

**LOCHNER**

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

SUBJECT: PRESTRESSED GIRDER ANALYSIS

BEAM REACTIONS

JMJ May-06  
KBM Jun-06

HIGH LEVEL BENT 160

Beam No.	Self Wt.	Topping (Deck + Haunch)	DL - Precast	Interior Diaphragms	D.L.-Comp	Total D.L.
Exterior						
Span 160	17.40	23.30	0.70	1.00	3.30	45.70
Span 161	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 160	17.40	21.60	0.70	1.90	3.10	44.70
Span 161	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

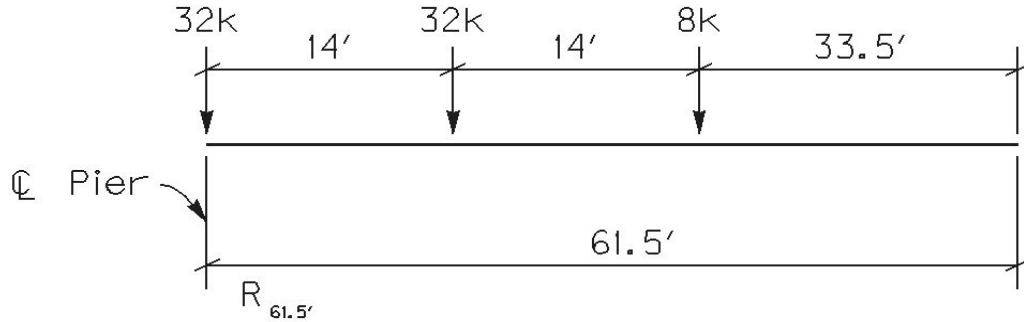
PROJECT: **BONNER BRIDGE - OREGON INLET NORTH CAROLINA**  
 SUBJECT: **HIGH LEVEL BENT ANALYSIS**  
 HIGH LEVEL BENTS

JMJ Jun-06  
 WDB Jun-06

**LIVE LOAD**

( Bents 137, 142, 160)

**HS-20 AXLE LOAD**



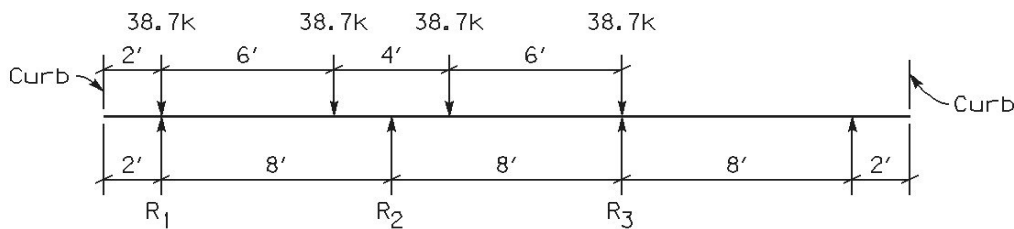
$$R_{61.5} = 32 \text{ k} + 32 \text{ k} \left( \frac{47.5}{61.5} \right) + 8 \text{ k} \left( \frac{33.5}{61.5} \right) = 61.1 \text{ k}$$

**HS-20 WHEEL LOAD**

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

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

**Max. NEGATIVE MOMENT**



w/ Impact

$$R_1 = 38.7 + 38.7 \left( \frac{2}{8} \right) = 48.4 \text{ k} = R_3$$

$$R_2 = ( 38.7 + 38.7 ) \left( \frac{6}{8} \right) = 58.1 \text{ k}$$

w/o Impact

$$R_1 = 30.5 + 30.5 \left( \frac{2}{8} \right) = 38.1 \text{ k} = R_3$$

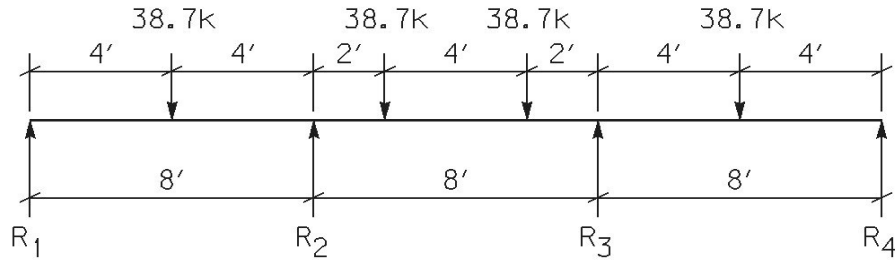
$$R_2 = ( 30.5 + 30.5 ) \left( \frac{6}{8} \right) = 45.8 \text{ k}$$

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

JMJ Jun-06  
 WDB Jun-06

**LIVE LOAD**

**MAX. POSITIVE MOMENT**



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

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

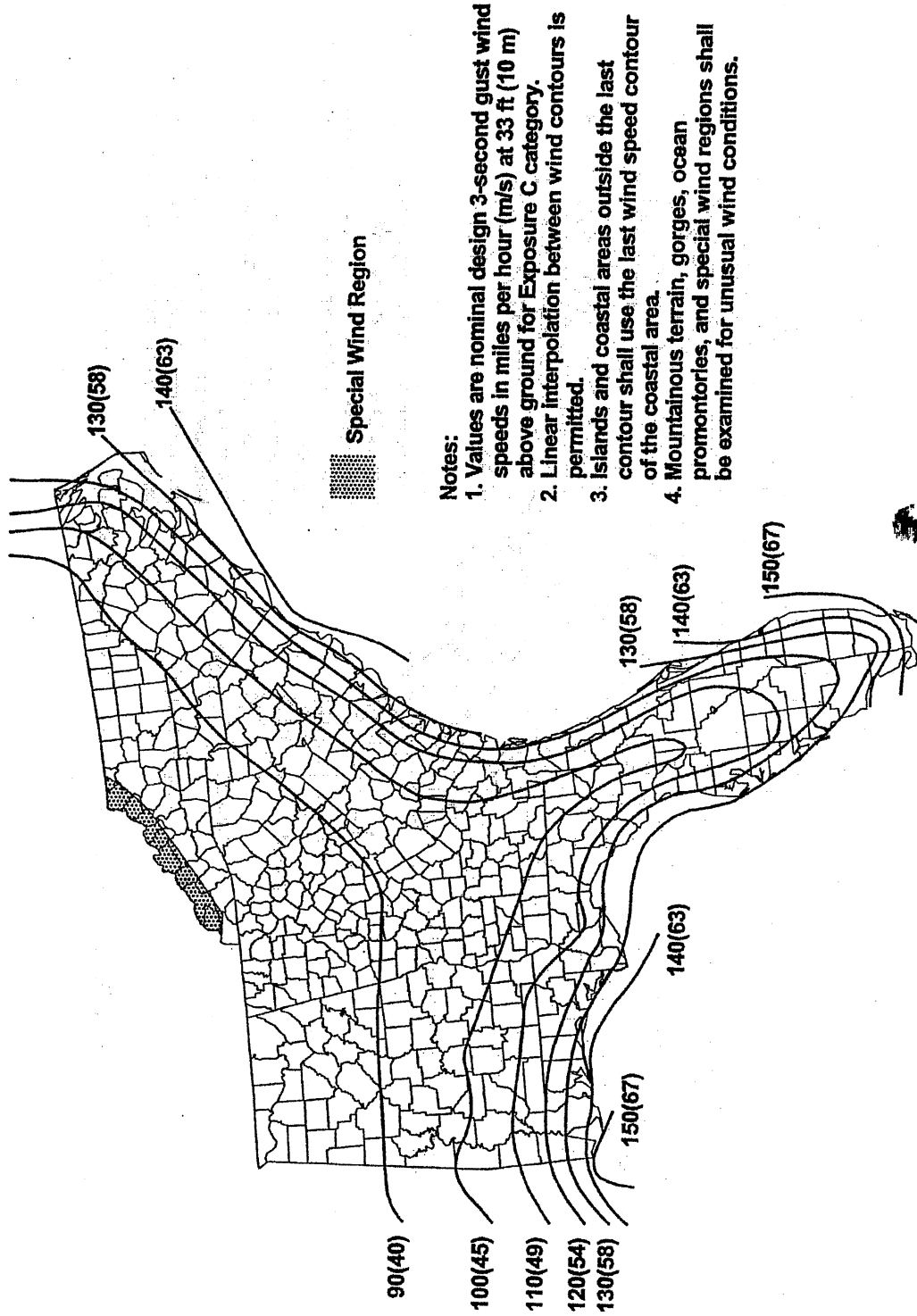


FIGURE 6-1b. Basic Wind Speed—Eastern Gulf of Mexico and Southeastern U.S. Hurricane Coastline



PROJECT: **BONNER BRIDGE - OREGON INLET NORTH CAROLINA**  
 SUBJECT: **HIGH LEVEL BENT ANALYSIS**  
 H.L.B. #160

JMJ May-06  
 WDB Jun-06

**Earth Loads**

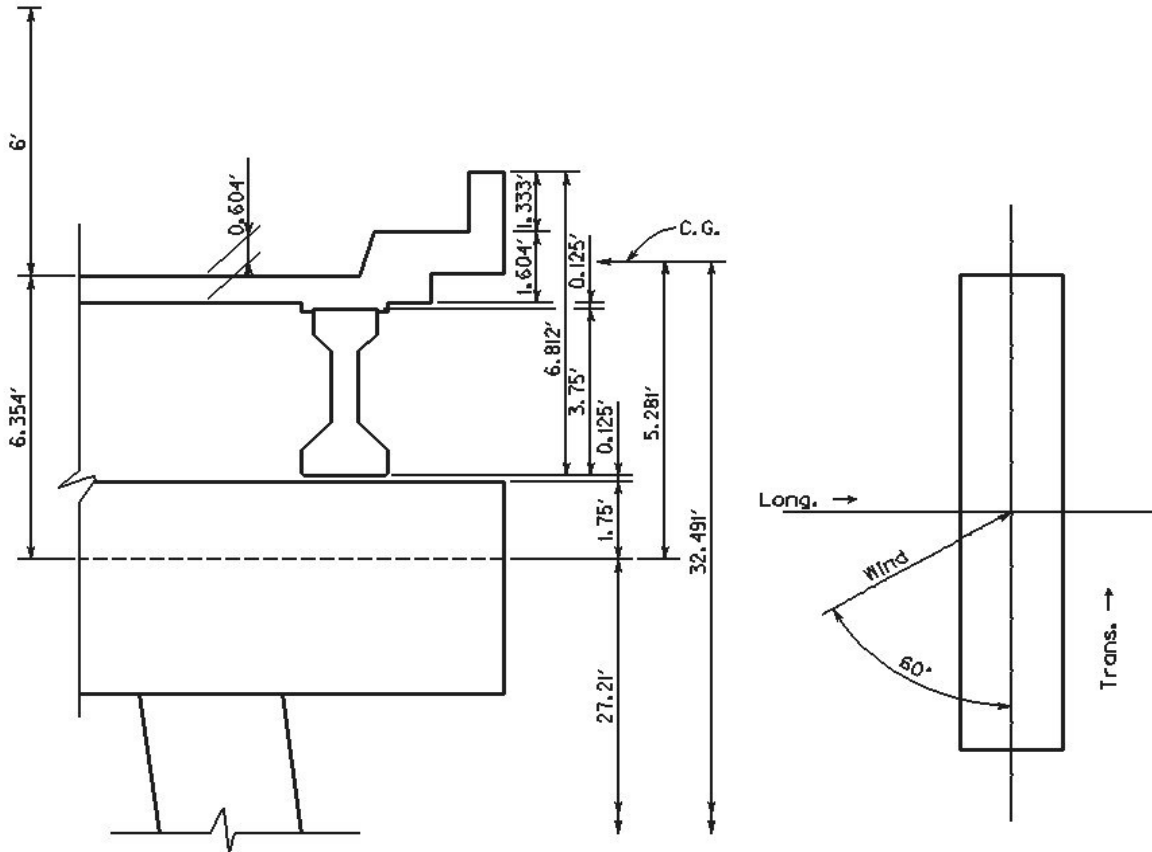
Assume No Earth Loading on Bents or Pile Cap.

**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 Bents 144 & 146 Take 1/2 Load

$$\text{Load Length} = (61.500 + 61.5) / 2 = 61.500 \text{ Ft.}$$

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

Moment Factor

$$M_F = 32.491 / 27.21 = 1.194$$

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JMJ May-06  
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Modify & Apply to Jt. 2 & 3

Long. Wind	= (	13.406 k)	*	(	1.194 )/	2 =	8.003 k/Jt
Trans. Wind	= (	12.149 k)	*	(	1.194 )/	2 =	7.253 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	= (	27.210 Ft. +	6.354 Ft. +	6.000 Ft. ) /	27.210 Ft. =	1.454
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Modify & Apply to Jt. 2 & 3

Long. Wind	= (	2.337 k)	*	(	1.454 )/	2.000 =	1.699 k/Jt
Trans. Wind	= (	2.091 k)	*	(	1.454 )/	2.000 =	1.520 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	=	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>	*	3.097 Ft.	=	0.105 k/Ft

Members 7 & 8

W <sub>z</sub>	=	0.177 k/Ft				
W <sub>x</sub>	=	0.034 k/Ft <sup>2</sup>	*	3.947 Ft.	=	0.134 k/Ft

Struts

Member 6

W <sub>z</sub>	=	0.059 k/Ft <sup>2</sup>	*	5.000 Ft.	=	0.295 k/Ft
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 H.L.B. #160

JMJ May-06  
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**Longitudinal Forces (AASHTO 3.9)**

Lane Loading

2 Lanes, HS20, No Reduction (AASHTO 3.12.1)

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

Modify & Apply to Jts. 2 & 3

$$M_F = 1.454 \text{ from Wind on L.L.}$$

$$F_z = (5.736 \text{ k} * 1.454) / 2 = 4.170 \text{ k/Jt}$$

**Thermal Forces (AASHTO 3.16)**

Longitudinal - Structure Free to move at Bents, No Long. Forces due to  $\Delta T$

Transverse

Assume  $45^\circ \Delta T$

Thermal = 0.000006 (AASHTO 8.5.3)

Shrinkage = 0.0002 (AASHTO 8.5.4)

$$\text{Ratio} = \frac{S}{T * \Delta T} = \frac{0.0002}{0.000006 * 45} = 0.7407 \text{ use } 1.741$$

**Stream Forces (AASHTO 3.18.1)**

Tidal, Stream, & Surge Forces Beyond Scope

**Seismic Loading (AASHTO 3.1)**

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



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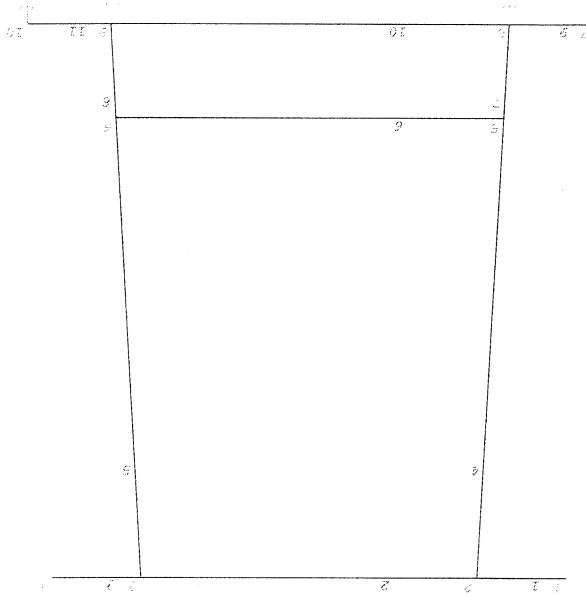
*****
* STAAD.Pro                               *
* Version 2004   Bld 1002.US              *
* Proprietary Program of                  *
* Research Engineers, Intl.                *
* Date= JUL 18, 2006                       *
* Time= 10:16:59                           *
* USER ID: H.W. Lochner                    *
*****

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*JMJ 7/06*  
*WDB 7/06*

1. STAAD SPACE BONNER BRIDGE, HLB160
- INPUT FILE: HLB160.STD
2. START JOB INFORMATION
3. JOB NAME BONNER BRIDGE
4. JOB CLIENT NORTH CAROLINA
5. ENGINEER NAME JMJ
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 1.42 27.21 0; 2 6.28 27.21 0; 3 24.72 27.21 0; 4 29.58 27.21 0
13. 5 4.87 4.63 0; 6 26.14 4.63 0; 7 0 0 0; 8 4.58 0 0; 9 26.42 0 0; 10 31.00 0 0
14. MEMBER INCIDENCES
15. 1 1 2; 2 2 3; 3 3 4; 4 2 5; 5 3 6; 6 5 6; 7 5 8; 8 6 9; 9 7 8; 10 8 9; 11 9 10
16. DEFINE MATERIAL START
17. ISOTROPIC CONCRETE
18. E 453600
19. POISSON 0.17
20. DENSITY 0.14999
21. ALPHA 5.5E-006
22. DAMP 0.05
23. END DEFINE MATERIAL
24. MEMBER PROPERTY AMERICAN
25. 1 TO 3 PRIS YD 3.5 ZD 3
26. 4 5 PRIS YD 2.994 ZD 3.097
27. 6 PRIS YD 5 ZD 1.5
28. 7 8 PRIS YD 2.994 ZD 3.947
29. 9 TO 11 PRIS YD 4.25 ZD 9
30. CONSTANTS
31. MATERIAL CONCRETE MEMB 1 TO 11
32. SUPPORTS
33. 7 TO 10 FIXED
34. DRAW JOINT MEMBER SUPPORT

DRAW JOINT MEMBER SUPPORT



STRUCTURE DATA:  
TYPE = SPACE  
NM = 10  
NE = 11  
NS = 4  
NL = 0  
UNIT FEET KIP  
XMAX = 31.0  
YMAX = 27.2  
ZMAX = 0.0

S T A A D - I I I  
REV: 2004

DATE: JUL 18, 2006  
TIME: 10:16:59

- 35. \*\*
- 36. \*\*DEAD LOAD
- 37. \*\*
- 38. LOAD 2 DEAD
- 39. SELFWEIGHT Y -1
- 40. MEMBER LOAD
- 41. 1 CON GY -91.4 2.08
- 42. 2 CON GY -89.4 5.22
- 43. 2 CON GY -89.4 13.22
- 44. 3 CON GY -91.4 2.78
- 45. JOINT LOAD
- 46. 2 3 FY -2.7
- 47. \*\*
- 48. \*\*MAXIMUM NEGATIVE MOMENT
- 49. \*\*
- 50. LOAD 11 LIVELoad + IMPACT FOR JT. 2 MEM 1 AND 2
- 51. MEMBER LOAD
- 52. 1 CON Y -48.4 2.08
- 53. 2 CON Y -58.1 5.22
- 54. 2 CON Y -48.4 13.22
- 55. LOAD 12 LIVELoad + IMPACT FOR JT. 3 MEM. 2 AND 3
- 56. MEMBER LOAD
- 57. 2 CON Y -48.4 5.22
- 58. 2 CON Y -58.1 13.22
- 59. 3 CON Y -48.4 2.78
- 60. \*\*
- 61. \*\*MAXIMUM POSITIVE MOMENT
- 62. \*\*
- 63. LOAD 13 LIVELoad + IMPACT MEM 2
- 64. MEMBER LOAD
- 65. 1 CON Y -19.4 2.08
- 66. 2 CON Y -58.1 5.22
- 67. 2 CON Y -58.1 13.22
- 68. 3 CON Y -19.4 2.78
- 69. \*\*
- 70. \*\*LOADS ON FOOTINGS
- 71. \*\*
- 72. LOAD 14 LIVELoad NO IMPACT JT. 8
- 73. MEMBER LOAD
- 74. 1 CON Y -38.1 2.08
- 75. 2 CON Y -45.8 5.22
- 76. 2 CON Y -38.1 13.22
- 77. LOAD 15 LIVELoad NO IMPACT FOR JT. 9
- 78. MEMBER LOAD
- 79. 2 CON Y -38.1 5.22
- 80. 2 CON Y -45.8 13.22
- 81. 3 CON Y -38.1 2.78
- 82. \*\*
- 83. \*\*WIND
- 84. \*\*
- 85. LOAD 4 WIND
- 86. JOINT LOAD
- 87. 2 3 FX -7.253 FZ -8.003
- 88. 4 FX -0.357
- 89. MEMBER LOAD
- 90. 1 TO 3 UNI GZ -0.207
- 91. 4 5 7 8 UNI GZ -0.177
- 92. 4 5 UNI GX -0.105
- 93. 7 8 UNI GX -0.134
- 94. 6 UNI GZ -0.295

- 95. \*\*
- 96. LOAD 5 WIND ON LL
- 97. JOINT LOAD
- 98. 2 3 FX -1.520 FZ -1.699
- 99. \*\*
- 100. LOAD 6 LONGITUDINAL FORCE
- 101. JOINT LOAD
- 102. 2 3 FZ -4.170
- 103. \*\*
- 104. LOAD 7 TEMP LOAD
- 105. TEMPERATURE LOAD
- 106. 1 TO 11 TEMP -45
- 107. \*\*
- 108. LOAD 8 STREAM LOAD
- 109. MEMBER LOAD
- 110. 9 TO 11 UNI GZ -0
- 111. \*\*
- 112. LOAD COMB 10 GROUP 1
- 113. 8 1.0
- 114. LOAD COMB 20 GROUP 2
- 115. 4 1.0 8 1.0
- 116. LOAD COMB 30 GROUP 3
- 117. 4 0.3 5 1.0 6 1.0 6 1.0
- 118. LOAD COMB 40 GROUP 4
- 119. 7 1.74 8 1.0
- 120. LOAD COMB 50 GROUP 5
- 121. 4 1.0 7 1.74 8 1.0
- 122. LOAD COMB 60 GROUP 6
- 123. 4 0.3 5 1.0 6 1.0 7 1.74 8 1.0
- 124. LOAD COMB 100 USED TO DETERMINE LOCATION OF MAX FACTORED POSITIVE MOMENT
- 125. 2 1.0 13 1.67
- 126. PERFORM ANALYSIS

PROBLEM STATISTICS

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NUMBER OF JOINTS/MEMBER-ELEMENTS/SUPPORTS = 10/ 11/ 4  
 ORIGINAL/FINAL BAND-WIDTH= 3/ 3/ 24 DOF  
 TOTAL PRIMARY LOAD CASES = 11, TOTAL DEGREES OF FREEDOM = 36  
 SIZE OF STIFFNESS MATRIX = 1 DOUBLE KILO-WORDS  
 REQD/AVAIL. DISK SPACE = 12.0/ 111379.3 MB

127. PRINT MEMBER FORCES LIST 2 4 5 7 8

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	17.32	103.97	0.00	0.00	0.00	328.06
	3	3	-17.32	103.87	0.00	0.00	0.00	-327.12
	11	2	8.77	59.59	0.00	0.00	0.00	170.21
	12	3	-8.77	46.91	0.00	0.00	0.00	-92.12
	13	2	8.78	46.95	0.00	0.00	0.00	92.45
	14	3	-8.78	59.55	0.00	0.00	0.00	-169.86
	15	2	9.72	58.12	0.00	0.00	0.00	133.36
	16	3	-9.72	58.08	0.00	0.00	0.00	-133.02
	17	2	6.91	46.95	0.00	0.00	0.00	134.04
	18	3	-6.91	36.95	0.00	0.00	0.00	-72.58
	19	2	6.92	36.98	0.00	0.00	0.00	72.84
	20	3	-6.92	46.92	0.00	0.00	0.00	-133.77
	21	2	0.18	9.39	1.91	-0.02	3.18	86.55
	22	3	-0.18	-9.39	1.91	0.02	-3.21	-86.55
	23	2	0.00	1.72	0.00	0.00	0.72	15.87
	24	3	0.00	-1.72	0.00	0.00	-0.73	-15.87
	25	2	0.00	0.00	0.00	0.00	0.00	0.00
	26	3	0.00	0.00	0.00	0.00	0.00	0.00
	27	2	0.00	0.00	0.00	0.00	0.00	0.00
	28	3	0.00	0.00	0.00	0.00	0.00	0.00
	29	2	6.63	0.00	0.00	0.00	0.00	25.10
	30	3	-6.63	0.00	0.00	0.00	0.00	-25.12
	31	2	0.00	0.00	0.00	0.00	0.00	0.00
	32	3	0.00	0.00	0.00	0.00	0.00	0.00
	33	2	0.00	0.00	0.00	0.00	0.00	0.00
	34	3	0.00	0.00	0.00	0.00	0.00	0.00
	35	2	0.18	9.39	1.91	-0.02	3.18	86.55
	36	3	-0.18	-9.39	1.91	0.02	-3.21	-86.55
	37	2	0.00	1.72	0.00	0.00	0.72	15.87
	38	3	0.00	-1.72	0.00	0.00	-0.73	-15.87
	39	2	0.00	0.00	0.00	0.00	0.00	0.00
	40	3	0.00	0.00	0.00	0.00	0.00	0.00
	41	2	0.18	9.39	1.91	-0.02	3.18	86.55
	42	3	-0.18	-9.39	1.91	0.02	-3.21	-86.55
	43	2	0.00	1.72	0.00	0.00	0.72	15.87
	44	3	0.00	-1.72	0.00	0.00	-0.73	-15.87
	45	2	0.00	0.00	0.00	0.00	0.00	0.00
	46	3	0.00	0.00	0.00	0.00	0.00	0.00
	47	2	6.63	0.00	0.00	0.00	0.00	25.10
	48	3	-6.63	0.00	0.00	0.00	0.00	-25.12
	49	2	0.00	0.00	0.00	0.00	0.00	0.00
	50	3	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	3	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	3	0.00	0.00	0.00	0.00	0.00	0.00
	55	2	0.18	9.39	1.91	-0.02	3.18	86.55
	56	3	-0.18	-9.39	1.91	0.02	-3.21	-86.55
	57	2	0.00	1.72	0.00	0.00	0.72	15.87
	58	3	0.00	-1.72	0.00	0.00	-0.73	-15.87
	59	2	0.00	0.00	0.00	0.00	0.00	0.00
	60	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	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	3	0.00	0.00	0.00	0.00	0.00	0.00

*Max. Neg. Mdl*  
*Max. Neg. Mltz*

*VdL*







H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 4 JT. 2

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 160			P MEMBER 4			JOINT 2			
		GROUP 1			GROUP 2			GROUP 2			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	206.41	0.00	55.37	DL	206.41	0.00	55.37	DL	206.41	0.00	55.37
LL	108.33	0.00	35.66	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	9.83	-0.37	86.55	GROUP 2	9.83	-0.37	86.55
SERVICE STRENGTH	314.74	0.00	91.03	SERVICE STRENGTH	216.24	-0.37	141.92	SERVICE STRENGTH	216.24	-0.37	141.92
	503.05	0.00	149.24		281.11	-0.48	184.50		281.11	-0.48	184.50
		GROUP 3			GROUP 4			GROUP 4			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	206.41	0.00	55.37	DL	206.41	0.00	55.37	DL	206.41	0.00	55.37
LL	108.33	0.00	35.66	LL	108.33	0.00	35.66	LL	108.33	0.00	35.66
GROUP 3	4.76	-0.28	41.83	GROUP 4	0.72	0.00	43.68	GROUP 4	0.72	0.00	43.68
SERVICE STRENGTH	319.50	-0.28	132.86	SERVICE STRENGTH	315.46	0.00	134.71	SERVICE STRENGTH	315.46	0.00	134.71
	415.35	-0.36	172.72		410.10	0.00	175.12		410.10	0.00	175.12
		GROUP 5			GROUP 6			GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	206.41	0.00	55.37	DL	206.41	0.00	55.37	DL	206.41	0.00	55.37
LL	0.00	0.00	0.00	LL	108.33	0.00	35.66	LL	108.33	0.00	35.66
GROUP 5	10.55	-0.37	130.23	GROUP 6	5.48	-0.28	85.52	GROUP 6	5.48	-0.28	85.52
SERVICE STRENGTH	216.96	-0.37	185.60	SERVICE STRENGTH	320.22	-0.28	176.55	SERVICE STRENGTH	320.22	-0.28	176.55
	271.20	-0.46	232.00		400.28	-0.35	220.69		400.28	-0.35	220.69

**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.	
			Depth of Rect. Col. =	D =	37.164	In.	
$r_y = 0.30 * D =$	11.15	In.	$L_y =$	17.833	Ft.	$K_y =$	2.0
$r_z = 0.30 * B =$	10.78	In.	$L_z =$	20.833	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	153681	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	143628	In <sup>5</sup>		
$K_y L_y / r$	=	38.4	>	22	CONSIDER SLENDERNESS		
$K_z L_z / r$	=	27.8	>	22	CONSIDER SLENDERNESS		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 4 JT. 2

JMJ Jun-06  
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**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	37.164	38.4	0.00	0.00	0.000	503	10998	1.070	1.070	72	*
MZ	35.928	37.164	27.8	149.24	71.98	0.482	503	14114	1.054	1.054	157	

**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	37.164	38.4	0.48	0.00	0.000	281	10998	1.038	1.038	40	*
MZ	35.928	37.164	27.8	184.50	71.98	0.390	281	15049	1.027	1.027	190	

**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	37.164	38.4	0.36	0.00	0.000	415	10998	1.057	1.057	59	*
MZ	35.928	37.164	27.8	172.72	71.98	0.417	415	14767	1.042	1.042	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>	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	37.164	38.4	0.00	0.00	0.000	410	10998	1.056	1.056	59	*
MZ	35.928	37.164	27.8	175.12	71.98	0.411	410	14827	1.041	1.041	182	

**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	37.164	38.4	0.46	0.00	0.000	271	10998	1.037	1.037	39	*
MZ	35.928	37.164	27.8	232.00	71.98	0.310	271	15967	1.025	1.025	238	

**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	37.164	38.4	0.35	0.00	0.000	400	10998	1.055	1.055	57	*
MZ	35.928	37.164	27.8	220.69	71.98	0.326	400	15776	1.038	1.038	229	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 4 JT. 2

JMJ Jun-06  
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**COLUMN LOADS**

				PMIN					
				HLB 160	MEMBER 4	JOINT 2			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		
DL	154.81	0.00	55.37	DL	154.81	0.00	55.37		
LL	47.40	0.00	92.45	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	9.83	-0.37	86.55		
SERVICE STRENGTH	202.21 303.95	0.00 0.00	147.82 272.29	SERVICE STRENGTH	164.64 214.03	-0.37 -0.48	141.92 184.50		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		
DL	154.81	0.00	55.37	DL	154.81	0.00	55.37		
LL	47.40	0.00	92.45	LL	47.40	0.00	92.45		
GROUP 3	4.76	-0.28	41.83	GROUP 4	0.72	0.00	43.68		
SERVICE STRENGTH	206.97 269.06	-0.28 -0.36	189.65 246.55	SERVICE STRENGTH	202.93 263.81	0.00 0.00	191.50 248.95		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		
DL	154.81	0.00	55.37	DL	154.81	0.00	55.37		
LL	0.00	0.00	0.00	LL	47.40	0.00	92.45		
GROUP 5	10.55	-0.37	130.23	GROUP 6	5.48	-0.28	85.52		
SERVICE STRENGTH	165.36 206.70	-0.37 -0.46	185.60 232.00	SERVICE STRENGTH	207.69 259.61	-0.28 -0.35	233.34 291.68		

**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.	
$r_y = 0.30 * D =$	11.15	In.	Depth of Rect. Col. =	D =	37.164	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	17.833	Ft.	$K_y =$	2.0
			$L_z =$	20.833	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	153681	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	143628	In <sup>5</sup>		
$K_y L_y / r$	=	38.4	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	27.8	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 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>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	37.164	38.4	0.00	0.00	0.000	304	10998	1.041	1.041	43	*
MZ	35.928	37.164	27.8	272.29	71.98	0.264	304	16547	1.027	1.027	280	

**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	37.164	38.4	0.48	0.00	0.000	214	10998	1.029	1.029	31	*
MZ	35.928	37.164	27.8	184.50	71.98	0.390	214	15049	1.021	1.021	188	

**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	37.164	38.4	0.36	0.00	0.000	269	10998	1.036	1.036	38	*
MZ	35.928	37.164	27.8	246.55	71.98	0.292	269	16193	1.024	1.024	253	

**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	37.164	38.4	0.00	0.00	0.000	264	10998	1.035	1.035	38	*
MZ	35.928	37.164	27.8	248.95	71.98	0.289	264	16229	1.024	1.024	255	

**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	37.164	38.4	0.46	0.00	0.000	207	10998	1.028	1.028	30	*
MZ	35.928	37.164	27.8	232.00	71.98	0.310	207	15967	1.019	1.019	236	

**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	37.164	38.4	0.35	0.00	0.000	260	10998	1.035	1.035	37	*
MZ	35.928	37.164	27.8	291.68	71.98	0.247	260	16780	1.023	1.023	298	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 4 JT. 5

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 160			P MEMBER 4			JOINT 5			
		GROUP 1			GROUP 2			GROUP 2			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-237.81	0.00	23.56	DL	-237.81	0.00	23.56	DL	-237.81	0.00	23.56
LL	-108.33	0.00	10.05	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	-9.98	-291.98	94.79	GROUP 2	-9.98	-291.98	94.79
SERVICE STRENGTH	-346.14	0.00	33.61	SERVICE STRENGTH	-247.79	-291.98	118.35	SERVICE STRENGTH	-247.79	-291.98	118.35
	-543.87	0.00	52.40		-322.13	-379.57	153.86		-322.13	-379.57	153.86
		GROUP 3			GROUP 4			GROUP 4			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-237.81	0.00	23.56	DL	-237.81	0.00	23.56	DL	-237.81	0.00	23.56
LL	-108.33	0.00	10.05	LL	-108.33	0.00	10.05	LL	-108.33	0.00	10.05
GROUP 3	-4.81	-220.23	44.45	GROUP 4	-0.72	0.00	216.90	GROUP 4	-0.72	0.00	216.90
SERVICE STRENGTH	-350.95	-220.23	78.06	SERVICE STRENGTH	-346.86	0.00	250.51	SERVICE STRENGTH	-346.86	0.00	250.51
	-456.24	-286.30	101.48		-450.92	0.00	325.66		-450.92	0.00	325.66
		GROUP 5			GROUP 6			GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-237.81	0.00	23.56	DL	-237.81	0.00	23.56	DL	-237.81	0.00	23.56
LL	0.00	0.00	0.00	LL	-108.33	0.00	10.05	LL	-108.33	0.00	10.05
GROUP 5	-10.70	-291.98	311.69	GROUP 6	-5.52	-220.23	261.35	GROUP 6	-5.52	-220.23	261.35
SERVICE STRENGTH	-248.51	-291.98	335.25	SERVICE STRENGTH	-351.66	-220.23	294.96	SERVICE STRENGTH	-351.66	-220.23	294.96
	-310.64	-364.98	419.06		-439.58	-275.29	368.70		-439.58	-275.29	368.70

**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.	
$r_y = 0.30 * D =$	11.15	In.	Depth of Rect. Col. =	D =	37.164	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	17.833	Ft.	$K_y =$	2.0
			$L_z =$	20.833	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	153681	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	143628	In <sup>5</sup>		
$K_y L_y / r$	=	38.4	>	22	CONSIDER SLENDERNESS		
$K_z L_z / r$	=	27.8	>	22	CONSIDER SLENDERNESS		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 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	37.164	38.4	0.00	0.00	0.000	544	10998	1.076	1.076	78	*
MZ	35.928	37.164	27.8	52.40	30.63	0.584	544	13204	1.063	1.063	76	*

**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	37.164	38.4	379.57	0.00	0.000	322	10998	1.044	1.044	396	
MZ	35.928	37.164	27.8	153.86	30.63	0.199	322	17448	1.027	1.027	158	

**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	37.164	38.4	286.30	0.00	0.000	456	10998	1.063	1.063	304	
MZ	35.928	37.164	27.8	101.48	30.63	0.302	456	16071	1.042	1.042	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	37.164	38.4	0.00	0.00	0.000	451	10998	1.062	1.062	64	*
MZ	35.928	37.164	27.8	325.66	30.63	0.094	451	19123	1.035	1.035	337	

**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	37.164	38.4	364.98	0.00	0.000	311	10998	1.042	1.042	380	
MZ	35.928	37.164	27.8	419.06	30.63	0.073	311	19496	1.023	1.023	429	

**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	37.164	38.4	275.29	0.00	0.000	440	10998	1.061	1.061	292	
MZ	35.928	37.164	27.8	368.70	30.63	0.083	440	19316	1.034	1.034	381	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 'HLB 160 MEM. 4 JT. 5

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 160				PMIN MEMBER 4				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	-178.36	0.00	23.56	DL	-178.36	0.00	23.56	DL	-178.36	0.00	23.56	DL	-178.36	0.00	23.56	DL	-178.36	0.00	23.56				
LL	-47.40	0.00	39.60	LL	0.00	0.00	0.00	LL	-47.40	0.00	39.60	LL	-47.40	0.00	39.60	LL	-47.40	0.00	39.60				
GROUP 1	0.00	0.00	0.00	GROUP 2	-9.98	-291.98	94.79	GROUP 3	-4.81	-220.23	44.45	GROUP 4	-0.72	0.00	216.90	GROUP 5	-10.70	-291.98	311.69				
SERVICE STRENGTH	-225.76	0.00	63.16	SERVICE STRENGTH	-188.34	-291.98	118.35	SERVICE STRENGTH	-230.57	-220.23	107.61	SERVICE STRENGTH	-226.48	0.00	280.06	SERVICE STRENGTH	-189.06	-291.98	335.25				
	-334.56	0.00	116.43		-244.84	-379.57	153.86		-299.74	-286.30	139.89		-294.42	0.00	364.08		-236.32	-364.98	419.06				

**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.	
$r_y = 0.30 * D =$	11.15	In.	Depth of Rect. Col. =	D =	37.164	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	17.833	Ft.	$K_y =$	2.0
			$L_z =$	20.833	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	153681	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	143628	In <sup>5</sup>		
$K_y L_y / r$	=	38.4	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	27.8	>	22	CONSIDER SLENDERNESSE		



H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 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	37.164	38.4	0.00	0.00	0.000	335	10998	1.045	1.045	48 *
MZ	35.928	37.164	27.8	116.43	30.63	0.263	335	16564	1.030	1.030	120

**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	37.164	38.4	379.57	0.00	0.000	245	10998	1.033	1.033	392
MZ	35.928	37.164	27.8	153.86	30.63	0.199	245	17448	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	37.164	38.4	286.30	0.00	0.000	300	10998	1.041	1.041	298
MZ	35.928	37.164	27.8	139.89	30.63	0.219	300	17163	1.026	1.026	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	37.164	38.4	0.00	0.00	0.000	294	10998	1.040	1.040	42 *
MZ	35.928	37.164	27.8	364.08	30.63	0.084	294	19298	1.022	1.022	372

**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	37.164	38.4	364.98	0.00	0.000	236	10998	1.032	1.032	377
MZ	35.928	37.164	27.8	419.06	30.63	0.073	236	19496	1.018	1.018	426

**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	37.164	38.4	275.29	0.00	0.000	289	10998	1.039	1.039	286
MZ	35.928	37.164	27.8	405.64	30.63	0.076	289	19452	1.022	1.022	414

\* 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\HLB160\PCACOL~1\M4PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #160 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 = 37.2 in  
 Gross section area, Ag = 1339.2 in<sup>2</sup>  
 Ix = 154437 in<sup>4</sup> Iy = 144634 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 2.10%  
 18 #11 Cover = 5 in

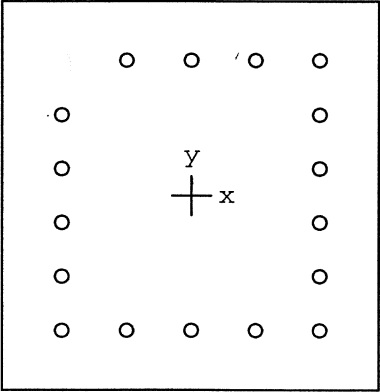
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====  
 =====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	503.0	72.0	157.0	514.2	1124.7	7.160
2	281.0	40.0	190.0	251.7	1196.4	6.297
3	415.0	59.0	180.0	376.1	1141.5	6.345
4	410.0	59.0	182.0	371.8	1140.4	6.269
5	271.0	39.0	238.0	198.8	1211.6	5.091
6	400.0	57.0	229.0	289.9	1169.6	5.106
7	304.0	43.0	280.0	186.9	1214.8	4.339
8	214.0	31.0	188.0	199.7	1203.8	6.404
9	269.0	38.0	253.0	183.0	1215.4	4.804
10	264.0	38.0	255.0	182.9	1214.8	4.765
11	207.0	30.0	236.0	153.0	1209.4	5.124
12	260.0	37.0	298.0	152.1	1219.2	4.091
13	544.0	78.0	76.0	872.7	852.5	11.202
14	322.0	396.0	158.0	1136.9	453.5	2.871
15	456.0	304.0	106.0	1160.5	406.4	3.819

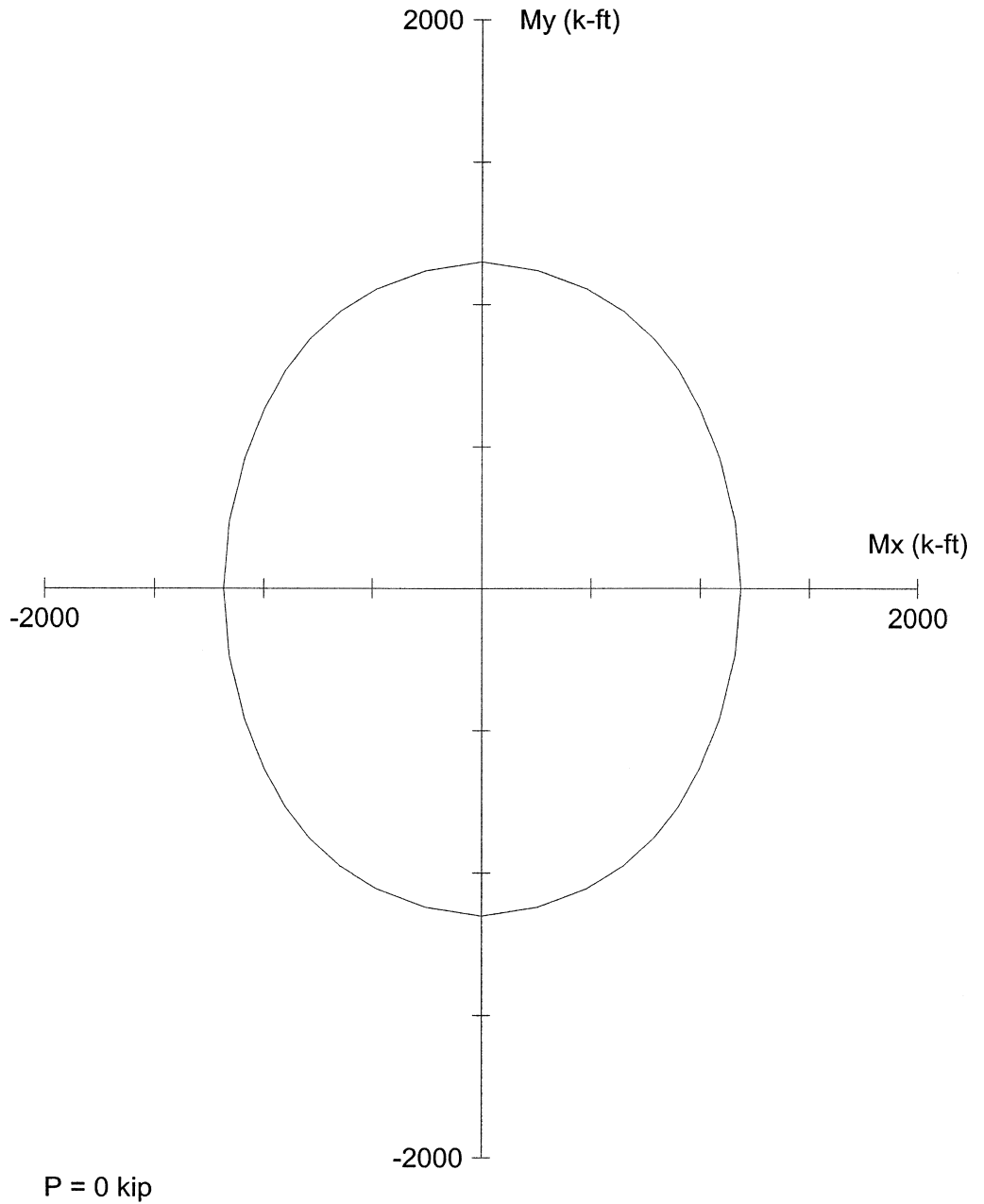
16	451.0	64.0	337.0	229.8	1220.4	3.620
17	311.0	380.0	429.0	795.3	897.5	2.092
18	440.0	292.0	381.0	718.9	939.3	2.464
19	335.0	48.0	120.0	448.5	1119.7	9.333
20	245.0	392.0	157.0	1137.9	456.2	2.903
21	300.0	298.0	143.0	1097.9	526.6	3.684
22	294.0	42.0	372.0	138.5	1224.8	3.292
23	236.0	377.0	426.0	800.9	903.4	2.122
24	289.0	286.0	414.0	686.7	990.7	2.396

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



36 x 37.2 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: 13:15:17



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File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB160\PCACOL~1\M4PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #160

Engineer: JMJ

$f'_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 1339.2$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

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

Rho = 2.10%

$f_c = 2.55$  ksi

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

$X_o = 0.00$  in

$I_x = 154437$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 144634$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 3.75 in

Clear cover = 5.00 in

Confinement: Tied  
 Appendix F.6

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

JMS 7/06  
WDB 7/06

```

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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-C~1\BONNER~1\ANALYSIS\PIERS\HLB160\PCACOL~1\M4ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #160 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 = 32.2 in  
  
 Gross section area, Ag = 998.2 in<sup>2</sup>  
 Ix = 86247.8 in<sup>4</sup> Iy = 79939.2 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 2.81%  
 18 #11 Cover = 2.5 in

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

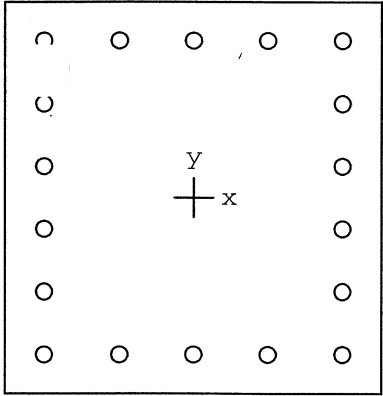
=====  

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	503.0	72.0	157.0	489.0	1062.9	6.774
2	281.0	40.0	190.0	239.9	1142.8	6.014
3	415.0	59.0	180.0	360.2	1097.8	6.099
4	410.0	59.0	182.0	356.6	1100.1	6.045
5	271.0	39.0	238.0	190.2	1154.8	4.853
6	400.0	57.0	229.0	281.3	1127.6	4.925
7	304.0	43.0	280.0	178.0	1161.8	4.149
8	214.0	31.0	188.0	189.7	1143.9	6.085
9	269.0	38.0	253.0	175.6	1157.4	4.576
10	264.0	38.0	255.0	172.4	1157.3	4.538
11	207.0	30.0	236.0	147.8	1150.4	4.875
12	260.0	37.0	298.0	143.8	1161.9	3.899
13	544.0	78.0	76.0	830.6	811.4	10.662
14	322.0	396.0	158.0	1087.9	435.7	2.749
15	456.0	304.0	106.0	1104.1	384.6	3.632

16	451.0	64.0	337.0	217.9	1148.1	3.407
17	311.0	380.0	429.0	765.4	863.2	2.013
18	440.0	292.0	381.0	684.0	893.0	2.343
19	335.0	48.0	120.0	430.3	1077.6	8.978
20	245.0	392.0	157.0	1084.8	433.2	2.766
21	300.0	298.0	143.0	1054.6	503.9	3.536
22	294.0	42.0	372.0	132.0	1169.4	3.144
23	236.0	377.0	426.0	765.9	865.3	2.031
24	289.0	286.0	414.0	657.2	952.3	2.300

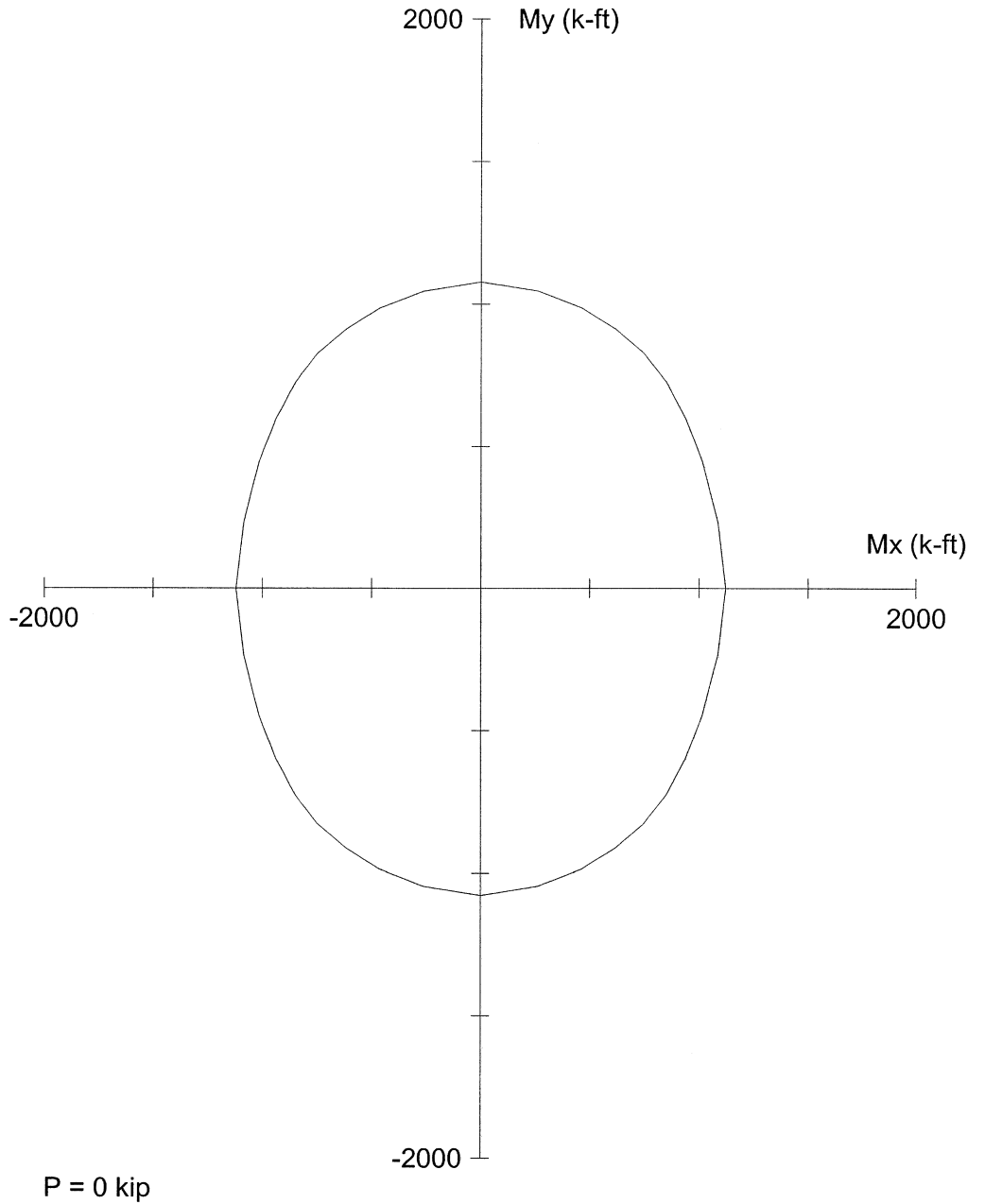
\*\*\* Program completed as requested! \*\*\*





31 x 32.2 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: 13:08:45



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File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB160\PCACOL~1\M4ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #160

Engineer: JMJ

$f'_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 998.2$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

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

Rho = 2.81%

$f_c = 3.74$  ksi

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

$X_o = 0.00$  in

$I_x = 86247.8$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 79939.2$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 3.75 in

Clear cover = 2.50 in

Confinement: Tied  
 Appendix F.6

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

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 5 JT. 3

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 160			P MEMBER 5			JOINT 3		
		<u>GROUP 1</u>				<u>GROUP 2</u>				
	P	MY	MZ		P	MY	MZ			
DL	206.31	0.00	54.43	DL	206.31	0.00	54.43			
LL	108.29	0.00	35.31	LL	0.00	0.00	0.00			
GROUP 1	0.00	0.00	0.00	GROUP 2	-9.84	0.34	-86.55			
SERVICE STRENGTH	314.60 502.83	0.00 0.00	89.74 147.26	SERVICE STRENGTH	196.47 255.41	0.34 0.44	-32.12 -41.76			
		<u>GROUP 3</u>				<u>GROUP 4</u>				
	P	MY	MZ		P	MY	MZ			
DL	206.31	0.00	54.43	DL	206.31	0.00	54.43			
LL	108.29	0.00	35.31	LL	108.29	0.00	35.31			
GROUP 3	-4.76	0.25	-41.84	GROUP 4	0.73	0.00	43.70			
SERVICE STRENGTH	309.84 402.79	0.25 0.33	47.90 62.27	SERVICE STRENGTH	315.33 409.93	0.00 0.00	133.44 173.47			
		<u>GROUP 5</u>				<u>GROUP 6</u>				
	P	MY	MZ		P	MY	MZ			
DL	206.31	0.00	54.43	DL	206.31	0.00	54.43			
LL	0.00	0.00	0.00	LL	108.29	0.00	35.31			
GROUP 5	-9.11	0.34	-42.85	GROUP 6	-4.04	0.25	1.86			
SERVICE STRENGTH	197.20 246.50	0.34 0.43	11.58 14.48	SERVICE STRENGTH	310.56 388.20	0.25 0.31	91.60 114.50			

**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.	
$r_y = 0.30 * D =$	11.15	In.	Depth of Rect. Col. =	D =	37.164	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	17.833	Ft.	$K_y =$	2.0
			$L_z =$	20.833	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	153681	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	143628	In <sup>5</sup>		
$K_y L_y / r$	=	38.4	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	27.8	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 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	37.164	38.4	0.00	0.00	0.000	503	10998	1.070	1.070	72	*
MZ	35.928	37.164	27.8	147.26	70.76	0.480	503	14131	1.054	1.054	155	

**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	37.164	38.4	0.44	0.00	0.000	255	10998	1.034	1.034	37	*
MZ	35.928	37.164	27.8	41.76	70.76	1.695	255	7764	1.049	1.049	44	

**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	37.164	38.4	0.33	0.00	0.000	403	10998	1.055	1.055	58	*
MZ	35.928	37.164	27.8	62.27	70.76	1.136	403	9793	1.062	1.062	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	37.164	38.4	0.00	0.00	0.000	410	10998	1.056	1.056	59	*
MZ	35.928	37.164	27.8	173.47	70.76	0.408	410	14860	1.041	1.041	181	

**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	37.164	38.4	0.43	0.00	0.000	247	10998	1.033	1.033	35	*
MZ	35.928	37.164	27.8	14.48	70.76	4.888	247	3553	1.110	1.110	34	*

**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	37.164	38.4	0.31	0.00	0.000	388	10998	1.053	1.053	55	*
MZ	35.928	37.164	27.8	114.50	70.76	0.618	388	12930	1.045	1.045	120	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 'HLB 160 MEM. 5 JT. 3

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				PMIN					
				HLB 160	MEMBER 5	JOINT 3			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		
DL	154.73	0.00	54.43	DL	154.73	0.00	54.43		
LL	47.37	0.00	92.12	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	-9.84	0.34	-86.55		
SERVICE STRENGTH	202.10 303.79	0.00 0.00	146.55 270.35	SERVICE STRENGTH	144.89 188.36	0.34 0.44	-32.12 -41.76		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		
DL	154.73	0.00	54.43	DL	154.73	0.00	54.43		
LL	47.37	0.00	92.12	LL	47.37	0.00	92.12		
GROUP 3	-4.76	0.25	-41.84	GROUP 4	0.73	0.00	43.70		
SERVICE STRENGTH	197.34 256.55	0.25 0.33	104.71 136.12	SERVICE STRENGTH	202.83 263.68	0.00 0.00	190.25 247.33		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		
DL	154.73	0.00	54.43	DL	154.73	0.00	54.43		
LL	0.00	0.00	0.00	LL	47.37	0.00	92.12		
GROUP 5	-9.11	0.34	-42.85	GROUP 6	-4.04	0.25	1.86		
SERVICE STRENGTH	145.62 182.03	0.34 0.43	11.58 14.48	SERVICE STRENGTH	198.06 247.58	0.25 0.31	148.41 185.51		

**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. =  $D = 37.164$  In.

$r_y = 0.30 * D = 11.15$  In.

$L_y = 17.833$  Ft.       $K_y = 2.0$

$r_z = 0.30 * B = 10.78$  In.

$L_z = 20.833$  Ft.       $K_z = 1.2$

$I_{yy} = B * D^3 / 12$        $I_{yy} = 153681$  In<sup>4</sup>

$I_{zz} = D * B^3 / 12$        $I_{zz} = 143628$  In<sup>5</sup>

$K_y L_y / r = 38.4 > 22$       CONSIDER SLENDERNESS

$K_z L_z / r = 27.8 > 22$       CONSIDER SLENDERNESS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 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>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	37.164	38.4	0.00	0.00	0.000	304	10998	1.041	1.041	43	*
MZ	35.928	37.164	27.8	270.35	70.76	0.262	304	16581	1.027	1.027	278	

**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	37.164	38.4	0.44	0.00	0.000	188	10998	1.025	1.025	27	*
MZ	35.928	37.164	27.8	41.76	70.76	1.695	188	7764	1.036	1.036	43	

**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	37.164	38.4	0.33	0.00	0.000	257	10998	1.034	1.034	37	*
MZ	35.928	37.164	27.8	136.12	70.76	0.520	257	13765	1.027	1.027	140	

**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	37.164	38.4	0.00	0.00	0.000	264	10998	1.035	1.035	38	*
MZ	35.928	37.164	27.8	247.33	70.76	0.286	264	16267	1.024	1.024	253	

**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	37.164	38.4	0.43	0.00	0.000	182	10998	1.024	1.024	26	*
MZ	35.928	37.164	27.8	14.48	70.76	4.888	182	3553	1.079	1.079	25	*

**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	37.164	38.4	0.31	0.00	0.000	248	10998	1.033	1.033	35	*
MZ	35.928	37.164	27.8	185.51	70.76	0.381	248	15145	1.024	1.024	190	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 5 JT. 6

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		P HLB 160			P MEMBER 5			P JOINT 6			
		<u>GROUP 1</u>			<u>GROUP 2</u>			<u>GROUP 2</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-237.71	0.00	22.43	DL	-237.71	0.00	22.43	DL	-237.71	0.00	22.43
LL	-108.29	0.00	9.65	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	9.98	291.92	-94.79	GROUP 2	9.98	291.92	-94.79
SERVICE STRENGTH	-346.00	0.00	32.08	SERVICE STRENGTH	-227.73	291.92	-72.36	SERVICE STRENGTH	-227.73	291.92	-72.36
	-543.65	0.00	50.07		-296.05	379.50	-94.07		-296.05	379.50	-94.07
		<u>GROUP 3</u>			<u>GROUP 4</u>			<u>GROUP 4</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-237.71	0.00	22.43	DL	-237.71	0.00	22.43	DL	-237.71	0.00	22.43
LL	-108.29	0.00	9.65	LL	-108.29	0.00	9.65	LL	-108.29	0.00	9.65
GROUP 3	4.81	220.19	-44.45	GROUP 4	-0.73	0.00	216.87	GROUP 4	-0.73	0.00	216.87
SERVICE STRENGTH	-341.19	220.19	-12.37	SERVICE STRENGTH	-346.73	0.00	248.95	SERVICE STRENGTH	-346.73	0.00	248.95
	-443.55	286.25	-16.08		-450.75	0.00	323.64		-450.75	0.00	323.64
		<u>GROUP 5</u>			<u>GROUP 6</u>			<u>GROUP 6</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-237.71	0.00	22.43	DL	-237.71	0.00	22.43	DL	-237.71	0.00	22.43
LL	0.00	0.00	0.00	LL	-108.29	0.00	9.65	LL	-108.29	0.00	9.65
GROUP 5	9.26	291.92	122.08	GROUP 6	4.08	220.19	172.42	GROUP 6	4.08	220.19	172.42
SERVICE STRENGTH	-228.45	291.92	144.51	SERVICE STRENGTH	-341.92	220.19	204.50	SERVICE STRENGTH	-341.92	220.19	204.50
	-285.56	364.90	180.64		-427.40	275.24	255.63		-427.40	275.24	255.63

**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.	
$r_y = 0.30 * D =$	11.15	In.	Depth of Rect. Col. =	D =	37.164	In.	
$r_z = 0.30 * B =$	10.78	In.	$L_y =$	17.833	Ft.	$K_y =$	2.0
			$L_z =$	20.833	Ft.	$K_z =$	1.2
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	153681	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	143628	In <sup>5</sup>		
$K_y L_y / r$	=	38.4	>	22	CONSIDER SLENDERNESSE		
$K_z L_z / r$	=	27.8	>	22	CONSIDER SLENDERNESSE		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 5 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	37.164	38.4	0.00	0.00	0.000	544	10998	1.076	1.076	78	*
MZ	35.928	37.164	27.8	50.07	29.16	0.582	544	13221	1.062	1.062	76	*

**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	37.164	38.4	379.50	0.00	0.000	296	10998	1.040	1.040	395	
MZ	35.928	37.164	27.8	94.07	29.16	0.310	296	15971	1.027	1.027	97	

**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	37.164	38.4	286.25	0.00	0.000	444	10998	1.061	1.061	304	
MZ	35.928	37.164	27.8	16.08	29.16	1.813	444	7437	1.093	1.093	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	37.164	38.4	0.00	0.00	0.000	451	10998	1.062	1.062	64	*
MZ	35.928	37.164	27.8	323.64	29.16	0.090	451	19192	1.035	1.035	335	

**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	37.164	38.4	364.90	0.00	0.000	286	10998	1.039	1.039	379	
MZ	35.928	37.164	27.8	180.64	29.16	0.161	286	18013	1.023	1.023	185	

**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	37.164	38.4	275.24	0.00	0.000	427	10998	1.059	1.059	291	
MZ	35.928	37.164	27.8	255.63	29.16	0.114	427	18779	1.034	1.034	264	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 5 JT. 6

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 160				PMIN MEMBER 5				JOINT 6			
<u>GROUP 1</u>				<u>GROUP 2</u>							
	P	MY	MZ		P	MY	MZ				
DL	-178.28	0.00	22.43	DL	-178.28	0.00	22.43				
LL	-47.37	0.00	39.23	LL	0.00	0.00	0.00				
GROUP 1	0.00	0.00	0.00	GROUP 2	9.98	291.92	-94.79				
SERVICE STRENGTH	-225.65	0.00	61.66	SERVICE STRENGTH	-168.30	291.92	-72.36				
	-334.40	0.00	114.16		-218.79	379.50	-94.07				
<u>GROUP 3</u>				<u>GROUP 4</u>							
	P	MY	MZ		P	MY	MZ				
DL	-178.28	0.00	22.43	DL	-178.28	0.00	22.43				
LL	-47.37	0.00	39.23	LL	-47.37	0.00	39.23				
GROUP 3	4.81	220.19	-44.45	GROUP 4	-0.73	0.00	216.87				
SERVICE STRENGTH	-220.84	220.19	17.21	SERVICE STRENGTH	-226.38	0.00	278.53				
	-287.10	286.25	22.37		-294.30	0.00	362.09				
<u>GROUP 5</u>				<u>GROUP 6</u>							
	P	MY	MZ		P	MY	MZ				
DL	-178.28	0.00	22.43	DL	-178.28	0.00	22.43				
LL	0.00	0.00	0.00	LL	-47.37	0.00	39.23				
GROUP 5	9.26	291.92	122.08	GROUP 6	4.08	220.19	172.42				
SERVICE STRENGTH	-169.02	291.92	144.51	SERVICE STRENGTH	-221.57	220.19	234.08				
	-211.28	364.90	180.64		-276.97	275.24	292.60				

**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. =  $D = 37.164$  In.

$r_y = 0.30 * D = 11.15$  In.

$L_y = 17.833$  Ft.       $K_y = 2.0$

$r_z = 0.30 * B = 10.78$  In.

$L_z = 20.833$  Ft.       $K_z = 1.2$

$I_{yy} = B * D^3 / 12 = 153681$  In<sup>4</sup>

$I_{zz} = D * B^3 / 12 = 143628$  In<sup>5</sup>

$K_y L_y / r = 38.4 > 22$       CONSIDER SLENDERNESS

$K_z L_z / r = 27.8 > 22$       CONSIDER SLENDERNESS



H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 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>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	37.164	38.4	0.00	0.00	0.000	334	10998	1.045	1.045	48	*
MZ	35.928	37.164	27.8	114.16	29.16	0.255	334	16664	1.030	1.030	118	

**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	37.164	38.4	379.50	0.00	0.000	219	10998	1.029	1.029	391	
MZ	35.928	37.164	27.8	94.07	29.16	0.310	219	15971	1.020	1.020	96	

**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	37.164	38.4	286.25	0.00	0.000	287	10998	1.039	1.039	297	
MZ	35.928	37.164	27.8	22.37	29.16	1.303	287	9083	1.047	1.047	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>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	37.164	38.4	0.00	0.00	0.000	294	10998	1.040	1.040	42	*
MZ	35.928	37.164	27.8	362.09	29.16	0.081	294	19362	1.022	1.022	370	

**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	37.164	38.4	364.90	0.00	0.000	211	10998	1.028	1.028	375	
MZ	35.928	37.164	27.8	180.64	29.16	0.161	211	18013	1.017	1.017	184	

**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	37.164	38.4	275.24	0.00	0.000	277	10998	1.037	1.037	286	
MZ	35.928	37.164	27.8	292.60	29.16	0.100	277	19025	1.021	1.021	299	

\* MINIMUM MOMENT CONTROLS

Jms 7/06  
WDB 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 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)
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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-1\BONNER-1\ANALYSIS\PIERS\HLB160\PCACOL-1\M5PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #160 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 = 37.2 in  
 Gross section area, Ag = 1339.2 in<sup>2</sup>  
 Ix = 154437 in<sup>4</sup> Iy = 144634 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 2.10%  
 18 #11 Cover = 5 in

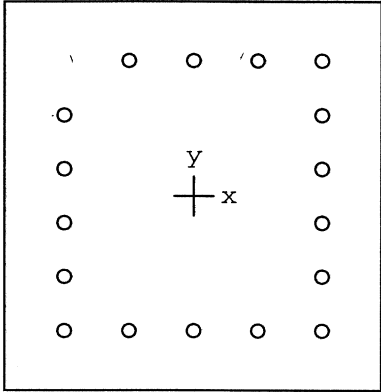
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====  
 =====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	503.0	72.0	155.0	520.3	1120.9	7.231
2	255.0	37.0	44.0	777.6	923.1	20.995
3	403.0	58.0	66.0	766.9	875.5	13.246
4	410.0	59.0	181.0	373.5	1139.6	6.299
5	247.0	35.0	34.0	866.7	840.9	24.748
6	388.0	55.0	120.0	496.7	1079.2	9.000
7	304.0	43.0	278.0	188.2	1214.5	4.369
8	188.0	27.0	43.0	642.4	1022.5	23.783
9	257.0	37.0	140.0	310.5	1177.4	8.409
10	264.0	38.0	253.0	184.2	1214.6	4.802
11	182.0	26.0	25.0	871.6	837.2	33.506
12	248.0	35.0	190.0	221.1	1204.3	6.338
13	544.0	78.0	76.0	872.7	852.5	11.202
14	296.0	395.0	97.0	1205.2	296.5	3.051
15	444.0	304.0	62.0	1221.0	248.5	4.016

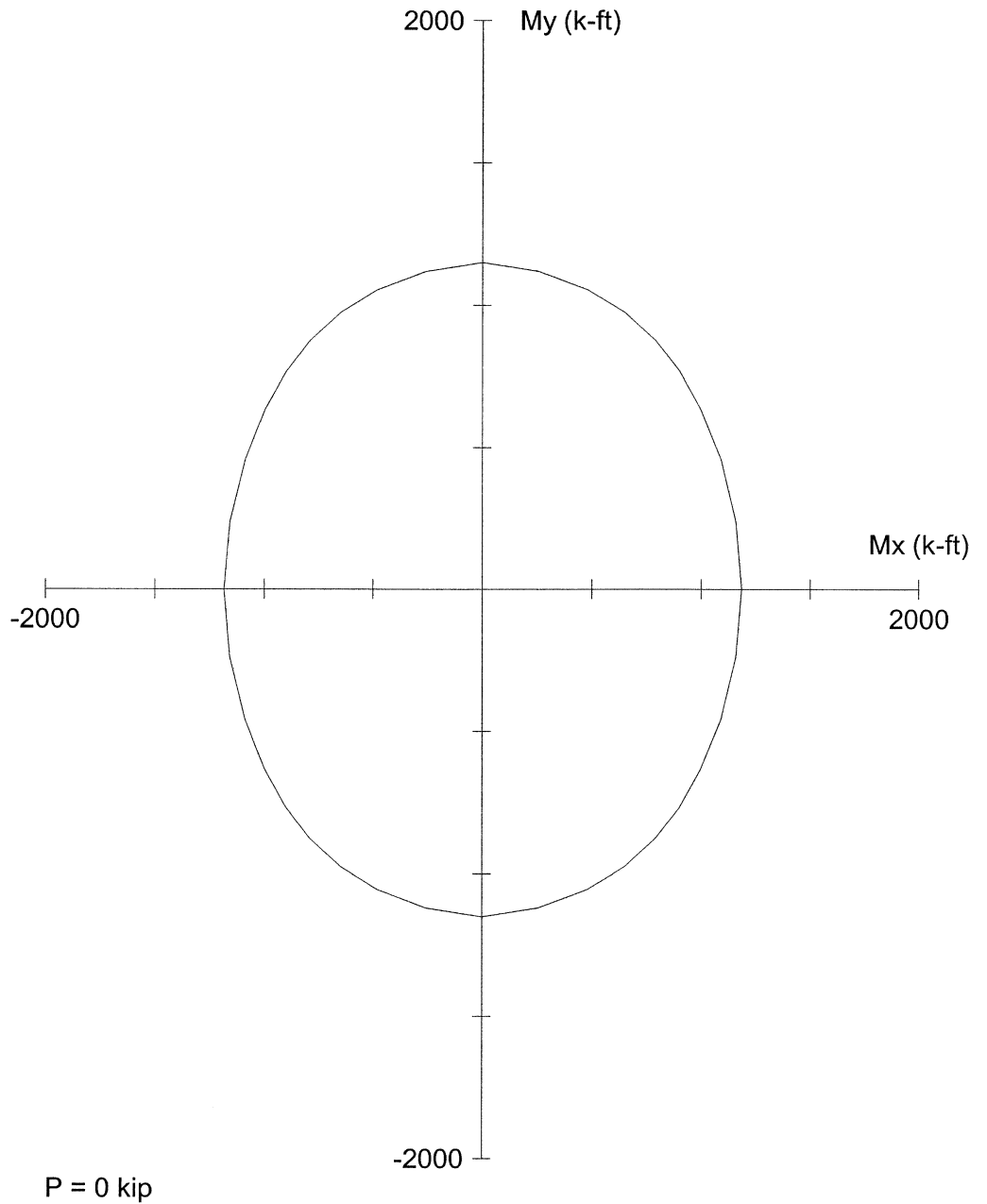
16	451.0	64.0	335.0	231.1	1220.0	3.641
17	286.0	379.0	185.0	1096.0	533.1	2.890
18	427.0	291.0	264.0	871.0	791.6	2.995
19	334.0	48.0	118.0	452.5	1117.9	9.467
20	219.0	391.0	96.0	1202.1	294.6	3.074
21	287.0	297.0	40.0	1242.1	166.6	4.182
22	294.0	42.0	370.0	139.3	1224.6	3.310
23	211.0	375.0	184.0	1095.6	537.5	2.921
24	277.0	286.0	299.0	833.2	869.7	2.911

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



36 x 37.2 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: 13:16:45



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

File: S:\DGN-ST\NORTHC~1\BONNER~1\ANALYSIS\PIERS\HLB160\PCACOL~1\M5PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #160

Engineer: JMJ

$f'_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 1339.2$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

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

Rho = 2.10%

$f_c = 2.55$  ksi

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

$X_o = 0.00$  in

$I_x = 154437$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 144634$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 3.75 in

Clear cover = 5.00 in

Confinement: Tied  
 Appendix F.6

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

JMS 7/06  
WOB 7/06

```

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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
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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  
 $f_c = 4400 \text{ PSI}$

General Information:

=====  
 File Name: S:\DGN-ST\NORTH-1\BONNER-1\ANALYSIS\PIERS\HLB160\PCACOL~1\M5ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #160 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 = 32.2 in  
 Gross section area, Ag = 998.2 in<sup>2</sup>  
 Ix = 86247.8 in<sup>4</sup> Iy = 79939.2 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 2.81%  
 18 #11 Cover = 2.5 in

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

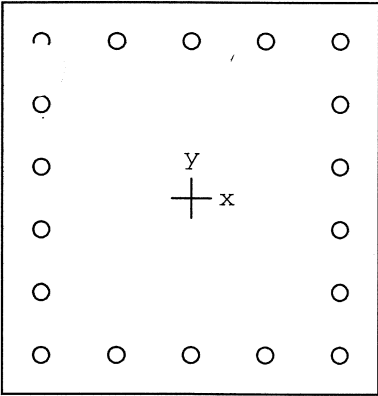
=====  
 =====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	503.0	72.0	155.0	494.0	1060.3	6.844
2	255.0	37.0	44.0	744.2	884.9	20.113
3	403.0	58.0	66.0	749.7	855.2	12.944
4	410.0	59.0	181.0	358.4	1099.5	6.074
5	247.0	35.0	34.0	830.3	806.0	23.714
6	388.0	55.0	120.0	478.6	1046.0	8.714
7	304.0	43.0	278.0	179.3	1161.5	4.178
8	188.0	27.0	43.0	611.6	971.2	22.604
9	257.0	37.0	140.0	297.1	1122.0	8.015
10	264.0	38.0	253.0	173.8	1157.0	4.573
11	182.0	26.0	25.0	832.9	800.8	32.032
12	248.0	35.0	190.0	211.3	1146.4	6.034
13	544.0	78.0	76.0	830.6	811.4	10.662
14	296.0	395.0	97.0	1151.5	282.0	2.915
15	444.0	304.0	62.0	1154.9	235.4	3.799

16	451.0	64.0	335.0	219.1	1147.8	3.426
17	286.0	379.0	185.0	1049.7	512.4	2.770
18	427.0	291.0	264.0	833.7	757.2	2.866
19	334.0	48.0	118.0	435.3	1075.5	9.108
20	219.0	391.0	96.0	1139.3	280.1	2.914
21	287.0	297.0	40.0	1182.8	160.5	3.983
22	294.0	42.0	370.0	132.7	1169.3	3.160
23	211.0	375.0	184.0	1042.1	511.1	2.779
24	277.0	286.0	299.0	799.1	834.6	2.793

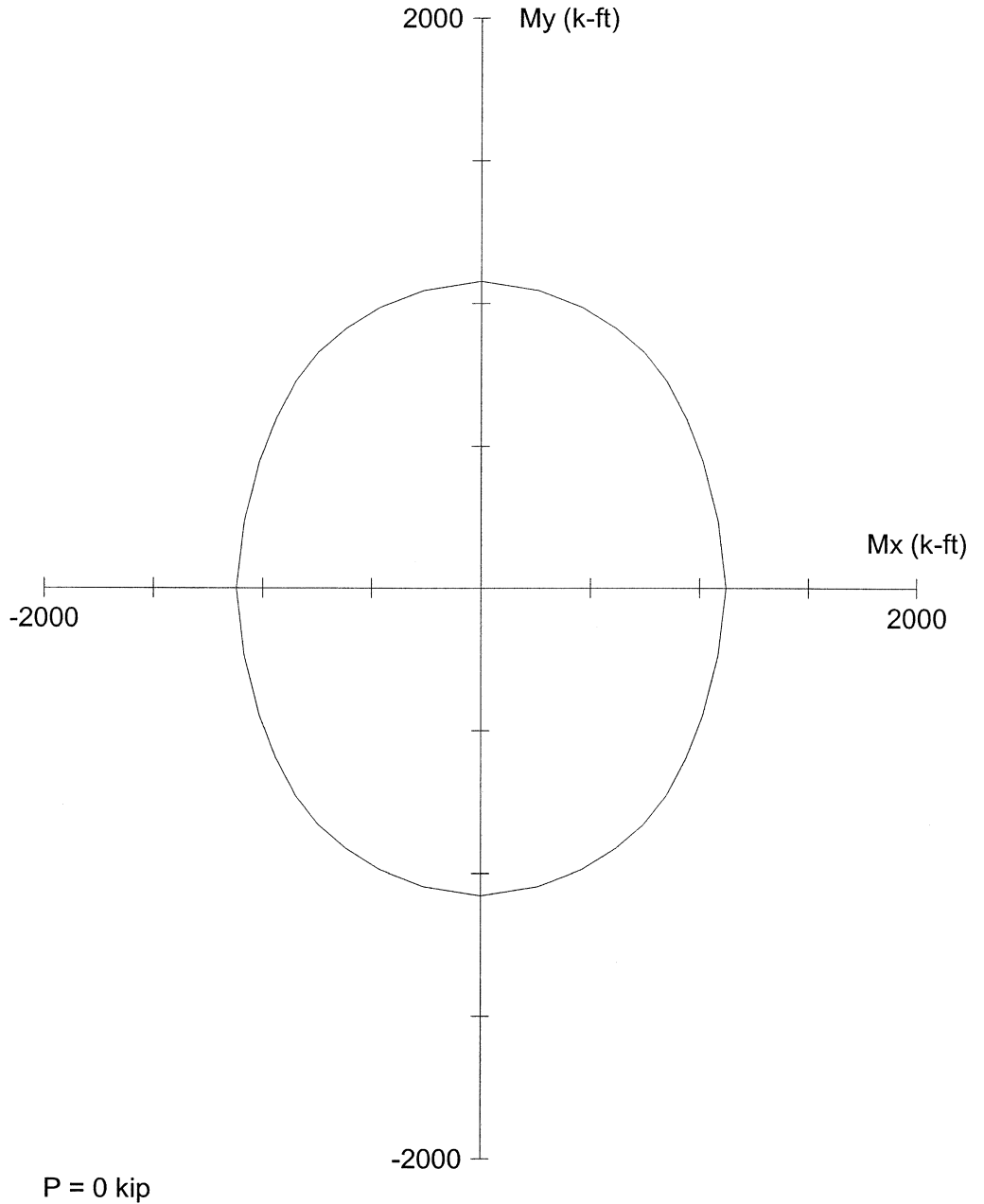
\*\*\* Program completed as requested! \*\*\*





31 x 32.2 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: 13:08:58



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File: S:\DGN-ST\NORTHC~1\BONNER~1\ANALYSIS\PIERS\HLB160\PCACOL~1\M5ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #160

Engineer: JMJ

$f'_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 998.2$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

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

Rho = 2.81%

$f_c = 3.74$  ksi

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

$X_o = 0.00$  in

$I_x = 86247.8$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 79939.2$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 3.75 in

Clear cover = 2.50 in

Confinement: Tied  
 Appendix F.6

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

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 7 JT. 5

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 160			P MEMBER 7			JOINT 5			
		<u>GROUP 1</u>						<u>GROUP 2</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	249.75	0.00	12.34	DL	249.75	0.00	12.34	DL	249.75	0.00	12.34
LL	106.59	0.00	-16.05	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	17.20	292.59	-17.92	GROUP 2	17.20	292.59	-17.92
SERVICE STRENGTH	356.34	0.00	-3.71	SERVICE STRENGTH	266.95	292.59	-5.58	SERVICE STRENGTH	266.95	292.59	-5.58
	555.62	0.00	-18.73		347.04	380.37	-7.25		347.04	380.37	-7.25
		<u>GROUP 3</u>						<u>GROUP 4</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	249.75	0.00	12.34	DL	249.75	0.00	12.34	DL	249.75	0.00	12.34
LL	106.59	0.00	-16.05	LL	106.59	0.00	-16.05	LL	106.59	0.00	-16.05
GROUP 3	8.16	220.40	-8.69	GROUP 4	-28.21	0.00	-577.43	GROUP 4	-28.21	0.00	-577.43
SERVICE STRENGTH	364.50	220.40	-12.40	SERVICE STRENGTH	328.13	0.00	-581.14	SERVICE STRENGTH	328.13	0.00	-581.14
	473.85	286.52	-16.12		426.57	0.00	-755.48		426.57	0.00	-755.48
		<u>GROUP 5</u>						<u>GROUP 6</u>			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	249.75	0.00	12.34	DL	249.75	0.00	12.34	DL	249.75	0.00	12.34
LL	0.00	0.00	0.00	LL	106.59	0.00	-16.05	LL	106.59	0.00	-16.05
GROUP 5	-11.01	292.59	-595.35	GROUP 6	-20.04	220.40	-586.12	GROUP 6	-20.04	220.40	-586.12
SERVICE STRENGTH	238.74	292.59	-583.01	SERVICE STRENGTH	336.30	220.40	-589.83	SERVICE STRENGTH	336.30	220.40	-589.83
	298.43	365.74	-728.76		420.38	275.50	-737.29		420.38	275.50	-737.29

**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.	
$r_y = 0.30 * D =$	14.21	In.	Depth of Rect. Col. =	D =	47.364	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
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	318124	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	183049	In <sup>5</sup>		
$K_y L_y / r$	=	0.0	<	22	NO SLENDERNESSE EFFECT		
$K_z L_z / r$	=	3.3	<	22	NO SLENDERNESSE EFFECT		

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 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>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	0.00	0.00	0.000	556	0	1.000	1.000	94	*
MZ	35.928	47.364	3.3	18.73	16.04	0.856	556	0	1.000	1.000	78	*

**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	47.364	0.0	380.37	0.00	0.000	347	0	1.000	1.000	380	
MZ	35.928	47.364	3.3	7.25	16.04	2.211	347	0	1.000	1.000	49	*

**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	47.364	0.0	286.52	0.00	0.000	474	0	1.000	1.000	287	
MZ	35.928	47.364	3.3	16.12	16.04	0.995	474	0	1.000	1.000	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>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	0.00	0.00	0.000	427	0	1.000	1.000	72	*
MZ	35.928	47.364	3.3	755.48	16.04	0.021	427	0	1.000	1.000	755	

**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	47.364	0.0	365.74	0.00	0.000	298	0	1.000	1.000	366	
MZ	35.928	47.364	3.3	728.76	16.04	0.022	298	0	1.000	1.000	729	

**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	47.364	0.0	275.50	0.00	0.000	420	0	1.000	1.000	276	
MZ	35.928	47.364	3.3	737.29	16.04	0.022	420	0	1.000	1.000	737	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 'HLB 160 MEM. 7 JT. 5

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				PMIN					
				HLB 160	MEMBER 7	JOINT 5			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		
DL	187.31	0.00	12.34	DL	187.31	0.00	12.34		
LL	48.31	0.00	-17.40	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	17.20	292.59	-17.92		
SERVICE STRENGTH	235.62 348.18	0.00 0.00	-5.06 -21.66	SERVICE STRENGTH	204.51 265.87	292.59 380.37	-5.58 -7.25		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		
DL	187.31	0.00	12.34	DL	187.31	0.00	12.34		
LL	48.31	0.00	-17.40	LL	48.31	0.00	-17.40		
GROUP 3	8.16	220.40	-8.69	GROUP 4	-28.21	0.00	-577.43		
SERVICE STRENGTH	243.78 316.92	220.40 286.52	-13.75 -17.88	SERVICE STRENGTH	207.41 269.64	0.00 0.00	-582.49 -757.24		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		
DL	187.31	0.00	12.34	DL	187.31	0.00	12.34		
LL	0.00	0.00	0.00	LL	48.31	0.00	-17.40		
GROUP 5	-11.01	292.59	-595.35	GROUP 6	-20.04	220.40	-586.12		
SERVICE STRENGTH	176.30 220.38	292.59 365.74	-583.01 -728.76	SERVICE STRENGTH	215.58 269.48	220.40 275.50	-591.18 -738.98		

**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. =  $D = 47.364$  In.

$r_y = 0.30 * D = 14.21$  In.

$L_y = 0$  Ft.       $K_y = 2.0$

$r_z = 0.30 * B = 10.78$  In.

$L_z = 2.5$  Ft.       $K_z = 1.2$

$I_{yy} = B * D^3 / 12$        $I_{yy} = 318124$  In<sup>4</sup>

$I_{zz} = D * B^3 / 12$        $I_{zz} = 183049$  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 160 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	47.364	0.0	0.00	0.00	0.000	348	0	1.000	1.000	59	*
MZ	35.928	47.364	3.3	21.66	16.04	0.741	348	0	1.000	1.000	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	47.364	0.0	380.37	0.00	0.000	266	0	1.000	1.000	380	
MZ	35.928	47.364	3.3	7.25	16.04	2.211	266	0	1.000	1.000	37	*

**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	47.364	0.0	286.52	0.00	0.000	317	0	1.000	1.000	287	
MZ	35.928	47.364	3.3	17.88	16.04	0.897	317	0	1.000	1.000	44	*

**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	47.364	0.0	0.00	0.00	0.000	270	0	1.000	1.000	45	*
MZ	35.928	47.364	3.3	757.24	16.04	0.021	270	0	1.000	1.000	757	

**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	47.364	0.0	365.74	0.00	0.000	220	0	1.000	1.000	366	
MZ	35.928	47.364	3.3	728.76	16.04	0.022	220	0	1.000	1.000	729	

**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	47.364	0.0	275.50	0.00	0.000	269	0	1.000	1.000	276	
MZ	35.928	47.364	3.3	738.98	16.04	0.022	269	0	1.000	1.000	739	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 7 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 160			P MEMBER 7	JOINT FOOTING		
		GROUP 1			GROUP 2			
	P	MY	MZ		P	MY	MZ	
DL	254.18	0.00	7.98	DL	254.18	0.00	7.98	
LL	106.59	0.00	-4.79	LL	0.00	0.00	0.00	
GROUP 1	0.00	0.00	0.00	GROUP 2	17.22	338.40	-40.28	
SERVICE STRENGTH	360.77 561.38	0.00 0.00	3.19 0.00	SERVICE STRENGTH	271.40 352.82	338.40 439.92	-32.30 -41.99	
		GROUP 3			GROUP 4			
	P	MY	MZ		P	MY	MZ	
DL	254.18	0.00	7.98	DL	254.18	0.00	7.98	
LL	106.59	0.00	-4.79	LL	106.59	0.00	-4.79	
GROUP 3	8.17	248.85	-18.75	GROUP 4	-28.21	0.00	550.08	
SERVICE STRENGTH	368.94 479.63	248.85 323.51	-15.56 -20.23	SERVICE STRENGTH	332.56 432.33	0.00 0.00	553.27 719.25	
		GROUP 5			GROUP 6			
	P	MY	MZ		P	MY	MZ	
DL	254.18	0.00	7.98	DL	254.18	0.00	7.98	
LL	0.00	0.00	0.00	LL	106.59	0.00	-4.79	
GROUP 5	-10.99	338.40	509.80	GROUP 6	-20.04	248.85	531.34	
SERVICE STRENGTH	243.19 303.99	338.40 423.00	517.78 647.23	SERVICE STRENGTH	340.74 425.92	248.85 311.06	534.53 668.16	

**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.	
$r_y = 0.30 * D =$	14.21	In.	Depth of Rect. Col. =	D =	47.364	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
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	318124	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	183049	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 160 MEM. 7 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	47.364	0.0	0.00	0.00	0.000	561	0	1.000	1.000	95	*
MZ	35.928	47.364	3.3	0.00	10.37	#####	561	0	1.000	1.000	78	*

**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	47.364	0.0	439.92	0.00	0.000	353	0	1.000	1.000	440	
MZ	35.928	47.364	3.3	41.99	10.37	0.247	353	0	1.000	1.000	49	*

**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	47.364	0.0	323.51	0.00	0.000	480	0	1.000	1.000	324	
MZ	35.928	47.364	3.3	20.23	10.37	0.513	480	0	1.000	1.000	67	*

**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	47.364	0.0	0.00	0.00	0.000	432	0	1.000	1.000	73	*
MZ	35.928	47.364	3.3	719.25	10.37	0.014	432	0	1.000	1.000	719	

**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	47.364	0.0	423.00	0.00	0.000	304	0	1.000	1.000	423	
MZ	35.928	47.364	3.3	647.23	10.37	0.016	304	0	1.000	1.000	647	

**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	47.364	0.0	311.06	0.00	0.000	426	0	1.000	1.000	311	
MZ	35.928	47.364	3.3	668.16	10.37	0.016	426	0	1.000	1.000	668	

\* MINIMUM MOMENT CONTROLS





H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 7 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	47.364	0.0	0.00	0.00	0.000	353	0	1.000	1.000	59	*
MZ	35.928	47.364	3.3	22.56	10.37	0.460	353	0	1.000	1.000	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>	$\delta_b$	$\delta_s$	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	439.92	0.00	0.000	270	0	1.000	1.000	440	
MZ	35.928	47.364	3.3	41.99	10.37	0.247	270	0	1.000	1.000	42	

**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	47.364	0.0	323.51	0.00	0.000	321	0	1.000	1.000	324	
MZ	35.928	47.364	3.3	33.76	10.37	0.307	321	0	1.000	1.000	45	*

**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	47.364	0.0	0.00	0.00	0.000	274	0	1.000	1.000	46	*
MZ	35.928	47.364	3.3	705.72	10.37	0.015	274	0	1.000	1.000	706	

**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	47.364	0.0	423.00	0.00	0.000	225	0	1.000	1.000	423	
MZ	35.928	47.364	3.3	647.23	10.37	0.016	225	0	1.000	1.000	647	

**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	47.364	0.0	311.06	0.00	0.000	274	0	1.000	1.000	311	
MZ	35.928	47.364	3.3	655.15	10.37	0.016	274	0	1.000	1.000	655	

\* MINIMUM MOMENT CONTROLS

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*Jms 7/06  
WOB 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\HLB160\PCACOL~1\M7PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #160 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 = 47.4 in  
 Gross section area, Ag = 1706.4 in<sup>2</sup>  
 Ix = 319489 in<sup>4</sup> Iy = 184291 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 1.65%  
 18 #11 Cover = 5 in

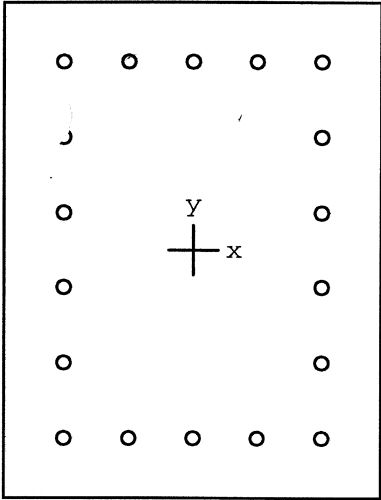
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	556.0	94.0	78.0	1200.1	995.5	12.765
2	347.0	380.0	49.0	1791.7	232.0	4.715
3	474.0	287.0	66.0	1737.9	396.7	6.053
4	427.0	72.0	755.0	130.2	1364.0	1.807
5	298.0	366.0	729.0	625.0	1244.6	1.707
6	420.0	276.0	737.0	486.9	1301.3	1.765
7	348.0	59.0	49.0	1197.0	992.6	20.275
8	266.0	380.0	37.0	1780.5	174.0	4.686
9	317.0	287.0	44.0	1768.9	270.3	6.163
10	270.0	45.0	757.0	79.8	1324.6	1.750
11	220.0	366.0	729.0	615.0	1221.2	1.676
12	269.0	276.0	739.0	477.2	1275.1	1.726
13	561.0	95.0	78.0	1210.3	991.7	12.730
14	353.0	440.0	49.0	1804.5	198.4	4.101
15	480.0	324.0	67.0	1756.1	361.2	5.419

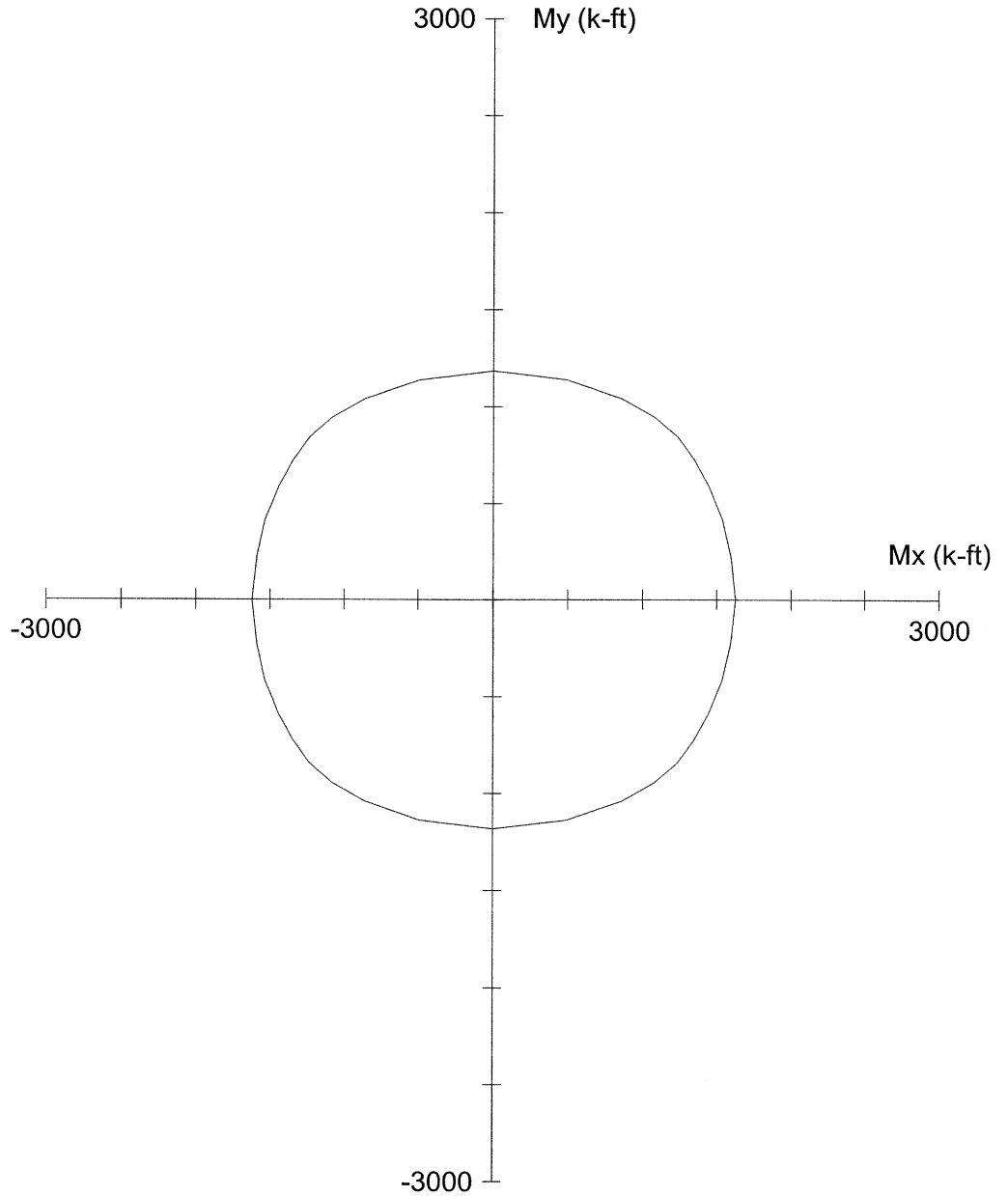
16	432.0	73.0	719.0	138.0	1364.3	1.897
17	304.0	423.0	647.0	780.5	1198.4	1.850
18	426.0	311.0	668.0	595.0	1273.9	1.908
19	353.0	59.0	49.0	1196.3	993.4	20.275
20	270.0	440.0	42.0	1783.1	171.0	4.053
21	321.0	324.0	45.0	1778.1	247.8	5.488
22	274.0	46.0	706.0	87.9	1325.4	1.878
23	225.0	423.0	647.0	770.4	1174.9	1.818
24	274.0	311.0	655.0	590.1	1247.0	1.903

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



36 x 47.4 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: 13:17:25



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

File: S:\DGN-ST\NORTH-C~1\BONNER~1\ANALYSIS\PIERS\HLB160\PCACOL~1\M7PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #160

Engineer: JMJ

$f_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 1706.4$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

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

Rho = 1.65%

$f_c = 2.55$  ksi

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

$X_o = 0.00$  in

$I_x = 319489$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 184291$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 4.74 in

Clear cover = 5.00 in

Confinement: Tied

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

*SMJ 7/06*  
*WOB 7/06*

```

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 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<sub>c</sub> = 4400 PSI*

General Information:

=====  
 File Name: S:\DGN-ST\NORTH-1\BONNER-1\ANALYSIS\PIERS\HLB160\PCACOL-1\M7ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #160 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 = 42.4 in  
  
 Gross section area, Ag = 1314.4 in<sup>2</sup>  
 Ix = 196915 in<sup>4</sup> Iy = 105262 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 = 2.5 in

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

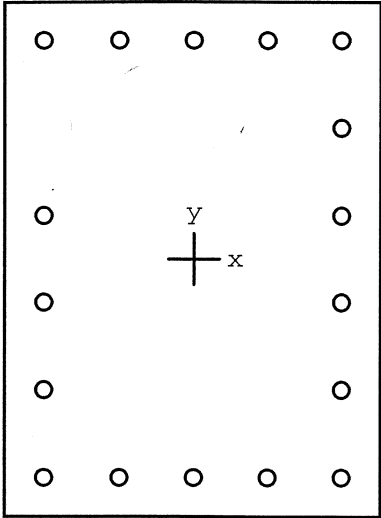
=====  

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	556.0	94.0	78.0	1168.0	967.6	12.417
2	347.0	380.0	49.0	1742.6	222.6	4.585
3	474.0	287.0	66.0	1714.1	392.8	5.972
4	427.0	72.0	755.0	124.5	1310.4	1.736
5	298.0	366.0	729.0	595.8	1183.7	1.625
6	420.0	276.0	737.0	469.5	1251.6	1.699
7	348.0	59.0	49.0	1162.9	965.9	19.711
8	266.0	380.0	37.0	1719.6	168.0	4.525
9	317.0	287.0	44.0	1716.1	261.5	5.978
10	270.0	45.0	757.0	73.3	1259.9	1.664
11	220.0	366.0	729.0	581.7	1157.0	1.587
12	269.0	276.0	739.0	453.2	1207.7	1.635
13	561.0	95.0	78.0	1174.8	962.2	12.354
14	353.0	440.0	49.0	1754.9	193.6	3.988
15	480.0	324.0	67.0	1734.3	356.6	5.352

16	432.0	73.0	719.0	132.5	1310.8	1.823
17	304.0	423.0	647.0	748.2	1140.4	1.764
18	426.0	311.0	668.0	572.5	1226.6	1.837
19	353.0	59.0	49.0	1162.2	967.2	19.715
20	270.0	440.0	42.0	1722.5	164.9	3.915
21	321.0	324.0	45.0	1726.0	238.5	5.327
22	274.0	46.0	706.0	82.7	1260.6	1.786
23	225.0	423.0	647.0	727.8	1115.8	1.723
24	274.0	311.0	655.0	561.8	1184.1	1.808

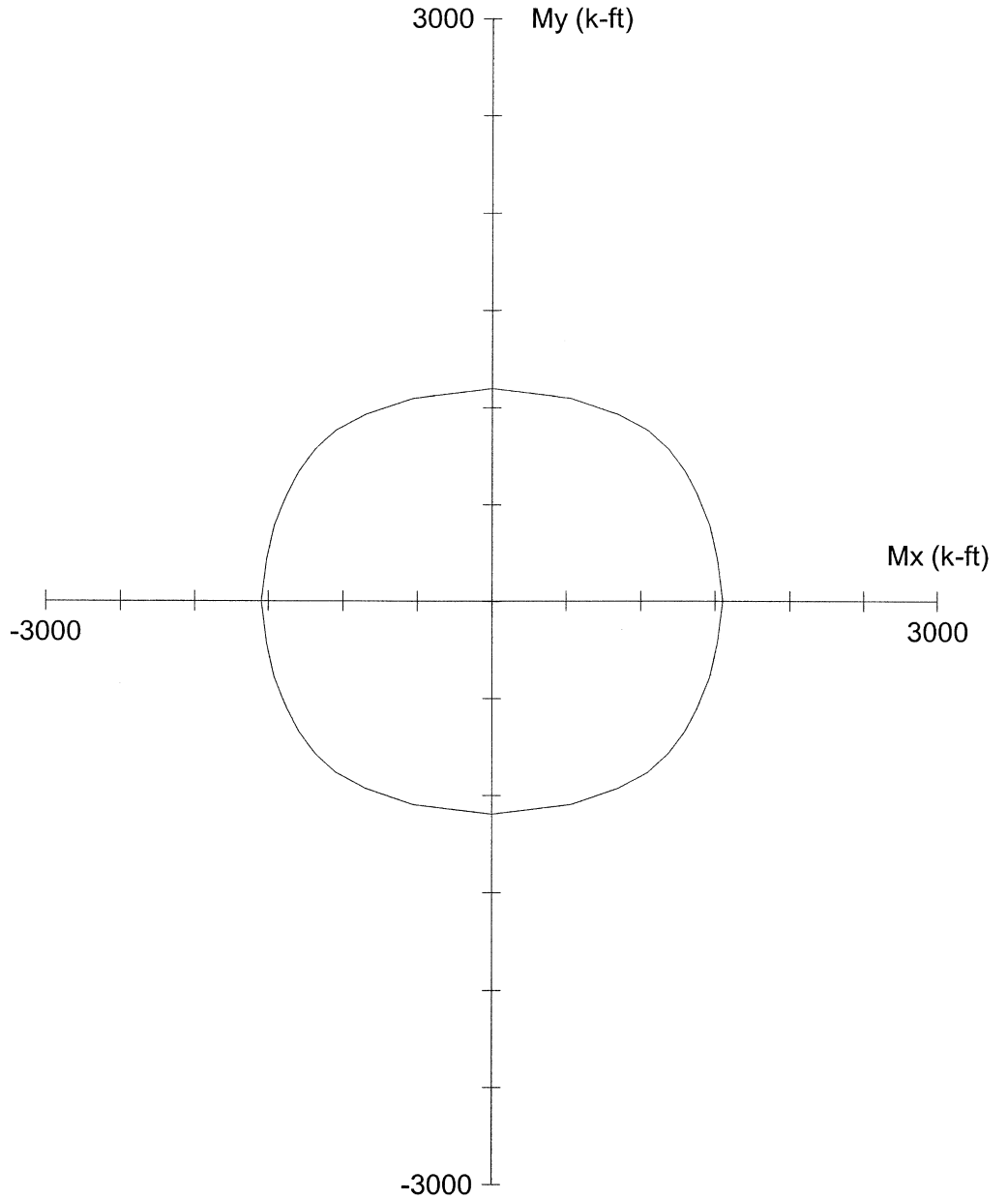
\*\*\* Program completed as requested! \*\*\*





31 x 42.4 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: 13:09:19



P = 0 kip

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File: S:\DGN-ST\NORTH-C~1\BONNER~1\ANALYSIS\PIERS\HLB160\PCACOL~1\M7ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #160

Engineer: JMJ

$f_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 1314.4$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

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

Rho = 2.14%

$f_c = 3.74$  ksi

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

$X_o = 0.00$  in

$I_x = 196915$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 105262$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 4.74 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 160 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	47.364	0.0	0.00	0.00	0.000	555	0	1.000	1.000	94	*
MZ	35.928	47.364	3.3	16.19	17.65	1.090	555	0	1.000	1.000	78	*

**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	47.364	0.0	380.30	0.00	0.000	302	0	1.000	1.000	380	
MZ	35.928	47.364	3.3	40.94	17.65	0.431	302	0	1.000	1.000	42	*

**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	47.364	0.0	286.48	0.00	0.000	452	0	1.000	1.000	286	
MZ	35.928	47.364	3.3	8.63	17.65	2.045	452	0	1.000	1.000	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	47.364	0.0	0.00	0.00	0.000	428	0	1.000	1.000	72	*
MZ	35.928	47.364	3.3	752.82	17.65	0.023	428	0	1.000	1.000	753	

**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	47.364	0.0	365.68	0.00	0.000	257	0	1.000	1.000	366	
MZ	35.928	47.364	3.3	681.95	17.65	0.026	257	0	1.000	1.000	682	

**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	47.364	0.0	275.46	0.00	0.000	401	0	1.000	1.000	275	
MZ	35.928	47.364	3.3	713.01	17.65	0.025	401	0	1.000	1.000	713	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 8 JT. 6

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				<b>PMIN</b>					
				HLB 160	MEMBER 8	JOINT 6			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		
DL	187.25	0.00	13.58	DL	187.25	0.00	13.58		
LL	48.28	0.00	-17.05	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	-17.18	-292.54	17.91		
SERVICE STRENGTH	235.53 348.03	0.00 0.00	-3.47 -19.29	SERVICE STRENGTH	170.07 221.08	-292.54 -380.30	31.49 40.94		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		
DL	187.25	0.00	13.58	DL	187.25	0.00	13.58		
LL	48.28	0.00	-17.05	LL	48.28	0.00	-17.05		
GROUP 3	-8.16	-220.37	8.68	GROUP 4	-27.21	0.00	-577.05		
SERVICE STRENGTH	227.37 295.57	-220.37 -286.48	5.21 6.77	SERVICE STRENGTH	208.32 270.81	0.00 0.00	-580.52 -754.68		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		
DL	187.25	0.00	13.58	DL	187.25	0.00	13.58		
LL	0.00	0.00	0.00	LL	48.28	0.00	-17.05		
GROUP 5	-44.38	-292.54	-559.14	GROUP 6	-35.36	-220.37	-568.37		
SERVICE STRENGTH	142.87 178.58	-292.54 -365.68	-545.56 -681.95	SERVICE STRENGTH	200.17 250.21	-220.37 -275.46	-571.84 -714.80		

**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 =	47.364	In.	
$r_y = 0.30 * D =$	14.21	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
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	318124	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	183049	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 160 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	47.364	0.0	0.00	0.00	0.000	348	0	1.000	1.000	59	*
MZ	35.928	47.364	3.3	19.29	17.65	0.915	348	0	1.000	1.000	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	47.364	0.0	380.30	0.00	0.000	221	0	1.000	1.000	380	
MZ	35.928	47.364	3.3	40.94	17.65	0.431	221	0	1.000	1.000	41	

**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	47.364	0.0	286.48	0.00	0.000	296	0	1.000	1.000	286	
MZ	35.928	47.364	3.3	6.77	17.65	2.607	296	0	1.000	1.000	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	47.364	0.0	0.00	0.00	0.000	271	0	1.000	1.000	46	*
MZ	35.928	47.364	3.3	754.68	17.65	0.023	271	0	1.000	1.000	755	

**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	47.364	0.0	365.68	0.00	0.000	179	0	1.000	1.000	366	
MZ	35.928	47.364	3.3	681.95	17.65	0.026	179	0	1.000	1.000	682	

**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	47.364	0.0	275.46	0.00	0.000	250	0	1.000	1.000	275	
MZ	35.928	47.364	3.3	714.80	17.65	0.025	250	0	1.000	1.000	715	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 8 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		P HLB 160			P MEMBER 8			P JOINT FOOTING			
		GROUP 1			GROUP 2			GROUP 3			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	254.09	0.00	7.85	DL	254.09	0.00	7.85	DL	254.09	0.00	7.85
LL	106.56	0.00	-4.85	LL	0.00	0.00	0.00	LL	106.56	0.00	-4.85
GROUP 1	0.00	0.00	0.00	GROUP 2	-17.20	-338.32	40.31	GROUP 3	-8.17	-248.80	18.76
SERVICE STRENGTH	360.65	0.00	3.00	SERVICE STRENGTH	236.90	-338.32	48.16	SERVICE STRENGTH	352.49	-248.80	21.76
	561.20	0.00	-0.30		307.97	-439.82	62.61		458.23	-323.44	28.29
		GROUP 4			GROUP 5			GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	254.09	0.00	7.85	DL	254.09	0.00	7.85	DL	254.09	0.00	7.85
LL	106.56	0.00	-4.85	LL	106.56	0.00	-4.85	LL	106.56	0.00	-4.85
GROUP 4	-8.17	-248.80	18.76	GROUP 5	-35.37	-248.80	569.22	GROUP 6	-44.40	-338.32	590.77
SERVICE STRENGTH	352.49	-248.80	21.76	SERVICE STRENGTH	333.44	0.00	553.46	SERVICE STRENGTH	209.69	-338.32	598.62
	458.23	-323.44	28.29		433.48	0.00	719.50		262.12	-422.90	748.28

**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.	
$r_y = 0.30 * D =$	14.21	In.	Depth of Rect. Col. =	D =	47.364	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
$I_{yy} =$	$B * D^3 / 12$		$I_{yy} =$	318124	In <sup>4</sup>		
$I_{zz} =$	$D * B^3 / 12$		$I_{zz} =$	183049	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 160 MEM. 8 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	47.364	0.0	0.00	0.00	0.000	561	0	1.000	1.000	95	*
MZ	35.928	47.364	3.3	0.30	10.21	33.643	561	0	1.000	1.000	78	*

**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	47.364	0.0	439.82	0.00	0.000	308	0	1.000	1.000	440	
MZ	35.928	47.364	3.3	62.61	10.21	0.163	308	0	1.000	1.000	63	

**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	47.364	0.0	323.44	0.00	0.000	458	0	1.000	1.000	323	
MZ	35.928	47.364	3.3	28.29	10.21	0.361	458	0	1.000	1.000	64	*

**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	47.364	0.0	0.00	0.00	0.000	433	0	1.000	1.000	73	*
MZ	35.928	47.364	3.3	719.50	10.21	0.014	433	0	1.000	1.000	719	

**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	47.364	0.0	422.90	0.00	0.000	262	0	1.000	1.000	423	
MZ	35.928	47.364	3.3	748.28	10.21	0.014	262	0	1.000	1.000	748	

**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	47.364	0.0	311.00	0.00	0.000	407	0	1.000	1.000	311	
MZ	35.928	47.364	3.3	715.28	10.21	0.014	407	0	1.000	1.000	715	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 8 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 160				PMIN MEMBER 8				JOINT FOOTING			
<u>GROUP 1</u>								<u>GROUP 2</u>			
	P	MY	MZ					P	MY	MZ	
DL	190.57	0.00	7.85		DL	190.57	0.00	190.57	0.00	7.85	
LL	48.28	0.00	-15.20		LL	0.00	0.00	0.00	0.00	0.00	
GROUP 1	0.00	0.00	0.00		GROUP 2	-17.20	-338.32	-17.20	-338.32	40.31	
SERVICE STRENGTH	238.85	0.00	-7.35		SERVICE STRENGTH	173.38	-338.32	173.38	-338.32	48.16	
	352.35	0.00	-22.73			225.39	-439.82	225.39	-439.82	62.61	
<u>GROUP 3</u>								<u>GROUP 4</u>			
	P	MY	MZ					P	MY	MZ	
DL	190.57	0.00	7.85		DL	190.57	0.00	190.57	0.00	7.85	
LL	48.28	0.00	-15.20		LL	48.28	0.00	48.28	0.00	-15.20	
GROUP 3	-8.17	-248.80	18.76		GROUP 4	-27.21	0.00	-27.21	0.00	550.46	
SERVICE STRENGTH	230.69	-248.80	11.41		SERVICE STRENGTH	211.64	0.00	211.64	0.00	543.11	
	299.89	-323.44	14.83			275.13	0.00	275.13	0.00	706.04	
<u>GROUP 5</u>								<u>GROUP 6</u>			
	P	MY	MZ					P	MY	MZ	
DL	190.57	0.00	7.85		DL	190.57	0.00	190.57	0.00	7.85	
LL	0.00	0.00	0.00		LL	48.28	0.00	48.28	0.00	-15.20	
GROUP 5	-44.40	-338.32	590.77		GROUP 6	-35.37	-248.80	-35.37	-248.80	569.22	
SERVICE STRENGTH	146.17	-338.32	598.62		SERVICE STRENGTH	203.49	-248.80	203.49	-248.80	561.87	
	182.71	-422.90	748.28			254.36	-311.00	254.36	-311.00	702.34	

**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. =  $D = 47.364$  In.

$r_y = 0.30 * D = 14.21$  In.

$L_y = 0$  Ft.       $K_y = 2.0$

$r_z = 0.30 * B = 10.78$  In.

$L_z = 2.5$  Ft.       $K_z = 1.2$

$I_{yy} = B * D^3 / 12 = 318124$  In<sup>4</sup>

$I_{zz} = D * B^3 / 12 = 183049$  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 160 MEM. 8 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	47.364	0.0	0.00	0.00	0.000	352	0	1.000	1.000	59	*
MZ	35.928	47.364	3.3	22.73	10.21	0.449	352	0	1.000	1.000	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	47.364	0.0	439.82	0.00	0.000	225	0	1.000	1.000	440	
MZ	35.928	47.364	3.3	62.61	10.21	0.163	225	0	1.000	1.000	63	

**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	47.364	0.0	323.44	0.00	0.000	300	0	1.000	1.000	323	
MZ	35.928	47.364	3.3	14.83	10.21	0.688	300	0	1.000	1.000	42	*

**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	47.364	0.0	0.00	0.00	0.000	275	0	1.000	1.000	46	*
MZ	35.928	47.364	3.3	706.04	10.21	0.014	275	0	1.000	1.000	706	

**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	47.364	0.0	422.90	0.00	0.000	183	0	1.000	1.000	423	
MZ	35.928	47.364	3.3	748.28	10.21	0.014	183	0	1.000	1.000	748	

**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	47.364	0.0	311.00	0.00	0.000	254	0	1.000	1.000	311	
MZ	35.928	47.364	3.3	702.34	10.21	0.015	254	0	1.000	1.000	702	

\* MINIMUM MOMENT CONTROLS

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0000000 00000 00000 00000 00000 00
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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-1\BONNER-1\ANALYSIS\PIERS\HLB160\PCACOL-1\M8PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #160 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 = 47.4 in  
  
 Gross section area, Ag = 1706.4 in<sup>2</sup>  
 Ix = 319489 in<sup>4</sup> Iy = 184291 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 1.65%  
 18 #11 Cover = 5 in

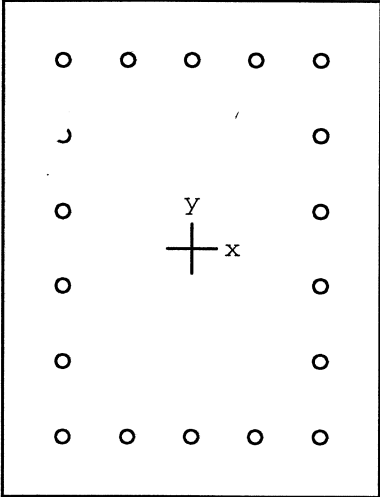
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====  

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	555.0	94.0	78.0	1199.9	995.0	12.762
2	302.0	380.0	42.0	1787.7	199.9	4.705
3	452.0	286.0	63.0	1745.7	384.6	6.104
4	428.0	72.0	753.0	130.9	1364.1	1.812
5	257.0	366.0	682.0	655.7	1222.6	1.792
6	401.0	275.0	713.0	501.3	1295.8	1.818
7	348.0	59.0	49.0	1197.0	992.6	20.275
8	221.0	380.0	41.0	1752.7	190.3	4.613
9	296.0	286.0	41.0	1766.9	254.9	6.179
10	271.0	46.0	755.0	79.9	1325.0	1.755
11	179.0	366.0	682.0	642.4	1196.7	1.755
12	250.0	275.0	715.0	486.4	1266.5	1.771
13	561.0	95.0	78.0	1210.3	991.7	12.730
14	308.0	440.0	63.0	1771.3	254.6	4.026
15	458.0	323.0	64.0	1763.3	350.6	5.460

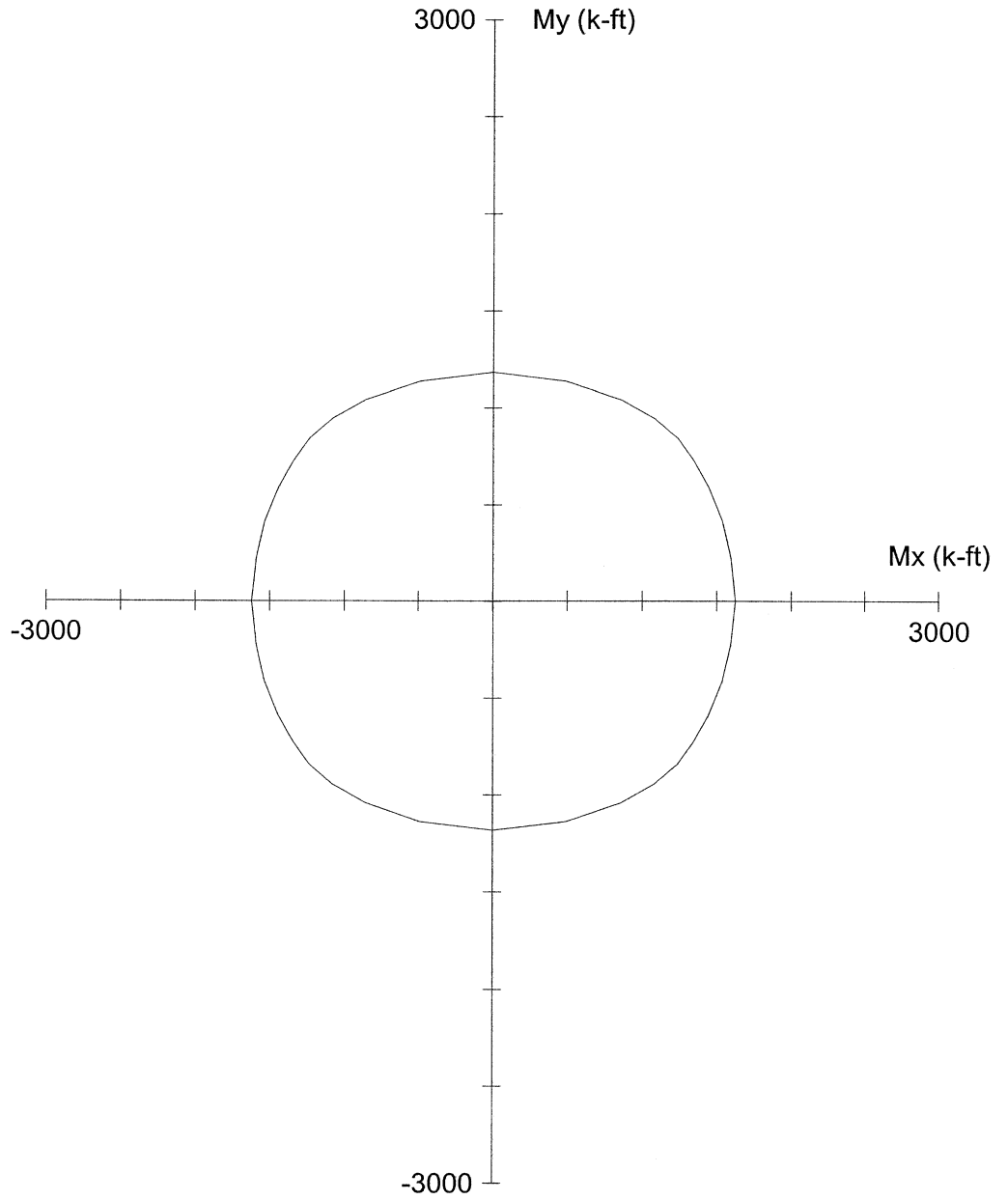
16	433.0	73.0	719.0	138.5	1364.4	1.898
17	262.0	423.0	748.0	689.3	1214.3	1.625
18	407.0	311.0	715.0	556.7	1282.5	1.793
19	352.0	59.0	49.0	1196.4	993.3	20.275
20	225.0	440.0	63.0	1738.1	250.3	3.951
21	300.0	323.0	42.0	1775.7	233.7	5.499
22	275.0	46.0	706.0	88.3	1325.8	1.878
23	183.0	423.0	748.0	671.5	1189.7	1.590
24	254.0	311.0	702.0	554.7	1250.0	1.781

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



36 x 47.4 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: 13:17:59



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\HLB160\PCACOL~1\M8PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #160

Engineer: JMJ

$f_c = 3$  ksi

$f_y = 40$  ksi

$A_g = 1706.4$  in<sup>2</sup>

18 #11 bars

$E_c = 3122$  ksi

$E_s = 29000$  ksi

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

Rho = 1.65%

$f_c = 2.55$  ksi

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

$X_o = 0.00$  in

$I_x = 319489$  in<sup>4</sup>

$J = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 184291$  in<sup>4</sup>

Beta1 = 0.85

Clear spacing = 4.74 in

Clear cover = 5.00 in

Confinement: Tied

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

JMJ 7/06  
WOB 7/06

```

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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\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB160\PCACOL~1\M8ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #160 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 = 42.4 in  
 Gross section area, Ag = 1314.4 in<sup>2</sup>  
 Ix = 196915 in<sup>4</sup> Iy = 105262 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 = 2.5 in

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

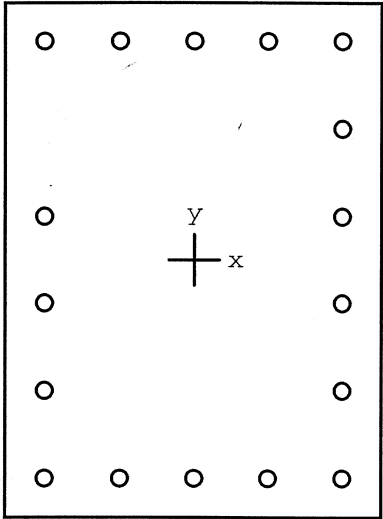
=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	555.0	94.0	78.0	1168.3	967.5	12.419
2	302.0	380.0	42.0	1733.0	193.9	4.561
3	452.0	286.0	63.0	1718.1	379.4	6.008
4	428.0	72.0	753.0	125.2	1310.6	1.740
5	257.0	366.0	682.0	621.6	1160.8	1.701
6	401.0	275.0	713.0	481.8	1244.6	1.746
7	348.0	59.0	49.0	1162.9	965.9	19.711
8	221.0	380.0	41.0	1690.3	180.5	4.448
9	296.0	286.0	41.0	1712.4	245.0	5.987
10	271.0	46.0	755.0	76.5	1260.0	1.669
11	179.0	366.0	682.0	607.6	1131.9	1.660
12	250.0	275.0	715.0	461.3	1197.6	1.675
13	561.0	95.0	78.0	1174.8	962.2	12.354
14	308.0	440.0	63.0	1717.9	245.1	3.904
15	458.0	323.0	64.0	1736.4	342.2	5.375

16	433.0	73.0	719.0	133.0	1311.0	1.823
17	262.0	423.0	748.0	653.2	1153.6	1.543
18	407.0	311.0	715.0	536.8	1232.1	1.724
19	352.0	59.0	49.0	1162.3	966.9	19.714
20	225.0	440.0	63.0	1678.1	238.9	3.813
21	300.0	323.0	42.0	1721.9	223.4	5.331
22	275.0	46.0	706.0	83.1	1261.0	1.786
23	183.0	423.0	748.0	635.5	1125.6	1.504
24	254.0	311.0	702.0	525.1	1187.2	1.691

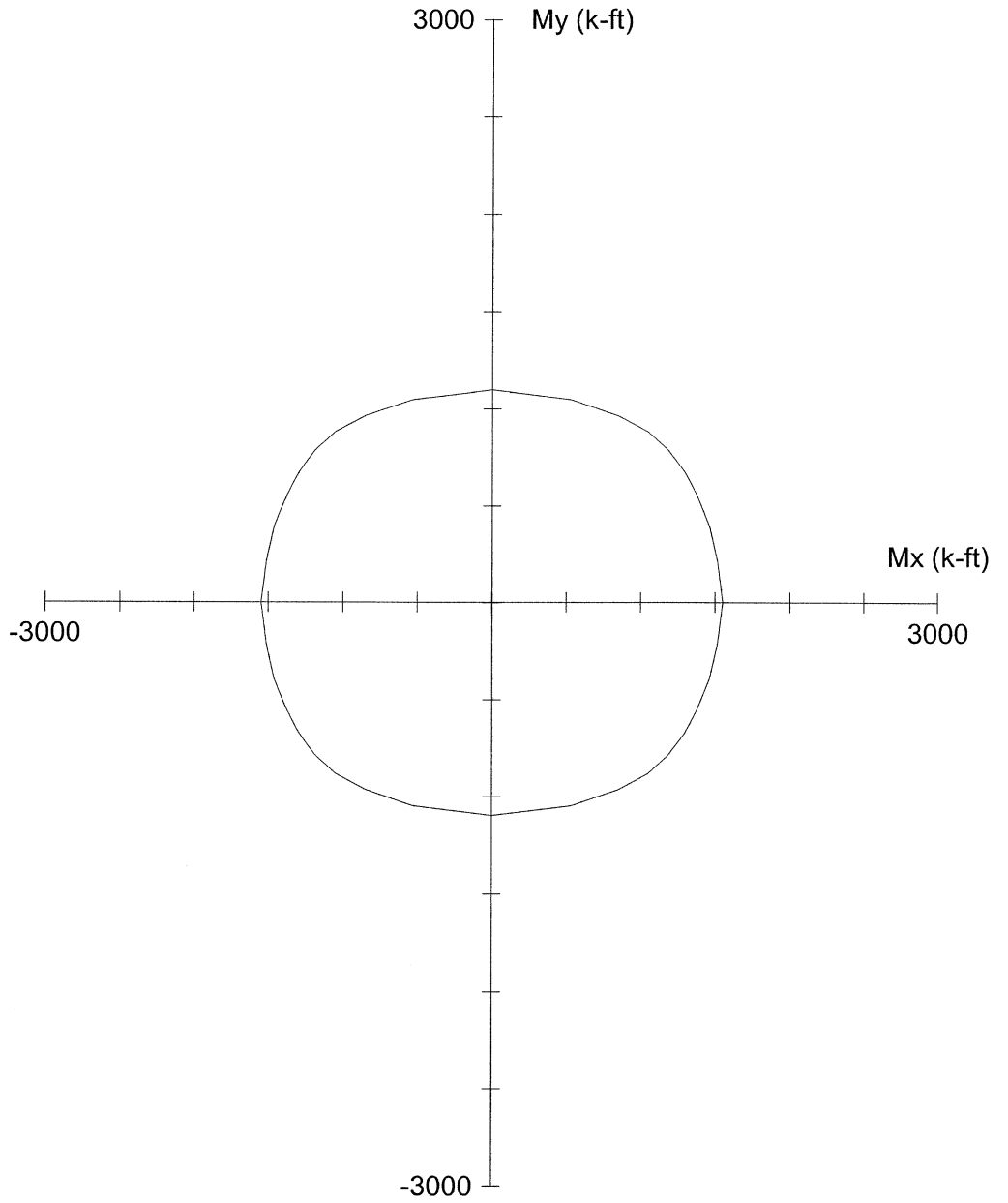
\*\*\* Program completed as requested! \*\*\*





31 x 42.4 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: 13:09:32



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

File: S:\DGN-ST\NORTHC~1\BONNER~1\ANALYSIS\PIERS\HLB160\PCACOL~1\M8ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #160

Engineer: JMJ

$f_c = 4.4$  ksi

$f_y = 40$  ksi

$A_g = 1314.4$  in<sup>2</sup>

18 #11 bars

$E_c = 3781$  ksi

$E_s = 29000$  ksi

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

Rho = 2.14%

$f_c = 3.74$  ksi

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

$X_o = 0.00$  in

$I_x = 196915$  in<sup>4</sup>

$\mu = 0.003$  in/in

$Y_o = 0.00$  in

$I_y = 105262$  in<sup>4</sup>

Beta1 = 0.83

Clear spacing = 4.74 in

Clear cover = 2.50 in

Confinement: Tied

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

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #160  
 SUBJECT: TOP OF CAP - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 KBM Jun-06

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	328.060	Ft. Kips	Working Stress Mom.	498.270	Ft. Kips
Live Load Moment	170.210	Ft. Kips	Load Factor Mom.	796.004	Ft. Kips
Avg. 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)	36.000	In.	f <sub>y</sub>	= 40.000	Ksi
Depth of Member (h)	42.000	In.			

**AREA OF STEEL**

Bar Size	11		d <sub>c</sub> =	4.330	In.
No. Bars	7		d <sub>c</sub> ' =	2.705	In.
A <sub>s</sub>	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	=	(498.27 x 12.00) / 10.93 x 35.29	=	15.50	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> > 1.2M <sub>cr</sub>	M <sub>cr</sub> = fr I <sub>g</sub> /y <sub>t</sub>
fr	=	7.5 (f <sub>c</sub> ) <sup>1/2</sup>		= 0.411 Ksi
I <sub>g</sub>	=	1/12 * b * h <sup>3</sup>	y <sub>t</sub> = h/2	= 21.00 In.
M <sub>cr</sub>	=	0.411 x 222264 / 21.00 / 12		= 362.32 Ft. Kips

AASHTO 8.17.1      φM<sub>n</sub> = 1157.13      >      1.2 M<sub>cr</sub> = 434.78      OK

f<sub>s</sub> Act = 15.50      <      f<sub>s</sub> Allow = 36.00      OK

φM<sub>n</sub> = 1157.13      >      Mu = 796.00      OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #160  
 SUBJECT: BOTTOM OF CAP - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 KBM Jun-06

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	206.020	Ft. Kips	Working Stress Mom.	376.110	Ft. Kips
Live Load Moment	170.090	Ft. Kips	Load Factor Mom.	637.091	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	=	(376.11 x 12.00) / 7.81 x 35.97	=	16.07 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 =      16.07      <      f<sub>s</sub> Allow =      36.00      OK

φM<sub>n</sub> =      842.46      >      Mu =      637.09      OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #160  
 SHEAR - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 KBM Jun-06

**SHEAR DESIGN - CAP COMPLETE**

$$V_{DL} = 103.97 \text{ KIPS} \quad V_{LL} = 59.59 \text{ KIPS} \quad F_V = 40000 \text{ PSI}$$

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

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

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

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

$$V_{DL} = V_{DL} - W_{DL} * d_{\text{DIST}} = 97.84$$

$$V_U = 1.3(V_{DL} + (1.67 * V_{LL})) = 256.57$$

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

$$V_U < q V_C + q V_S$$

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

$$q V_S = V_U - q V_C$$

$$V_S = V_U / q - V_C = 153.29 \text{ KIPS}$$

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

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

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

$$S = A_V * F_V * d / V_S = 6.0 \text{ INCHES}$$

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

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

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jul-06

SUBJECT: HIGH LEVEL BENT #160

WDB Jul-06

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

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	328.060	Ft. Kips	Working Stress Mom.	498.270	Ft. Kips
Live Load Moment	170.210	Ft. Kips	Load Factor Mom.	796.004	Ft. Kips
Avrg. Bar Clearance	3.625	In.	Z For Steel Dist.	170	
Cover	3.000	In.	$f_c$	=	4.400 Ksi
Width of Member (b)	33.000	In.	$f_y$	=	40.000 Ksi
Depth of Member (h)	42.000	In.			

**AREA OF STEEL**

Bar Size	11		$d_c$	=	4.330	In.
No. Bars	7		$d_c'$	=	2.705	In.
$A_s$	10.93	Sq. In.	$d$	=	37.670	In.

**RESULTS**

A	=	2.00 x 4.06 x 2.705	=	21.98	
$f_s$ Allow	=	170.00 / (21.98 x 2.705) <sup>.33</sup>	=	43.56 Ksi	36.00 Max
a	=	(10.93 x 40.00) / 0.85 x 4.40 x 33.00	=	3.542	In.
jd	=	37.670 - 3.54 / 2.00	=	35.90	
$f_s$ Act	=	(498.27 x 12.00) / 10.93 x 35.90	=	15.24 Ksi	
$\theta M_N$	=	0.90 x 10.93 x 40.00 x 35.90 / 12	=	1177.14	Ft. Kips

AASHTO 8.17.1	Min. Reinforcement	$\phi M_n > 1.2M_{cr}$	$M_{cr} = f_r I_g / y_t$
$f_r$	= $7.5 (f_c)^{1/2}$		= 0.497 Ksi
$I_g$	= $1/12 * b * h^3$	= 203742 In. <sup>4</sup>	$y_t = h/2$
$M_{cr}$	= $0.497 x 203742 / 21.00 / 12$		= 402.22 Ft. Kips

AASHTO 8.17.1       $\phi M_n = 1177.14 > 1.2 M_{cr} = 482.67$       **OK**

$f_s$  Act = 15.24 <  $f_s$  Allow = 36.00      **OK**

$\phi M_n = 1177.14 > M_u = 796.00$       **OK**

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jul-06

SUBJECT: HIGH LEVEL BENT #160

WDB Jul-06

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

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	206.020	Ft. Kips	Working Stress Mom.	376.110	Ft. Kips
Live Load Moment	170.090	Ft. Kips	Load Factor Mom.	637.091	Ft. Kips
Bar Clearance	3.625	In.	Z For Steel Dist.	170	
Cover	3.000	In.	f <sub>c</sub>	=	4.400 Ksi
Width of Member (b)	33.00	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 6.09 x 2.705	=	32.97	
f <sub>s</sub> Allow	=	170.00 / (32.97 x 2.705) <sup>.33</sup>	=	38.06 Ksi	36.00 Max
a	=	(7.81 x 40.00) / 0.85 x 4.40 x 33.00	=	2.530 In.	
jd	=	37.670 - 2.53 / 2.00	=	36.40	
f <sub>s</sub> Act	=	(376.11 x 12.00) / 7.81 x 36.40	=	15.88 Ksi	
θM <sub>N</sub>	=	0.90 x 7.81 x 40.00 x 36.40 / 12	=	852.67 Ft. Kips	

AASHTO 8.17.1	Min. Reinforcement	φM <sub>n</sub> >	1.2M <sub>cr</sub>	M <sub>cr</sub> =	f <sub>r</sub> I <sub>g</sub> / y <sub>t</sub>
f <sub>r</sub>	= 7.5 (f <sub>c</sub> ) <sup>1/2</sup>			=	0.497 Ksi
I <sub>g</sub>	= 1/12 * b * h <sup>3</sup>	=	203742 In. <sup>4</sup>	y <sub>t</sub> =	h/2
M <sub>cr</sub>	= 0.497 x 203742 / 21.00 / 12			=	402.22 Ft. Kips

AASHTO 8.17.1	φM <sub>n</sub> =	852.67	>	1.2 M <sub>cr</sub> =	482.67	OK
	f <sub>s</sub> Act =	15.88	<	f <sub>s</sub> Allow =	36.00	OK
	φM <sub>n</sub> =	852.67	>	Mu =	637.09	OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jul-06

SUBJECT: HIGH LEVEL BENT #160

WDB Jul-06

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

**SHEAR DESIGN - CAP COMPLETE**

$$V_{DL} = 103.97 \text{ KIPS} \quad V_{LL} = 59.59 \text{ KIPS} \quad F_V = 40000 \text{ PSI}$$

$$d = 37.67 \text{ INCHES} \quad b = 33.00 \text{ INCHES} \quad f_c = 4400 \text{ PSI}$$

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

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

$$d_{DIST.} = 37.67 / 12.00 + 0.750 = 3.89 \text{ FT.} \quad W_{DL} \text{ CAP} = 1.444 \text{ KIPS/FT}$$

$$V_{DL} = V_{DL} - W_{DL} * d_{DIST} = 98.36$$

$$V_U = 1.3(V_{DL} + (1.67 * V_{LL})) = 257.23$$

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

$$V_U < q V_C + q V_S$$

$$V_C = 2 * (f_c)^{1/2} * b * d = 164.92 \text{ KIPS}$$

$$q V_S = V_U - q V_C$$

$$V_S = V_U / q - V_C = 137.71 \text{ KIPS}$$

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

USE #	5	STIRRUPS	$A_s = 0.31$	SQ. IN.
			No. of Bars =	2

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

$$S = A_V * F_V * d / V_S = 6.7 \text{ INCHES}$$

$$S_{MIN} = A_V * F_V / 50 * b = 22.31 \text{ INCHES}$$

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

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 7 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**FOOTING LOADS**

HLB 160				PMIN MEMBER 7	JOINT FOOTING			
<u>GROUP 1</u>					<u>GROUP 2</u>			
	P	MY	MZ		P	MY	MZ	
DL	254.18	0.00	7.98	DL	254.18	0.00	7.98	
LL	38.05	0.00	-11.98	LL	0.00	0.00	0.00	
GROUP 1	0.00	0.00	0.00	GROUP 2	17.22	338.40	-40.28	
SERVICE	292.23	0.00	-4.00	SERVICE	271.40	338.40	-32.30	
STRENGTH	412.88	0.00	-15.58	STRENGTH	352.82	439.92	-41.99	
<u>GROUP 3</u>					<u>GROUP 4</u>			
	P	MY	MZ		P	MY	MZ	
DL	254.18	0.00	7.98	DL	254.18	0.00	7.98	
LL	38.05	0.00	-11.98	LL	38.05	0.00	-11.98	
GROUP 3	8.17	248.85	-18.75	GROUP 4	-28.21	0.00	550.08	
SERVICE	300.40	248.85	-22.75	SERVICE	264.02	0.00	546.08	
STRENGTH	390.52	323.51	-29.58	STRENGTH	343.23	0.00	709.90	
<u>GROUP 5</u>					<u>GROUP 6</u>			
	P	MY	MZ		P	MY	MZ	
DL	254.18	0.00	7.98	DL	254.18	0.00	7.98	
LL	0.00	0.00	0.00	LL	38.05	0.00	-11.98	
GROUP 5	-10.99	338.40	509.80	GROUP 6	-20.04	248.85	531.34	
SERVICE	243.19	338.40	517.78	SERVICE	272.19	248.85	527.34	
STRENGTH	303.99	423.00	647.23	STRENGTH	340.24	311.06	659.18	



H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 160 MEM. 8 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**FOOTING LOADS**

HLB 160				P MEMBER 8				JOINT FOOTING			
<u>GROUP 1</u>				<u>GROUP 2</u>							
	P	MY	MZ		P	MY	MZ				
DL	254.09	0.00	7.85	DL	254.09	0.00	7.85				
LL	83.93	0.00	-3.82	LL	0.00	0.00	0.00				
GROUP 1	0.00	0.00	0.00	GROUP 2	-17.20	-338.32	40.31				
SERVICE	338.02	0.00	4.03	SERVICE	236.89	-338.32	48.16				
STRENGTH	512.17	0.00	1.93	STRENGTH	307.96	-439.82	62.61				
<u>GROUP 3</u>				<u>GROUP 4</u>							
	P	MY	MZ		P	MY	MZ				
DL	254.09	0.00	7.85	DL	254.09	0.00	7.85				
LL	83.93	0.00	-3.82	LL	83.93	0.00	-3.82				
GROUP 3	-8.17	-248.80	18.76	GROUP 4	-27.21	0.00	550.46				
SERVICE	329.85	-248.80	22.79	SERVICE	310.81	0.00	554.49				
STRENGTH	428.81	-323.44	29.63	STRENGTH	404.05	0.00	720.84				
<u>GROUP 5</u>				<u>GROUP 6</u>							
	P	MY	MZ		P	MY	MZ				
DL	254.09	0.00	7.85	DL	254.09	0.00	7.85				
LL	0.00	0.00	0.00	LL	83.93	0.00	-3.82				
GROUP 5	-44.40	-338.32	590.77	GROUP 6	-35.37	-248.80	569.22				
SERVICE	209.69	-338.32	598.62	SERVICE	302.65	-248.80	573.25				
STRENGTH	262.11	-422.90	748.28	STRENGTH	378.31	-311.00	716.56				

H. W. Lochner, Inc. PHONE: 859-224-4476 SHEET 1 OF 9  
1040 Monarch St. Suite 300 Lexington, KY 40513 JOB NO. HLB#160  
PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida BY JMJ DATE Jun/12/2006  
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170 CKD.WDB DATE 7/06

F.6-86

-----  
PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

PROJECT DATA

=====

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#160  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #160 - 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	-412.88	0.00	----	----
Force	Y	0.00	-512.17	1.00	----	----
Moment	Z	----	-15.58	0.00	----	----
Moment	Z	----	1.93	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	-352.82	0.00	----	----
Force	Y	0.00	-307.96	1.00	----	----
Moment	X	----	-439.82	1.00	----	----
Moment	X	----	439.92	0.00	----	----
Moment	Z	----	-41.99	0.00	----	----
Moment	Z	----	62.61	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	-390.52	0.00	----	----
Force	Y	0.00	-428.81	1.00	----	----
Moment	X	----	-323.44	1.00	----	----
Moment	X	----	323.51	0.00	----	----
Moment	Z	----	-29.58	0.00	----	----
Moment	Z	----	29.63	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) = 31.00 ft, Hf(Z) = 9.00 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 = 21.58 ft, Round D = 12.00 in

Ag = 279.00 ft<sup>2</sup>, Ix = 62.50 ft<sup>2</sup>, Iz = 985.00 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.

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

=====

Pile Loc(X) ft	X in	Z in	-----				-----			Pile Reac. kips	
			col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft			
1	-2.70	24.0	30.0	1	1	1.000	-412.88	0.00	-19.67	95.47	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.31	33.42		-58.53
				2	4	1.250	428.81	323.24	-29.65		
2	2.80	90.0	30.0	1	1	1.000	-412.88	0.00	-19.67	101.51*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.31	33.42		-60.82
				2	4	1.250	428.81	323.24	-29.65		
3	10.80	186.0	30.0	1	1	1.000	-412.88	0.00	-19.67	110.29*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.31	33.42		-64.15
				2	4	1.250	428.81	323.24	-29.65		
4	18.80	282.0	30.0	1	1	1.000	-412.88	0.00	-19.67	119.07*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.31	33.42		-67.48
				2	4	1.250	428.81	323.24	-29.65		
5	24.30	348.0	30.0	1	1	1.000	-412.88	0.00	-19.67	125.11*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.31	33.42		-69.77
				2	4	1.250	428.81	323.24	-29.65		
6	-2.70	24.0	-30.0	1	1	1.000	-412.88	0.00	-19.67	95.47	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.31	33.42		-58.52

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 4 OF 9  
 JOB NO. HLB#160  
 BY JMJ DATE Jun/12/2006  
 CKD.WDE DATE 7/06

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

				2	4	1.250	428.81	323.24	-29.65	
7	2.80	90.0	-30.0	1	1	1.000	-412.88	0.00	-19.67	101.51*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.31	33.42	-60.81
				2	4	1.250	428.81	323.24	-29.65	
8	10.80	186.0	-30.0	1	1	1.000	-412.88	0.00	-19.67	110.29*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.31	33.42	-64.14
				2	4	1.250	428.81	323.24	-29.65	
9	18.80	282.0	-30.0	1	1	1.000	-412.88	0.00	-19.67	119.07*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.31	33.42	-67.47
				2	4	1.250	428.81	323.24	-29.65	
10	24.30	348.0	-30.0	1	1	1.000	-412.88	0.00	-19.67	125.11*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.31	33.42	-69.76
				2	4	1.250	428.81	323.24	-29.65	

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	-2.70	24.0	30.0	1	1	1.000	-412.88	0.00	95.47
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.31	33.42
				2	4	1.250	428.81	323.24	-29.65
2	2.80	90.0	30.0	1	1	1.000	-412.88	0.00	101.51*
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.31	33.42
				2	4	1.250	428.81	323.24	-29.65
3	10.80	186.0	30.0	1	1	1.000	-412.88	0.00	110.29*
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.31	33.42
				2	4	1.250	428.81	323.24	-29.65
4	18.80	282.0	30.0	1	1	1.000	-412.88	0.00	119.07*
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.31	33.42
				2	4	1.250	428.81	323.24	-29.65
5	24.30	348.0	30.0	1	1	1.000	-412.88	0.00	125.11*
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.31	33.42
				2	4	1.250	428.81	323.24	-29.65
6	-2.70	24.0	-30.0	1	1	1.000	-412.88	0.00	95.47
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.31	33.42
				2	4	1.250	428.81	323.24	-29.65
7	2.80	90.0	-30.0	1	1	1.000	-412.88	0.00	101.51*
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.31	33.42
				2	4	1.250	428.81	323.24	-29.65
8	10.80	186.0	-30.0	1	1	1.000	-412.88	0.00	110.29*
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.31	33.42
				2	4	1.250	428.81	323.24	-29.65
9	18.80	282.0	-30.0	1	1	1.000	-412.88	0.00	119.07*
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.31	33.42

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

				2	4	1.250	428.81	323.24	-29.65	
10	24.30	348.0	-30.0	1	1	1.000	-412.88	0.00	-19.67	125.11*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.31	33.42	-55.81
				2	4	1.250	428.81	323.24	-29.65	

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 = 107.33 kips

Reinforcement Schedule:

=====:

Dir	Quantity	Size	Bar dist. in	As total in^2	From ft	To ft	Hook
X	13	# 8	44.38	10.27	0.50	30.50	None
X	12	# 6	22.13	5.28	0.50	30.50	Both
X	5	# 6	6.00	2.20	0.50	30.50	Both
Z	24	# 5	45.19	7.44	----	----	Both
Z	41	# 6	21.38	18.04	----	----	Both
Z	8	# 11	7.45	12.48	----	----	None
Z	24	# 5	5.31	7.44	----	----	Both

Flexure:

=====

X direction

Loc ft	Mmax Mmin kft	Comb Comb	Asb_req Asb_req in^2	Asb_prv Asb_prv in^2	Asb_eff Asb_eff in^2	Ast_req Ast_req in^2	Ast_prv Ast_prv in^2	Ast_eff Ast_eff in^2
-4.70	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
-4.23	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
-3.75	0.0	1	0.00	7.48	3.65	0.00	10.27	3.76
	0.0	1	0.00	7.48	3.65	0.00	10.27	2.55
-3.24	0.0	1	0.00	7.48	7.48	0.00	10.27	8.06
	0.0	1	0.00	7.48	7.48	0.00	10.27	5.47
-2.81	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	7.96
-2.34	78.3	1	1.92	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-1.86	179.9	1	4.47	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-1.39	281.4	1	7.08	7.48	7.48	0.00	10.27	10.27

H. W. Lochner, Inc. PHONE: 859-224-4476 SHEET 1 OF 9  
1040 Monarch St. Suite 300 Lexington, KY 40513 JOB NO. HLB#160  
PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida BY JMJ DATE Jun/12/2006  
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170 CKD. WJB DATE 7/06

-----  
PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

PROJECT DATA  
=====

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#160  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #160 - Load Groups 4-6 (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 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	-343.23	0.00	----	----
Force	Y	0.00	-404.05	1.00	----	----
Moment	Z	----	709.90	0.00	----	----
Moment	Z	----	720.84	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	-303.99	0.00	----	----
Force	Y	0.00	-262.11	1.00	----	----
Moment	X	----	-422.90	1.00	----	----
Moment	X	----	423.00	0.00	----	----
Moment	Z	----	647.23	0.00	----	----
Moment	Z	----	748.28	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	-340.24	0.00	----	----
Force	Y	0.00	-378.31	1.00	----	----
Moment	X	----	-311.00	1.00	----	----
Moment	X	----	311.06	0.00	----	----
Moment	Z	----	659.18	0.00	----	----
Moment	Z	----	716.56	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) = 31.00 ft, Hf(Z) = 9.00 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 = 21.58 ft, Round D = 12.00 in  
  
 Ag = 279.00 ft<sup>2</sup>, Ix = 62.50 ft<sup>2</sup>, Iz = 985.00 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.

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

=====

Pile Loc(X) ft	X in	Z in	Column Loads						Pile Reac. kips		
			col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft			
1	-2.70	24.0	30.0	1	1	1.000	-343.36	0.00	704.74	103.17*	
				2	1	1.000	-403.92	0.00	719.76		
				1	4	1.250	340.36	-310.86	-654.16		-67.33
				2	4	1.250	378.19	310.80	-715.54		
2	2.80	90.0	30.0	1	1	1.000	-343.36	0.00	704.74	98.83	
				2	1	1.000	-403.92	0.00	719.76		
				1	4	1.250	340.36	-310.86	-654.16		-61.93
				2	4	1.250	378.19	310.80	-715.54		
3	10.80	186.0	30.0	1	1	1.000	-343.36	0.00	704.74	92.51	
				2	1	1.000	-403.92	0.00	719.76		
				1	4	1.250	340.36	-310.86	-654.16		-54.07
				2	4	1.250	378.19	310.80	-715.54		
4	18.80	282.0	30.0	1	1	1.000	-343.36	0.00	704.74	86.20	
				2	1	1.000	-403.92	0.00	719.76		
				1	4	1.250	340.36	-310.86	-654.16		-46.21
				2	4	1.250	378.19	310.80	-715.54		
5	24.30	348.0	30.0	1	1	1.000	-343.36	0.00	704.74	81.86	
				2	1	1.000	-403.92	0.00	719.76		
				1	4	1.250	340.36	-310.86	-654.16		-40.81
				2	4	1.250	378.19	310.80	-715.54		
6	-2.70	24.0	-30.0	1	1	1.000	-343.36	0.00	704.74	103.17*	
				2	1	1.000	-403.92	0.00	719.76		
				1	4	1.250	340.36	-310.86	-654.16		-67.33
				2	4	1.250	378.19	310.80	-715.54		

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 4 OF 9  
 JOB NO. HLB#160  
 BY JMJ DATE Jun/12/2006  
 CKD. WDB DATE 7/06

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Loc	X	Z	col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Reac	
7	2.80	90.0	-30.0	2	4	1.250	378.19	310.80	-715.54	
				1	1	1.000	-343.36	0.00	704.74	98.83
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-61.93
8	10.80	186.0	-30.0	2	4	1.250	378.19	310.80	-715.54	
				1	1	1.000	-343.36	0.00	704.74	92.51
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-54.07
9	18.80	282.0	-30.0	2	4	1.250	378.19	310.80	-715.54	
				1	1	1.000	-343.36	0.00	704.74	86.20
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-46.21
10	24.30	348.0	-30.0	2	4	1.250	378.19	310.80	-715.54	
				1	1	1.000	-343.36	0.00	704.74	81.86
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-40.80
				2	4	1.250	378.19	310.80	-715.54	

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.	
ft	in	in							kips	
1	-2.70	24.0	30.0	1	1	1.000	-343.36	0.00	704.74	103.17*
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-53.87
				2	4	1.250	378.19	310.80	-715.54	
2	2.80	90.0	30.0	1	1	1.000	-343.36	0.00	704.74	98.83
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-49.54
				2	4	1.250	378.19	310.80	-715.54	
3	10.80	186.0	30.0	1	1	1.000	-343.36	0.00	704.74	92.51
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-43.26
				2	4	1.250	378.19	310.80	-715.54	
4	18.80	282.0	30.0	1	1	1.000	-343.36	0.00	704.74	86.20
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-36.97
				2	4	1.250	378.19	310.80	-715.54	
5	24.30	348.0	30.0	1	1	1.000	-343.36	0.00	704.74	81.86
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-32.65
				2	4	1.250	378.19	310.80	-715.54	
6	-2.70	24.0	-30.0	1	1	1.000	-343.36	0.00	704.74	103.17*
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-53.86
				2	4	1.250	378.19	310.80	-715.54	
7	2.80	90.0	-30.0	1	1	1.000	-343.36	0.00	704.74	98.83
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-49.54
				2	4	1.250	378.19	310.80	-715.54	
8	10.80	186.0	-30.0	1	1	1.000	-343.36	0.00	704.74	92.51
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-43.25
				2	4	1.250	378.19	310.80	-715.54	
9	18.80	282.0	-30.0	1	1	1.000	-343.36	0.00	704.74	86.20
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-36.97

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

				2	4	1.250	378.19	310.80	-715.54	
10	24.30	348.0	-30.0	1	1	1.000	-343.36	0.00	704.74	81.86
				2	1	1.000	-403.92	0.00	719.76	
				1	4	1.250	340.36	-310.86	-654.16	-32.64
				2	4	1.250	378.19	310.80	-715.54	

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 = 85.38 kips

Reinforcement Schedule:

Dir	Quantity	Size	Bar dist. in	As total in <sup>2</sup>	From ft	To ft	Hook
X	13	# 8	44.38	10.27	0.50	30.50	None
X	12	# 6	22.13	5.28	0.50	30.50	Both
X	5	# 6	6.00	2.20	0.50	30.50	Both
Z	24	# 5	45.19	7.44	----	----	Both
Z	41	# 6	21.38	18.04	----	----	Both
Z	8	# 11	7.45	12.48	----	----	None
Z	24	# 5	5.31	7.44	----	----	Both

Flexure:

X direction

Loc ft	Mmax Mmin kft	Comb Comb	Asb_req Asb_req in <sup>2</sup>	Asb_prv Asb_prv in <sup>2</sup>	Asb_eff Asb_eff in <sup>2</sup>	Ast_req Ast_req in <sup>2</sup>	Ast_prv Ast_prv in <sup>2</sup>	Ast_eff Ast_eff in <sup>2</sup>
-4.70	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
-4.23	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
-3.75	0.0	1	0.00	7.48	3.65	0.00	10.27	3.76
	0.0	1	0.00	7.48	3.65	0.00	10.27	2.55
-3.24	0.0	1	0.00	7.48	7.48	0.00	10.27	8.06
	0.0	1	0.00	7.48	7.48	0.00	10.27	5.47
-2.81	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	7.96
-2.34	62.3	1	1.52	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-1.86	143.1	1	3.54	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-1.39	223.9	1	5.60	7.48	7.48	0.00	10.27	10.27

H. W. Lochner, Inc. PHONE: 859-224-4476 | SHEET 1 OF 8  
1040 Monarch St. Suite 300 Lexington, KY 40513 | JOB NO. HLB#160  
PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida | BY JMJ DATE Jun/12/2006  
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170 | CKD. DATE

F.6-96

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PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

PROJECT DATA  
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Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#160  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #160 - Load Groups 1-3 (For Ease of Checking) - Per Field Data, Assume Pile #4 Missing

*JMJ 7/06*  
*NDB 7/06*



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) = 31.00 ft, Hf(Z) = 9.00 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 47.50 in  
 Column No. 2 at x = 21.58 ft, Rectangular 36.00 in x 47.50 in

Ag = 279.00 ft<sup>2</sup>, Ix = 55.56 ft<sup>2</sup>, Iz = 913.89 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. kips				
			col#	comb	Ovs	P, kips		Mxx, kft	Mzz, kft		
1	-2.70	24.0	30.0	1	1	1.000	-412.88	0.00	-19.68	128.10*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.36	33.43		-83.09
				2	4	1.250	428.81	323.29	-29.66		
2	2.80	90.0	30.0	1	1	1.000	-412.88	0.00	-19.68	129.22*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.36	33.43		-82.79
				2	4	1.250	428.81	323.29	-29.66		
3	10.80	186.0	30.0	1	1	1.000	-412.88	0.00	-19.68	130.85*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.36	33.43		-82.36
				2	4	1.250	428.81	323.29	-29.66		
4	18.80	282.0	30.0	1	1	1.000	-412.88	0.00	-19.68	132.47*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.36	33.43		-81.92
				2	4	1.250	428.81	323.29	-29.66		
5	24.30	348.0	30.0	1	1	1.000	-412.88	0.00	-19.68	133.59*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.36	33.43		-81.62
				2	4	1.250	428.81	323.29	-29.66		
6	-2.70	24.0	-30.0	1	1	1.000	-412.88	0.00	-19.68	109.02*	
				2	1	1.000	-512.17	0.00	1.95		
				1	4	1.250	390.52	-323.36	33.43		-58.26

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Loc	X	Z	Col	Comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Reac, kips
7	10.80	186.0	-30.0	2	4	1.250	428.81	323.29	-29.66
				1	1	1.000	-412.88	0.00	-19.68
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.36	33.43
				2	4	1.250	428.81	323.29	-29.66
8	18.80	282.0	-30.0	1	1	1.000	-412.88	0.00	-19.68
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.36	33.43
				2	4	1.250	428.81	323.29	-29.66
9	24.30	348.0	-30.0	1	1	1.000	-412.88	0.00	-19.68
				2	1	1.000	-512.17	0.00	1.95
				1	4	1.250	390.52	-323.36	33.43
				2	4	1.250	428.81	323.29	-29.66

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

Pile Loc(X)	X	Z	col#	comb	Ovs	Column Loads	Pile Reac.			
ft	in	in				P, kips	Mxx, kft	Mzz, kft	kips	
1	-2.70	24.0	30.0	1	1	1.000	-412.88	0.00	-19.68	128.10*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.36	33.43	-66.47
				2	4	1.250	428.81	323.29	-29.66	
2	2.80	90.0	30.0	1	1	1.000	-412.88	0.00	-19.68	129.22*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.36	33.43	-66.23
				2	4	1.250	428.81	323.29	-29.66	
3	10.80	186.0	30.0	1	1	1.000	-412.88	0.00	-19.68	130.85*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.36	33.43	-65.89
				2	4	1.250	428.81	323.29	-29.66	
4	18.80	282.0	30.0	1	1	1.000	-412.88	0.00	-19.68	132.47*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.36	33.43	-65.54
				2	4	1.250	428.81	323.29	-29.66	
5	24.30	348.0	30.0	1	1	1.000	-412.88	0.00	-19.68	133.59*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.36	33.43	-65.30
				2	4	1.250	428.81	323.29	-29.66	
6	-2.70	24.0	-30.0	1	1	1.000	-412.88	0.00	-19.68	109.02*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.36	33.43	-46.61
				2	4	1.250	428.81	323.29	-29.66	
7	10.80	186.0	-30.0	1	1	1.000	-412.88	0.00	-19.68	111.76*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.36	33.43	-46.02
				2	4	1.250	428.81	323.29	-29.66	
8	18.80	282.0	-30.0	1	1	1.000	-412.88	0.00	-19.68	113.39*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.36	33.43	-45.68
				2	4	1.250	428.81	323.29	-29.66	
9	24.30	348.0	-30.0	1	1	1.000	-412.88	0.00	-19.68	114.51*
				2	1	1.000	-512.17	0.00	1.95	
				1	4	1.250	390.52	-323.36	33.43	-45.44
				2	4	1.250	428.81	323.29	-29.66	

Note:

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

\* 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 = 118.46 kips

Reinforcement Schedule:

=====

Dir	Quantity	Size	Bar dist. in	As total in^2	From ft	To ft	Hook
X	13	# 8	44.38	10.27	0.50	30.50	None
X	12	# 6	22.13	5.28	0.50	30.50	Both
X	5	# 6	6.00	2.20	0.50	30.50	Both
Z	24	# 5	45.19	7.44	----	----	Both
Z	41	# 6	21.38	18.04	----	----	Both
Z	8	# 11	7.45	12.48	----	----	None
Z	24	# 5	5.31	7.44	----	----	Both

Flexure:

=====

X direction

Loc ft	Mmax Mmin kft	Comb Comb	Asb_req Asb_req in^2	Asb_prv Asb_prv in^2	Asb_eff Asb_eff in^2	Ast_req Ast_req in^2	Ast_prv Ast_prv in^2	Ast_eff Ast_eff in^2
-4.70	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
-4.34	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
-4.30	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
-3.63	0.0	1	0.00	7.48	5.62	0.00	10.27	5.79
	0.0	1	0.00	7.48	5.62	0.00	10.27	3.93
-3.28	0.0	1	0.00	7.48	7.48	0.00	10.27	9.42
	0.0	1	0.00	7.48	7.48	0.00	10.27	6.39
-2.92	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	8.85
-2.57	31.6	1	0.76	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-2.21	115.8	1	2.85	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-1.86	200.1	1	4.97	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-1.50	284.3	1	7.12	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
0.00	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
1.50	262.0	1	6.54	7.48	7.48	0.00	10.27	10.27



PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
4.30	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-265.7	1	0.00	7.48	7.48	4.97	10.27	10.27
6.15	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-511.6	1	0.00	7.48	7.48	9.71	10.27	10.27
8.47	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-821.4	1	0.00	7.48	7.48	15.80	10.27 *	10.27
10.79	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1131.2	1	0.00	7.48	7.48	22.00	10.27 *	10.27
13.11	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-892.6	1	0.00	7.48	7.48	17.22	10.27 *	10.27
15.44	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-652.1	1	0.00	7.48	7.48	12.46	10.27 *	10.27
17.28	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-461.1	1	0.00	7.48	7.48	8.73	10.27	10.27
20.08	133.0	1	3.27	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
21.58	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
23.08	288.3	1	7.22	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
23.44	203.6	1	5.06	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
23.80	119.0	1	2.92	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
24.16	34.3	1	0.83	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
24.51	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	8.92
24.87	0.0	1	0.00	7.48	7.48	0.00	10.27	9.50
	0.0	1	0.00	7.48	7.48	0.00	10.27	6.44
25.23	0.0	1	0.00	7.48	5.68	0.00	10.27	5.85
	0.0	1	0.00	7.48	5.68	0.00	10.27	3.97
25.59	0.0	1	0.00	7.48	2.13	0.00	10.27	2.20
	0.0	1	0.00	7.48	2.13	0.00	10.27	1.49
25.88	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
26.30	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
-1.98	246.8	1	5.40	37.96	37.96	0.00	7.44	7.44
1.98	308.5	1	6.77	37.96	37.96	0.00	7.44	7.44

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
-----	-----	-----	-----	-----	-----

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

X direction

1	-4.30	1	48.00	0.0	326.7
	4.30	1	33.62	133.4	228.8
2	17.28	1	33.62	103.6	228.8
	25.88	1	48.00	0.0	326.7

Z direction

Z -5.09 ---- - Outside of Footing

Two Way Shear:

=====

#	Bo ft	Ao ft^2	Comb	Avg. d in	V kips	Vc kips
-----						
Columns:						
1	26.94	45.14	1	39.08	488.7	1508.6
2	26.94	45.14	1	39.08	577.4	1508.6
Piles - max:						
2	8.00	12.72	1	39.08	0.0	447.8
Piles - min:						
1	6.00	15.45	1	39.08	0.0	335.9

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 8  
1040 Monarch St. Suite 300 Lexington, KY 40513 JOB NO. HLB#160  
PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida BY JMJ DATE Jun/12/2006  
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170 CKD. DATE

F.6-103

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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#160  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #160 - Load Groups 4-6 (For Ease of Checking) - Per Field Data, Assume Pile #4 Missing

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	-343.23	0.00	----	----
Force	Y	0.00	-404.05	1.00	----	----
Moment	Z	----	709.90	0.00	----	----
Moment	Z	----	720.84	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	-303.99	0.00	----	----
Force	Y	0.00	-262.11	1.00	----	----
Moment	X	----	-422.90	1.00	----	----
Moment	X	----	423.00	0.00	----	----
Moment	Z	----	647.23	0.00	----	----
Moment	Z	----	748.28	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	-340.24	0.00	----	----
Force	Y	0.00	-378.31	1.00	----	----
Moment	X	----	-311.00	1.00	----	----
Moment	X	----	311.06	0.00	----	----
Moment	Z	----	659.18	0.00	----	----
Moment	Z	----	716.56	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) = 31.00 ft, Hf(Z) = 9.00 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 47.50 in  
 Column No. 2 at x = 21.58 ft, Rectangular 36.00 in x 47.50 in

Ag = 279.00 ft<sup>2</sup>, Ix = 55.56 ft<sup>2</sup>, Iz = 913.89 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)	X	Z	Column Loads				Pile Reac.			
			col#	comb	Ovs	P, kips		Mxx, kft	Mzz, kft	kips
1	-2.70	24.0	30.0	1	1	1.000	-343.32	0.00	705.15	132.04*
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-90.16
				2	4	1.250	378.23	310.86	-715.95	
2	2.80	90.0	30.0	1	1	1.000	-343.32	0.00	705.15	122.70*
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-81.96
				2	4	1.250	378.23	310.86	-715.95	
3	10.80	186.0	30.0	1	1	1.000	-343.32	0.00	705.15	109.12*
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-70.04
				2	4	1.250	378.23	310.86	-715.95	
4	18.80	282.0	30.0	1	1	1.000	-343.32	0.00	705.15	95.54
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-58.12
				2	4	1.250	378.23	310.86	-715.95	
5	24.30	348.0	30.0	1	1	1.000	-343.32	0.00	705.15	86.20
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-49.92
				2	4	1.250	378.23	310.86	-715.95	
6	-2.70	24.0	-30.0	1	3	1.250	-340.32	310.92	654.56	121.28*
				2	3	1.250	-378.23	-310.86	715.95	
				1	4	1.250	340.32	-310.92	-654.56	-70.72

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

				2	4	1.250	378.23	310.86	-715.95	
7	10.80	186.0	-30.0	1	1	1.000	-343.32	0.00	705.15	98.28
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-50.60
				2	4	1.250	378.23	310.86	-715.95	
8	18.80	282.0	-30.0	1	1	1.000	-343.32	0.00	705.15	84.70
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-38.68
				2	4	1.250	378.23	310.86	-715.95	
9	24.30	348.0	-30.0	1	1	1.000	-343.32	0.00	705.15	75.36
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-30.49
				2	4	1.250	378.23	310.86	-715.95	

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

=====

Pile Loc(X)	X	Z	----- Column Loads -----				Pile Reac.			
			col#	comb	Ovs	P, kips		Mxx, kft	Mzz, kft	kips
1	-2.70	24.0	30.0	1	1	1.000	-343.32	0.00	705.15	132.04*
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-72.12
				2	4	1.250	378.23	310.86	-715.95	
2	2.80	90.0	30.0	1	1	1.000	-343.32	0.00	705.15	122.70*
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-65.57
				2	4	1.250	378.23	310.86	-715.95	
3	10.80	186.0	30.0	1	1	1.000	-343.32	0.00	705.15	109.12*
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-56.03
				2	4	1.250	378.23	310.86	-715.95	
4	18.80	282.0	30.0	1	1	1.000	-343.32	0.00	705.15	95.54
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-46.49
				2	4	1.250	378.23	310.86	-715.95	
5	24.30	348.0	30.0	1	1	1.000	-343.32	0.00	705.15	86.20
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-39.94
				2	4	1.250	378.23	310.86	-715.95	
6	-2.70	24.0	-30.0	1	1	1.000	-343.32	0.00	705.15	121.20*
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-56.58
				2	4	1.250	378.23	310.86	-715.95	
7	10.80	186.0	-30.0	1	1	1.000	-343.32	0.00	705.15	98.28
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-40.48
				2	4	1.250	378.23	310.86	-715.95	
8	18.80	282.0	-30.0	1	1	1.000	-343.32	0.00	705.15	84.70
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-30.95
				2	4	1.250	378.23	310.86	-715.95	
9	24.30	348.0	-30.0	1	1	1.000	-343.32	0.00	705.15	75.36
				2	1	1.000	-403.96	0.00	720.18	
				1	4	1.250	340.32	-310.92	-654.56	-24.39
				2	4	1.250	378.23	310.86	-715.95	

Note:

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

\* 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 = 111.60 kips

Reinforcement Schedule:

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Dir	Quantity	Size	Bar dist. in	As total in <sup>2</sup>	From ft	To ft	Hook
X	13	# 8	44.38	10.27	0.50	30.50	None
X	12	# 6	22.13	5.28	0.50	30.50	Both
X	5	# 6	6.00	2.20	0.50	30.50	Both
Z	24	# 5	45.19	7.44	----	----	Both
Z	41	# 6	21.38	18.04	----	----	Both
Z	8	# 11	7.45	12.48	----	----	None
Z	24	# 5	5.31	7.44	----	----	Both

Flexure:

=====

X direction

Loc ft	Mmax Mmin kft	Comb Comb	Asb_req Asb_req in <sup>2</sup>	Asb_prv Asb_prv in <sup>2</sup>	Asb_eff Asb_eff in <sup>2</sup>	Ast_req Ast_req in <sup>2</sup>	Ast_prv Ast_prv in <sup>2</sup>	Ast_eff Ast_eff in <sup>2</sup>
-4.70	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
-4.34	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
-4.30	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
-3.63	0.0	1	0.00	7.48	5.62	0.00	10.27	5.79
	0.0	1	0.00	7.48	5.62	0.00	10.27	3.93
-3.28	0.0	1	0.00	7.48	7.48	0.00	10.27	9.42
	0.0	1	0.00	7.48	7.48	0.00	10.27	6.39
-2.92	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	8.85
-2.57	29.8	1	0.72	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-2.21	109.1	1	2.68	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-1.86	188.5	1	4.67	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
-1.50	267.8	1	6.69	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
0.00	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
1.50	246.8	1	6.15	7.48	7.48	0.00	10.27	10.27

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
4.30	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-250.3	1	0.00	7.48	7.48	4.67	10.27	10.27
6.15	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-482.0	1	0.00	7.48	7.48	9.13	10.27	10.27
8.47	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-773.8	1	0.00	7.48	7.48	14.86	10.27 *	10.27
10.79	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1065.7	1	0.00	7.48	7.48	20.68	10.27 *	10.27
13.11	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-840.9	1	0.00	7.48	7.48	16.19	10.27 *	10.27
15.44	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-614.3	1	0.00	7.48	7.48	11.72	10.27 *	10.27
17.28	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-434.4	1	0.00	7.48	7.48	8.21	10.27	10.27
20.08	125.3	1	3.08	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
21.58	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
23.08	271.6	1	6.79	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
23.44	191.9	1	4.76	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
23.80	112.1	1	2.75	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
24.16	32.3	1	0.78	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
24.51	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	0.0	1	0.00	7.48	7.48	0.00	10.27	8.92
24.87	0.0	1	0.00	7.48	7.48	0.00	10.27	9.50
	0.0	1	0.00	7.48	7.48	0.00	10.27	6.44
25.23	0.0	1	0.00	7.48	5.68	0.00	10.27	5.85
	0.0	1	0.00	7.48	5.68	0.00	10.27	3.97
25.59	0.0	1	0.00	7.48	2.13	0.00	10.27	2.20
	0.0	1	0.00	7.48	2.13	0.00	10.27	1.49
25.88	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
26.30	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
-1.98	232.5	1	5.09	37.96	37.96	0.00	7.44	7.44
1.98	290.6	1	6.38	37.96	37.96	0.00	7.44	7.44

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
-----					



H. W. Lochner, Inc.  
1040 Monarch St. Suite 300

PHONE: 859-224-4476  
Lexington, KY 40513

SHEET 7 OF 8  
JOB NO. HLB#160  
BY JMJ DATE Jun/12/2006  
CKD. DATE

PROGRAM: RC-PIER® v4.1.0 LEAP Software Inc., Tampa, Florida  
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

X direction

1	-4.30	1	48.00	0.0	326.7
	4.30	1	33.62	125.6	228.8
2	17.28	1	33.62	97.6	228.8
	25.88	1	48.00	0.0	326.7

Z direction

Z -5.09 ---- Outside of Footing

Two Way Shear:

=====

#	Bo ft	Ao ft^2	Comb	Avg. d in	V kips	Vc kips
-----						
Columns:						
1	26.94	45.14	1	39.08	460.4	1508.6
2	26.94	45.14	1	39.08	544.0	1508.6
Piles - max:						
2	8.00	12.72	1	39.08	0.0	447.8
Piles - min:						
1	6.00	15.45	1	39.08	0.0	335.9

Note:

TWO WAY SHEAR IN FOOTING IS NOT DESIGNED AND STIRRUPS ARE NOT CONSIDERED.