = 15.46      <      f<sub>s</sub> Allow = 36.00      **OK**

φM<sub>n</sub> = 1157.13      >      Mu = 792.76      **OK**

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #137  
 SUBJECT: BOTTOM OF CAP - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 KBM Jun-06

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	205.070	Ft. Kips	Working Stress Mom.	374.250	Ft. Kips
Live Load Moment	169.180	Ft. Kips	Load Factor Mom.	633.881	Ft. Kips
Bar Clearance	3.625	In.	Z For Steel Dist.	170	
Cover	3.000	In.	f <sub>c</sub>	=	3.000 Ksi
Width of Member (b)	36.00	In.	f <sub>y</sub>	=	40.000 Ksi
Depth of Member (h)	42.00	In.			

**AREA OF STEEL**

Bar Size	11		d <sub>c</sub> =	4.330	In.
No. Bars	5		d <sub>c</sub> ' =	2.705	In.
A <sub>s</sub>	7.81	Sq. In.	d =	37.670	In.

**RESULTS**

A	=	2.00 x 6.84 x 2.705	=	37.02
f <sub>s</sub> Allow	=	170.00 / (37.02 x 2.705) <sup>.33</sup>	=	36.61 Ksi 36.00 Max
a	=	(7.81 x 40.00) / 0.85 x 3.00 x 36.00	=	3.402 In.
jd	=	37.670 - 3.40 / 2.00	=	35.97
f <sub>s</sub> Act	=	(374.25 x 12.00) / 7.81 x 35.97	=	15.99 Ksi
θM <sub>N</sub>	=	0.90 x 7.81 x 40.00 x 35.97 / 12	=	842.46 Ft. Kips

AASHTO 8.17.1	Min. Reinforcement	φM <sub>n</sub> >	1.2M <sub>cr</sub>	M <sub>cr</sub> =	fr Ig/yt
fr	= 7.5 (f <sub>c</sub> ) <sup>1/2</sup>			=	0.411 Ksi
Ig	= 1/12 * b * h <sup>3</sup>	=	222264 In. <sup>4</sup>	yt =	h/2
M <sub>cr</sub>	= 0.411 x 222264 / 21.00 / 12			=	362.32 Ft. Kips

AASHTO 8.17.1	φM <sub>n</sub> =	842.46	>	1.2 M <sub>cr</sub> =	434.78	OK
	f <sub>s</sub> Act =	15.99	<	f <sub>s</sub> Allow =	36.00	OK
	φM <sub>n</sub> =	842.46	>	Mu =	633.88	OK



**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #137  
 SHEAR - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 KBM Jun-06

**SHEAR DESIGN - CAP COMPLETE**

$$V_{DL} = 103.93 \text{ KIPS} \quad V_{LL} = 59.31 \text{ KIPS} \quad F_v = 40000 \text{ PSI}$$

$$d = 37.67 \text{ INCHES} \quad b = 36.00 \text{ INCHES} \quad f_c = 3000 \text{ PSI}$$

$$V @ d \text{ DIST. FROM FACE OF SUPPORT} \quad \text{Col. Width} = D = 3.00 \text{ FT}$$

$$\text{ASSUME FACE OF SUPPORT} \quad D/4 = 0.75 \text{ FT.} \quad \text{FROM CENTER OF COL.}$$

$$d_{DIST.} = 37.67 / 12.00 + 0.750 = 3.89 \text{ FT.} \quad W_{DL} \text{ CAP} = 1.575 \text{ KIPS/FT}$$

$$V_{DL} = V_{DL} - W_{DL} * d_{DIST} = 97.80$$

$$V_U = 1.3(V_{DL} + (1.67 * V_{LL})) = 255.91$$

$$V_U < q V_N \quad V_N = V_C + V_S$$

$$V_U < q V_C + q V_S$$

$$V_C = 2 * (f_c)^{1/2} * b * d = 148.56 \text{ KIPS}$$

$$q V_S = V_U - q V_C$$

$$V_S = V_U / q - V_C = 152.51 \text{ KIPS}$$

$$V_S = A_V * F_V * d / S$$

USE # 5 STIRRUPS  $A_S = 0.31 \text{ SQ. IN.}$   
 No. of Bars = 2

$$A_V = 2 * A_S = 2 * 0.307 = 0.61359232 \text{ SQ. IN.}$$

$$S = A_V * F_V * d / V_S = 6.1 \text{ INCHES}$$

$$S_{MIN} = A_V * F_V / 50 * b = 20.45 \text{ INCHES}$$

$$S_{ACT} = 6.00 \text{ INCHES} \quad \text{OK}$$

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jun-06

SUBJECT: HIGH LEVEL BENT #137

WDB Jun-06

SUBJECT: TOP OF CAP - BASED ON FIELD DATA, ASSUME 50% COVER LOSS EVERYWHERE

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	328.620	Ft. Kips	Working Stress Mom.	497.000	Ft. Kips
Live Load Moment	168.380	Ft. Kips	Load Factor Mom.	792.759	Ft. Kips
Avrg. Bar Clearance	2.125	In.	Z For Steel Dist.	170	
Cover	1.500	In.	fc	= 4.400	Ksi
Width of Member (b)	33.000	In.	fy	= 40.000	Ksi
Depth of Member (h)	39.000	In.			

**AREA OF STEEL**

Bar Size	11		dc =	2.830	In.
No. Bars	7		dc' =	2.705	In.
As	10.93	Sq. In.	d =	36.170	In.

**RESULTS**

A	=	2.00 x 4.56 x 2.705	=	24.68	
f <sub>s</sub> Allow	=	170.00 / (24.68 x 2.705) <sup>.33</sup>	=	41.91 Ksi	36.00 Max
a	=	(10.93 x 40.00) / 0.85 x 4.40 x 33.00	=	3.542 In.	
jd	=	36.170 - 3.54 / 2.00	=	34.40	
f <sub>s</sub> Act	=	(497.00 x 12.00) / 10.93 x 34.40	=	15.86 Ksi	
θM <sub>N</sub>	=	0.90 x 10.93 x 40.00 x 34.40 / 12	=	1127.95 Ft. Kips	

AASHTO 8.17.1	Min. Reinforcement	φM <sub>n</sub> > 1.2Mcr	Mcr = fr Ig/yt
fr =	7.5 (fc) <sup>1/2</sup>		= 0.497 Ksi
Ig =	1/12 * b * h <sup>3</sup>	yt = h/2	= 19.50 In.
Mcr =	0.497 x 163127 / 19.50 / 12		= 346.82 Ft. Kips

AASHTO 8.17.1      φM<sub>n</sub> = 1127.95      >      1.2 Mcr = 416.18      OK

f<sub>s</sub> Act = 15.86      <      f<sub>s</sub> Allow = 36.00      OK

φM<sub>n</sub> = 1127.95      >      Mu = 792.76      OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jun-06

SUBJECT: HIGH LEVEL BENT #137

WDB Jun-06

SUBJECT: BOTTOM OF CAP - BASED ON FIELD DATA. ASSUME 50% COVER LOSS EVERYWHERE

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	205.070	Ft. Kips	Working Stress Mom.	374.250	Ft. Kips
Live Load Moment	169.180	Ft. Kips	Load Factor Mom.	633.881	Ft. Kips
Bar Clearance	2.125	In.	Z For Steel Dist.	170	
Cover	1.500	In.	fc	=	4.400 Ksi
Width of Member (b)	33.00	In.	fy	=	40.000 Ksi
Depth of Member (h)	39.00	In.			

**AREA OF STEEL**

Bar Size	11		dc =	2.830	In.
No. Bars	5		dc' =	2.705	In.
As	7.81	Sq. In.	d =	36.170	In.

**RESULTS**

A	=	2.00 x 6.84 x 2.705	=	37.02	
f <sub>s</sub> Allow	=	170.00 / (37.02 x 2.705) <sup>0.33</sup>	=	36.61 Ksi	36.00 Max
a	=	(7.81 x 40.00) / 0.85 x 4.40 x 33.00	=	2.530	In.
jd	=	36.170 - 2.53 / 2.00	=	34.90	
f <sub>s</sub> Act	=	(374.25 x 12.00) / 7.81 x 34.90	=	16.48	Ksi
θM <sub>N</sub>	=	0.90 x 7.81 x 40.00 x 34.90 / 12	=	817.53	Ft. Kips

AASHTO 8.17.1	Min. Reinforcement	φM <sub>n</sub> >	1.2M <sub>cr</sub>	M <sub>cr</sub> =	fr Ig/yt
fr	= 7.5 (fc) <sup>1/2</sup>			=	0.497 Ksi
Ig	= 1/12 * b * h <sup>3</sup>	=	163127 In. <sup>4</sup>	yt =	h/2
M <sub>cr</sub>	= 0.497 x 163127 / 19.50 / 12			=	346.82 Ft. Kips

AASHTO 8.17.1	φM <sub>n</sub> =	817.53	>	1.2 M <sub>cr</sub> =	416.18	OK
	f <sub>s</sub> Act =	16.48	<	f <sub>s</sub> Allow =	36.00	OK
	φM <sub>n</sub> =	817.53	>	Mu =	633.88	OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jun-06

SUBJECT: HIGH LEVEL BENT #137

WDB Jun-06

SHEAR - BASED ON FIELD DATA. ASSUME 50% COVER LOSS EVERYWHERE

**SHEAR DESIGN - CAP COMPLETE**

$$V_{DL} = 103.93 \text{ KIPS} \quad V_{LL} = 59.31 \text{ KIPS} \quad F_v = 40000 \text{ PSI}$$

$$d = 36.17 \text{ INCHES} \quad b = 33.00 \text{ INCHES} \quad f_c = 4400 \text{ PSI}$$

$$V @ d \text{ DIST. FROM FACE OF SUPPORT} \quad \text{Col. Width} = D = 3.00 \text{ FT}$$

$$\text{ASSUME FACE OF SUPPORT} \quad D/4 = 0.75 \text{ FT.} \quad \text{FROM CENTER OF COL.}$$

$$d_{\text{DIST.}} = 36.17 / 12.00 + 0.750 = 3.76 \text{ FT.} \quad W_{DL \text{ CAP}} = 1.341 \text{ KIPS/FT}$$

$$V_{DL} = V_{DL} - W_{DL} * d_{\text{DIST}} = 98.88$$

$$V_U = 1.3(V_{DL} + (1.67 * V_{LL})) = 257.31$$

$$V_U < q V_N \quad V_N = V_C + V_S$$

$$V_U < q V_C + q V_S$$

$$V_C = 2 * (f_c)^{1/2} * b * d = 158.35 \text{ KIPS}$$

$$q V_S = V_U - q V_C$$

$$V_S = V_U / q - V_C = 144.37 \text{ KIPS}$$

$$V_S = A_v * F_v * d / S$$

$$\text{USE \# } 5 \quad \text{STIRRUPS} \quad A_s = 0.31 \text{ SQ. IN.}$$

$$\text{No. of Bars} = 2$$

$$A_v = 2 * A_s = 2 * 0.307 = 0.61359232 \text{ SQ. IN.}$$

$$S = A_v * F_v * d / V_S = 6.1 \text{ INCHES}$$

$$S_{\text{MIN}} = A_v * F_v / 50 * b = 22.31 \text{ INCHES}$$

$$S_{\text{ACT}} = 6.00 \text{ INCHES} \quad \text{OK}$$

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #137  
 SUBJECT: TOP OF STRUT - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 KBM Jun-06

**CONCRETE DESIGN - STRUT**

**INPUT**

Dead Load Moment	39.930	Ft. Kips	Working Stress Mom.	69.900	Ft. Kips
Live Load Moment	29.970	Ft. Kips	Load Factor Mom.	116.974	Ft. Kips
Avg. Bar Clearance	3.625	In.	Z For Steel Dist.	170	
Cover	3.000	In.	fc	= 3.000	Ksi
Width of Member (b)	30.000	In.	fy	= 40.000	Ksi
Depth of Member (h)	36.000	In.			

**AREA OF STEEL**

Bar Size	11		dc =	4.330	In.
No. Bars	5		dc' =	2.705	In.
As	7.81	Sq. In.	d =	31.670	In.

**RESULTS**

A	=	2.00 x 5.34 x 2.705	=	28.91
f <sub>s</sub> Allow	=	170.00 / (28.91 x 2.705) <sup>0.33</sup>	=	39.76 Ksi 36.00 Max
a	=	(7.81 x 40.00) / 0.85 x 3.00 x 30.00	=	4.082 In.
jd	=	31.670 - 4.08 / 2.00	=	29.63
f <sub>s</sub> Act	=	(69.90 x 12.00) / 7.81 x 29.63	=	3.63 Ksi
θM <sub>N</sub>	=	0.90 x 7.81 x 40.00 x 29.63 / 12	=	693.96 Ft. Kips

AASHTO 8.17.1	Min. Reinforcement	φM <sub>n</sub> > 1.2Mcr	Mcr = fr Ig/yt
fr =	7.5 (fc) <sup>1/2</sup>		= 0.411 Ksi
Ig =	1/12 * b * h <sup>3</sup>	yt = h/2	= 18.00 In.
Mcr =	0.411 x 116640 / 18.00 / 12		= 221.83 Ft. Kips

AASHTO 8.17.1      φM<sub>n</sub> = 693.96      >      1.2 Mcr = 266.19      OK

f<sub>s</sub> Act = 3.63      <      f<sub>s</sub> Allow = 36.00      OK

φM<sub>n</sub> = 693.96      >      Mu = 116.97      OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #137  
 SUBJECT: BOTTOM OF STRUT - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 KBM Jun-06

**CONCRETE DESIGN - STRUT**

**INPUT**

Dead Load Moment	22.740	Ft. Kips	Working Stress Mom.	29.140	Ft. Kips
Live Load Moment	6.400	Ft. Kips	Load Factor Mom.	43.456	Ft. Kips
Bar Clearance	3.625	In.	Z For Steel Dist.	170	
Cover	3.000	In.	f <sub>c</sub>	=	3.000 Ksi
Width of Member (b)	30.00	In.	f <sub>y</sub>	=	40.000 Ksi
Depth of Member (h)	36.00	In.			

**AREA OF STEEL**

Bar Size	11		d <sub>c</sub> =	4.330	In.
No. Bars	5		d <sub>c</sub> ' =	2.705	In.
A <sub>s</sub>	7.81	Sq. In.	d =	31.670	In.

**RESULTS**

A	=	2.00 x 5.34 x 2.705	=	28.91	
f <sub>s</sub> Allow	=	170.00 / (28.91 x 2.705) <sup>.33</sup>	=	39.76 Ksi	36.00 Max
a	=	(7.81 x 40.00) / 0.85 x 3.00 x 30.00	=	4.082	In.
jd	=	31.670 - 4.08 / 2.00	=	29.63	
f <sub>s</sub> Act	=	(29.14 x 12.00) / 7.81 x 29.63	=	1.51 Ksi	
θM <sub>N</sub>	=	0.90 x 7.81 x 40.00 x 29.63 / 12	=	693.96	Ft. Kips

AASHTO 8.17.1	Min. Reinforcement	φM <sub>n</sub> >	1.2M <sub>cr</sub>	M <sub>cr</sub> =	fr Ig/yt
fr	= 7.5 (f <sub>c</sub> ) <sup>1/2</sup>			=	0.411 Ksi
Ig	= 1/12 * b * h <sup>3</sup>	=	116640 In. <sup>4</sup>	yt =	h/2
M <sub>cr</sub>	= 0.411 x 116640 / 18.00 / 12			=	221.83 Ft. Kips

AASHTO 8.17.1	φM <sub>n</sub> =	693.96	>	1.2 M <sub>cr</sub> =	266.19	OK
	f <sub>s</sub> Act =	1.51	<	f <sub>s</sub> Allow =	36.00	OK
	φM <sub>n</sub> =	693.96	>	Mu =	43.46	OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #137  
 SHEAR - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 KBM Jun-06

**SHEAR DESIGN - STRUT COMPLETE**

$$V_{DL} = 11.87 \text{ KIPS} \quad V_{LL} = 2.36 \text{ KIPS} \quad F_V = 40000 \text{ PSI}$$

$$d = 31.67 \text{ INCHES} \quad b = 30.00 \text{ INCHES} \quad f_c = 3000 \text{ PSI}$$

$$V @ d \text{ DIST. FROM FACE OF SUPPORT} \quad \text{Col. Width} = D = 3.00 \text{ FT}$$

$$\text{ASSUME FACE OF SUPPORT} \quad D/4 = 0.75 \text{ FT.} \quad \text{FROM CENTER OF COL.}$$

$$d_{DIST.} = 31.67 / 12.00 + 0.750 = 3.39 \text{ FT.} \quad W_{DL} \text{ CAP} = 1.125 \text{ KIPS/FT}$$

$$V_{DL} = V_{DL} - W_{DL} * d_{DIST} = 8.06$$

$$V_U = 1.3(V_{DL} + (1.67 * V_{LL})) = 15.60$$

$$V_U < q V_N \quad V_N = V_C + V_S$$

$$V_U < q V_C + q V_S$$

$$V_C = 2 * (f_c)^{1/2} * b * d = 104.08 \text{ KIPS}$$

$$q V_S = V_U - q V_C$$

$$V_S = V_U / q - V_C = -85.73 \text{ KIPS}$$

$$V_S = A_V * F_V * d / S$$

USE # 5 STIRRUPS  $A_S = 0.31 \text{ SQ. IN.}$   
 No. of Bars = 2

$$A_V = 2 * A_S = 2 * 0.307 = 0.61359232 \text{ SQ. IN.}$$

$$S = A_V * F_V * d / V_S = -9.1 \text{ INCHES}$$

$$S_{MIN} = A_V * F_V / 50 * b = 24.54 \text{ INCHES}$$

$$S_{ACT} = 13.00 \text{ INCHES} \quad \text{OK}$$

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jun-06

SUBJECT: HIGH LEVEL BENT #137

WDB Jun-06

SUBJECT: TOP OF STRUT - BASED ON FIELD DATA. ASSUME 50% COVER LOSS EVERYWHERE

**CONCRETE DESIGN - STRUT****INPUT**

Dead Load Moment	39.930	Ft. Kips	Working Stress Mom.	69.900	Ft. Kips
Live Load Moment	29.970	Ft. Kips	Load Factor Mom.	116.974	Ft. Kips
Avg. Bar Clearance	2.125	In.	Z For Steel Dist.	170	
Cover	1.500	In.	$f_c$	=	4.400 Ksi
Width of Member (b)	27.000	In.	$f_y$	=	40.000 Ksi
Depth of Member (h)	33.000	In.			

**AREA OF STEEL**

Bar Size	11		$d_c$ =	2.830	In.
No. Bars	5		$d_c'$ =	2.705	In.
$A_s$	7.81	Sq. In.	$d$ =	30.170	In.

**RESULTS**

A	=	$2.00 \times 5.34 \times 2.705$	=	28.91	
$f_s$ Allow	=	$170.00 / (28.91 \times 2.705)^{.33}$	=	39.76 Ksi	36.00 Max
a	=	$(7.81 \times 40.00) / 0.85 \times 4.40 \times 27.00$	=	3.093	In.
jd	=	$30.170 - 3.09 / 2.00$	=	28.62	
$f_s$ Act	=	$(69.90 \times 12.00) / 7.81 \times 28.62$	=	3.75 Ksi	
$\theta M_N$	=	$0.90 \times 7.81 \times 40.00 \times 28.62 / 12$	=	670.42	Ft. Kips

AASHTO 8.17.1	Min. Reinforcement	$\phi M_n > 1.2 M_{cr}$	$M_{cr} = f_r I_g / y_t$
$f_r$	= $7.5 (f_c)^{1/2}$		= 0.497 Ksi
$I_g$	= $1/12 * b * h^3$	= 80858 In. <sup>4</sup>	$y_t = h/2$
$M_{cr}$	= $0.497 \times 80858 / 16.50 / 12$		= 203.16 Ft. Kips

AASHTO 8.17.1  $\phi M_n = 670.42 > 1.2 M_{cr} = 243.80$  OK

$f_s$  Act = 3.75 <  $f_s$  Allow = 36.00 OK

$\phi M_n = 670.42 > M_u = 116.97$  OK



**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jun-06

SUBJECT: HIGH LEVEL BENT #137

WDB Jun-06

SUBJECT: BOTTOM OF STRUT - BASED ON FIELD DATA, ASSUME 50% COVER LOSS EVERYWHERE

**CONCRETE DESIGN - STRUT**

**INPUT**

Dead Load Moment	22.740	Ft. Kips	Working Stress Mom.	29.140	Ft. Kips
Live Load Moment	6.400	Ft. Kips	Load Factor Mom.	43.456	Ft. Kips
Bar Clearance	2.125	In.	Z For Steel Dist.	170	
Cover	1.500	In.	$f_c$	=	4.400 Ksi
Width of Member (b)	27.00	In.	$f_y$	=	40.000 Ksi
Depth of Member (h)	33.00	In.			

**AREA OF STEEL**

Bar Size	11		$d_c$ =	2.830	In.
No. Bars	5		$d_c'$ =	2.705	In.
$A_s$	7.81	Sq. In.	d =	30.170	In.

**RESULTS**

A	=	2.00 x 5.34 x 2.705	=	28.91	
$f_s$ Allow	=	170.00 / (28.91 x 2.705) <sup>0.33</sup>	=	39.76 Ksi	36.00 Max
a	=	(7.81 x 40.00) / 0.85 x 4.40 x 27.00	=	3.093	In.
jd	=	30.170 - 3.09 / 2.00	=	28.62	
$f_s$ Act	=	(29.14 x 12.00) / 7.81 x 28.62	=	1.56	Ksi
$\theta M_N$	=	0.90 x 7.81 x 40.00 x 28.62 / 12	=	670.42	Ft. Kips

AASHTO 8.17.1	Min. Reinforcement	$\phi M_n > 1.2 M_{cr}$	$M_{cr} = f_r I_g / y_t$
$f_r$	= 7.5 ( $f_c$ ) <sup>1/2</sup>		= 0.497 Ksi
$I_g$	= 1/12 * b * h <sup>3</sup>	= 80858 In. <sup>4</sup>	$y_t = h/2$
$M_{cr}$	= 0.497 x 80858 / 16.50 / 12		= 203.16 Ft. Kips

AASHTO 8.17.1       $\phi M_n = 670.42 > 1.2 M_{cr} = 243.80$       **OK**

$f_s$  Act = 1.56 <  $f_s$  Allow = 36.00      **OK**

$\phi M_n = 670.42 > M_u = 43.46$       **OK**

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jun-06

SUBJECT: HIGH LEVEL BENT #137

WDB Jun-06

SHEAR - BASED ON FIELD DATA, ASSUME 50% COVER LOSS EVERYWHERE

**SHEAR DESIGN - STRUT COMPLETE**

$$V_{DL} = 11.87 \text{ KIPS} \quad V_{LL} = 2.36 \text{ KIPS} \quad F_V = 40000 \text{ PSI}$$

$$d = 30.17 \text{ INCHES} \quad b = 27.00 \text{ INCHES} \quad f_c = 4400 \text{ PSI}$$

$$V@ d \text{ DIST. FROM FACE OF SUPPORT} \quad \text{Col. Width} = D = 3.00 \text{ FT}$$

$$\text{ASSUME FACE OF SUPPORT} \quad D/4 = 0.75 \text{ FT.} \quad \text{FROM CENTER OF COL.}$$

$$d_{\text{DIST.}} = 30.17 / 12.00 + 0.750 = 3.26 \text{ FT.} \quad W_{DL} \text{ CAP} = 0.928 \text{ KIPS/FT}$$

$$V_{DL} = V_{DL} - W_{DL} * d_{\text{DIST}} = 8.84$$

$$V_U = 1.3(V_{DL} + (1.67 * V_{LL})) = 16.62$$

$$V_U < q V_N \quad V_N = V_C + V_S$$

$$V_U < q V_C + q V_S$$

$$V_C = 2 * (f_c)^{1/2} * b * d = 108.07 \text{ KIPS}$$

$$q V_S = V_U - q V_C$$

$$V_S = V_U / q - V_C = -88.52 \text{ KIPS}$$

$$V_S = A_V * F_V * d / S$$

$$\text{USE \# } 5 \text{ STIRRUPS} \quad A_S = 0.31 \text{ SQ. IN.}$$

$$\text{No. of Bars} = 2$$

$$A_V = 2 * A_S = 2 * 0.307 = 0.61359232 \text{ SQ. IN.}$$

$$S = A_V * F_V * d / V_S = -8.4 \text{ INCHES}$$

$$S_{\text{MIN}} = A_V * F_V / 50 * b = 27.27 \text{ INCHES}$$

$$S_{\text{ACT}} = 13.00 \text{ INCHES} \quad \text{OK}$$

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**FOOTING LOADS**

				<b>PMIN</b>			
			HLB 137	MEMBER 10	JOINT FOOTING		
				<u>GROUP 1</u>			
	P	MY	MZ		P	MY	MZ
DL	310.80	0.00	20.45	DL	310.80	0.00	20.45
LL	40.24	0.00	-4.92	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	30.76	697.02	-66.07
<hr/>				<hr/>			
SERVICE	351.04	0.00	15.53	SERVICE	341.56	697.02	-45.62
STRENGTH	491.23	0.00	15.92	STRENGTH	444.03	906.13	-59.31
				<u>GROUP 3</u>			
	P	MY	MZ		P	MY	MZ
DL	310.80	0.00	20.45	DL	310.80	0.00	20.45
LL	40.24	0.00	-4.92	LL	40.24	0.00	-4.92
GROUP 3	13.58	437.66	-27.58	GROUP 4	-35.05	0.00	748.81
<hr/>				<hr/>			
SERVICE	364.62	437.66	-12.05	SERVICE	315.99	0.00	764.34
STRENGTH	474.01	568.96	-15.67	STRENGTH	410.79	0.00	993.64
				<u>GROUP 5</u>			
	P	MY	MZ		P	MY	MZ
DL	310.80	0.00	20.45	DL	310.80	0.00	20.45
LL	0.00	0.00	0.00	LL	40.24	0.00	-4.92
GROUP 5	-4.28	697.02	682.74	GROUP 6	-21.47	437.66	721.23
<hr/>				<hr/>			
SERVICE	306.52	697.02	703.19	SERVICE	329.57	437.66	736.76
STRENGTH	383.15	871.28	878.99	STRENGTH	411.96	547.08	920.95

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 137 MEM. 11 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**FOOTING LOADS**

				<b>PMAX</b>			
				HLB 137	MEMBER 11	JOINT FOOTING	
				<u>GROUP 1</u>			
	P	MY	MZ				
DL	310.70	0.00	20.34	DL	310.70	0.00	20.34
LL	82.00	0.00	10.27	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	-30.74	-696.89	66.11
<hr/>							
SERVICE STRENGTH	392.70	0.00	30.61	SERVICE STRENGTH	279.96	-696.89	86.45
	581.58	0.00	48.69		363.95	-905.96	112.39
				<u>GROUP 3</u>			
	P	MY	MZ				
DL	310.70	0.00	20.34	DL	310.70	0.00	20.34
LL	82.00	0.00	10.27	LL	82.00	0.00	10.27
GROUP 3	-13.57	-437.59	27.60	GROUP 4	-33.81	0.00	749.21
<hr/>							
SERVICE STRENGTH	379.13	-437.59	58.21	SERVICE STRENGTH	358.89	0.00	779.82
	492.87	-568.87	75.67		466.56	0.00	1013.77
				<u>GROUP 5</u>			
	P	MY	MZ				
DL	310.70	0.00	20.34	DL	310.70	0.00	20.34
LL	0.00	0.00	0.00	LL	82.00	0.00	10.27
GROUP 5	-64.55	-696.89	815.32	GROUP 6	-47.38	-437.59	776.81
<hr/>							
SERVICE STRENGTH	246.15	-696.89	835.66	SERVICE STRENGTH	345.32	-437.59	807.42
	307.69	-871.11	1044.58		431.65	-546.99	1009.28

H. W. Lochner, Inc. PHONE: 859-224-4476 SHEET 1 OF 9  
1040 Monarch St. Suite 300 Lexington, KY 40513 JOB NO. HLB#137  
PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida BY JMJ DATE Jun/15/2006  
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170 CKD. ~~WOB~~ DATE 7/06

F.2-125

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PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ 7/06  
WOB 7/06

PROJECT DATA  
=====

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#137  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #137 - Load Groups 1-3 (For Ease of Checking) - Per Plan Dimensions

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

LOADS  
 =====

Load Cases: 3

Loadcase ID: (L+In)1      Name: Group 1 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-491.23	0.00	----	----
Force	Y	0.00	-581.58	1.00	----	----
Moment	Z	----	15.92	0.00	----	----
Moment	Z	----	48.69	1.00	----	----

Loadcase ID: (L+Ip)1      Name: Group 2 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-444.03	0.00	----	----
Force	Y	0.00	-363.95	1.00	----	----
Moment	X	----	-905.96	1.00	----	----
Moment	X	----	906.13	0.00	----	----
Moment	Z	----	-59.31	0.00	----	----
Moment	Z	----	112.39	1.00	----	----

Loadcase ID: W1      Name: Group 3 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-474.01	0.00	----	----
Force	Y	0.00	-492.87	1.00	----	----
Moment	X	----	-568.87	1.00	----	----
Moment	X	----	568.96	0.00	----	----
Moment	Z	----	-15.67	0.00	----	----
Moment	Z	----	75.67	1.00	----	----

Selected load groups:

SERVICE GROUP I  
 SERVICE GROUP IB  
 SERVICE GROUP II

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

COMBINED FOOTING DESIGN

Code: AASHTO STANDARD (17th Edition 2002) - Service Load Design  
 Units: US

Geometry:

=====

Name : 1  
 Shape : Rectangular, Type : Pile/Shaft Cap  
 Bf(X) = 33.00 ft, Hf(Z) = 11.00 ft, Thickness(Y) = 51.00 in

Footing concentric.  
 Columns located on the footing:  
 Column No. 1 at x = 0.00 ft, Round D = 12.00 in  
 Column No. 2 at x = 24.04 ft, Round D = 12.00 in

Ag = 363.00 ft<sup>2</sup>, Ix = 122.50 ft<sup>2</sup>, Iz = 1308.00 ft<sup>2</sup>

Surcharge = 0.00 ksf

Piles: Circular Size: 22.00 in Capacity: 100.00 kips

Design Parameters:

===== f'c = 3000.00 psi fy = 40000.00 psi  
 Ec = 3320.6 ksi Es = 29000.0 ksi  
 Crack control factor z = 130.00 kips/in  
 Concrete Type : Normal Weight.

File Reactions, Service (Without the reduction of overstress allowance):

=====

Pile Loc(X) ft	X in	Z in	Column Loads				Pile Reac.				
			col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	kips		
1	-2.50	24.0	42.0	1	3	1.250	-474.01	568.64	-20.39	97.73	
				2	3	1.250	-492.87	-568.55	75.66		
				1	4	1.250	474.01	-568.64	20.39		-59.17
				2	4	1.250	492.87	568.55	-75.66		
2	4.50	108.0	42.0	1	1	1.000	-491.23	0.00	10.97	102.67*	
				2	1	1.000	-581.58	0.00	48.66		
				1	4	1.250	474.01	-568.64	20.39		-60.19
				2	4	1.250	492.87	568.55	-75.66		
3	12.00	198.0	42.0	1	1	1.000	-491.23	0.00	10.97	108.69*	
				2	1	1.000	-581.58	0.00	48.66		
				1	4	1.250	474.01	-568.64	20.39		-61.29
				2	4	1.250	492.87	568.55	-75.66		
4	19.50	288.0	42.0	1	1	1.000	-491.23	0.00	10.97	114.70*	
				2	1	1.000	-581.58	0.00	48.66		
				1	4	1.250	474.01	-568.64	20.39		-62.39
				2	4	1.250	492.87	568.55	-75.66		
5	26.50	372.0	42.0	1	1	1.000	-491.23	0.00	10.97	120.31*	
				2	1	1.000	-581.58	0.00	48.66		
				1	4	1.250	474.01	-568.64	20.39		-63.42
				2	4	1.250	492.87	568.55	-75.66		
6	-2.50	24.0	-42.0	1	3	1.250	-474.01	568.64	-20.39	97.73	
				2	3	1.250	-492.87	-568.55	75.66		
				1	4	1.250	474.01	-568.64	20.39		-59.16

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Loc	X	Y	Z	Col	Comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Reac, kips
7	4.50	108.0	-42.0	2	4	1.250	492.87	568.55	-75.66	
				1	1	1.000	-491.23	0.00	10.97	102.67*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-60.19
8	12.00	198.0	-42.0	2	4	1.250	492.87	568.55	-75.66	
				1	1	1.000	-491.23	0.00	10.97	108.69*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-61.29
9	19.50	288.0	-42.0	2	4	1.250	492.87	568.55	-75.66	
				1	1	1.000	-491.23	0.00	10.97	114.70*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-62.39
10	26.50	372.0	-42.0	2	4	1.250	492.87	568.55	-75.66	
				1	1	1.000	-491.23	0.00	10.97	120.31*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-63.41
11	1.00	66.0	0.0	2	4	1.250	492.87	568.55	-75.66	
				1	1	1.000	-491.23	0.00	10.97	99.86
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-59.68
12	23.00	330.0	0.0	2	4	1.250	492.87	568.55	-75.66	
				1	1	1.000	-491.23	0.00	10.97	117.51*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-62.90
				2	4	1.250	492.87	568.55	-75.66	

Pile Reactions, Service (After the reduction of overstress allowance):

=====

Pile	Loc(X) ft	X in	Z in	col#	comb	Ovs	Column Loads P, kips	Mxx, kft	Mzz, kft	Pile Reac. kips
1	-2.50	24.0	42.0	1	2	1.000	-444.02	905.62	-63.64	97.64
				2	2	1.000	-363.96	-905.45	112.41	
				1	4	1.250	474.01	-568.64	20.39	-47.33
				2	4	1.250	492.87	568.55	-75.66	
2	4.50	108.0	42.0	1	1	1.000	-491.23	0.00	10.97	102.67*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-48.15
				2	4	1.250	492.87	568.55	-75.66	
3	12.00	198.0	42.0	1	1	1.000	-491.23	0.00	10.97	108.69*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-49.03
				2	4	1.250	492.87	568.55	-75.66	
4	19.50	288.0	42.0	1	1	1.000	-491.23	0.00	10.97	114.70*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-49.91
				2	4	1.250	492.87	568.55	-75.66	
5	26.50	372.0	42.0	1	1	1.000	-491.23	0.00	10.97	120.31*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-50.73
				2	4	1.250	492.87	568.55	-75.66	
6	-2.50	24.0	-42.0	1	2	1.000	-444.02	905.62	-63.64	97.63
				2	2	1.000	-363.96	-905.45	112.41	
				1	4	1.250	474.01	-568.64	20.39	-47.33
				2	4	1.250	492.87	568.55	-75.66	
7	4.50	108.0	-42.0	1	1	1.000	-491.23	0.00	10.97	102.67*
				2	1	1.000	-581.58	0.00	48.66	
				1	4	1.250	474.01	-568.64	20.39	-48.15



PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Loc	Y	Z	X	1	2	3	4	5	6	7	8
8	12.00	198.0	-42.0	2	4	1.250	492.87	568.55	-75.66		
				1	1	1.000	-491.23	0.00	10.97	108.69*	
				2	1	1.000	-581.58	0.00	48.66		
				1	4	1.250	474.01	-568.64	20.39	-49.03	
9	19.50	288.0	-42.0	2	4	1.250	492.87	568.55	-75.66		
				1	1	1.000	-491.23	0.00	10.97	114.70*	
				2	1	1.000	-581.58	0.00	48.66		
				1	4	1.250	474.01	-568.64	20.39	-49.91	
10	26.50	372.0	-42.0	2	4	1.250	492.87	568.55	-75.66		
				1	1	1.000	-491.23	0.00	10.97	120.31*	
				2	1	1.000	-581.58	0.00	48.66		
				1	4	1.250	474.01	-568.64	20.39	-50.73	
11	1.00	66.0	0.0	2	4	1.250	492.87	568.55	-75.66		
				1	1	1.000	-491.23	0.00	10.97	99.86	
				2	1	1.000	-581.58	0.00	48.66		
				1	4	1.250	474.01	-568.64	20.39	-47.74	
12	23.00	330.0	0.0	2	4	1.250	492.87	568.55	-75.66		
				1	1	1.000	-491.23	0.00	10.97	117.51*	
				2	1	1.000	-581.58	0.00	48.66		
				1	4	1.250	474.01	-568.64	20.39	-50.32	
				2	4	1.250	492.87	568.55	-75.66		

Note:

\* Force in pile is greater than pile capacity.

Only max. force in piles is considered for design.  
 Pile coordinates X and Z are from the most left edge of the footing.

Max. Pile Reaction Used in Design: (without selfweight and surcharge)  
 =====

Working Stress pile reaction = 101.03 kips

Reinforcement Schedule:  
 =====

Dir	Quantity	Size	Bar dist. in	As total in^2	From ft	To ft	Hook
X	16	# 9	45.50	16.00	0.50	32.50	None
X	15	# 5	22.00	4.65	0.50	32.50	Both
X	6	# 5	6.00	1.86	0.50	32.50	Both
Z	22	# 5	46.38	6.82	----	----	Both
Z	44	# 7	21.25	26.40	----	----	Both
Z	12	# 11	7.02	18.72	----	----	None
Z	22	# 5	5.38	6.82	----	----	Both

Flexure:  
 =====

X direction

Loc	Mmax	Comb	Asb_req	Asb_prv	Asb_eff	Ast_req	Ast_prv	Ast_eff
ft	kft	Comb	in^2	in^2	in^2	in^2	in^2	in^2

H. W. Lochner, Inc. PHONE: 859-224-4476 | SHEET 1 OF 9  
1040 Monarch St. Suite 300 Lexington, KY 40513 | JOB NO. HLB#137  
PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida | BY JMJ DATE Jun/15/2006  
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170 | CKD. DATE

F.2-130

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PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

PROJECT DATA  
=====

JMJ 7/06  
WOB 7/06

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#137  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #137 - Load Groups 4-6 (For Ease of Checking) - Per Plan Dimensions

H. W. Lochner, Inc.  
 1040 Monarch St. Suite 300  
 PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida  
 PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170

PHONE: 859-224-4476  
 Lexington, KY 40513  
 BY JMJ DATE Jun/15/2006  
 CKD. DATE

SHEET 2 OF 9  
 JOB NO. HLB#137  
 BY JMJ DATE Jun/15/2006  
 CKD. DATE

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

LOADS  
 =====

Load Cases: 3

Loadcase ID: (L+In)1 Name: Group 4 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-410.79	0.00	----	----
Force	Y	0.00	-466.56	1.00	----	----
Moment	Z	----	993.64	0.00	----	----
Moment	Z	----	1013.77	1.00	----	----

Loadcase ID: (L+Ip)1 Name: Group 5 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-383.15	0.00	----	----
Force	Y	0.00	-307.69	1.00	----	----
Moment	X	----	-871.11	1.00	----	----
Moment	X	----	871.28	0.00	----	----
Moment	Z	----	878.99	0.00	----	----
Moment	Z	----	1044.58	1.00	----	----

Loadcase ID: W1 Name: Group 6 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-411.96	0.00	----	----
Force	Y	0.00	-431.65	1.00	----	----
Moment	X	----	-546.99	1.00	----	----
Moment	X	----	547.08	0.00	----	----
Moment	Z	----	920.95	0.00	----	----
Moment	Z	----	1009.28	1.00	----	----

Selected load groups:

SERVICE GROUP I  
 SERVICE GROUP IB  
 SERVICE GROUP II

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

COMBINED FOOTING DESIGN

Code: AASHTO STANDARD (17th Edition 2002) - Service Load Design  
 Units: US

Geometry:

=====  
 Name : 1  
 Shape : Rectangular, Type : Pile/Shaft Cap  
  
 Bf(X) = 33.00 ft, Hf(Z) = 11.00 ft, Thickness(Y) = 51.00 in  
  
 Footing concentric.  
 Columns located on the footing:  
 Column No. 1 at x = 0.00 ft, Round D = 12.00 in  
 Column No. 2 at x = 24.04 ft, Round D = 12.00 in  
  
 Ag = 363.00 ft<sup>2</sup>, Ix = 122.50 ft<sup>2</sup>, Iz = 1308.00 ft<sup>2</sup>  
  
 Surcharge = 0.00 ksf  
  
 Piles: Circular Size: 22.00 in Capacity: 100.00 kips

Design Parameters:

=====  
 f'c = 3000.00 psi fy = 40000.00 psi  
 Ec = 3320.6 ksi Es = 29000.0 ksi  
 Crack control factor z = 130.00 kips/in  
 Concrete Type : Normal Weight.

File Reactions, Service (Without the reduction of overstress allowance):

=====  
 =====

Pile Loc(X) ft	X in	Z in	Column Loads				Pile Reac.			
			col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	kips	
1	-2.50	24.0	42.0	1	3	1.250	-412.10	546.77	914.80	108.12*
				2	3	1.250	-431.51	-546.68	1008.00	
				1	4	1.250	412.10	-546.77	-914.80	-69.55
				2	4	1.250	431.51	546.68	-1008.00	
2	4.50	108.0	42.0	1	1	1.000	-410.94	0.00	987.35	99.93
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-60.60
				2	4	1.250	431.51	546.68	-1008.00	
3	12.00	198.0	42.0	1	1	1.000	-410.94	0.00	987.35	92.40
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-51.02
				2	4	1.250	431.51	546.68	-1008.00	
4	19.50	288.0	42.0	1	1	1.000	-410.94	0.00	987.35	84.86
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-41.43
				2	4	1.250	431.51	546.68	-1008.00	
5	26.50	372.0	42.0	1	1	1.000	-410.94	0.00	987.35	77.83
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-32.49
				2	4	1.250	431.51	546.68	-1008.00	
6	-2.50	24.0	-42.0	1	3	1.250	-412.10	546.77	914.80	108.11*
				2	3	1.250	-431.51	-546.68	1008.00	
				1	4	1.250	412.10	-546.77	-914.80	-69.55

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Loc	X	Z	Col	Comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Reac, kips	
7	4.50	108.0	-42.0	2	4	1.250	431.51	546.68	-1008.00	
				1	1	1.000	-410.94	0.00	987.35	99.93
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-60.60
8	12.00	198.0	-42.0	2	4	1.250	431.51	546.68	-1008.00	
				1	1	1.000	-410.94	0.00	987.35	92.40
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-51.01
9	19.50	288.0	-42.0	2	4	1.250	431.51	546.68	-1008.00	
				1	1	1.000	-410.94	0.00	987.35	84.86
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-41.43
10	26.50	372.0	-42.0	2	4	1.250	431.51	546.68	-1008.00	
				1	1	1.000	-410.94	0.00	987.35	77.83
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-32.48
11	1.00	66.0	0.0	2	4	1.250	431.51	546.68	-1008.00	
				1	3	1.250	-412.10	546.77	914.80	103.64*
				2	3	1.250	-431.51	-546.68	1008.00	
				1	4	1.250	412.10	-546.77	-914.80	-65.08
12	23.00	330.0	0.0	2	4	1.250	431.51	546.68	-1008.00	
				1	1	1.000	-410.94	0.00	987.35	81.34
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-36.96
				2	4	1.250	431.51	546.68	-1008.00	

Pile Reactions, Service (After the reduction of overstress allowance):

=====

Pile	Loc(X)	X	Z	col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Pile Reac, kips
1	-2.50	24.0	42.0	1	2	1.000	-383.28	870.79	873.21	108.04*
				2	2	1.000	-307.56	-870.62	1043.33	
				1	4	1.250	412.10	-546.77	-914.80	-55.64
				2	4	1.250	431.51	546.68	-1008.00	
2	4.50	108.0	42.0	1	1	1.000	-410.94	0.00	987.35	99.93
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-48.48
				2	4	1.250	431.51	546.68	-1008.00	
3	12.00	198.0	42.0	1	1	1.000	-410.94	0.00	987.35	92.40
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-40.82
				2	4	1.250	431.51	546.68	-1008.00	
4	19.50	288.0	42.0	1	1	1.000	-410.94	0.00	987.35	84.86
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-33.15
				2	4	1.250	431.51	546.68	-1008.00	
5	26.50	372.0	42.0	1	1	1.000	-410.94	0.00	987.35	77.83
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-25.99
				2	4	1.250	431.51	546.68	-1008.00	
6	-2.50	24.0	-42.0	1	2	1.000	-383.28	870.79	873.21	108.03*
				2	2	1.000	-307.56	-870.62	1043.33	
				1	4	1.250	412.10	-546.77	-914.80	-55.64
				2	4	1.250	431.51	546.68	-1008.00	
7	4.50	108.0	-42.0	1	1	1.000	-410.94	0.00	987.35	99.93
				2	1	1.000	-466.41	0.00	1012.41	
				1	4	1.250	412.10	-546.77	-914.80	-48.48

H. W. Lochner, Inc.  
 1040 Monarch St. Suite 300  
 PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida  
 PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170

PHONE: 859-224-4476  
 Lexington, KY 40513

SHEET 5 OF 9  
 JOB NO. HLB#137  
 BY JMJ DATE Jun/15/2006  
 CKD. DATE

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Node	X	Y	Z	1	2	3	4	5	6	7	8	9	10
8	12.00	198.0	-42.0	2	4	1.250	431.51	546.68	-1008.00				
				1	1	1.000	-410.94	0.00	987.35	92.40			
				2	1	1.000	-466.41	0.00	1012.41				
				1	4	1.250	412.10	-546.77	-914.80	-40.81			
9	19.50	288.0	-42.0	2	4	1.250	431.51	546.68	-1008.00				
				1	1	1.000	-410.94	0.00	987.35	84.86			
				2	1	1.000	-466.41	0.00	1012.41				
				1	4	1.250	412.10	-546.77	-914.80	-33.14			
10	26.50	372.0	-42.0	2	4	1.250	431.51	546.68	-1008.00				
				1	1	1.000	-410.94	0.00	987.35	77.83			
				2	1	1.000	-466.41	0.00	1012.41				
				1	4	1.250	412.10	-546.77	-914.80	-25.99			
11	1.00	66.0	0.0	2	4	1.250	431.51	546.68	-1008.00				
				1	1	1.000	-410.94	0.00	987.35	103.45*			
				2	1	1.000	-466.41	0.00	1012.41				
				1	4	1.250	412.10	-546.77	-914.80	-52.06			
12	23.00	330.0	0.0	2	4	1.250	431.51	546.68	-1008.00				
				1	1	1.000	-410.94	0.00	987.35	81.34			
				2	1	1.000	-466.41	0.00	1012.41				
				1	4	1.250	412.10	-546.77	-914.80	-29.57			
				2	4	1.250	431.51	546.68	-1008.00				

Note:

\* Force in pile is greater than pile capacity.

Only max. force in piles is considered for design.

Pile coordinates X and Z are from the most left edge of the footing.

Max. Pile Reaction Used in Design: (without selfweight and surcharge)

=====

Working Stress pile reaction = 88.75 kips

Reinforcement Schedule:

=====:

Dir	Quantity	Size	Bar dist. in	As total in^2	From ft	To ft	Hook
X	16	# 9	45.50	16.00	0.50	32.50	None
X	15	# 5	22.00	4.65	0.50	32.50	Both
X	6	# 5	6.00	1.86	0.50	32.50	Both
Z	22	# 5	46.38	6.82	----	----	Both
Z	44	# 7	21.25	26.40	----	----	Both
Z	12	# 11	7.02	18.72	----	----	None
Z	22	# 5	5.38	6.82	----	----	Both

Flexure:

=====

X direction

Loc	Mmax	Comb	Asb_req	Asb_prv	Asb_eff	Ast_req	Ast_prv	Ast_eff
ft	kft	Comb	in^2	in^2	in^2	in^2	in^2	in^2

H. W. Lochner, Inc. PHONE: 859-224-4476 SHEET 1 OF 9  
1040 Monarch St. Suite 300 Lexington, KY 40513 JOB NO. HLB#137  
PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida BY JMJ DATE Jun/15/2006  
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170 CKD. DATE

F.2-135

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PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

*JMJ 7/06*  
*WOB 7/06*

PROJECT DATA  
=====

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#137  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #137 - Load Groups 1-3 (For Ease of Checking) - Per Field Data

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

LOADS  
 =====

Load Cases: 3

Loadcase ID: (L+In)1 Name: Group 1 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-491.23	0.00	----	----
Force	Y	0.00	-581.58	1.00	----	----
Moment	Z	----	15.92	0.00	----	----
Moment	Z	----	48.69	1.00	----	----

Loadcase ID: (L+Ip)1 Name: Group 2 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-444.03	0.00	----	----
Force	Y	0.00	-363.95	1.00	----	----
Moment	X	----	-905.96	1.00	----	----
Moment	X	----	906.13	0.00	----	----
Moment	Z	----	-59.31	0.00	----	----
Moment	Z	----	112.39	1.00	----	----

Loadcase ID: W1 Name: Group 3 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-474.01	0.00	----	----
Force	Y	0.00	-492.87	1.00	----	----
Moment	X	----	-568.87	1.00	----	----
Moment	X	----	568.96	0.00	----	----
Moment	Z	----	-15.67	0.00	----	----
Moment	Z	----	75.67	1.00	----	----

Selected load groups:

- SERVICE GROUP I
- SERVICE GROUP IB
- SERVICE GROUP II



PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

COMBINED FOOTING DESIGN

Code: AASHTO STANDARD (17th Edition 2002) - Service Load Design  
 Units: US

Geometry:

=====

Name : 1  
 Shape : Rectangular, Type : Pile/Shaft Cap  
 Bf(X) = 33.00 ft, Hf(Z) = 11.00 ft, Thickness(Y) = 51.00 in

Footings concentric.  
 Columns located on the footing:  
 Column No. 1 at x = 0.00 ft, Rectangular 36.00 in x 62.25 in  
 Column No. 2 at x = 24.04 ft, Rectangular 36.00 in x 62.25 in

Ag = 363.00 ft<sup>2</sup>, Ix = 122.50 ft<sup>2</sup>, Iz = 1308.00 ft<sup>2</sup>

Surcharge = 0.00 ksf

Piles: Circular Size: 22.00 in Capacity: 100.00 kips

Design Parameters:

=====

f'c = 4400.00 psi fy = 40000.00 psi  
 Ec = 4021.4 ksi Es = 29000.0 ksi  
 Crack control factor z = 130.00 kips/in  
 Concrete Type : Normal Weight.

File Reactions, Service (Without the reduction of overstress allowance):

=====

Pile Loc(X) ft	X in	Z in	Column Loads				Pile Reac.			
			col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	kips	
1	-2.50	24.0	42.0	1	3	1.250	-474.01	568.72	-20.38	97.73
				2	3	1.250	-492.87	-568.63	75.68	
				1	4	1.250	474.01	-568.72	20.38	
				2	4	1.250	492.87	568.63	-75.68	
2	4.50	108.0	42.0	1	1	1.000	-491.23	0.00	10.99	102.67*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	
				2	4	1.250	492.87	568.63	-75.68	
3	12.00	198.0	42.0	1	1	1.000	-491.23	0.00	10.99	108.69*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	
				2	4	1.250	492.87	568.63	-75.68	
4	19.50	288.0	42.0	1	1	1.000	-491.23	0.00	10.99	114.70*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	
				2	4	1.250	492.87	568.63	-75.68	
5	26.50	372.0	42.0	1	1	1.000	-491.23	0.00	10.99	120.31*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	
				2	4	1.250	492.87	568.63	-75.68	
6	-2.50	24.0	-42.0	1	3	1.250	-474.01	568.72	-20.38	97.73
				2	3	1.250	-492.87	-568.63	75.68	
				1	4	1.250	474.01	-568.72	20.38	

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Loc	X	Z	Col	Comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Reac, kips	
7	4.50	108.0	-42.0	2	4	1.250	492.87	568.63	-75.68	
				1	1	1.000	-491.23	0.00	10.99	102.67*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-60.19
8	12.00	198.0	-42.0	2	4	1.250	492.87	568.63	-75.68	
				1	1	1.000	-491.23	0.00	10.99	108.69*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-61.29
9	19.50	288.0	-42.0	2	4	1.250	492.87	568.63	-75.68	
				1	1	1.000	-491.23	0.00	10.99	114.70*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-62.39
10	26.50	372.0	-42.0	2	4	1.250	492.87	568.63	-75.68	
				1	1	1.000	-491.23	0.00	10.99	120.31*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-63.41
11	1.00	66.0	0.0	2	4	1.250	492.87	568.63	-75.68	
				1	1	1.000	-491.23	0.00	10.99	99.86
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-59.68
12	23.00	330.0	0.0	2	4	1.250	492.87	568.63	-75.68	
				1	1	1.000	-491.23	0.00	10.99	117.51*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-62.90
				2	4	1.250	492.87	568.63	-75.68	

Pile Reactions, Service (After the reduction of overstress allowance):

=====

Pile	Loc(X)	X	Z	col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Pile Reac, kips
	ft	in	in							
1	-2.50	24.0	42.0	1	2	1.000	-444.02	905.75	-63.65	97.64
				2	2	1.000	-363.96	-905.58	112.44	
				1	4	1.250	474.01	-568.72	20.38	-47.33
				2	4	1.250	492.87	568.63	-75.68	
2	4.50	108.0	42.0	1	1	1.000	-491.23	0.00	10.99	102.67*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-48.15
				2	4	1.250	492.87	568.63	-75.68	
3	12.00	198.0	42.0	1	1	1.000	-491.23	0.00	10.99	108.69*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-49.03
				2	4	1.250	492.87	568.63	-75.68	
4	19.50	288.0	42.0	1	1	1.000	-491.23	0.00	10.99	114.70*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-49.91
				2	4	1.250	492.87	568.63	-75.68	
5	26.50	372.0	42.0	1	1	1.000	-491.23	0.00	10.99	120.31*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-50.73
				2	4	1.250	492.87	568.63	-75.68	
6	-2.50	24.0	-42.0	1	2	1.000	-444.02	905.75	-63.65	97.63
				2	2	1.000	-363.96	-905.58	112.44	
				1	4	1.250	474.01	-568.72	20.38	-47.33
				2	4	1.250	492.87	568.63	-75.68	
7	4.50	108.0	-42.0	1	1	1.000	-491.23	0.00	10.99	102.67*
				2	1	1.000	-581.58	0.00	48.68	
				1	4	1.250	474.01	-568.72	20.38	-48.15

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Node	X	Z	Y	1	2	3	4	5	6	7	8
8	12.00	198.0	-42.0	2	4	1.250	492.87	568.63	-75.68		
				1	1	1.000	-491.23	0.00	10.99	108.69*	
				2	1	1.000	-581.58	0.00	48.68		
				1	4	1.250	474.01	-568.72	20.38	-49.03	
9	19.50	288.0	-42.0	2	4	1.250	492.87	568.63	-75.68		
				1	1	1.000	-491.23	0.00	10.99	114.70*	
				2	1	1.000	-581.58	0.00	48.68		
				1	4	1.250	474.01	-568.72	20.38	-49.91	
10	26.50	372.0	-42.0	2	4	1.250	492.87	568.63	-75.68		
				1	1	1.000	-491.23	0.00	10.99	120.31*	
				2	1	1.000	-581.58	0.00	48.68		
				1	4	1.250	474.01	-568.72	20.38	-50.73	
11	1.00	66.0	0.0	2	4	1.250	492.87	568.63	-75.68		
				1	1	1.000	-491.23	0.00	10.99	99.86	
				2	1	1.000	-581.58	0.00	48.68		
				1	4	1.250	474.01	-568.72	20.38	-47.74	
12	23.00	330.0	0.0	2	4	1.250	492.87	568.63	-75.68		
				1	1	1.000	-491.23	0.00	10.99	117.51*	
				2	1	1.000	-581.58	0.00	48.68		
				1	4	1.250	474.01	-568.72	20.38	-50.32	
				2	4	1.250	492.87	568.63	-75.68		

Note:

\* Force in pile is greater than pile capacity.

Only max. force in piles is considered for design.

Pile coordinates X and Z are from the most left edge of the footing.

Max. Pile Reaction Used in Design: (without selfweight and surcharge)

=====

Working Stress pile reaction = 101.03 kips

Reinforcement Schedule:

=====:

Dir	Quantity	Size	Bar dist. in	As total in^2	From ft	To ft	Hook
X	16	# 9	45.50	16.00	0.50	32.50	None
X	15	# 5	22.00	4.65	0.50	32.50	Both
X	6	# 5	6.00	1.86	0.50	32.50	Both
Z	22	# 5	46.38	6.82	----	----	Both
Z	44	# 7	21.25	26.40	----	----	Both
Z	12	# 11	7.02	18.72	----	----	None
Z	22	# 5	5.38	6.82	----	----	Both

Flexure:

=====

X direction

Loc	Mmax	Comb	Asb_req	Asb_prv	Asb_eff	Ast_req	Ast_prv	Ast_eff
ft	Mmin	Comb	Asb_req	Asb_prv	Asb_eff	Ast_req	Ast_prv	Ast_eff
	kft		in^2	in^2	in^2	in^2	in^2	in^2

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

-4.50	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-4.17	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-4.30	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-3.50	0.0	1	0.00	6.51	5.18	0.00	16.00	7.06	
	0.0	1	0.00	6.51	5.18	0.00	16.00	4.26	
-3.17	0.0	1	0.00	6.51	6.51	0.00	16.00	11.76	
	0.0	1	0.00	6.51	6.51	0.00	16.00	7.11	
-2.83	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	9.95	
-2.50	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	12.79	
-2.17	67.4	1	1.64	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	15.64	
-1.83	134.7	1	3.31	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
-1.50	202.1	1	5.00	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
0.00	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
1.50	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	-52.1	1	0.00	6.51	6.51	0.93	16.00	16.00	
4.30	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	-903.0	1	0.00	6.51	6.51	16.86	16.00	*	16.00
6.76	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	-1195.3	1	0.00	6.51	6.51	22.52	16.00	*	16.00
9.39	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	-1463.8	1	0.00	6.51	6.51	27.78	16.00	*	16.00
12.02	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	-1728.1	1	0.00	6.51	6.51	33.00	16.00	*	16.00
14.65	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	-1465.2	1	0.00	6.51	6.51	27.80	16.00	*	16.00
17.28	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	-1202.2	1	0.00	6.51	6.51	22.65	16.00	*	16.00
19.74	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	-906.6	1	0.00	6.51	6.51	16.93	16.00	*	16.00
22.54	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	-61.7	1	0.00	6.51	6.51	1.10	16.00	16.00	
24.04	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
25.54	193.6	1	4.79	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
25.87	127.2	1	3.12	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
26.20	60.8	1	1.48	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	15.36	
26.53	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	12.55	
26.86	0.0	1	0.00	6.51	6.51	0.00	16.00	16.00	
	0.0	1	0.00	6.51	6.51	0.00	16.00	9.75	
27.19	0.0	1	0.00	6.51	6.51	0.00	16.00	11.50	
	0.0	1	0.00	6.51	6.51	0.00	16.00	6.95	
27.51	0.0	1	0.00	6.51	5.04	0.00	16.00	6.86	
	0.0	1	0.00	6.51	5.04	0.00	16.00	4.14	
27.84	0.0	1	0.00	6.51	1.63	0.00	16.00	2.22	
	0.0	1	0.00	6.51	1.63	0.00	16.00	1.34	
28.34	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00	
	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00	

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

28.50	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00

Z direction

Loc ft	Mmax kft	Comb	Asb_req in^2	Asb_prv in^2	Asb_eff in^2	Ast_req in^2	Ast_prv in^2	Ast_eff in^2
-2.59	457.8	1	10.21	51.94	51.94	0.00	6.82	6.82
2.59	457.8	1	10.21	51.94	51.94	0.00	6.82	6.82

Note:

\* The provided reinforcement is not adequate, either less than required or larger than maximum allowed.

One Way Shear:

=====

Col	Dist ft	Comb	d in	V kips	Vc kips
-----	-----	-----	-----	-----	-----

X direction

1	-4.30	1	48.00	0.0	399.3
	4.30	1	33.57	225.4	279.3
2	19.74	1	33.57	227.9	279.3
	28.34	1	48.00	0.0	399.3

Z direction

Z -5.67 ---- - Outside of Footing

Two Way Shear:

=====

#	Bo ft	Ao ft^2	Comb	Avg. d in	V kips	Vc kips
-----	-----	-----	-----	-----	-----	-----

Columns:

1	29.33	52.58	1	38.87	607.2	1633.8
2	29.33	52.58	1	38.87	605.1	1633.8

Piles - max:

11	15.94	20.21	1	38.87	0.0	887.7
----	-------	-------	---	-------	-----	-------

Piles - min:

1	5.99	15.41	1	38.87	0.0	333.7
---	------	-------	---	-------	-----	-------

Note:

TWO WAY SHEAR IN FOOTING IS NOT DESIGNED AND STIRRUPS ARE NOT CONSIDERED.

H. W. Lochner, Inc. PHONE: 859-224-4476 | SHEET 1 OF 9  
1040 Monarch St. Suite 300 Lexington, KY 40513 | JOB NO. HLB#137  
PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida | BY JMJ DATE Jun/15/2006  
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170 | CKD. DATE

F.2-142

-----  
PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

PROJECT DATA  
=====

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#137  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #137 - Load Groups 4-6 (For Ease of Checking) - Per Field Data

JMJ 7/06  
WOB 7/06

H. W. Lochner, Inc.  
 1040 Monarch St. Suite 300  
 PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida  
 PHONE : TOLL-FREE 1-800-451-5327

PHONE: 859-224-4476  
 Lexington, KY 40513  
 TAMPA AREA: 813-985-9170

SHEET 2 OF 9  
 JOB NO. HLB#137  
 BY JMJ DATE Jun/15/2006  
 CKD. DATE

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

LOADS  
 =====

Load Cases: 3

Loadcase ID: (L+In)1 Name: Group 4 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-410.79	0.00	----	----
Force	Y	0.00	-466.56	1.00	----	----
Moment	Z	----	993.64	0.00	----	----
Moment	Z	----	1013.77	1.00	----	----

Loadcase ID: (L+Ip)1 Name: Group 5 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-383.15	0.00	----	----
Force	Y	0.00	-307.69	1.00	----	----
Moment	X	----	-871.11	1.00	----	----
Moment	X	----	871.28	0.00	----	----
Moment	Z	----	878.99	0.00	----	----
Moment	Z	----	1044.58	1.00	----	----

Loadcase ID: W1 Name: Group 6 Loadings  
 Multiplier = 1.000

Cap loads:

Type	Dir	Arm ft	Mag1 kip,kip/ft, kft	x1/L	Mag2 kip,kip/ft, kft	x2/L
Force	Y	0.00	-411.96	0.00	----	----
Force	Y	0.00	-431.65	1.00	----	----
Moment	X	----	-546.99	1.00	----	----
Moment	X	----	547.08	0.00	----	----
Moment	Z	----	920.95	0.00	----	----
Moment	Z	----	1009.28	1.00	----	----

Selected load groups:

- SERVICE GROUP I
- SERVICE GROUP IB
- SERVICE GROUP II

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

COMBINED FOOTING DESIGN

Code: AASHTO STANDARD (17th Edition 2002) - Service Load Design  
 Units: US

Geometry:

=====

Name : 1  
 Shape : Rectangular, Type : Pile/Shaft Cap

Bf(X) = 33.00 ft, Hf(Z) = 11.00 ft, Thickness(Y) = 51.00 in

Footing concentric.

Columns located on the footing:

Column No. 1 at x = 0.00 ft, Rectangular 36.00 in x 62.25 in  
 Column No. 2 at x = 24.04 ft, Rectangular 36.00 in x 62.25 in

Ag = 363.00 ft<sup>2</sup>, Ix = 122.50 ft<sup>2</sup>, Iz = 1308.00 ft<sup>2</sup>

Surcharge = 0.00 ksf

Piles: Circular Size: 22.00 in Capacity: 100.00 kips

Design Parameters:

=====

f'c = 4400.00 psi fy = 40000.00 psi  
 Ec = 4021.4 ksi Es = 29000.0 ksi  
 Crack control factor z = 130.00 kips/in  
 Concrete Type : Normal Weight.

Pile Reactions, Service (Without the reduction of overstress allowance):

=====

Pile Loc(X) ft	X in	Z in	Column Loads				Pile Reac.				
			col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	kips		
1	-2.50	24.0	42.0	1	3	1.250	-412.06	546.85	915.30	108.12*	
				2	3	1.250	-431.55	-546.76	1008.51		
				1	4	1.250	412.06	-546.85	-915.30		-69.55
				2	4	1.250	431.55	546.76	-1008.51		
2	4.50	108.0	42.0	1	1	1.000	-410.89	0.00	987.88	99.93	
				2	1	1.000	-466.46	0.00	1012.94		
				1	4	1.250	412.06	-546.85	-915.30		-60.60
				2	4	1.250	431.55	546.76	-1008.51		
3	12.00	198.0	42.0	1	1	1.000	-410.89	0.00	987.88	92.40	
				2	1	1.000	-466.46	0.00	1012.94		
				1	4	1.250	412.06	-546.85	-915.30		-51.02
				2	4	1.250	431.55	546.76	-1008.51		
4	19.50	288.0	42.0	1	1	1.000	-410.89	0.00	987.88	84.86	
				2	1	1.000	-466.46	0.00	1012.94		
				1	4	1.250	412.06	-546.85	-915.30		-41.43
				2	4	1.250	431.55	546.76	-1008.51		
5	26.50	372.0	42.0	1	1	1.000	-410.89	0.00	987.88	77.83	
				2	1	1.000	-466.46	0.00	1012.94		
				1	4	1.250	412.06	-546.85	-915.30		-32.49
				2	4	1.250	431.55	546.76	-1008.51		
6	-2.50	24.0	-42.0	1	3	1.250	-412.06	546.85	915.30	108.11*	
				2	3	1.250	-431.55	-546.76	1008.51		
				1	4	1.250	412.06	-546.85	-915.30		-69.55



H. W. Lochner, Inc.  
 1040 Monarch St. Suite 300  
 PROGRAM: RC-PIER® v4.1.0  
 PHONE : TOLL-FREE 1-800-451-5327

PHONE: 859-224-4476  
 Lexington, KY 40513  
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SHEET 4 OF 9  
 JOB NO. HLB#137  
 BY JMJ DATE Jun/15/2006  
 CKD. DATE

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Loc	X	Z	col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Reac
7	4.50	108.0	-42.0	2	4	1.250	431.55	546.76	-1008.51
				1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
8	12.00	198.0	-42.0	1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
9	19.50	288.0	-42.0	1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
10	26.50	372.0	-42.0	1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
11	1.00	66.0	0.0	1	3	1.250	-412.06	546.85	915.30
				2	3	1.250	-431.55	-546.76	1008.51
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
12	23.00	330.0	0.0	1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51

Pile Reactions, Service (After the reduction of overstress allowance):

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Pile Loc(X)	X	Z	col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Pile Reac.
ft	in	in							kips
1	-2.50	24.0	42.0	1	2	1.000	-383.24	870.92	873.70
				2	2	1.000	-307.60	-870.75	1043.85
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
2	4.50	108.0	42.0	1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
3	12.00	198.0	42.0	1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
4	19.50	288.0	42.0	1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
5	26.50	372.0	42.0	1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
6	-2.50	24.0	-42.0	1	2	1.000	-383.24	870.92	873.70
				2	2	1.000	-307.60	-870.75	1043.85
				1	4	1.250	412.06	-546.85	-915.30
				2	4	1.250	431.55	546.76	-1008.51
7	4.50	108.0	-42.0	1	1	1.000	-410.89	0.00	987.88
				2	1	1.000	-466.46	0.00	1012.94
				1	4	1.250	412.06	-546.85	-915.30

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Loc	Y	Z	Y	Z	Y	Z	Y	Z	Y	Z
			2	4	1.250	431.55	546.76	-1008.51		
8	12.00	198.0	-42.0	1	1	1.000	-410.89	0.00	987.88	92.40
				2	1	1.000	-466.46	0.00	1012.94	
				1	4	1.250	412.06	-546.85	-915.30	-40.81
				2	4	1.250	431.55	546.76	-1008.51	
9	19.50	288.0	-42.0	1	1	1.000	-410.89	0.00	987.88	84.86
				2	1	1.000	-466.46	0.00	1012.94	
				1	4	1.250	412.06	-546.85	-915.30	-33.14
				2	4	1.250	431.55	546.76	-1008.51	
10	26.50	372.0	-42.0	1	1	1.000	-410.89	0.00	987.88	77.83
				2	1	1.000	-466.46	0.00	1012.94	
				1	4	1.250	412.06	-546.85	-915.30	-25.99
				2	4	1.250	431.55	546.76	-1008.51	
11	1.00	66.0	0.0	1	1	1.000	-410.89	0.00	987.88	103.45*
				2	1	1.000	-466.46	0.00	1012.94	
				1	4	1.250	412.06	-546.85	-915.30	-52.06
				2	4	1.250	431.55	546.76	-1008.51	
12	23.00	330.0	0.0	1	1	1.000	-410.89	0.00	987.88	81.34
				2	1	1.000	-466.46	0.00	1012.94	
				1	4	1.250	412.06	-546.85	-915.30	-29.57
				2	4	1.250	431.55	546.76	-1008.51	

Note:

\* Force in pile is greater than pile capacity.

Only max. force in piles is considered for design.

Pile coordinates X and Z are from the most left edge of the footing.

Max. Pile Reaction Used in Design: (without selfweight and surcharge)

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Working Stress pile reaction = 88.75 kips

Reinforcement Schedule:

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Dir	Quantity	Size	Bar dist. in	As total in^2	From ft	To ft	Hook
X	16	# 9	45.50	16.00	0.50	32.50	None
X	15	# 5	22.00	4.65	0.50	32.50	Both
X	6	# 5	6.00	1.86	0.50	32.50	Both
Z	22	# 5	46.38	6.82	----	----	Both
Z	44	# 7	21.25	26.40	----	----	Both
Z	12	# 11	7.02	18.72	----	----	None
Z	22	# 5	5.38	6.82	----	----	Both

Flexure:

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X direction

Loc	Mmax	Comb	Asb_req	Asb_prv	Asb_eff	Ast_req	Ast_prv	Ast_eff
ft	kft	Comb	in^2	in^2	in^2	in^2	in^2	in^2

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-4.50	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00
-4.17	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00
-4.30	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00
-3.50	0.0	2	0.00	6.51	5.18	0.00	16.00	7.06
	0.0	2	0.00	6.51	5.18	0.00	16.00	4.26
-3.17	0.0	2	0.00	6.51	6.51	0.00	16.00	11.76
	0.0	2	0.00	6.51	6.51	0.00	16.00	7.11
-2.83	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	9.95
-2.50	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	12.79
-2.17	59.2	2	1.44	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	15.64
-1.83	118.3	2	2.90	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
-1.50	177.5	2	4.38	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
0.00	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
1.50	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	-45.8	2	0.00	6.51	6.51	0.81	16.00	16.00
4.30	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	-793.3	2	0.00	6.51	6.51	14.75	16.00	16.00
6.76	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	-1050.0	2	0.00	6.51	6.51	19.70	16.00 *	16.00
9.39	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	-1285.9	2	0.00	6.51	6.51	24.29	16.00 *	16.00
12.02	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	-1518.1	2	0.00	6.51	6.51	28.84	16.00 *	16.00
14.65	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	-1287.1	2	0.00	6.51	6.51	24.31	16.00 *	16.00
17.28	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	-1056.1	2	0.00	6.51	6.51	19.81	16.00 *	16.00
19.74	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	-796.4	2	0.00	6.51	6.51	14.82	16.00	16.00
22.54	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	-54.2	2	0.00	6.51	6.51	0.97	16.00	16.00
24.04	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
25.54	170.0	2	4.20	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
25.87	111.7	2	2.74	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
26.20	53.4	2	1.30	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	15.36
26.53	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	12.55
26.86	0.0	2	0.00	6.51	6.51	0.00	16.00	16.00
	0.0	2	0.00	6.51	6.51	0.00	16.00	9.75
27.19	0.0	2	0.00	6.51	6.51	0.00	16.00	11.50
	0.0	2	0.00	6.51	6.51	0.00	16.00	6.95
27.51	0.0	2	0.00	6.51	5.04	0.00	16.00	6.86
	0.0	2	0.00	6.51	5.04	0.00	16.00	4.14
27.84	0.0	2	0.00	6.51	1.63	0.00	16.00	2.22
	0.0	2	0.00	6.51	1.63	0.00	16.00	1.34
28.34	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00

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28.50	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	2	0.00	0.00	0.00	0.00	0.00	0.00

Z direction

Loc ft	Mmax kft	Comb	Asb_req in^2	Asb_prv in^2	Asb_eff in^2	Ast_req in^2	Ast_prv in^2	Ast_eff in^2
-2.59	402.2	2	8.95	51.94	51.94	0.00	6.82	6.82
2.59	402.2	2	8.95	51.94	51.94	0.00	6.82	6.82

Note:

\* The provided reinforcement is not adequate, either less than required or larger than maximum allowed.

One Way Shear:

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Col	Dist ft	Comb	d in	V kips	Vc kips

X direction

1	-4.30	2	48.00	0.0	399.3
	4.30	2	33.57	198.0	279.3
2	19.74	2	33.57	200.2	279.3
	28.34	2	48.00	0.0	399.3

Z direction

Z -5.67 ---- - Outside of Footing

Two Way Shear:

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#	Bo ft	Ao ft^2	Comb	Avg. d in	V kips	Vc kips

Columns:

1	29.33	52.58	2	38.87	533.4	1633.8
2	29.33	52.58	2	38.87	531.6	1633.8

Piles - max:

11	15.94	20.21	2	38.87	0.0	887.7
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Piles - min:

1	5.99	15.41	2	38.87	0.0	333.7
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Note:

TWO WAY SHEAR IN FOOTING IS NOT DESIGNED AND STIRRUPS ARE NOT CONSIDERED.