

**LOCHNER**

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

JMJ May-06  
 WDB Jun-06

HIGH LEVEL BENT 129

Beam No.	Self Wt.	Topping (Deck + Haunch)	DL - Precast	Interior Diaphragms	D.L.-Comp	Total D.L.
Exterior						
* Span 129						5.26
Span 130	17.40	23.30	0.70	1.00	3.30	45.70
Interior						
* Span 129						
Span 130	17.40	21.60	0.70	1.90	3.10	44.70

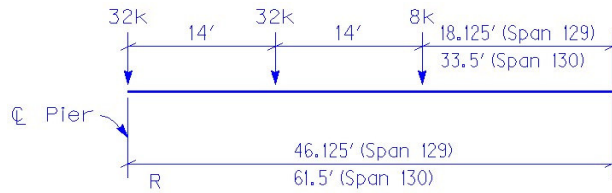
\* Span 129 DL is k/ft applied along length of cap.  
 DL = 189 k / 36 ft = 5.262 k/ft

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

JMJ Jun-06  
 WDB Jun-06

**LIVE LOAD** ( Bent 129)

**HS-20 AXLE LOAD**



$$R_{129} = 32 + 32 * ( 32.125 / 46.125 ) + 8 * ( 18.125 / 46.125 ) = 57.4 \text{ k}$$

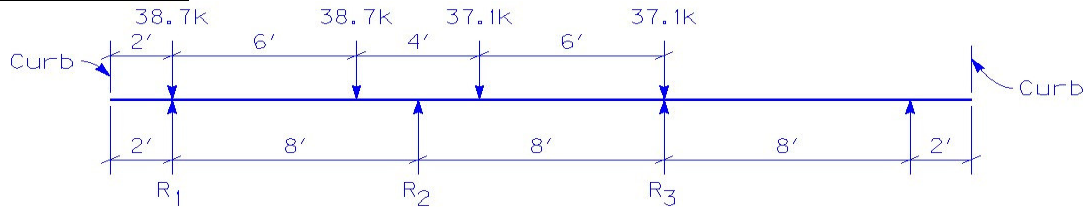
$$R_{130} = 32 + 32 * ( 47.5 / 61.5 ) + 8 * ( 33.5 / 61.5 ) = 61.1 \text{ k}$$

**HS-20 WHEEL LOAD**

$$W_{129} = R_{129} / 2 = 28.7 \text{ k} \Rightarrow w/\text{Impact} = 28.7 * ( 50 / ( 46.125 + 125 ) + 1 ) = 37.1 \text{ k}$$

$$W_{130} = R_{130} / 2 = 30.5 \text{ k} \Rightarrow w/\text{Impact} = 30.5 * ( 50 / ( 61.5 + 125 ) + 1 ) = 38.7 \text{ k}$$

**Max. NEGATIVE MOMENT (Cap)**



w/ Impact

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

$$R_2 = ( 38.7 + 37.1 ) * ( 6 / 8 ) = 56.9 \text{ k}$$

$$R_3 = 37.1 + 37.1 * ( 2 / 8 ) = 46.4 \text{ k}$$

w/o Impact

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

$$R_2 = ( 30.5 + 28.7 ) * ( 6 / 8 ) = 44.4 \text{ k}$$

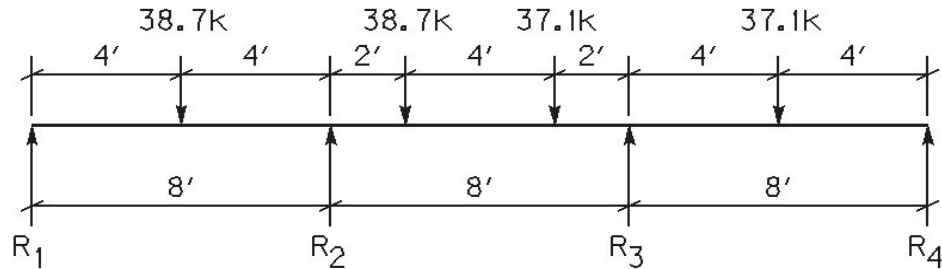
$$R_3 = 28.7 + 28.7 * ( 2 / 8 ) = 35.9 \text{ k}$$

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

JMJ Jun-06  
 WDB Jun-06

**LIVE LOAD** ( Bent 129)

**MAX. POSITIVE MOMENT (Cap)**



w/ Impact

$$\begin{aligned}
 R_1 &= 38.7 * ( 4 / 8 ) = 19.4 \text{ k} \\
 R_2 &= 19.4 + 38.7 * ( 6 / 8 ) + ( 37.1 * ( 2 / 8 ) = 57.7 \text{ k} \\
 R_3 &= 38.7 * ( 2 / 8 ) + 37.1 * ( 6 / 8 ) + 37.1 * ( 4 / 8 ) = 56.0 \text{ k} \\
 R_4 &= 37.1 * ( 4 / 8 ) = 18.6 \text{ k}
 \end{aligned}$$

w/o Impact

$$\begin{aligned}
 R_1 &= 30.5 * ( 4 / 8 ) = 15.3 \text{ k} \\
 R_2 &= 15.3 + 30.5 * ( 6 / 8 ) + ( 28.7 * ( 2 / 8 ) = 45.3 \text{ k} \\
 R_3 &= 30.5 * ( 2 / 8 ) + 28.7 * ( 6 / 8 ) + 28.7 * ( 4 / 8 ) = 43.5 \text{ k} \\
 R_4 &= 28.7 * ( 4 / 8 ) = 14.4 \text{ k}
 \end{aligned}$$

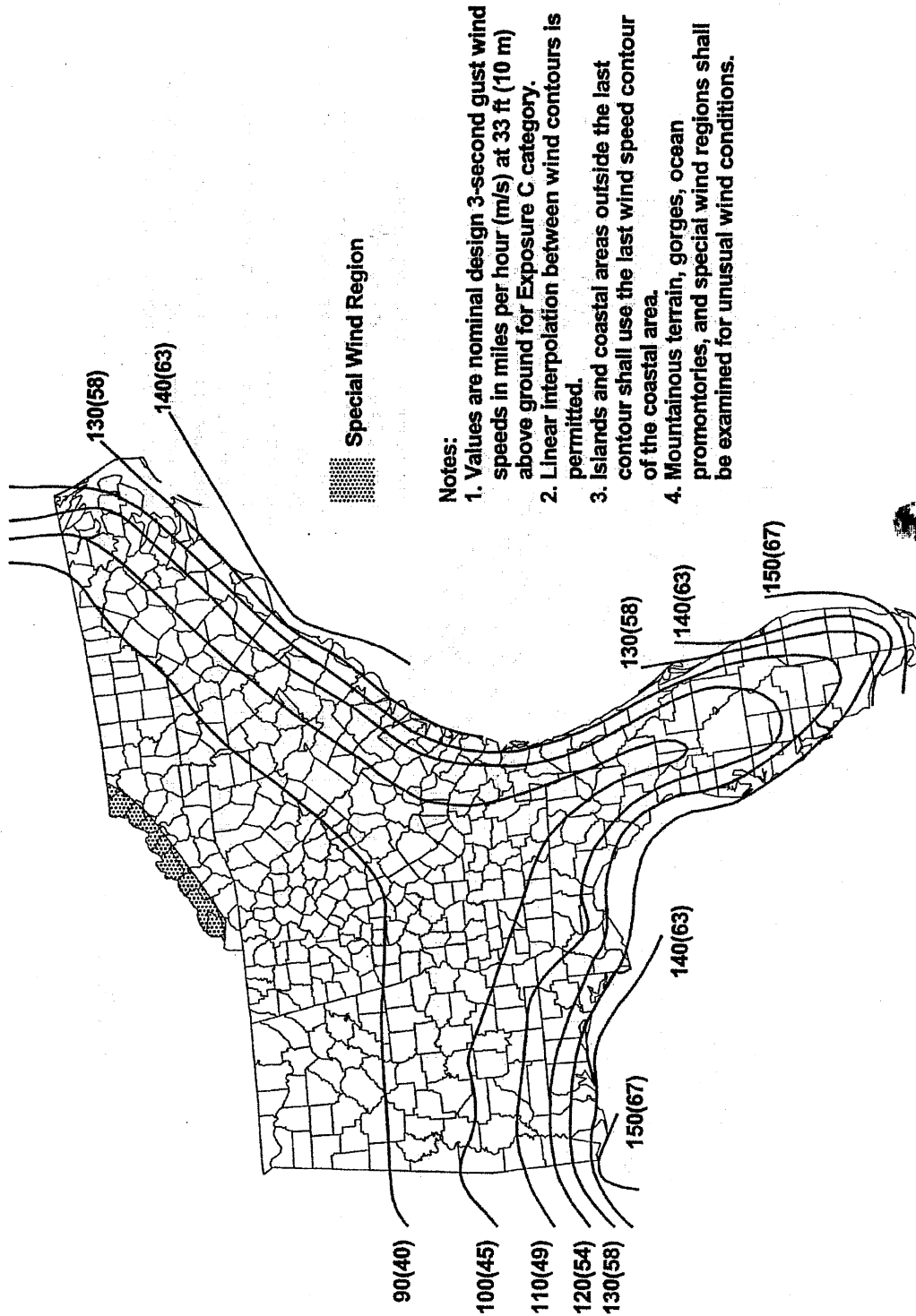


FIGURE 6-1b. Basic Wind Speed—Eastern Gulf of Mexico and Southeastern U.S. Hurricane Coastline

PROJECT: **BONNER BRIDGE - OREGON INLET NORTH CAROLINA**  
 SUBJECT: **HIGH LEVEL BENT ANALYSIS**  
 H.L.B. #129

JMJ May-06  
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**LOADING**

**Earth Loads**

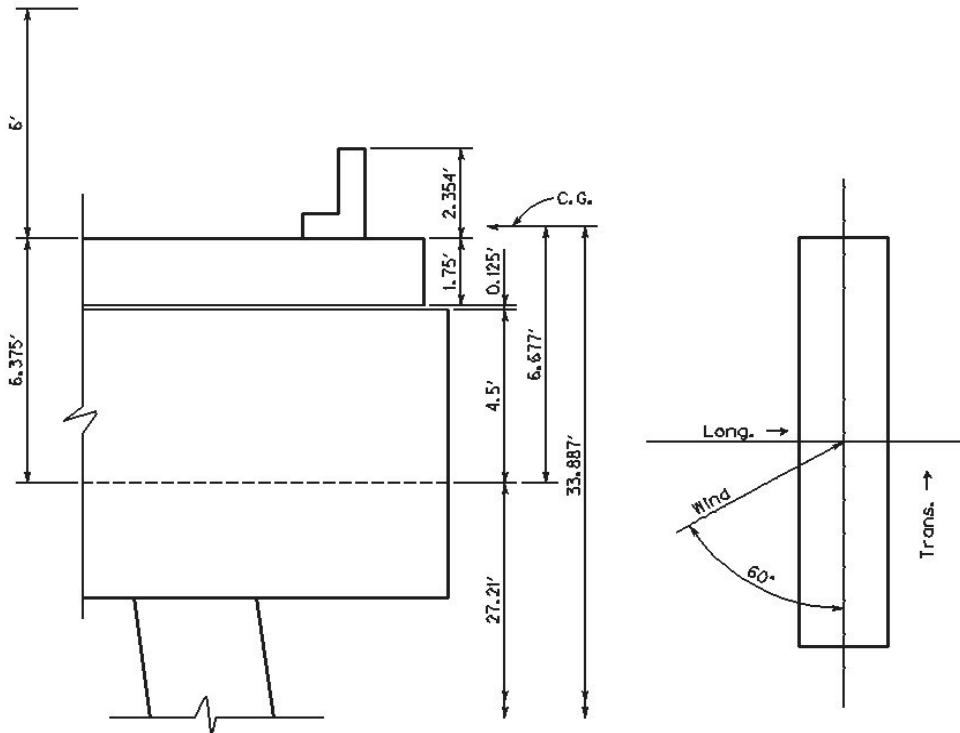
Assume No Earth Loading on Bents or Pile Cap.

**Wind Loads (AASHTO 3.15)**

Design Wind Speed = 130 MPH (Original Design Speed)

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

**Wind on Superstructure (AASHTO 3.15.2.1) --> SPAN 129**



Assume Wind @ 60° Skew

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

Assume Adjacent Bent Takes 1/2 Load

$$\text{Load Length} = 46.125 / 2 = 23.063 \text{ Ft.}$$

$$\begin{aligned} \text{Long. Force} &= (0.032 \text{ k/Ft}^2) (4.104 \text{ Ft.}) (23.063 \text{ Ft.}) = 3.029 \text{ k} \\ \text{Trans. Force} &= (0.029 \text{ k/Ft}^2) (4.104 \text{ Ft.}) (23.063 \text{ Ft.}) = 2.745 \text{ k} \end{aligned}$$

$$\text{Moment Factor} = 33.887 / 27.21 = 1.245$$

Modify & Apply to Jt. 3 & 4

$$\begin{aligned} \text{Long. Wind} &= (3.029 \text{ k}) * (1.245) / 2 = 1.8856 \text{ k/Jt} \\ \text{Trans. Wind} &= (2.745 \text{ k}) * (1.245) / 2 = 1.7088 \text{ k/Jt} \end{aligned}$$

PROJECT: **BONNER BRIDGE - OREGON INLET NORTH CAROLINA**  
 SUBJECT: **HIGH LEVEL BENT ANALYSIS**  
 H.L.B. #129

JMJ May-06  
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**Wind on Live Load (AASHTO 3.15.2.1.2) --> SPAN 129**

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> ) \* ( 23.063 Ft. ) = 0.876 k  
 Trans. Force = ( 0.034 k/Ft<sup>2</sup> ) \* ( 23.063 Ft. ) = 0.784 k

Moment Factor = ( 27.210 Ft. + 6.375 Ft. + 6.000 Ft. ) / 27.210 Ft. = 1.455

Modify & Apply to Jt. 3 & 4

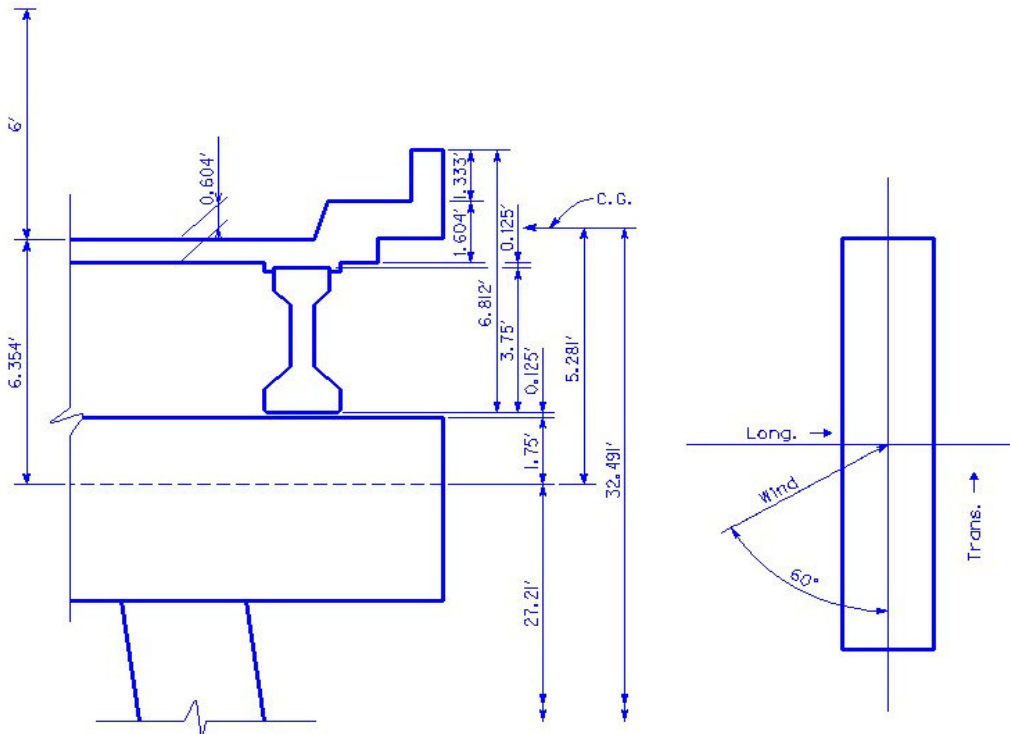
Long. Wind = ( 0.876 k ) \* ( 1.455 ) / 2.000 = 0.638 k/Jt  
 Trans. Wind = ( 0.784 k ) \* ( 1.455 ) / 2.000 = 0.570 k/Jt

**Additional Dead Load Due to Voided Slabs**

Height = 2.750 Ft.  
 Length = 38.500 Ft.  
 Thickness = 1.500 Ft.

Weight = ( 2.750 ' ) \* ( 1.500 ' ) \* ( 0.150 )k/Ft<sup>3</sup> = 0.619 k/Ft

**Wind on Superstructure (AASHTO 3.15.2.1) --> SPAN 130**



Assume Wind @ 60° Skew

Long. = 0.032 k/Ft<sup>2</sup>  
 Trans. = 0.029 k/Ft<sup>2</sup>

Assume Adjacent Bent Takes 1/2 Load

Load Length = 61.500 / 2 = 30.750 Ft.

Long. Force = ( 0.032 k/Ft<sup>2</sup> ) ( 6.812 Ft. ) ( 30.750 Ft. ) = 6.703 k  
 Trans. Force = ( 0.029 k/Ft<sup>2</sup> ) ( 6.812 Ft. ) ( 30.750 Ft. ) = 6.075 k

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 H.L.B. #129

JMJ May-06  
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Moment Factor

$$M_F = ( 32.491' / 27.21' ) = 1.19$$

Modify & Apply to Jt. 3 & 4

$$\begin{aligned} \text{Long. Wind} &= ( 6.703 \text{ k} ) * ( 1.190 ) / 2 = 3.988 \text{ k/Jt} \\ \text{Trans. Wind} &= ( 6.075 \text{ k} ) * ( 1.190 ) / 2 = 3.615 \text{ k/Jt} \end{aligned}$$

**Wind on Live Load (AASHTO 3.15.2.1.2) --> SPAN 130**

Assume Wind @ 60° Skew & Apply @ 6' above Deck

$$\begin{aligned} \text{Long.} &= ( 0.038 \text{ k/Ft}^2 ) \\ \text{Trans.} &= ( 0.034 \text{ k/Ft}^2 ) \end{aligned}$$

$$\begin{aligned} \text{Long. Force} &= ( 0.038 \text{ k/Ft}^2 ) * ( 30.750 \text{ Ft.} ) = 1.169 \text{ k} \\ \text{Trans. Force} &= ( 0.034 \text{ k/Ft}^2 ) * ( 30.750 \text{ Ft.} ) = 1.046 \text{ k} \end{aligned}$$

$$\text{Moment Factor} = ( 27.210 \text{ Ft.} + 6.354 \text{ Ft.} + 6.000 \text{ Ft.} ) / 27.210 \text{ Ft.} = 1.454$$

Modify & Apply to Jt. 3 & 4

$$\begin{aligned} \text{Long. Wind} &= ( 1.169 \text{ k} ) * ( 1.454 ) / 2.000 = 0.849 \text{ k/Jt} \\ \text{Trans. Wind} &= ( 1.046 \text{ k} ) * ( 1.454 ) / 2.000 = 0.760 \text{ k/Jt} \end{aligned}$$

**Wind on Superstructure**

$$\begin{aligned} \text{Wind Pressure} &= 0.040 \text{ k/Ft}^2 * 1.690 = 0.068 \text{ k/Ft}^2 \\ \text{Long.} &= 0.068 \text{ k/Ft}^2 * \sin 60.000 = 0.059 \text{ k/Ft}^2 \\ \text{Trans.} &= 0.068 \text{ k/Ft}^2 * \cos 60.000 = 0.034 \text{ k/Ft}^2 \end{aligned}$$

Cap

$$\begin{aligned} W_z &= 0.059 \text{ k/Ft}^2 * 6.250 \text{ Ft.} = 0.369 \text{ k/Ft} \text{ on members 1-5} \\ F_x &= 0.034 \text{ k/Ft}^2 [ ( 3.500 * 3.000 ) + ( 2.750 * 1.500 ) ] = 0.497 \text{ k} \text{ at Jt. 6} \end{aligned}$$

Columns

Members 6 & 7

$$\begin{aligned} W_z &= 0.059 \text{ k/Ft}^2 * 3.000 \text{ Ft.} = 0.177 \text{ k/Ft} \\ W_x &= 0.034 \text{ k/Ft}^2 * 3.097 \text{ Ft.} = 0.105 \text{ k/Ft} \end{aligned}$$

Members 9 & 10

$$\begin{aligned} W_z &= 0.177 \text{ k/Ft} \\ W_x &= 0.034 \text{ k/Ft}^2 * 3.947 \text{ Ft.} = 0.134 \text{ k/Ft} \end{aligned}$$

Struts

Member 8

$$W_z = 0.059 \text{ k/Ft}^2 * 5.000 \text{ Ft.} = 0.295 \text{ k/Ft}$$

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 H.L.B. #129

JMJ May-06  
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**Longitudinal Forces (AASHTO 3.9) --> SPAN 129**

Lane Loading

2 Lanes, HS20, No Reduction (AASHTO 3.12.1)

$$LF = [( 0.64 \text{ k/Ft} * 23.063 \text{ '}) + 18 \text{ k}] * 2 \text{ Lanes} * 0.05 = 3.276 \text{ k}$$

Modify & Apply to Jts. 3 & 4

$$M_F = 1.455 \text{ from Wind on L.L.}$$

$$F_z = ( 3.276 \text{ k} * 1 ) / 2 = 2.383 \text{ k/Jt}$$

**Longitudinal Forces (AASHTO 3.9) --> SPAN 130**

Lane Loading

2 Lanes, HS20, No Reduction (AASHTO 3.12.1)

$$LF = [( 0.64 \text{ k/Ft} * 30.750 \text{ '}) + 18 \text{ k}] * 2 \text{ Lanes} * 0.05 = 3.768 \text{ k}$$

Modify & Apply to Jts. 3 & 4

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

$$F_z = ( 3.768 \text{ k} * 1 ) / 2 = 2.739 \text{ k/Jt}$$

**Thermal Forces (AASHTO 3.16)**

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

Assume  $45^\circ \Delta T$   
 Thermal = 0.000006 (AASHTO 8.5.3)  
 Shrinkage = 0.0002 (AASHTO 8.5.4)

$$\text{Ratio} = \frac{S}{T * \Delta T} = \frac{0.0002}{0 * \#} = 0.74 \text{ use } 1.741$$

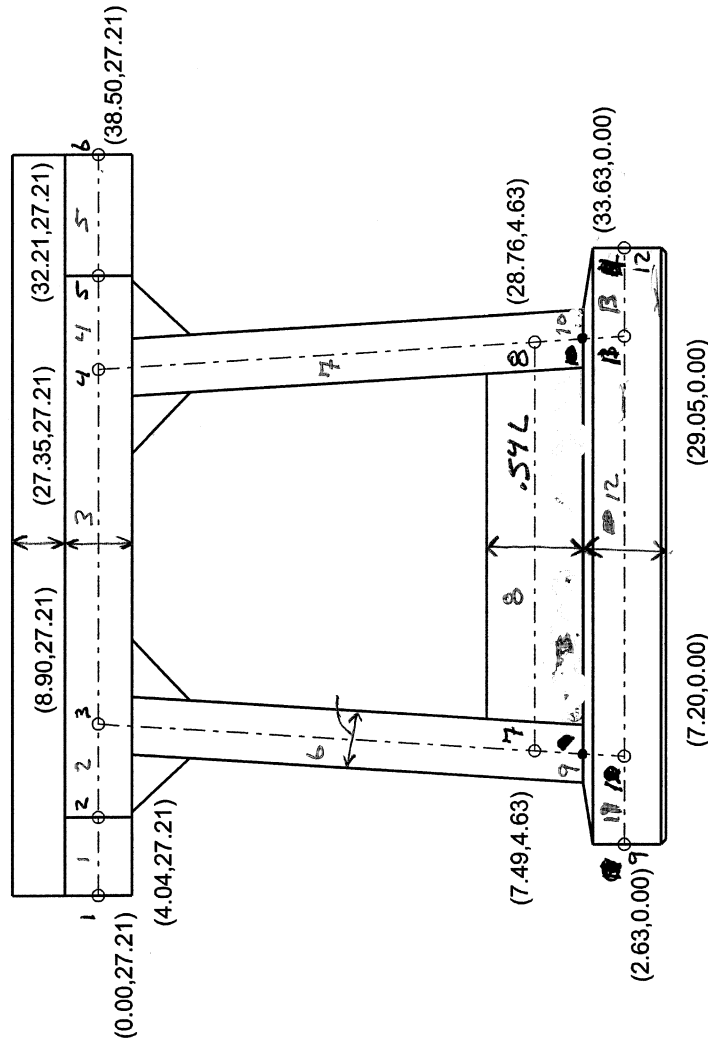
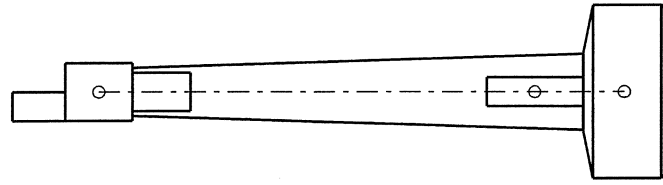
**Stream Forces (AASHTO 3.18.1)**

Tidal, Stream, & Surge Forces are Beyond the Scope.

**Seismic Loading (AASHTO 3.1)**

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





\* ADD (3')(3')(2)(.150<sup>4</sup>/ft<sup>3</sup>) = 2.7<sup>k</sup> FOR CURTEN.

BENT 129  
 SINGLE STRUT  
 VOIDED SLAB - PRESTRESSED GIRDER

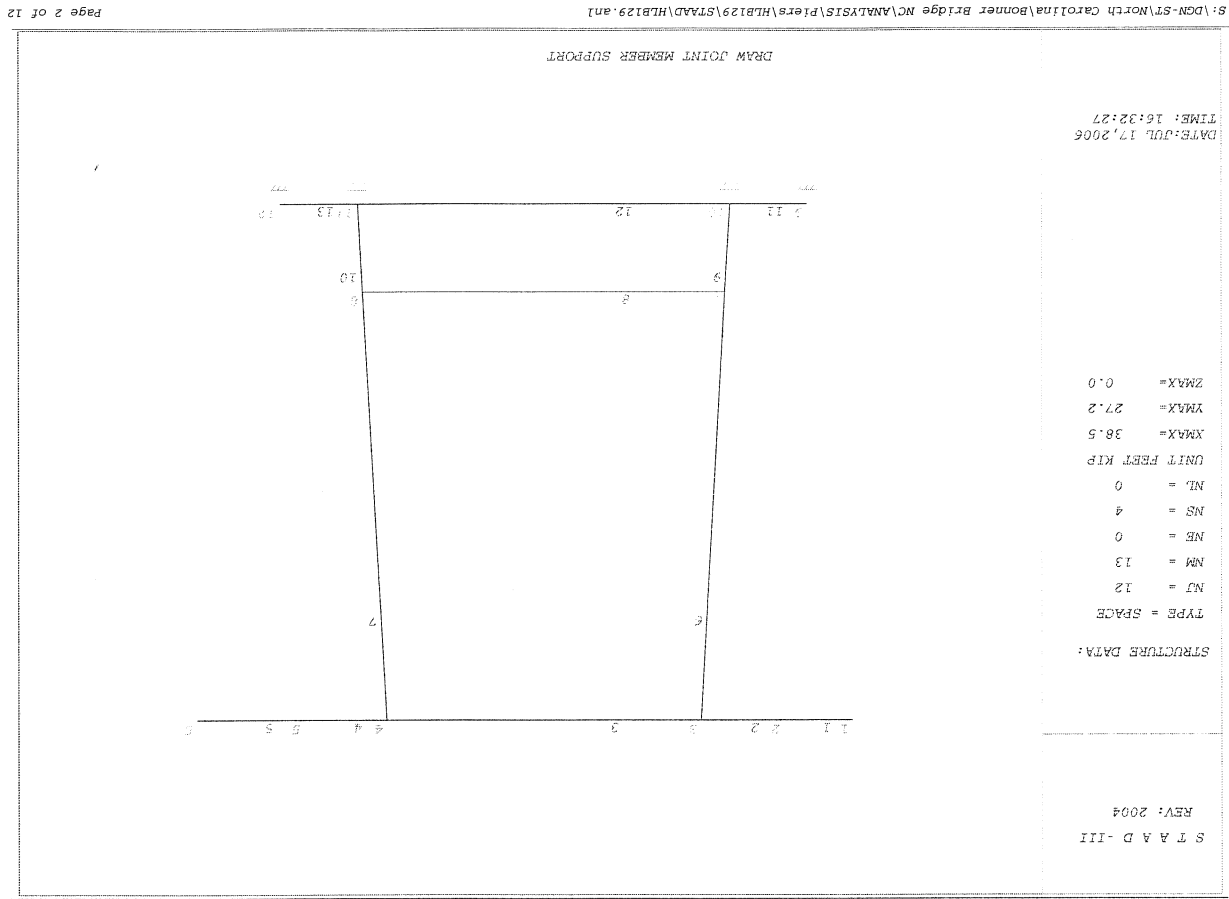
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* STAAD.Pro
* Version 2004 Bld 1002.US
* Proprietary Program of
* Research Engineers, Intl.
* Date= JUL 17, 2006
* Time= 16:32:27
*
* USER ID: H.W. Lochner
*****
    
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*JMJ 6/06*  
*WSB 6/06*

1. STAAD SPACE BONNER BRIDGE, HLB129
- INPUT FILE: HLB129.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 0 27.21 0; 2 4.04 27.21 0; 3 8.9 27.21 0; 4 27.35 27.21 0
13. 5 32.21 27.21 0; 6 38.5 27.21 0; 7 7.49 4.63 0; 8 28.76 4.63 0
14. 9 2.63 0 0; 10 7.2 0 0; 11 29.05 0 0; 12 33.63 0 0
15. MEMBER INCIDENCES
16. 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 3 7; 7 4 8; 8 7 8; 9 7 10; 10 8 11
17. 11 9 10; 12 10 11; 13 11 12
18. DEFINE MATERIAL START
19. ISOTROPIC CONCRETE
20. E 453600
21. POISSON 0.17
22. DENSITY 0.14999
23. ALPHA 5.5E-006
24. DAMP 0.05
25. END DEFINE MATERIAL
26. MEMBER PROPERTY AMERICAN
27. 1 TO 5 PRIS YD 3.5 ZD 3
28. 6 PRIS YD 2.994 ZD 3.097
29. 8 PRIS YD 5 ZD 1.5
30. 9 10 PRIS YD 2.994 ZD 3.947
31. 11 TO 13 PRIS YD 4.25 ZD 9
32. CONSTANTS
33. MATERIAL CONCRETE MEMB 1 TO 13
34. SUPPORTS
35. 9 TO 12 FIXED
36. DRAW JOINT MEMBER SUPPORT



37. \*\*  
 38. \*\*DEAD LOAD  
 39. \*\*  
 40. LOAD 2 DEAD  
 41. SELFWEIGHT Y -1  
 42. MEMBER LOAD  
 43. 2 CON GY -45.7 2.08  
 44. 3 CON GY -44.7 5.22  
 45. 3 CON GY -44.7 13.22  
 46. 4 CON GY -45.7 2.78  
 47. 1 TO 5 UNI GY -5.262  
 48. 1 TO 5 UNI GY -0.619  
 49. JOINT LOAD  
 50. 3 4 FY -2.7  
 51. \*\*  
 52. \*\*MAXIMUM NEGATIVE MOMENT  
 53. \*\*  
 54. LOAD 11 LIVELOAD + IMPACT FOR JT. 3 MEM 1 2 AND 3  
 55. MEMBER LOAD  
 56. 2 CON Y -48.4 2.08  
 57. 3 CON Y -56.9 5.22  
 58. 3 CON Y -46.4 13.22  
 59. LOAD 12 LIVELOAD + IMPACT FOR JT. 4 MEM. 3 4 AND 5  
 60. MEMBER LOAD  
 61. 3 CON Y -46.4 5.22  
 62. 3 CON Y -56.9 13.22  
 63. 4 CON Y -48.4 2.78  
 64. \*\*  
 65. \*\*MAXIMUM POSITIVE MOMENT  
 66. \*\*  
 67. LOAD 13 LIVELOAD + IMPACT MEM 3  
 68. MEMBER LOAD  
 69. 2 CON Y -19.4 2.08  
 70. 3 CON Y -57.7 5.22  
 71. 3 CON Y -56.0 13.22  
 72. 4 CON Y -18.6 2.78  
 73. \*\*  
 74. \*\*LOADS ON FOOTINGS  
 75. \*\*  
 76. LOAD 14 LIVELOAD NO IMPACT JT. 10  
 77. MEMBER LOAD  
 78. 2 CON Y -38.1 2.08  
 79. 3 CON Y -44.4 5.22  
 80. 3 CON Y -35.9 13.22  
 81. LOAD 15 LIVELOAD NO IMPACT FOR JT. 11  
 82. MEMBER LOAD  
 83. 3 CON Y -35.9 5.22  
 84. 3 CON Y -44.4 13.22  
 85. 4 CON Y -38.1 2.78  
 86. \*\*  
 87. \*\*WIND  
 88. \*\*  
 89. LOAD 4 WIND  
 90. JOINT LOAD  
 91. 3 4 FX -1.709 FZ -1.886  
 92. 3 4 FX -3.615 FZ -3.988  
 93. 6 FX -0.497  
 94. MEMBER LOAD  
 95. 1 TO 5 UNI GZ -0.369  
 96. 6 7 9 10 UNI GZ -0.177

97. 6 7 UNI GX -0.105  
 98. 9 10 UNI GX -0.134  
 99. 8 UNI GZ -0.295  
 100. \*\*  
 101. LOAD 5 WIND ON LL  
 102. JOINT LOAD  
 103. 3 4 FX -0.57 FZ -.638  
 104. 3 4 FX -.76 FZ -.849  
 105. \*\*  
 106. LOAD 6 LONGITUDINAL FORCE  
 107. JOINT LOAD  
 108. 3 4 FZ -2.383  
 109. 3 4 FZ -2.739  
 110. \*\*  
 111. LOAD 7 TEMP LOAD  
 112. TEMPERATURE LOAD  
 113. 1 TO 13 TEMP -45  
 114. \*\*  
 115. LOAD 8 STREAM LOAD  
 116. MEMBER LOAD  
 117. 11 TO 13 UNI GZ -0  
 118. \*\*  
 119. LOAD COMB 10 GROUP 1  
 120. 8 1.0  
 121. LOAD COMB 20 GROUP 2  
 122. 4 1.0 8 1.0  
 123. LOAD COMB 30 GROUP 3  
 124. 4 0.3 5 1.0 6 1.0 8 1.0  
 125. LOAD COMB 40 GROUP 4  
 126. 7 1.74 8 1.0  
 127. LOAD COMB 50 GROUP 5  
 128. 4 1.0 7 1.74 8 1.0  
 129. LOAD COMB 60 GROUP 6  
 130. 4 0.3 5 1.0 6 1.0 7 1.74 8 1.0  
 131. LOAD COMB 100 USED TO DETERMINE LOCATION OF MAX FACTORED POSITIVE MOMENT  
 132. 2 1.0 13 1.67  
 133. PERFORM ANALYSIS

PROBLEM STATISTICS

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 12/ 13/ 4  
 ORIGINAL/FINAL BAND-WIDTH= 4/ 3/ 24 DOF  
 TOTAL PRIMARY LOAD CASES = 11, TOTAL DEGREES OF FREEDOM = 48  
 SIZE OF STIFFNESS MATRIX = 2 DOUBLE KILLO-WORDS  
 RECORD/AVAIL. DISK SPACE = 12.0/ 111701.6 MB

134. PRINT MEMBER FORCES LIST 2 3 4 6 7 9 10

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

Table with columns: MEMBER, LOAD, JT, AXIAL, SHEAR-Y, SHEAR-Z, TORSION, MOM-Y, MOM-Z. Contains numerical data for members 2 through 15.

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

Table with columns: MEMBER, LOAD, JT, AXIAL, SHEAR-Y, SHEAR-Z, TORSION, MOM-Y, MOM-Z. Contains numerical data for members 4 through 15, with handwritten notes 'Max Neg. MoL' and 'Max Neg. MuTZ'.

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

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

Table with 11 columns: MEMBER, LOAD, JT, AXIAL, SHEAR-Y, SHEAR-Z, TORSION, MOM-Y, MOM-Z. Rows 30-60.

Table with 11 columns: MEMBER, LOAD, JT, AXIAL, SHEAR-Y, SHEAR-Z, TORSION, MOM-Y, MOM-Z. Rows 12-100.

BONNER BRIDGE, HLB129

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

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

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MON-Y	MON-Z
7	7	7	-16.21	-258.78	0.00	0.00	0.00	-331.90
10	16.21	258.78	0.00	0.00	0.00	0.00	0.00	-868.62
8	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	7	13.52	7.12	19.61	-4.23	333.16	-13.88	48.34
10	-13.56	-7.74	-20.43	4.23	1.74	249.28	-7.07	22.82
30	7	6.68	3.30	12.49	1.74	307.81	22.82	-577.51
10	-6.70	-3.49	-12.74	-1.74	0.00	0.00	0.00	-1511.39
40	7	-28.20	-450.28	0.00	0.00	0.00	0.00	333.16
10	28.20	450.28	0.00	0.00	0.00	0.00	0.00	-591.39
50	7	-14.68	-443.17	19.61	-4.23	-426.05	-1463.05	-584.58
10	14.65	442.55	-20.43	4.23	1.74	249.28	-584.58	-307.81
60	7	-21.52	-446.98	12.49	1.74	393.88	1.65	9.80
10	21.51	446.90	-12.74	-1.74	0.00	0.00	9.80	-402.09
10	-402.09	-1.13	0.00	0.00	0.00	0.00	0.00	-3.35
10	2	8	296.01	5.07	0.00	0.00	0.00	41.05
11	-304.21	-4.56	0.00	0.00	0.00	0.00	0.00	-18.70
11	46.52	-0.70	0.00	0.00	0.00	0.00	0.00	-16.51
11	-46.52	0.70	0.00	0.00	0.00	0.00	0.00	13.28
12	8	105.11	-4.37	0.00	0.00	0.00	0.00	-15.21
11	-105.11	4.37	0.00	0.00	0.00	0.00	0.00	-5.04
13	8	75.00	-3.08	0.00	0.00	0.00	0.00	-20.19
11	-75.00	3.08	0.00	0.00	0.00	0.00	0.00	5.91
14	8	36.07	-0.51	0.00	0.00	0.00	0.00	-12.76
11	-36.07	0.51	0.00	0.00	0.00	0.00	0.00	10.40
15	8	82.28	-3.40	0.00	0.00	0.00	0.00	-11.73
11	-82.28	3.40	0.00	0.00	0.00	0.00	0.00	-4.07
4	8	-13.52	-7.12	-20.63	-1.72	-344.79	13.89	-48.34
11	13.56	7.14	21.45	1.72	442.38	-48.34	2.90	-33.60
5	8	-2.63	-1.17	-1.49	0.68	40.50	-8.32	115.74
11	2.63	1.17	1.49	-0.68	-2.34	-115.74	0.00	139.50
6	8	0.00	0.00	5.12	2.34	139.50	0.00	-331.90
11	-16.21	-258.78	0.00	0.00	0.00	0.00	0.00	-868.62
7	16.21	258.78	0.00	0.00	0.00	0.00	0.00	0.00
8	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	8	-13.52	-7.12	-20.63	-1.72	-344.79	13.89	-48.34
11	13.56	7.14	21.45	1.72	442.38	-48.34	2.90	-33.60
30	8	-6.68	-3.30	-12.80	-3.53	-252.77	7.07	22.82
11	6.70	3.49	13.04	3.53	312.71	-22.82	0.00	-577.51
40	8	-28.20	-450.28	0.00	0.00	0.00	0.00	-1511.39
11	28.20	450.28	0.00	0.00	0.00	0.00	0.00	1511.39
50	8	-41.72	-457.40	-20.63	-1.72	-344.79	-563.62	-1559.74
11	41.76	458.02	21.45	1.72	442.38	-1559.74	0.00	563.62

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

135. SECTION .54 MEMBERS 9 10  
136. PRINT MEMBER SECTION FORCES LIST 9 10

MEMBER FORCES AT INTERMEDIATE SECTIONS  
 ALL UNITS ARE -- KIP FEET

MEMB	LOAD	SEC	SHEAR-Y	SHEAR-Z	MOM-Y	MOM-Z
9	2	0.54	6.68	0.00	0.00	26.20
	11	0.54	-4.37	0.00	0.00	-4.26
	12	0.54	-0.70	0.00	0.00	-14.75
	13	0.54	-3.18	0.00	0.00	-12.08
	14	0.54	-3.41	0.00	0.00	-3.19
	15	0.54	-0.51	0.00	0.00	-11.48
	4	0.54	7.45	20.06	382.85	-32.13
	5	0.54	1.17	1.49	37.32	-5.83
	6	0.54	0.00	5.12	128.57	0.00
	7	0.54	-258.78	0.00	0.00	316.38
	8	0.54	0.00	0.00	0.00	0.00
	10	0.54	0.00	0.00	0.00	0.00
	20	0.54	7.45	20.06	382.85	-32.13
	30	0.54	3.40	12.63	280.75	-15.47
	40	0.54	-450.28	0.00	0.00	550.50
	50	0.54	-442.83	20.06	382.85	518.37
	60	0.54	-446.88	12.63	280.75	535.03
	100	0.54	1.37	0.00	0.00	6.02
10	2	0.54	4.80	0.00	0.00	28.69
	11	0.54	-0.70	0.00	0.00	-14.77
	12	0.54	-4.37	0.00	0.00	-4.27
	13	0.54	-3.08	0.00	0.00	-12.48
	14	0.54	-0.51	0.00	0.00	-11.49
	15	0.54	-3.40	0.00	0.00	-3.20
	4	0.54	-7.45	-21.07	-397.02	32.14
	5	0.54	-1.17	-1.49	-37.32	5.83
	6	0.54	0.00	-5.12	-128.57	0.00
	7	0.54	-258.78	0.00	0.00	316.38
	8	0.54	0.00	0.00	0.00	0.00
	10	0.54	0.00	0.00	0.00	0.00
	20	0.54	-7.45	-21.07	-397.02	32.14
	30	0.54	-3.40	-12.93	-285.00	15.47
	40	0.54	-450.28	0.00	0.00	550.50
	50	0.54	-457.74	-21.07	-397.02	582.64
	60	0.54	-453.69	-12.93	-285.00	565.97
	100	0.54	-0.34	0.00	0.00	7.85

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

- 137. LOAD LIST 2 13 100
- 138. SECTION 0.43 0.44 0.45 MEMB 3
- 139. PRINT MEMBER SECTION FORCES LIST 3

MEMBER FORCES AT INTERMEDIATE SECTIONS  
 ALL UNITS ARE -- KIP FEET

MEMB	LOAD	SEC	SHEAR-Y	SHEAR-Z	MOM-Y	MOM-Z
3	2	0.43	2.55	0.00	0.00	-106.80
		0.44	1.18	0.00	0.00	-107.15
		0.45	-0.20	0.00	0.00	-107.24
	13	0.43	-0.40	0.00	0.00	-167.09
		0.44	-0.40	0.00	0.00	-167.02
		0.45	-0.40	0.00	0.00	-166.94
	100	0.43	1.89	0.00	0.00	-385.85
		0.44	0.51	0.00	0.00	-386.07
		0.45	-0.86	0.00	0.00	-386.03

*- Max. Pos. Mol*  
*- Max. Pos. Multz*  
*- Max. Pos. Factored M*

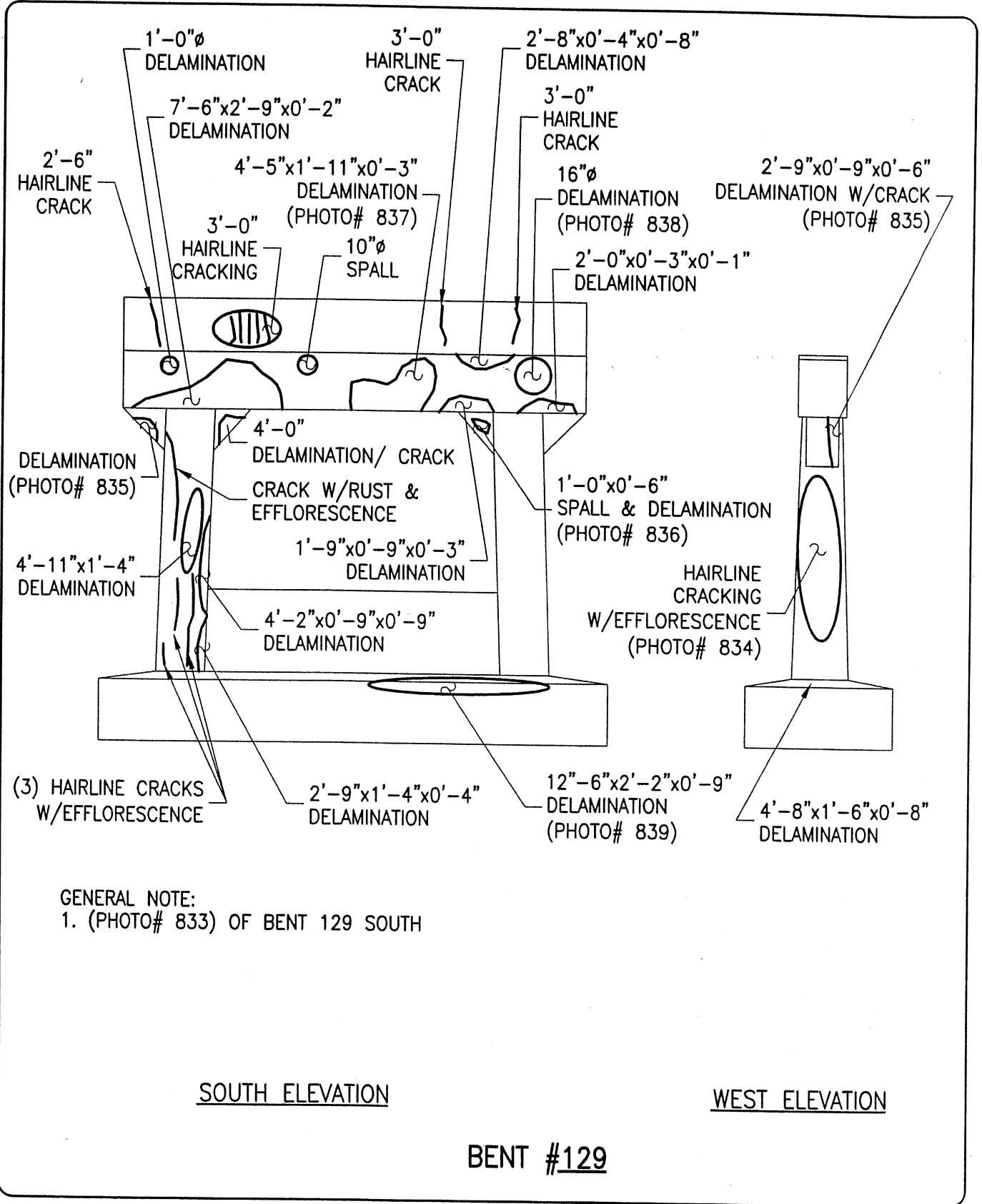
\*\*\*\*\* END OF LATEST ANALYSIS RESULT \*\*\*\*\*

140. FINISH

\*\*\*\*\* END OF THE STAAD PRO RUN \*\*\*\*\*

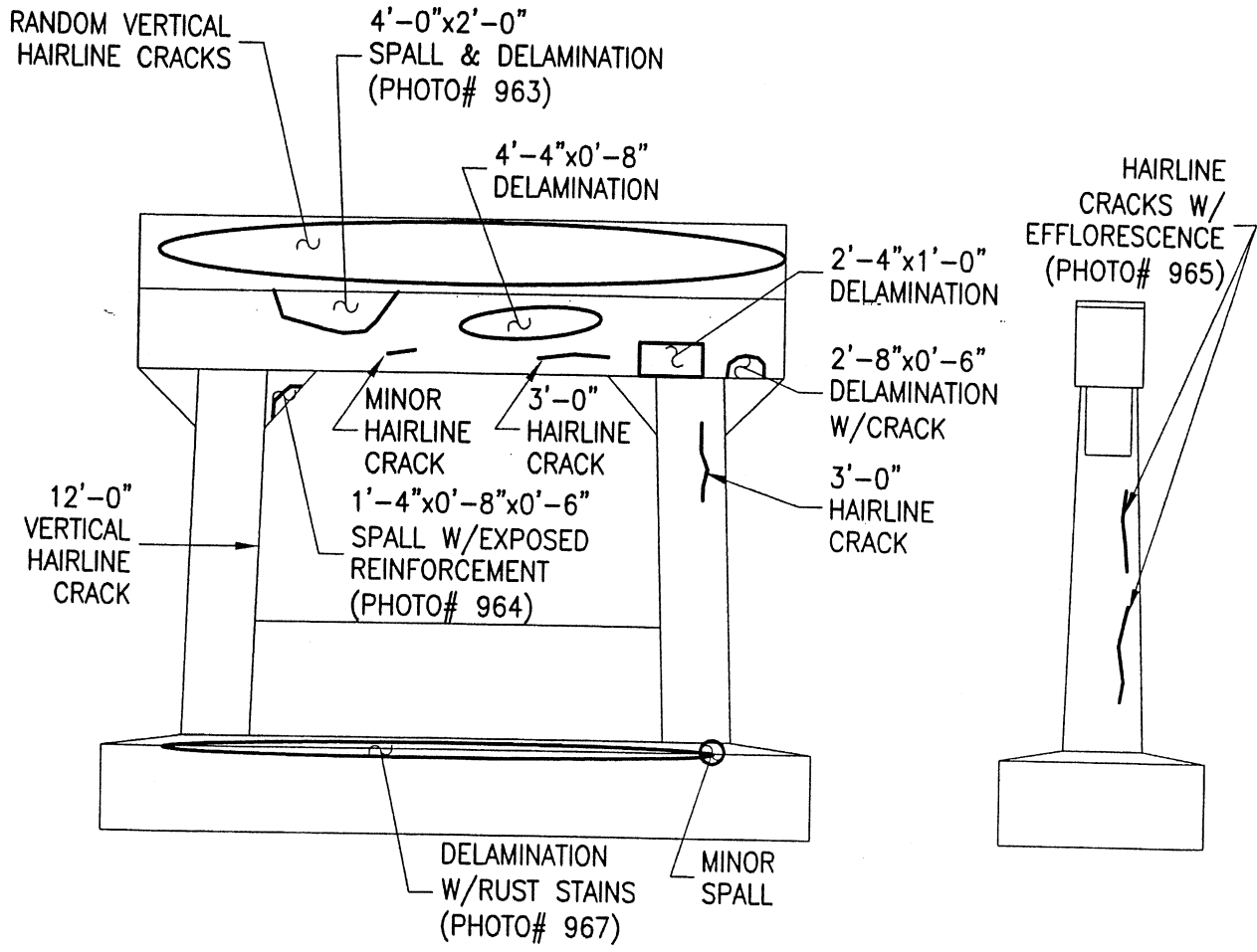
\*\*\*\* DATE= JUL 17, 2006 TIME= 16:32:28 \*\*\*\*

\*\*\*\*\*  
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 \* \* \* \* \* support@reiasia.net \* \* \* \* \*



GENERAL NOTE:  
1. (PHOTO# 833) OF BENT 129 SOUTH





GENERAL NOTE:  
 1. (PHOTO# 968, 969) OF BENT 129 NORTH  
 1. (PHOTO# 966) OF 2'x6" SPALL/DELAM WEST ELEV

NORTH ELEVATION

EAST ELEVATION

**BENT #129**



**ALPHA & OMEGA GROUP**  
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BRIDGE NO: 270011

COUNTY: DARE

PREPARED BY: OHS

SCALE: NTS

DATE:

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 SHT OF

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 6 JT. 3

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 129				P MEMBER 6				JOINT 3			
GROUP 1				GROUP 2				GROUP 3			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	221.49	0.00	-40.91	DL	221.49	0.00	-40.91	DL	221.49	0.00	-40.91
LL	106.89	0.00	32.65	LL	0.00	0.00	0.00	LL	106.89	0.00	32.65
GROUP 1	0.00	0.00	0.00	GROUP 2	7.61	3.85	67.14	GROUP 3	3.87	0.98	34.03
SERVICE STRENGTH	328.38	0.00	-8.26	SERVICE STRENGTH	229.10	3.85	26.23	SERVICE STRENGTH	332.25	0.98	25.77
	519.53	0.00	17.56		297.83	5.01	34.10		431.93	1.27	33.50
GROUP 5				GROUP 6				GROUP 4			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	221.49	0.00	-40.91	DL	221.49	0.00	-40.91	DL	221.49	0.00	-40.91
LL	0.00	0.00	0.00	LL	106.89	0.00	32.65	LL	106.89	0.00	32.65
GROUP 5	8.33	3.85	110.84	GROUP 6	4.59	0.98	77.73	GROUP 4	0.72	0.00	43.70
SERVICE STRENGTH	229.82	3.85	69.93	SERVICE STRENGTH	332.97	0.98	69.47	SERVICE STRENGTH	329.10	0.00	35.44
	287.28	4.81	87.41		416.21	1.23	86.84		427.83	0.00	46.07

**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 129 MEM. 6 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	520	10998	1.072	1.072	74	*
MZ	35.928	37.164	27.8	17.56	53.18	3.029	520	5193	1.167	1.167	73	*

**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	5.01	0.00	0.000	298	10998	1.040	1.040	43	*
MZ	35.928	37.164	27.8	34.10	53.18	1.560	298	8173	1.055	1.055	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	37.164	38.4	1.27	0.00	0.000	432	10998	1.059	1.059	62	*
MZ	35.928	37.164	27.8	33.50	53.18	1.588	432	8085	1.083	1.083	60	*

**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	428	10998	1.059	1.059	61	*
MZ	35.928	37.164	27.8	46.07	53.18	1.154	428	9711	1.067	1.067	60	*

**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	4.81	0.00	0.000	287	10998	1.039	1.039	41	*
MZ	35.928	37.164	27.8	87.41	53.18	0.608	287	13007	1.033	1.033	90	

**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	1.23	0.00	0.000	416	10998	1.057	1.057	59	*
MZ	35.928	37.164	27.8	86.84	53.18	0.612	416	12975	1.048	1.048	91	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 6 JT. 3

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				PMIN					
				HLB 129	MEMBER 6	JOINT 3			
				GROUP 1			GROUP 2		
	P	MY	MZ		P	MY	MZ		
DL	166.12	0.00	-40.91	DL	166.12	0.00	-40.91		
LL	45.63	0.00	89.48	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	7.61	3.85	67.14		
SERVICE	211.75	0.00	48.57	SERVICE	173.73	3.85	26.23		
STRENGTH	314.82	0.00	140.69	STRENGTH	225.85	5.01	34.10		
				GROUP 3			GROUP 4		
	P	MY	MZ		P	MY	MZ		
DL	166.12	0.00	-40.91	DL	166.12	0.00	-40.91		
LL	45.63	0.00	89.48	LL	45.63	0.00	89.48		
GROUP 3	3.87	0.98	34.03	GROUP 4	0.72	0.00	43.70		
SERVICE	215.62	0.98	82.60	SERVICE	212.47	0.00	92.27		
STRENGTH	280.30	1.27	107.38	STRENGTH	276.21	0.00	119.95		
				GROUP 5			GROUP 6		
	P	MY	MZ		P	MY	MZ		
DL	166.12	0.00	-40.91	DL	166.12	0.00	-40.91		
LL	0.00	0.00	0.00	LL	45.63	0.00	89.48		
GROUP 5	8.33	3.85	110.84	GROUP 6	4.59	0.98	77.73		
SERVICE	174.45	3.85	69.93	SERVICE	216.34	0.98	126.30		
STRENGTH	218.06	4.81	87.41	STRENGTH	270.42	1.23	157.88		

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

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
$r_y = 0.30 * D =$	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 129 MEM. 6 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	315	10998	1.043	1.043	45	*
MZ	35.928	37.164	27.8	140.69	53.18	0.378	315	15182	1.031	1.031	145	

**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	5.01	0.00	0.000	226	10998	1.030	1.030	32	*
MZ	35.928	37.164	27.8	34.10	53.18	1.560	226	8173	1.041	1.041	36	

**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	1.27	0.00	0.000	280	10998	1.038	1.038	40	*
MZ	35.928	37.164	27.8	107.38	53.18	0.495	280	13991	1.029	1.029	111	

**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	276	10998	1.037	1.037	39	*
MZ	35.928	37.164	27.8	119.95	53.18	0.443	276	14495	1.028	1.028	123	

**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	4.81	0.00	0.000	218	10998	1.029	1.029	31	*
MZ	35.928	37.164	27.8	87.41	53.18	0.608	218	13007	1.025	1.025	90	

**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	1.23	0.00	0.000	270	10998	1.036	1.036	39	*
MZ	35.928	37.164	27.8	157.88	53.18	0.337	270	15649	1.025	1.025	162	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 6 JT. 7

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				<b>P MAX</b>								
				HLB 129		MEMBER 6		JOINT 7				
				<u>GROUP 1</u>			<u>GROUP 2</u>					
	P	MY	MZ		P	MY	MZ		P	MY	MZ	
DL	-252.89	0.00	-18.62	DL	-252.89	0.00	-18.62	DL	-252.89	0.00	-18.62	
LL	-106.89	0.00	8.68	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00	
GROUP 1	0.00	0.00	0.00	GROUP 2	-7.76	-332.15	75.23	GROUP 2	-7.76	-332.15	75.23	
SERVICE STRENGTH	-359.78	0.00	-9.94	SERVICE STRENGTH	-260.65	-332.15	56.61	SERVICE STRENGTH	-260.65	-332.15	56.61	
SERVICE STRENGTH	-560.35	0.00	-5.40	SERVICE STRENGTH	-338.85	-431.80	73.59	SERVICE STRENGTH	-338.85	-431.80	73.59	
				<u>GROUP 3</u>			<u>GROUP 4</u>					
	P	MY	MZ		P	MY	MZ		P	MY	MZ	
DL	-252.89	0.00	-18.62	DL	-252.89	0.00	-18.62	DL	-252.89	0.00	-18.62	
LL	-106.89	0.00	8.68	LL	-106.89	0.00	8.68	LL	-106.89	0.00	8.68	
GROUP 3	-3.91	-248.99	36.59	GROUP 4	-0.72	0.00	216.98	GROUP 4	-0.72	0.00	216.98	
SERVICE STRENGTH	-363.69	-248.99	26.65	SERVICE STRENGTH	-360.50	0.00	207.04	SERVICE STRENGTH	-360.50	0.00	207.04	
SERVICE STRENGTH	-472.80	-323.69	34.65	SERVICE STRENGTH	-468.65	0.00	269.15	SERVICE STRENGTH	-468.65	0.00	269.15	
				<u>GROUP 5</u>			<u>GROUP 6</u>					
	P	MY	MZ		P	MY	MZ		P	MY	MZ	
DL	-252.89	0.00	-18.62	DL	-252.89	0.00	-18.62	DL	-252.89	0.00	-18.62	
LL	0.00	0.00	0.00	LL	-106.89	0.00	8.68	LL	-106.89	0.00	8.68	
GROUP 5	-8.48	-332.15	292.21	GROUP 6	-4.63	-248.99	253.57	GROUP 6	-4.63	-248.99	253.57	
SERVICE STRENGTH	-261.37	-332.15	273.59	SERVICE STRENGTH	-364.41	-248.99	243.63	SERVICE STRENGTH	-364.41	-248.99	243.63	
SERVICE STRENGTH	-326.71	-415.19	341.99	SERVICE STRENGTH	-455.51	-311.24	304.54	SERVICE STRENGTH	-455.51	-311.24	304.54	

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

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	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 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 129 MEM. 6 JT. 7

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	37.164	38.4	0.00	0.00	0.000	560	10998	1.078	1.078	80	*
MZ	35.928	37.164	27.8	5.40	24.21	4.483	560	3816	1.266	1.266	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	37.164	38.4	431.80	0.00	0.000	339	10998	1.046	1.046	452	
MZ	35.928	37.164	27.8	73.59	24.21	0.329	339	15743	1.032	1.032	76	

**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	323.69	0.00	0.000	473	10998	1.065	1.065	345	
MZ	35.928	37.164	27.8	34.65	24.21	0.699	473	12316	1.058	1.058	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	469	10998	1.065	1.065	67	*
MZ	35.928	37.164	27.8	269.15	24.21	0.090	469	19195	1.036	1.036	279	

**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	415.19	0.00	0.000	327	10998	1.044	1.044	434	
MZ	35.928	37.164	27.8	341.99	24.21	0.071	327	19538	1.024	1.024	350	

**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	311.24	0.00	0.000	456	10998	1.063	1.063	331	
MZ	35.928	37.164	27.8	304.54	24.21	0.079	456	19381	1.035	1.035	315	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 6 JT. 7

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				PMIN							
				HLB 129		MEMBER 6		JOINT 7			
				GROUP 1			GROUP 2				
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-189.67	0.00	-18.62	DL	-189.67	0.00	-18.62	DL	-189.67	0.00	-18.62
LL	-45.63	0.00	38.41	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	-7.76	-332.15	75.23	GROUP 2	-7.76	-332.15	75.23
SERVICE STRENGTH	-235.30	0.00	19.79	SERVICE STRENGTH	-197.43	-332.15	56.61	SERVICE STRENGTH	-197.43	-332.15	56.61
	-345.43	0.00	59.02		-256.66	-431.80	73.59		-256.66	-431.80	73.59
				GROUP 3			GROUP 4				
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-189.67	0.00	-18.62	DL	-189.67	0.00	-18.62	DL	-189.67	0.00	-18.62
LL	-45.63	0.00	38.41	LL	-45.63	0.00	38.41	LL	-45.63	0.00	38.41
GROUP 3	-3.91	-248.99	36.59	GROUP 4	-0.72	0.00	216.98	GROUP 4	-0.72	0.00	216.98
SERVICE STRENGTH	-239.21	-248.99	56.38	SERVICE STRENGTH	-236.02	0.00	236.77	SERVICE STRENGTH	-236.02	0.00	236.77
	-310.97	-323.69	73.29		-306.82	0.00	307.80		-306.82	0.00	307.80
				GROUP 5			GROUP 6				
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	-189.67	0.00	-18.62	DL	-189.67	0.00	-18.62	DL	-189.67	0.00	-18.62
LL	0.00	0.00	0.00	LL	-45.63	0.00	38.41	LL	-45.63	0.00	38.41
GROUP 5	-8.48	-332.15	292.21	GROUP 6	-4.63	-248.99	253.57	GROUP 6	-4.63	-248.99	253.57
SERVICE STRENGTH	-198.15	-332.15	273.59	SERVICE STRENGTH	-239.93	-248.99	273.36	SERVICE STRENGTH	-239.93	-248.99	273.36
	-247.68	-415.19	341.99		-299.91	-311.24	341.70		-299.91	-311.24	341.70

**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.	
			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 129 MEM. 6 JT. 7

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips
MY	35.928	37.164	38.4	0.00	0.00	0.000	345	10998	1.047	1.047	49 *
MZ	35.928	37.164	27.8	59.02	24.21	0.410	345	14836	1.034	1.034	61

**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	431.80	0.00	0.000	257	10998	1.034	1.034	447
MZ	35.928	37.164	27.8	73.59	24.21	0.329	257	15743	1.024	1.024	75

**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	323.69	0.00	0.000	311	10998	1.042	1.042	337
MZ	35.928	37.164	27.8	73.29	24.21	0.330	311	15727	1.029	1.029	75

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	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	307	10998	1.042	1.042	44 *
MZ	35.928	37.164	27.8	307.80	24.21	0.079	307	19396	1.023	1.023	315

**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	415.19	0.00	0.000	248	10998	1.033	1.033	429
MZ	35.928	37.164	27.8	341.99	24.21	0.071	248	19538	1.018	1.018	348

**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	311.24	0.00	0.000	300	10998	1.041	1.041	324
MZ	35.928	37.164	27.8	341.70	24.21	0.071	300	19537	1.022	1.022	349

\* MINIMUM MOMENT CONTROLS

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0000000 00000 00000 00000 00000 00
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00 00 00 00 00 00 00 00 00 00 00
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0000000 00 00 00 00 00 00 00 00 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-C~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M6PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #129 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

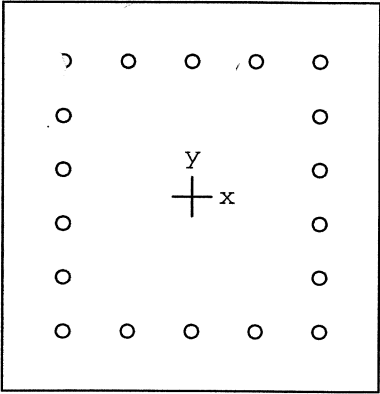
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	520.0	74.0	73.0	861.3	852.4	11.658
2	298.0	43.0	42.0	858.4	838.3	19.962
3	432.0	62.0	60.0	845.5	819.3	13.645
4	428.0	61.0	60.0	837.4	824.6	13.736
5	287.0	41.0	90.0	502.1	1099.4	12.221
6	416.0	59.0	91.0	639.3	989.5	10.863
7	315.0	45.0	145.0	360.2	1160.8	8.005
8	226.0	32.0	36.0	803.1	901.8	25.071
9	280.0	40.0	111.0	411.6	1142.8	10.295
10	276.0	39.0	123.0	367.2	1158.9	9.422
11	218.0	31.0	90.0	395.7	1145.1	12.727
12	270.0	39.0	162.0	285.1	1186.0	7.320
13	560.0	80.0	78.0	878.6	853.8	10.965
14	339.0	452.0	76.0	1230.7	207.3	2.723
15	473.0	345.0	66.0	1241.6	237.3	3.599

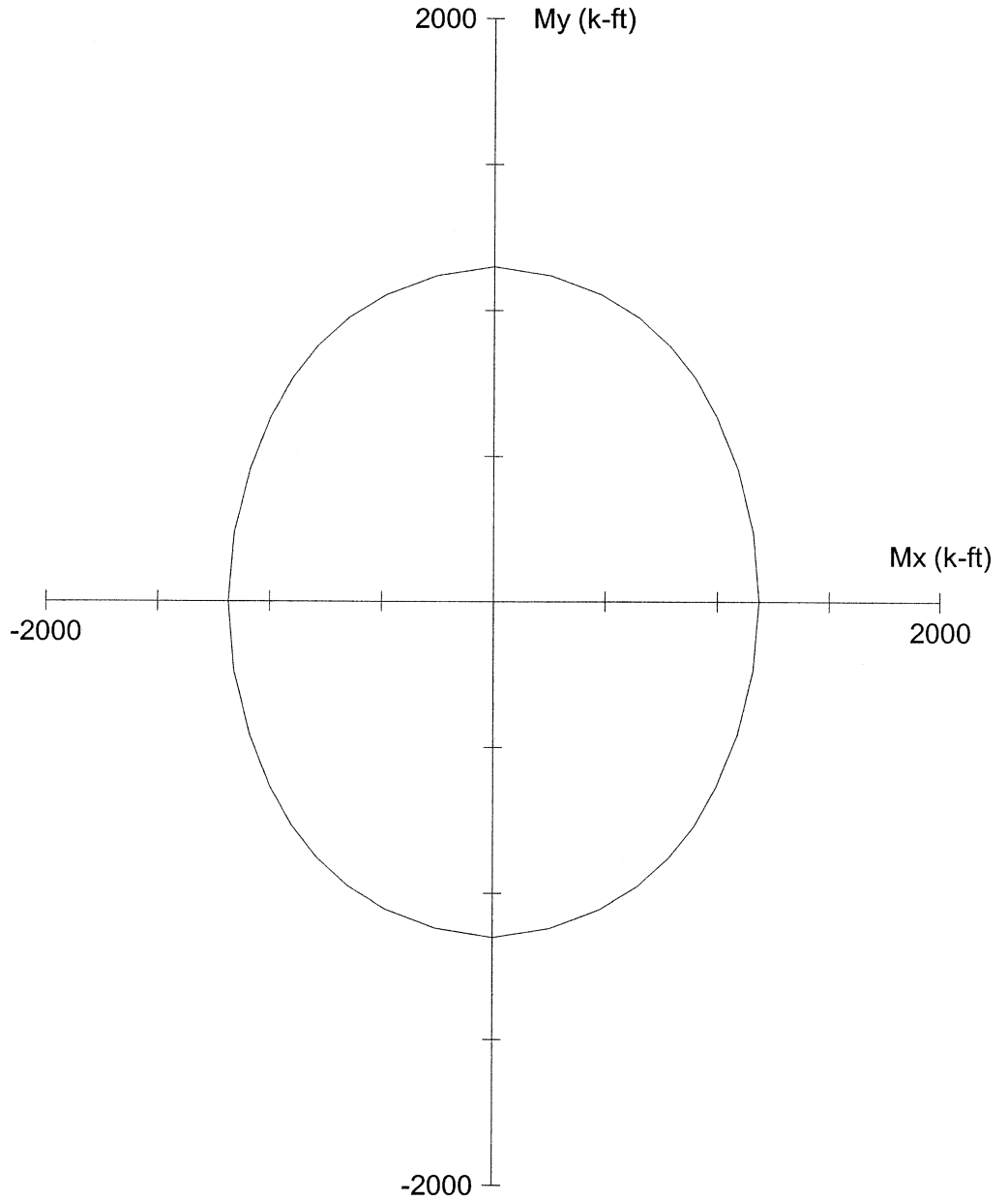
16	469.0	67.0	279.0	289.7	1212.2	4.344
17	327.0	434.0	350.0	929.8	750.2	2.143
18	456.0	331.0	315.0	860.0	819.6	2.600
19	345.0	49.0	61.0	744.8	927.3	15.201
20	257.0	447.0	75.0	1230.6	205.9	2.753
21	311.0	337.0	75.0	1214.1	270.2	3.603
22	307.0	44.0	315.0	170.8	1219.2	3.871
23	248.0	429.0	348.0	938.7	761.7	2.188
24	300.0	324.0	349.0	817.7	880.5	2.523

\*\*\* 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: 14:25:07



P = 0 kip

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

File: S:\DGN-ST\NORTH-C~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M6PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #129

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

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

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

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

General Information:

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File Name: S:\DGN-ST\NORTH-C~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M6ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #129 Engineer: JMJ  
 Code: ACI 318-95 Units: English

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

Material Properties:

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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:

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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:

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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)

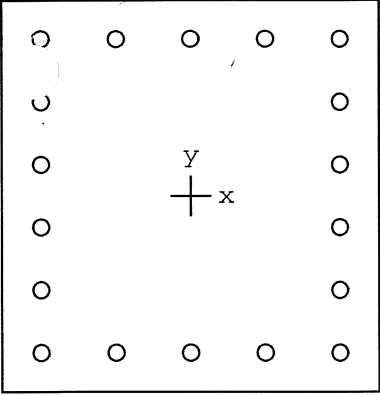
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No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	520.0	74.0	73.0	818.9	810.5	11.084
2	298.0	43.0	42.0	826.5	806.6	19.214
3	432.0	62.0	60.0	807.9	782.5	13.036
4	428.0	61.0	60.0	802.5	790.3	13.163
5	287.0	41.0	90.0	481.0	1054.7	11.721
6	416.0	59.0	91.0	618.5	954.9	10.490
7	315.0	45.0	145.0	343.5	1110.3	7.655
8	226.0	32.0	36.0	767.6	863.4	23.986
9	280.0	40.0	111.0	393.4	1089.6	9.819
10	276.0	39.0	123.0	351.3	1104.9	8.985
11	218.0	31.0	90.0	373.8	1089.4	12.100
12	270.0	39.0	162.0	270.7	1132.2	6.986
13	560.0	80.0	78.0	834.5	815.7	10.444
14	339.0	452.0	76.0	1177.9	197.2	2.606
15	473.0	345.0	66.0	1174.5	224.0	3.404

16	469.0	67.0	279.0	273.1	1141.9	4.092
17	327.0	434.0	350.0	897.8	725.1	2.070
18	456.0	331.0	315.0	816.0	778.9	2.469
19	345.0	49.0	61.0	722.1	897.9	14.726
20	257.0	447.0	75.0	1169.8	197.1	2.617
21	311.0	337.0	75.0	1160.4	257.3	3.443
22	307.0	44.0	315.0	162.5	1165.3	3.699
23	248.0	429.0	348.0	901.6	733.8	2.104
24	300.0	324.0	349.0	785.7	845.4	2.424

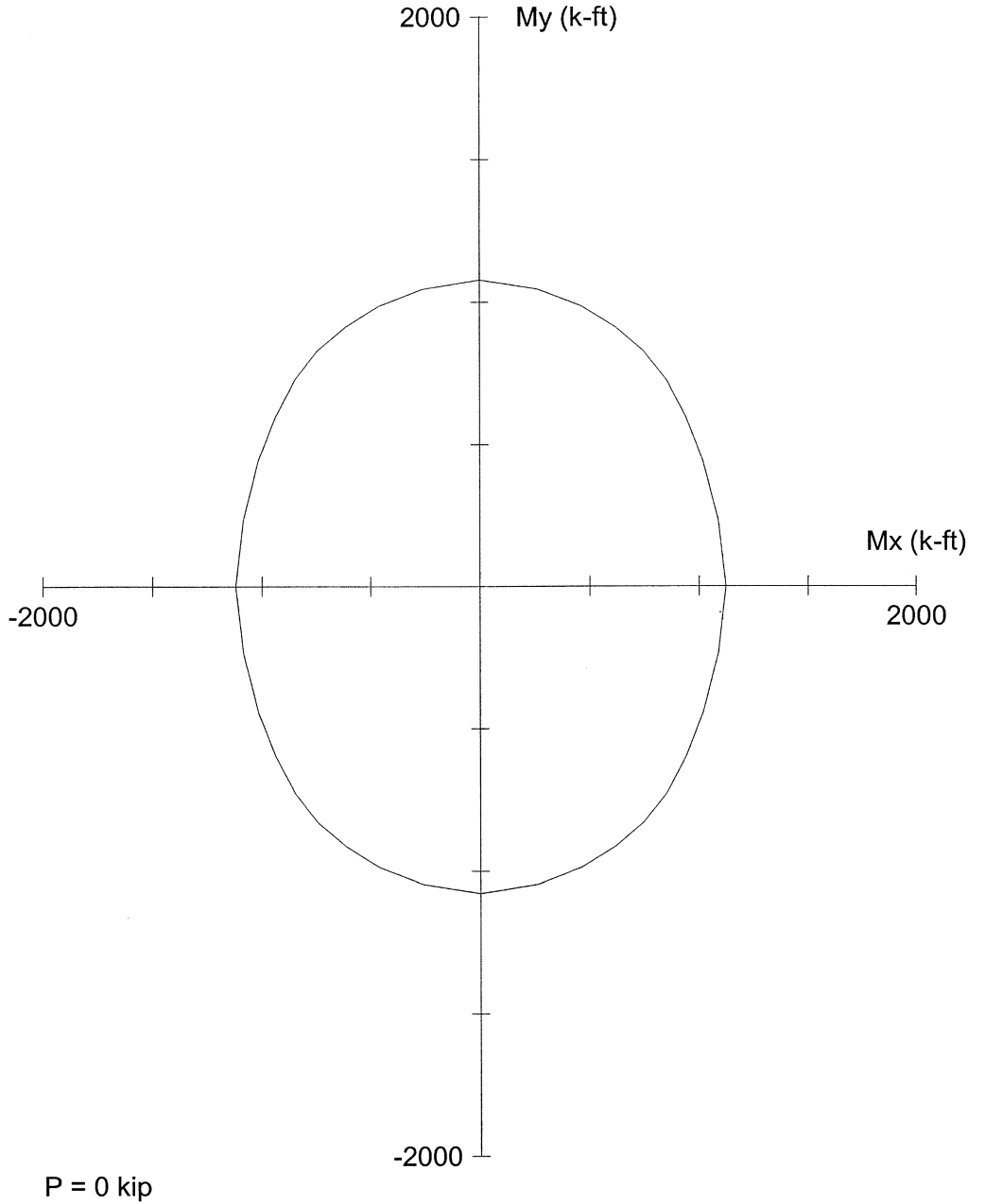
\*\*\* Program completed as requested! \*\*\*





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: 12:17:42



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

File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M6ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #129

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

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

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 7 JT. 4

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		P HLB 129			P MEMBER 7			P JOINT 4			
		GROUP 1			GROUP 2			GROUP 3			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	252.36	0.00	-78.08	DL	252.36	0.00	-78.08	DL	252.36	0.00	-78.08
LL	106.83	0.00	32.69	LL	0.00	0.00	0.00	LL	106.83	0.00	32.69
GROUP 1	0.00	0.00	0.00	GROUP 2	-7.61	4.93	-67.15	GROUP 3	-3.87	1.66	-34.04
SERVICE STRENGTH	359.19	0.00	-45.39	SERVICE STRENGTH	244.75	4.93	-145.23	SERVICE STRENGTH	359.91	0.00	-1.69
	559.53	0.00	-30.68		318.18	6.41	-188.80		467.88	0.00	-2.20
		GROUP 4			GROUP 5			GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	252.36	0.00	-78.08	DL	252.36	0.00	-78.08	DL	252.36	0.00	-78.08
LL	106.83	0.00	32.69	LL	106.83	0.00	32.69	LL	106.83	0.00	32.69
GROUP 4	-3.87	1.66	-34.04	GROUP 5	-6.89	4.93	-23.45	GROUP 6	-3.15	1.66	9.67
SERVICE STRENGTH	355.32	1.66	-79.43	SERVICE STRENGTH	359.91	0.00	-1.69	SERVICE STRENGTH	356.04	1.66	-35.72
	461.92	2.16	-103.26		467.88	0.00	-2.20		445.05	2.08	-44.65

**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 129 MEM. 7 JT. 4

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B In.	D In.	KL/R	M <sub>U</sub> Ft. Kips	M <sub>DL</sub> Ft. Kips	B <sub>D</sub>	P <sub>U</sub> Kips	P <sub>C</sub> Kips	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub> Ft. Kips	
MY	35.928	37.164	38.4	0.00	0.00	0.000	560	10998	1.078	1.078	80	*
MZ	35.928	37.164	27.8	30.68	101.50	3.309	560	4855	1.197	1.197	78	*

**GROUP 2**

	B In.	D In.	KL/R	M <sub>U</sub> Ft. Kips	M <sub>DL</sub> Ft. Kips	B <sub>D</sub>	P <sub>U</sub> Kips	P <sub>C</sub> Kips	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub> Ft. Kips	
MY	35.928	37.164	38.4	6.41	0.00	0.000	318	10998	1.043	1.043	45	*
MZ	35.928	37.164	27.8	188.80	101.50	0.538	318	13606	1.035	1.035	195	

**GROUP 3**

	B In.	D In.	KL/R	M <sub>U</sub> Ft. Kips	M <sub>DL</sub> Ft. Kips	B <sub>D</sub>	P <sub>U</sub> Kips	P <sub>C</sub> Kips	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub> Ft. Kips	
MY	35.928	37.164	38.4	2.16	0.00	0.000	462	10998	1.064	1.064	66	*
MZ	35.928	37.164	27.8	103.26	101.50	0.983	462	10550	1.067	1.067	110	

**GROUP 4**

	B In.	D In.	KL/R	M <sub>U</sub> Ft. Kips	M <sub>DL</sub> Ft. Kips	B <sub>D</sub>	P <sub>U</sub> Kips	P <sub>C</sub> Kips	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub> Ft. Kips	
MY	35.928	37.164	38.4	0.00	0.00	0.000	468	10998	1.065	1.065	67	*
MZ	35.928	37.164	27.8	2.20	101.50	46.201	468	443	-1.968	-1.968	65	*

**GROUP 5**

	B In.	D In.	KL/R	M <sub>U</sub> Ft. Kips	M <sub>DL</sub> Ft. Kips	B <sub>D</sub>	P <sub>U</sub> Kips	P <sub>C</sub> Kips	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub> Ft. Kips	
MY	35.928	37.164	38.4	6.16	0.00	0.000	307	10998	1.042	1.042	44	*
MZ	35.928	37.164	27.8	126.91	101.50	0.800	307	11624	1.039	1.039	132	

**GROUP 6**

	B In.	D In.	KL/R	M <sub>U</sub> Ft. Kips	M <sub>DL</sub> Ft. Kips	B <sub>D</sub>	P <sub>U</sub> Kips	P <sub>C</sub> Kips	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub> Ft. Kips	
MY	35.928	37.164	38.4	2.08	0.00	0.000	445	10998	1.061	1.061	64	*
MZ	35.928	37.164	27.8	44.65	101.50	2.273	445	6391	1.110	1.110	62	*

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 7 JT. 4

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				PMIN					
				HLB 129	MEMBER 7	JOINT 4			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	189.27	0.00	-78.08	DL	189.27	0.00	-78.08		
LL	45.58	0.00	89.50	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	-7.61	4.93	-67.15		
SERVICE STRENGTH	234.85 344.81	0.00 0.00	11.42 92.41	SERVICE STRENGTH	181.66 236.16	4.93 6.41	-145.23 -188.80		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	189.27	0.00	-78.08	DL	189.27	0.00	-78.08		
LL	45.58	0.00	89.50	LL	45.58	0.00	89.50		
GROUP 3	-3.87	1.66	-34.04	GROUP 4	0.72	0.00	43.70		
SERVICE STRENGTH	230.98 300.27	1.66 2.16	-22.62 -29.41	SERVICE STRENGTH	235.57 306.24	0.00 0.00	55.12 71.66		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		MZ
DL	189.27	0.00	-78.08	DL	189.27	0.00	-78.08		
LL	0.00	0.00	0.00	LL	45.58	0.00	89.50		
GROUP 5	-6.89	4.93	-23.45	GROUP 6	-3.15	1.66	9.67		
SERVICE STRENGTH	182.38 227.98	4.93 6.16	-101.53 -126.91	SERVICE STRENGTH	231.70 289.63	1.66 2.08	21.09 26.36		

**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 129 MEM. 7 JT. 4

JMJ Jun-06  
 WDB 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>	$\delta_b$	$\delta_s$	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	345	10998	1.047	1.047	49	*
MZ	35.928	37.164	27.8	92.41	101.50	1.098	345	9970	1.052	1.052	97	

**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	6.41	0.00	0.000	236	10998	1.032	1.032	34	*
MZ	35.928	37.164	27.8	188.80	101.50	0.538	236	13606	1.025	1.025	194	

**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	2.16	0.00	0.000	300	10998	1.041	1.041	43	*
MZ	35.928	37.164	27.8	29.41	101.50	3.452	300	4699	1.100	1.100	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>	$\delta_b$	$\delta_s$	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	306	10998	1.041	1.041	44	*
MZ	35.928	37.164	27.8	71.66	101.50	1.417	306	8657	1.053	1.053	75	

**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	6.16	0.00	0.000	228	10998	1.031	1.031	33	*
MZ	35.928	37.164	27.8	126.91	101.50	0.800	228	11624	1.029	1.029	131	

**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	2.08	0.00	0.000	290	10998	1.039	1.039	41	*
MZ	35.928	37.164	27.8	26.36	101.50	3.850	290	4313	1.106	1.106	40	*

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 7 JT. 8

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		P HLB 129			P MEMBER 7			P JOINT 8		
		<u>GROUP 1</u>				<u>GROUP 2</u>				
		P	MY	MZ		P	MY	MZ		
DL		-283.76	0.00	-25.07	DL	-283.76	0.00	-25.07		
LL		-106.83	0.00	8.73	LL	0.00	0.00	0.00		
GROUP 1		0.00	0.00	0.00	GROUP 2	7.76	344.55	-75.25		
SERVICE STRENGTH		-390.59	0.00	-16.34	SERVICE STRENGTH	-276.00	344.55	-100.32		
		-600.35	0.00	-13.68		-358.80	447.92	-130.42		
		<u>GROUP 3</u>				<u>GROUP 4</u>				
		P	MY	MZ		P	MY	MZ		
DL		-283.76	0.00	-25.07	DL	-283.76	0.00	-25.07		
LL		-106.83	0.00	8.73	LL	-106.83	0.00	8.73		
GROUP 3		3.91	252.71	-36.59	GROUP 4	-0.72	0.00	216.98		
SERVICE STRENGTH		-386.68	252.71	-52.93	SERVICE STRENGTH	-391.31	0.00	200.64		
		-502.68	328.52	-68.81		-508.70	0.00	260.83		
		<u>GROUP 5</u>				<u>GROUP 6</u>				
		P	MY	MZ		P	MY	MZ		
DL		-283.76	0.00	-25.07	DL	-283.76	0.00	-25.07		
LL		0.00	0.00	0.00	LL	-106.83	0.00	8.73		
GROUP 5		7.04	344.55	141.74	GROUP 6	3.19	252.71	180.39		
SERVICE STRENGTH		-276.72	344.55	116.67	SERVICE STRENGTH	-387.40	252.71	164.05		
		-345.90	430.69	145.84		-484.25	315.89	205.06		

**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 129 MEM. 7 JT. 8

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	37.164	38.4	0.00	0.00	0.000	600	10998	1.085	1.085	86	*
MZ	35.928	37.164	27.8	13.68	32.59	2.383	600	6184	1.161	1.161	84	*

**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	447.92	0.00	0.000	359	10998	1.049	1.049	470	
MZ	35.928	37.164	27.8	130.42	32.59	0.250	359	16738	1.032	1.032	135	

**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	328.52	0.00	0.000	503	10998	1.070	1.070	351	
MZ	35.928	37.164	27.8	68.81	32.59	0.474	503	14197	1.053	1.053	72	

**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	509	10998	1.071	1.071	73	*
MZ	35.928	37.164	27.8	260.83	32.59	0.125	509	18597	1.041	1.041	271	

**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	430.69	0.00	0.000	346	10998	1.047	1.047	451	
MZ	35.928	37.164	27.8	145.84	32.59	0.223	346	17100	1.030	1.030	150	

**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	315.89	0.00	0.000	484	10998	1.067	1.067	337	
MZ	35.928	37.164	27.8	205.06	32.59	0.159	484	18052	1.040	1.040	213	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 7 JT. 8

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

	HLB 129			PMIN MEMBER 7			JOINT 8		
	<u>GROUP 1</u>				<u>GROUP 2</u>				
	P	MY	MZ		P	MY	MZ		
DL	-212.82	0.00	-25.07	DL	-212.82	0.00	-25.07		
LL	-45.58	0.00	38.44	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	7.76	344.55	-75.25		
SERVICE STRENGTH	-258.40 -375.42	0.00 0.00	13.37 50.70	SERVICE STRENGTH	-205.06 -266.58	344.55 447.92	-100.32 -130.42		
	<u>GROUP 3</u>				<u>GROUP 4</u>				
	P	MY	MZ		P	MY	MZ		
DL	-212.82	0.00	-25.07	DL	-212.82	0.00	-25.07		
LL	-45.58	0.00	38.44	LL	-45.58	0.00	38.44		
GROUP 3	3.91	252.71	-36.59	GROUP 4	-0.72	0.00	216.98		
SERVICE STRENGTH	-254.49 -330.84	252.71 328.52	-23.22 -30.19	SERVICE STRENGTH	-259.12 -336.86	0.00 0.00	230.35 299.46		
	<u>GROUP 5</u>				<u>GROUP 6</u>				
	P	MY	MZ		P	MY	MZ		
DL	-212.82	0.00	-25.07	DL	-212.82	0.00	-25.07		
LL	0.00	0.00	0.00	LL	-45.58	0.00	38.44		
GROUP 5	7.04	344.55	141.74	GROUP 6	3.19	252.71	180.39		
SERVICE STRENGTH	-205.78 -257.23	344.55 430.69	116.67 145.84	SERVICE STRENGTH	-255.21 -319.01	252.71 315.89	193.76 242.20		

**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 129 MEM. 7 JT. 8

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	37.164	38.4	0.00	0.00	0.000	375	10998	1.051	1.051	54	*
MZ	35.928	37.164	27.8	50.70	32.59	0.643	375	12734	1.044	1.044	53	

**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	447.92	0.00	0.000	267	10998	1.036	1.036	464	
MZ	35.928	37.164	27.8	130.42	32.59	0.250	267	16738	1.023	1.023	133	

**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	328.52	0.00	0.000	331	10998	1.045	1.045	343	
MZ	35.928	37.164	27.8	30.19	32.59	1.080	331	10060	1.049	1.049	46	*

**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	337	10998	1.046	1.046	48	*
MZ	35.928	37.164	27.8	299.46	32.59	0.109	337	18868	1.026	1.026	307	

**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	430.69	0.00	0.000	257	10998	1.035	1.035	446	
MZ	35.928	37.164	27.8	145.84	32.59	0.223	257	17100	1.022	1.022	149	

**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	315.89	0.00	0.000	319	10998	1.043	1.043	330	
MZ	35.928	37.164	27.8	242.20	32.59	0.135	319	18440	1.025	1.025	248	

\* MINIMUM MOMENT CONTROLS

```
0000000 00000 00000 00000 00000 00
00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00
00 00 00 0000000 00 00 00 00
0000000 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00
00 00000 00 00 00000 00000 00000 (TM)
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*SMS 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\HLB129\PCACOL~1\M7PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #129 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

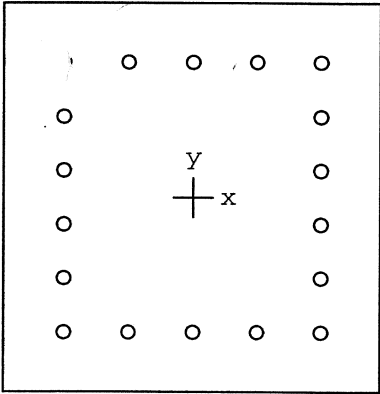
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	560.0	80.0	78.0	878.6	853.8	10.965
2	318.0	45.0	195.0	274.4	1188.8	6.096
3	462.0	66.0	110.0	618.7	1031.6	9.377
4	468.0	67.0	65.0	855.4	831.0	12.776
5	307.0	44.0	132.0	383.0	1153.0	8.732
6	445.0	64.0	62.0	849.0	823.6	13.275
7	345.0	49.0	97.0	539.7	1069.0	11.019
8	236.0	34.0	194.0	211.8	1205.7	6.215
9	300.0	43.0	42.0	858.1	838.1	19.955
10	306.0	44.0	75.0	609.0	1037.4	13.835
11	228.0	33.0	131.0	295.5	1180.1	9.006
12	290.0	41.0	40.0	860.0	838.9	20.974
13	600.0	86.0	84.0	886.7	863.7	10.297
14	359.0	470.0	135.0	1178.7	337.7	2.507
15	503.0	351.0	72.0	1251.8	257.7	3.567

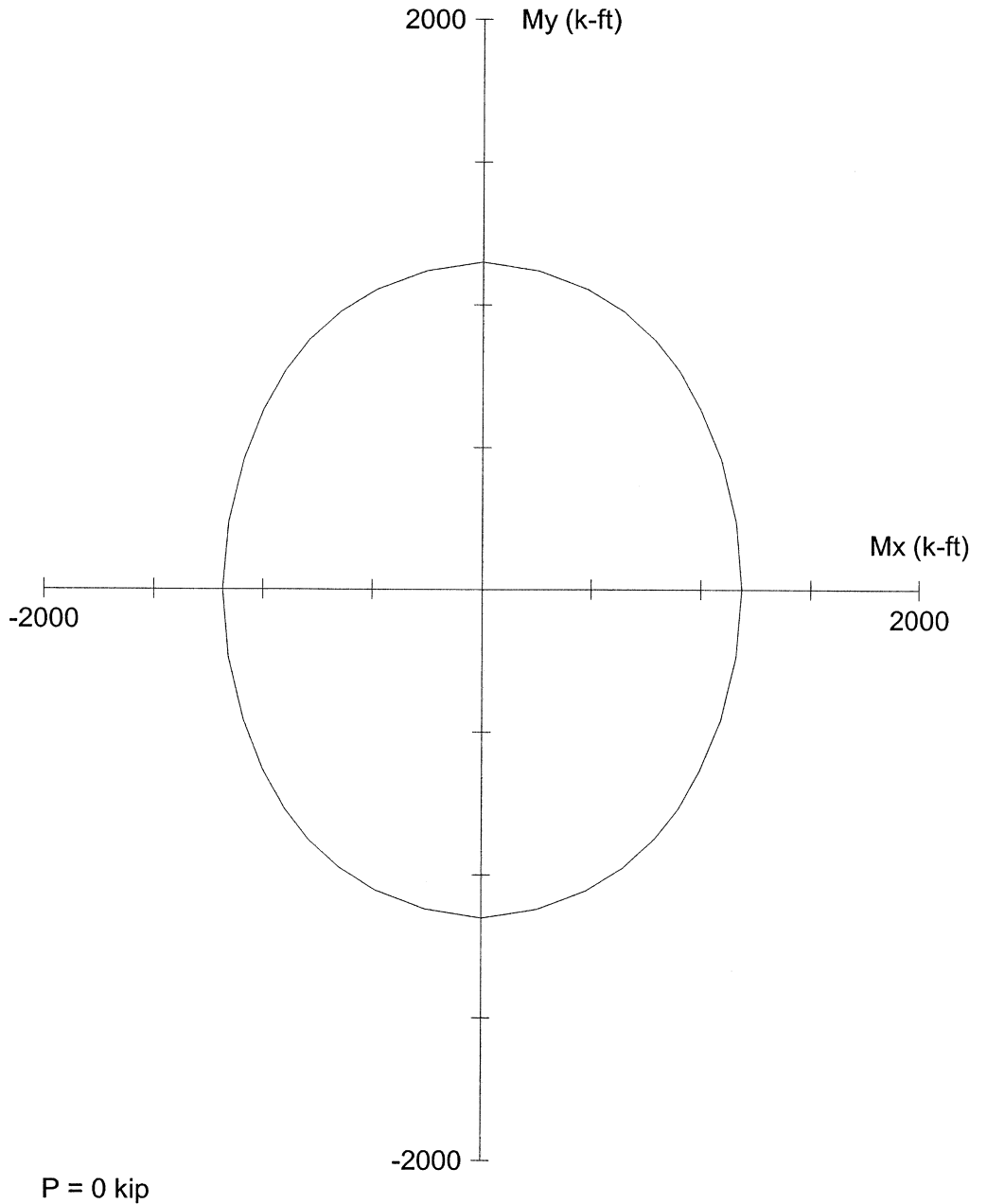
16	509.0	73.0	271.0	327.9	1218.8	4.497
17	346.0	451.0	150.0	1163.0	385.5	2.578
18	484.0	337.0	213.0	1025.2	646.8	3.041
19	375.0	54.0	53.0	839.3	824.8	15.552
20	267.0	464.0	133.0	1188.2	341.5	2.561
21	331.0	343.0	46.0	1242.2	164.9	3.621
22	337.0	48.0	307.0	189.7	1212.0	3.948
23	257.0	446.0	149.0	1167.5	390.8	2.618
24	319.0	330.0	248.0	957.1	721.6	2.904

\*\*\* 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: 14:30:05



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

File: S:\DGN-ST\NORTHHC~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M7PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #129

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

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

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

JMS 7/06  
WDB 7/06

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

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BASED ON FIELD DATA  
ASSUME 50% COVER LOSS.  
 $f_c = 4400 \text{ PSI}$

General Information:

=====

File Name: S:\DGN-ST\NORTH~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M7ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #129 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)

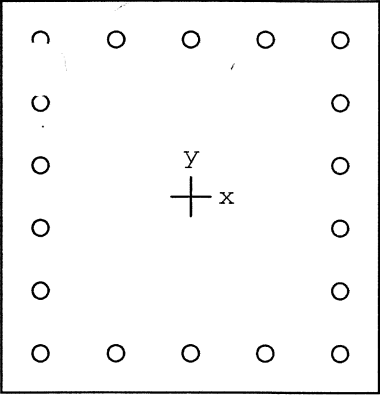
=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	560.0	80.0	78.0	834.5	815.7	10.444
2	318.0	45.0	195.0	261.5	1137.7	5.833
3	462.0	66.0	110.0	588.7	980.5	8.915
4	468.0	67.0	65.0	811.7	789.6	12.131
5	307.0	44.0	132.0	365.7	1101.9	8.344
6	445.0	64.0	62.0	805.9	782.9	12.609
7	345.0	49.0	97.0	519.6	1030.4	10.619
8	236.0	34.0	194.0	200.8	1146.4	5.909
9	300.0	43.0	42.0	826.4	806.5	19.211
10	306.0	44.0	75.0	584.1	995.7	13.276
11	228.0	33.0	131.0	281.5	1123.6	8.574
12	290.0	41.0	40.0	827.4	806.5	20.172
13	600.0	86.0	84.0	845.4	823.8	9.819
14	359.0	470.0	135.0	1134.1	327.5	2.414
15	503.0	351.0	72.0	1184.7	241.4	3.374

16	509.0	73.0	271.0	310.9	1151.4	4.249
17	346.0	451.0	150.0	1115.5	373.1	2.475
18	484.0	337.0	213.0	974.8	614.6	2.891
19	375.0	54.0	53.0	815.4	800.8	15.104
20	267.0	464.0	133.0	1134.2	324.7	2.444
21	331.0	343.0	46.0	1186.8	159.3	3.460
22	337.0	48.0	307.0	182.8	1161.9	3.785
23	257.0	446.0	149.0	1113.0	372.6	2.496
24	319.0	330.0	248.0	926.2	694.9	2.805

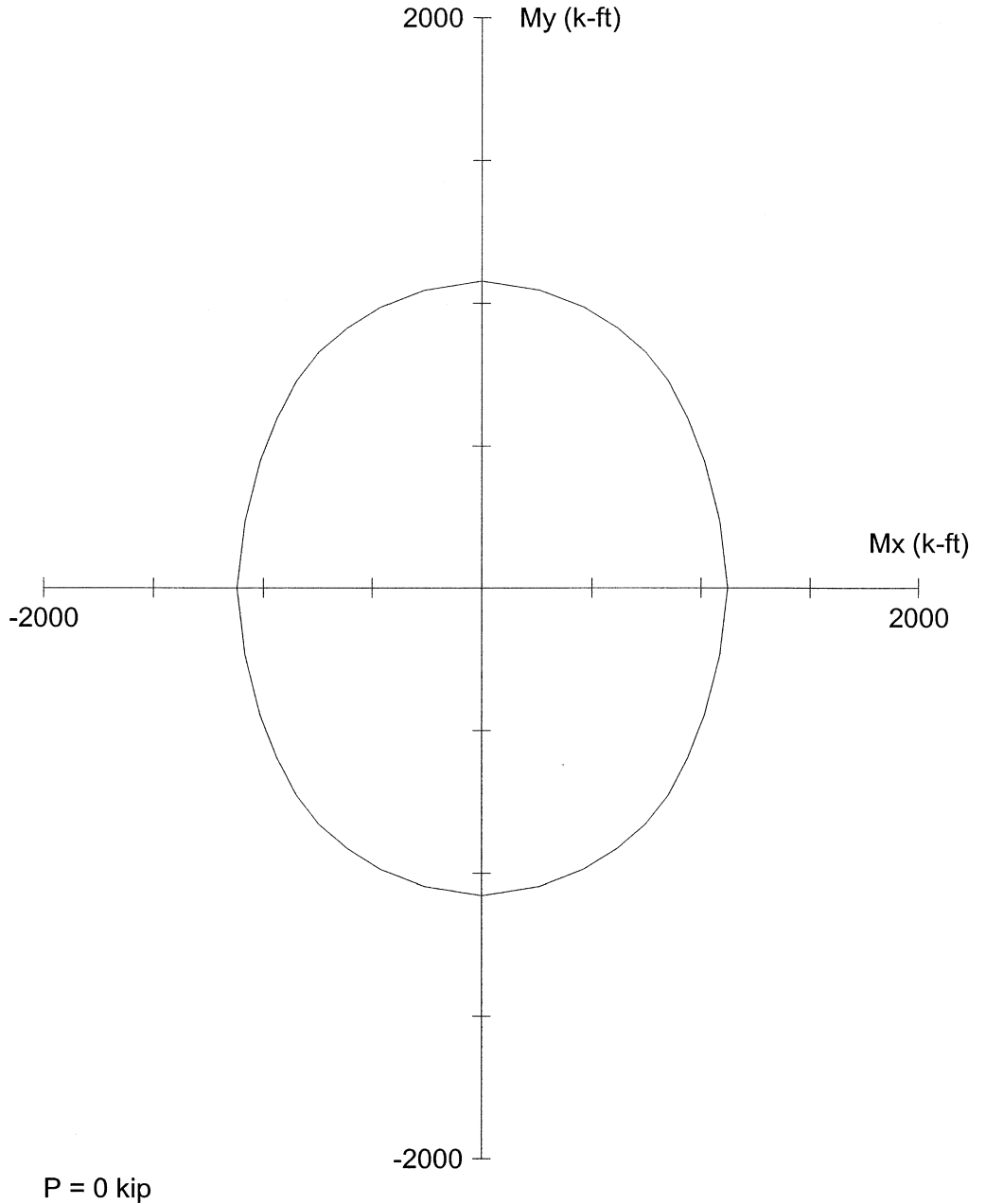
\*\*\* Program completed as requested! \*\*\*





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: 12:18:07



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

File: S:\DGN-ST\NORTHC~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M7ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #129

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

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

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 9 JT. 7

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 129			P MEMBER 9			JOINT 7			
		GROUP 1			GROUP 2			GROUP 3			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	265.95	0.00	43.28	DL	265.95	0.00	43.28	DL	265.95	0.00	43.28
LL	105.16	0.00	-15.20	LL	0.00	0.00	0.00	LL	105.16	0.00	-15.20
GROUP 1	0.00	0.00	0.00	GROUP 2	13.52	333.16	-13.88	GROUP 3	6.68	249.28	-7.07
SERVICE STRENGTH	371.11 573.58	0.00 0.00	28.08 23.33	SERVICE STRENGTH	279.47 363.31	333.16 433.11	29.40 38.22	SERVICE STRENGTH	377.79 491.13	249.28 324.06	21.01 27.31
		GROUP 4			GROUP 5			GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	265.95	0.00	43.28	DL	265.95	0.00	43.28	DL	265.95	0.00	43.28
LL	105.16	0.00	-15.20	LL	105.16	0.00	-15.20	LL	105.16	0.00	-15.20
GROUP 4	6.68	249.28	-7.07	GROUP 5	-28.20	0.00	-577.51	GROUP 6	-21.52	249.28	-584.58
SERVICE STRENGTH	342.91 445.78	0.00 0.00	-549.43 -714.26	SERVICE STRENGTH	251.27 314.09	333.16 416.45	-548.11 -685.14	SERVICE STRENGTH	349.59 436.99	249.28 311.60	-556.50 -695.63

**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.	
$r_y = 0.30 * D =$	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 129 MEM. 9 JT. 7

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	0.00	0.00	0.000	574	0	1.000	1.000	97	*
MZ	35.928	47.364	3.3	23.33	56.26	2.412	574	0	1.000	1.000	80	*

**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	433.11	0.00	0.000	363	0	1.000	1.000	433	
MZ	35.928	47.364	3.3	38.22	56.26	1.472	363	0	1.000	1.000	51	*

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	324.06	0.00	0.000	491	0	1.000	1.000	324	
MZ	35.928	47.364	3.3	27.31	56.26	2.060	491	0	1.000	1.000	69	*

**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	446	0	1.000	1.000	75	*
MZ	35.928	47.364	3.3	714.26	56.26	0.079	446	0	1.000	1.000	714	

**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	416.45	0.00	0.000	314	0	1.000	1.000	416	
MZ	35.928	47.364	3.3	685.14	56.26	0.082	314	0	1.000	1.000	685	

**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	311.60	0.00	0.000	437	0	1.000	1.000	312	
MZ	35.928	47.364	3.3	695.63	56.26	0.081	437	0	1.000	1.000	696	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 9 JT. 7

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				PMIN					
				HLB 129	MEMBER 9	JOINT 7			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		
DL	199.46	0.00	43.28	DL	199.46	0.00	43.28		
LL	46.57	0.00	-16.50	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	13.52	333.16	-13.88		
SERVICE	246.03	0.00	26.78	SERVICE	212.98	333.16	29.40		
STRENGTH	360.20	0.00	20.51	STRENGTH	276.88	433.11	38.22		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		
DL	199.46	0.00	43.28	DL	199.46	0.00	43.28		
LL	46.57	0.00	-16.50	LL	46.57	0.00	-16.50		
GROUP 3	6.68	249.28	-7.07	GROUP 4	-28.20	0.00	-577.51		
SERVICE	252.71	249.28	19.71	SERVICE	217.83	0.00	-550.73		
STRENGTH	328.53	324.06	25.62	STRENGTH	283.18	0.00	-715.95		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		
DL	199.46	0.00	43.28	DL	199.46	0.00	43.28		
LL	0.00	0.00	0.00	LL	46.57	0.00	-16.50		
GROUP 5	-14.68	333.16	-591.39	GROUP 6	-21.52	249.28	-584.58		
SERVICE	184.78	333.16	-548.11	SERVICE	224.51	249.28	-557.80		
STRENGTH	230.98	416.45	-685.14	STRENGTH	280.64	311.60	-697.25		

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

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	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 129 MEM. 9 JT. 7

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	0.00	0.00	0.000	360	0	1.000	1.000	61	*
MZ	35.928	47.364	3.3	20.51	56.26	2.743	360	0	1.000	1.000	50	*

**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	433.11	0.00	0.000	277	0	1.000	1.000	433	
MZ	35.928	47.364	3.3	38.22	56.26	1.472	277	0	1.000	1.000	39	*

**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	324.06	0.00	0.000	329	0	1.000	1.000	324	
MZ	35.928	47.364	3.3	25.62	56.26	2.196	329	0	1.000	1.000	46	*

**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	283	0	1.000	1.000	48	*
MZ	35.928	47.364	3.3	715.95	56.26	0.079	283	0	1.000	1.000	716	

**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	416.45	0.00	0.000	231	0	1.000	1.000	416	
MZ	35.928	47.364	3.3	685.14	56.26	0.082	231	0	1.000	1.000	685	

**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	311.60	0.00	0.000	281	0	1.000	1.000	312	
MZ	35.928	47.364	3.3	697.25	56.26	0.081	281	0	1.000	1.000	697	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 9 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 129				P MEMBER 9				JOINT FOOTING															
GROUP 1				GROUP 2				GROUP 3				GROUP 4				GROUP 5				GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ		P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	270.38	0.00	26.20	DL	270.38	0.00	26.20	DL	270.38	0.00	26.20	DL	270.38	0.00	26.20	DL	270.38	0.00	26.20	DL	270.38	0.00	26.20
LL	105.16	0.00	-4.26	LL	0.00	0.00	0.00	LL	105.16	0.00	-4.26	LL	105.16	0.00	-4.26	LL	0.00	0.00	0.00	LL	105.16	0.00	-4.26
GROUP 1	0.00	0.00	0.00	GROUP 2	13.54	382.85	-32.13	GROUP 3	6.69	280.75	-15.47	GROUP 4	-28.20	0.00	550.50	GROUP 5	-14.67	382.85	518.37	GROUP 6	-21.50	280.75	535.03
SERVICE STRENGTH	375.54	0.00	21.94	SERVICE STRENGTH	283.92	382.85	-5.93	SERVICE STRENGTH	382.23	280.75	6.47	SERVICE STRENGTH	347.34	0.00	572.44	SERVICE STRENGTH	255.72	382.85	544.57	SERVICE STRENGTH	354.04	280.75	556.97
SERVICE STRENGTH	579.35	0.00	24.83	SERVICE STRENGTH	369.10	497.71	-7.71	SERVICE STRENGTH	496.90	364.98	8.41	SERVICE STRENGTH	451.55	0.00	744.17	SERVICE STRENGTH	319.65	478.56	680.71	SERVICE STRENGTH	442.55	350.94	696.21

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

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			Depth of Rect. Col. =	D =	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 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 129 MEM. 9 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	579	0	1.000	1.000	98	*
MZ	35.928	47.364	3.3	24.83	34.06	1.372	579	0	1.000	1.000	81	*

**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	497.71	0.00	0.000	369	0	1.000	1.000	498	
MZ	35.928	47.364	3.3	7.71	34.06	4.418	369	0	1.000	1.000	52	*

**GROUP 3**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	364.98	0.00	0.000	497	0	1.000	1.000	365	
MZ	35.928	47.364	3.3	8.41	34.06	4.049	497	0	1.000	1.000	69	*

**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	452	0	1.000	1.000	76	*
MZ	35.928	47.364	3.3	744.17	34.06	0.046	452	0	1.000	1.000	744	

**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	478.56	0.00	0.000	320	0	1.000	1.000	479	
MZ	35.928	47.364	3.3	680.71	34.06	0.050	320	0	1.000	1.000	681	

**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	350.94	0.00	0.000	443	0	1.000	1.000	351	
MZ	35.928	47.364	3.3	696.21	34.06	0.049	443	0	1.000	1.000	696	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 9 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

HLB 129				PMIN MEMBER 9			
GROUP 1				GROUP 2			
	P	MY	MZ		P	MY	MZ
DL	202.79	0.00	26.20	DL	202.79	0.00	26.20
LL	46.57	0.00	-14.75	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	13.54	382.85	-32.13
SERVICE STRENGTH	249.36 364.53	0.00 0.00	11.45 2.10	SERVICE STRENGTH	216.33 281.23	382.85 497.71	-5.93 -7.71

HLB 129				PMIN MEMBER 9			
GROUP 3				GROUP 4			
	P	MY	MZ		P	MY	MZ
DL	202.79	0.00	26.20	DL	202.79	0.00	26.20
LL	46.57	0.00	-14.75	LL	46.57	0.00	-14.75
GROUP 3	6.69	280.75	-15.47	GROUP 4	-28.20	0.00	550.50
SERVICE STRENGTH	256.05 332.86	280.75 364.98	-4.02 -5.23	SERVICE STRENGTH	221.16 287.50	0.00 0.00	561.95 730.54

HLB 129				PMIN MEMBER 9			
GROUP 5				GROUP 6			
	P	MY	MZ		P	MY	MZ
DL	202.79	0.00	26.20	DL	202.79	0.00	26.20
LL	0.00	0.00	0.00	LL	46.57	0.00	-14.75
GROUP 5	-14.67	382.85	518.37	GROUP 6	-21.50	280.75	535.03
SERVICE STRENGTH	188.12 235.15	382.85 478.56	544.57 680.71	SERVICE STRENGTH	227.86 284.82	280.75 350.94	546.48 683.10

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

$f_c =$	3000	psi	$\phi =$	0.70	$W_c =$	150	PCF
$E_c = W_c^{1.5} * 33 * f_c^{0.5} =$	3320561	PSI	Width of Rect. Col. =	B =	35.928	In.	
			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 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 129 MEM. 9 JT. FOOTING

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>	$\delta_b$	$\delta_s$	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	365	0	1.000	1.000	61	*
MZ	35.928	47.364	3.3	2.10	34.06	16.206	365	0	1.000	1.000	51	*

**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	497.71	0.00	0.000	281	0	1.000	1.000	498	
MZ	35.928	47.364	3.3	7.71	34.06	4.418	281	0	1.000	1.000	39	*

**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	364.98	0.00	0.000	333	0	1.000	1.000	365	
MZ	35.928	47.364	3.3	5.23	34.06	6.517	333	0	1.000	1.000	47	*

**GROUP 4**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	$\delta_b$	$\delta_s$	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	288	0	1.000	1.000	48	*
MZ	35.928	47.364	3.3	730.54	34.06	0.047	288	0	1.000	1.000	731	

**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	478.56	0.00	0.000	235	0	1.000	1.000	479	
MZ	35.928	47.364	3.3	680.71	34.06	0.050	235	0	1.000	1.000	681	

**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	350.94	0.00	0.000	285	0	1.000	1.000	351	
MZ	35.928	47.364	3.3	683.10	34.06	0.050	285	0	1.000	1.000	683	

\* MINIMUM MOMENT CONTROLS

JMS 7/06  
WDB 7/06

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

General Information:

=====

File Name: S:\DGN-ST\NORTH~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M9PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #129 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

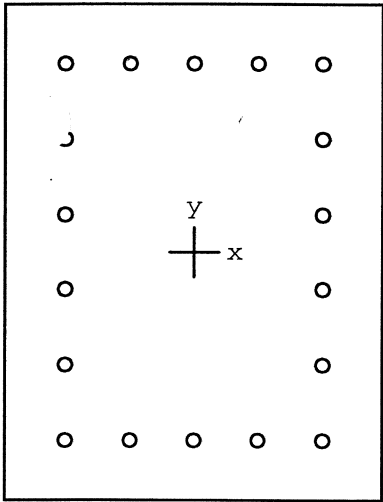
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	574.0	97.0	80.0	1212.4	998.3	12.491
2	363.0	433.0	51.0	1802.1	214.3	4.162
3	491.0	324.0	69.0	1747.6	374.9	5.396
4	446.0	75.0	714.0	143.4	1365.9	1.913
5	314.0	416.0	685.0	739.6	1214.2	1.774
6	437.0	312.0	696.0	572.6	1280.5	1.839
7	360.0	61.0	50.0	1205.8	987.4	19.760
8	277.0	433.0	39.0	1788.3	163.0	4.130
9	329.0	324.0	46.0	1779.1	252.6	5.491
10	283.0	48.0	716.0	91.3	1328.3	1.855
11	231.0	416.0	685.0	726.6	1191.8	1.742
12	281.0	312.0	697.0	564.3	1256.4	1.804
13	579.0	98.0	81.0	1211.2	1002.2	12.365
14	369.0	498.0	52.0	1812.3	187.4	3.639
15	497.0	365.0	69.0	1768.2	332.8	4.844

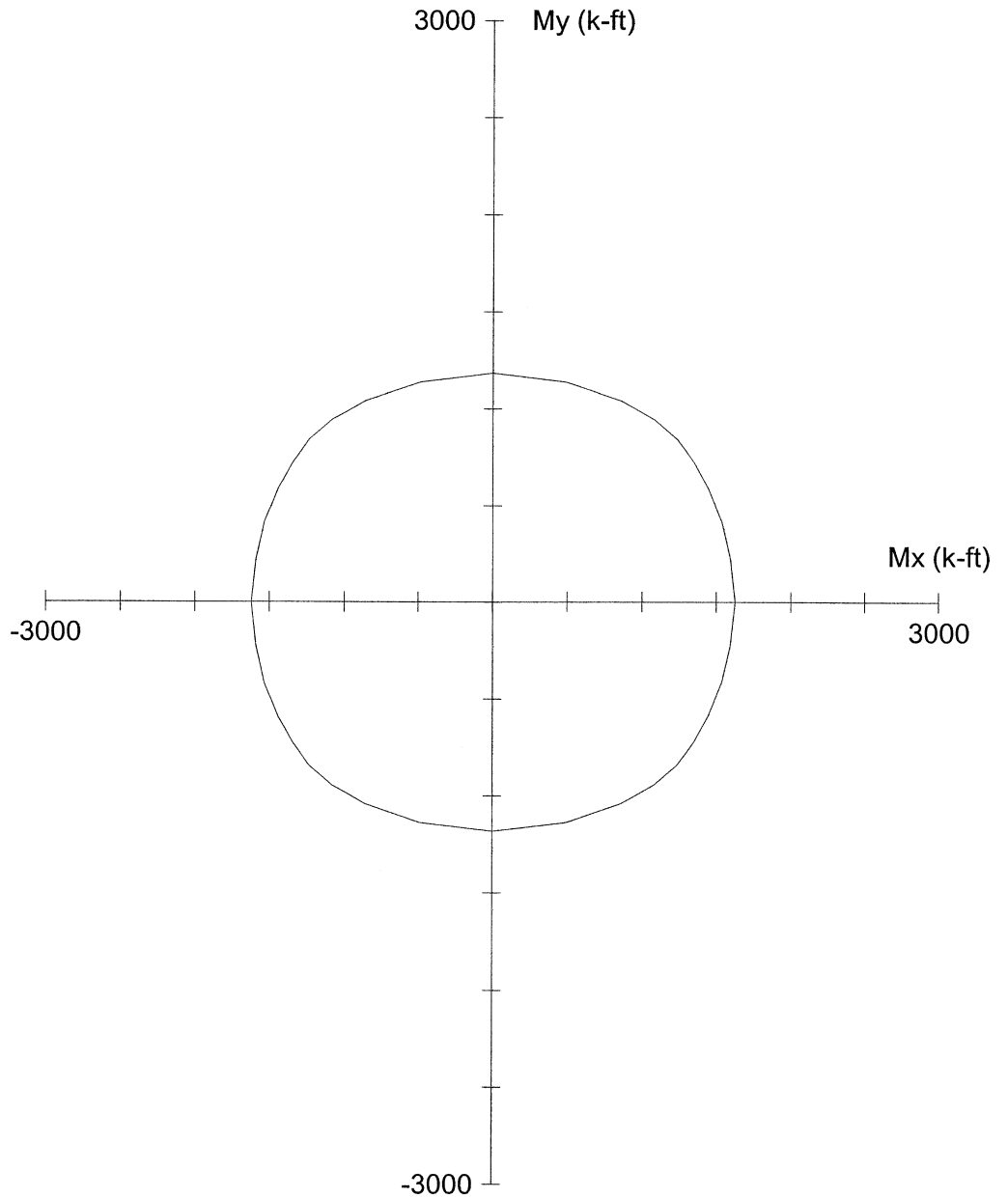
16	452.0	76.0	744.0	139.3	1367.0	1.837
17	320.0	479.0	681.0	833.2	1181.5	1.736
18	443.0	351.0	696.0	637.4	1261.9	1.814
19	365.0	61.0	51.0	1194.2	995.5	19.553
20	281.0	498.0	39.0	1794.6	139.4	3.603
21	333.0	365.0	47.0	1787.5	231.8	4.898
22	288.0	48.0	731.0	85.9	1330.4	1.820
23	235.0	479.0	681.0	820.1	1161.7	1.708
24	285.0	351.0	683.0	635.7	1237.7	1.812

\*\*\* 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: 14:34:14



P = 0 kip

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

File: S:\DGN-ST\NORTH-C~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M9PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #129

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

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

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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 FIELD DATA.  
ASSUME 50% COVER LOSS.  
 $f'_c = 4400 \text{ PSI}$

General Information:

=====

File Name: S:\DGN-ST\NORTH~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M9ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #129 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)

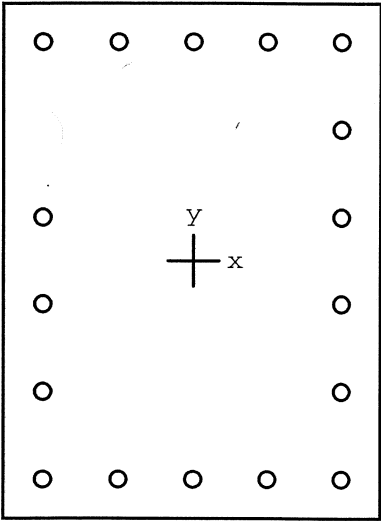
=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	574.0	97.0	80.0	1169.3	963.5	12.051
2	363.0	433.0	51.0	1755.2	204.3	4.053
3	491.0	324.0	69.0	1730.8	365.5	5.340
4	446.0	75.0	714.0	137.7	1313.5	1.840
5	314.0	416.0	685.0	705.5	1157.4	1.691
6	437.0	312.0	696.0	552.1	1234.0	1.772
7	360.0	61.0	50.0	1173.4	961.1	19.230
8	277.0	433.0	39.0	1728.2	156.6	3.991
9	329.0	324.0	46.0	1727.7	243.7	5.332
10	283.0	48.0	716.0	84.4	1264.5	1.766
11	231.0	416.0	685.0	688.2	1130.5	1.651
12	281.0	312.0	697.0	536.7	1194.5	1.715
13	579.0	98.0	81.0	1166.0	965.0	11.904
14	369.0	498.0	52.0	1764.8	182.3	3.543
15	497.0	365.0	69.0	1749.4	330.8	4.793

16	452.0	76.0	744.0	136.0	1315.0	1.768
17	320.0	479.0	681.0	795.7	1130.5	1.660
18	443.0	351.0	696.0	613.7	1218.5	1.750
19	365.0	61.0	51.0	1159.5	971.0	19.020
20	281.0	498.0	39.0	1735.3	133.7	3.484
21	333.0	365.0	47.0	1736.9	222.1	4.758
22	288.0	48.0	731.0	82.3	1267.0	1.733
23	235.0	479.0	681.0	778.6	1103.6	1.622
24	285.0	351.0	683.0	604.2	1176.5	1.722

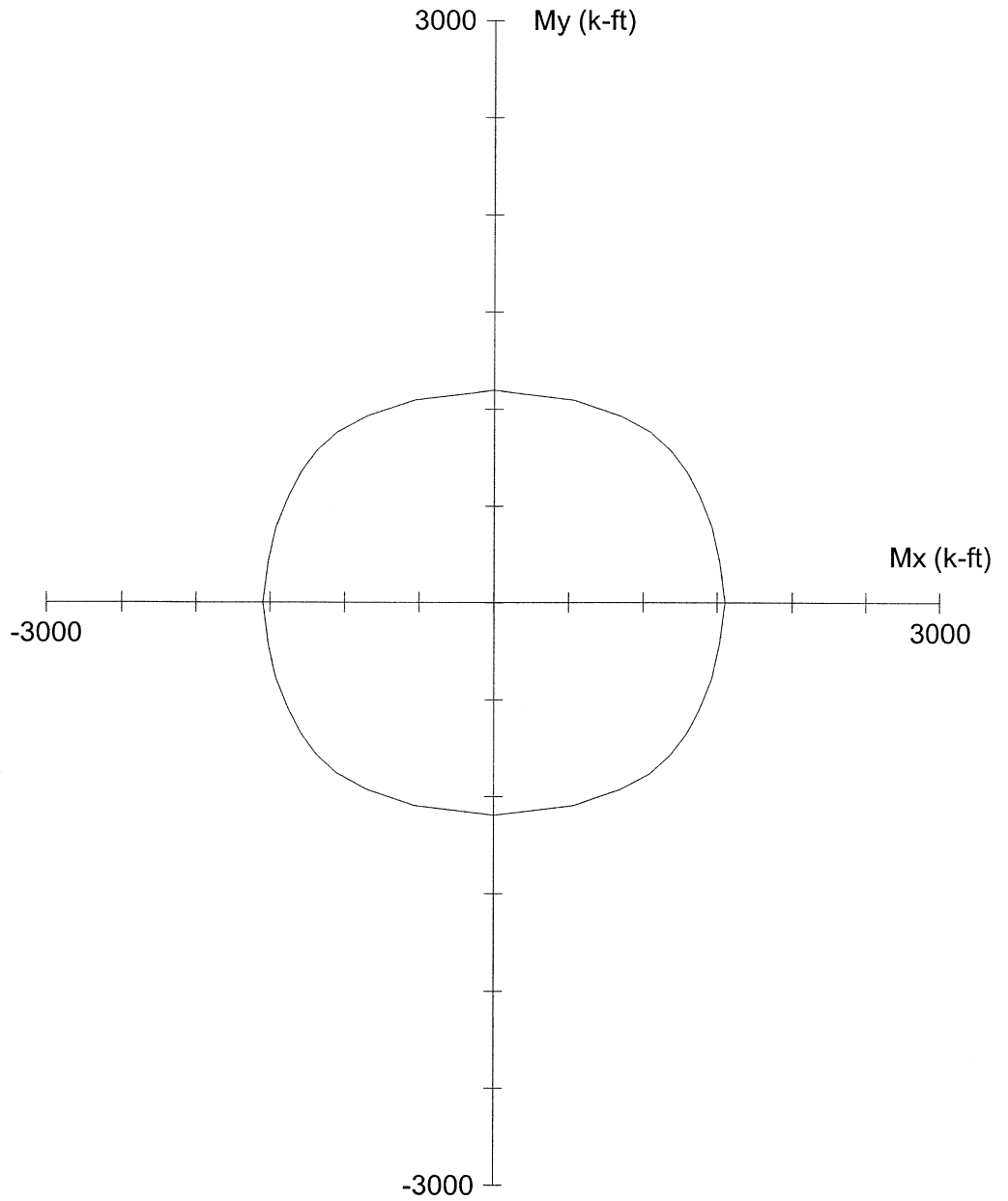
\*\*\* Program completed as requested! \*\*\*





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: 12:18:22



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File: S:\DGN-ST\NORTH-C~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M9ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #129

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 129 MEM. 10 JT. 8

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

				<b>P MAX</b>					
				HLB 129	MEMBER 10	JOINT 8			
				<u>GROUP 1</u>			<u>GROUP 2</u>		
	P	MY	MZ		P	MY	MZ		
DL	296.01	0.00	41.05	DL	296.01	0.00	41.05		
LL	105.11	0.00	-15.21	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	-13.52	-344.79	13.89		
SERVICE	401.12	0.00	25.84	SERVICE	282.49	-344.79	54.94		
STRENGTH	612.55	0.00	20.41	STRENGTH	367.24	-448.23	71.42		
				<u>GROUP 3</u>			<u>GROUP 4</u>		
	P	MY	MZ		P	MY	MZ		
DL	296.01	0.00	41.05	DL	296.01	0.00	41.05		
LL	105.11	0.00	-15.21	LL	105.11	0.00	-15.21		
GROUP 3	-6.68	-252.77	7.07	GROUP 4	-28.20	0.00	-577.51		
SERVICE	394.44	-252.77	32.91	SERVICE	372.92	0.00	-551.67		
STRENGTH	512.77	-328.60	42.78	STRENGTH	484.80	0.00	-717.17		
				<u>GROUP 5</u>			<u>GROUP 6</u>		
	P	MY	MZ		P	MY	MZ		
DL	296.01	0.00	41.05	DL	296.01	0.00	41.05		
LL	0.00	0.00	0.00	LL	105.11	0.00	-15.21		
GROUP 5	-41.72	-344.79	-563.62	GROUP 6	-34.89	-252.77	-570.44		
SERVICE	254.29	-344.79	-522.57	SERVICE	366.23	-252.77	-544.60		
STRENGTH	317.86	-430.99	-653.21	STRENGTH	457.79	-315.96	-680.75		

**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 129 MEM. 10 JT. 8

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	0.00	0.00	0.000	613	0	1.000	1.000	103	*
MZ	35.928	47.364	3.3	20.41	53.37	2.615	613	0	1.000	1.000	86	*

**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	448.23	0.00	0.000	367	0	1.000	1.000	448	
MZ	35.928	47.364	3.3	71.42	53.37	0.747	367	0	1.000	1.000	71	

**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	328.60	0.00	0.000	513	0	1.000	1.000	329	
MZ	35.928	47.364	3.3	42.78	53.37	1.247	513	0	1.000	1.000	72	*

**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	485	0	1.000	1.000	82	*
MZ	35.928	47.364	3.3	717.17	53.37	0.074	485	0	1.000	1.000	717	

**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	430.99	0.00	0.000	318	0	1.000	1.000	431	
MZ	35.928	47.364	3.3	653.21	53.37	0.082	318	0	1.000	1.000	653	

**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	315.96	0.00	0.000	458	0	1.000	1.000	316	
MZ	35.928	47.364	3.3	680.75	53.37	0.078	458	0	1.000	1.000	681	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 10 JT. 8

JMJ Jun-06  
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**COLUMN LOADS**

				PMIN					
				HLB 129	MEMBER 10	JOINT 8			
				GROUP 1			GROUP 2		
	P	MY	MZ		P	MY	MZ		
DL	222.01	0.00	41.05	DL	222.01	0.00	41.05		
LL	46.52	0.00	-16.51	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	-13.52	-344.79	13.89		
SERVICE STRENGTH	268.53 389.40	0.00 0.00	24.54 17.59	SERVICE STRENGTH	208.49 271.03	-344.79 -448.23	54.94 71.42		
				GROUP 3			GROUP 4		
	P	MY	MZ		P	MY	MZ		
DL	222.01	0.00	41.05	DL	222.01	0.00	41.05		
LL	46.52	0.00	-16.51	LL	46.52	0.00	-16.51		
GROUP 3	-6.68	-252.77	7.07	GROUP 4	-28.20	0.00	-577.51		
SERVICE STRENGTH	261.85 340.40	-252.77 -328.60	31.61 41.09	SERVICE STRENGTH	240.33 312.43	0.00 0.00	-552.97 -718.86		
				GROUP 5			GROUP 6		
	P	MY	MZ		P	MY	MZ		
DL	222.01	0.00	41.05	DL	222.01	0.00	41.05		
LL	0.00	0.00	0.00	LL	46.52	0.00	-16.51		
GROUP 5	-41.72	-344.79	-563.62	GROUP 6	-34.89	-252.77	-570.44		
SERVICE STRENGTH	180.29 225.36	-344.79 -430.99	-522.57 -653.21	SERVICE STRENGTH	233.64 292.05	-252.77 -315.96	-545.90 -682.38		

**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 129 MEM. 10 JT. 8

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	47.364	0.0	0.00	0.00	0.000	389	0	1.000	1.000	66	*
MZ	35.928	47.364	3.3	17.59	53.37	3.033	389	0	1.000	1.000	54	*

**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	448.23	0.00	0.000	271	0	1.000	1.000	448	
MZ	35.928	47.364	3.3	71.42	53.37	0.747	271	0	1.000	1.000	71	

**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	328.60	0.00	0.000	340	0	1.000	1.000	329	
MZ	35.928	47.364	3.3	41.09	53.37	1.299	340	0	1.000	1.000	48	*

**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	312	0	1.000	1.000	53	*
MZ	35.928	47.364	3.3	718.86	53.37	0.074	312	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	430.99	0.00	0.000	225	0	1.000	1.000	431	
MZ	35.928	47.364	3.3	653.21	53.37	0.082	225	0	1.000	1.000	653	

**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	315.96	0.00	0.000	292	0	1.000	1.000	316	
MZ	35.928	47.364	3.3	682.38	53.37	0.078	292	0	1.000	1.000	682	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

		HLB 129			P MEMBER 10			JOINT FOOTING			
		GROUP 1			GROUP 2			GROUP 2			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	300.44	0.00	28.69	DL	300.44	0.00	28.69	DL	300.44	0.00	28.69
LL	105.11	0.00	-4.27	LL	0.00	0.00	0.00	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	-13.54	-397.02	32.14	GROUP 2	-13.54	-397.02	32.14
SERVICE	405.55	0.00	24.42	SERVICE	286.90	-397.02	60.83	SERVICE	286.90	-397.02	60.83
STRENGTH	618.31	0.00	28.05	STRENGTH	372.97	-516.13	79.08	STRENGTH	372.97	-516.13	79.08
		GROUP 3			GROUP 4			GROUP 4			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	300.44	0.00	28.69	DL	300.44	0.00	28.69	DL	300.44	0.00	28.69
LL	105.11	0.00	-4.27	LL	105.11	0.00	-4.27	LL	105.11	0.00	-4.27
GROUP 3	-6.69	-285.00	15.47	GROUP 4	-28.20	0.00	550.50	GROUP 4	-28.20	0.00	550.50
SERVICE	398.86	-285.00	39.89	SERVICE	377.35	0.00	574.92	SERVICE	377.35	0.00	574.92
STRENGTH	518.52	-370.50	51.86	STRENGTH	490.55	0.00	747.40	STRENGTH	490.55	0.00	747.40
		GROUP 5			GROUP 6			GROUP 6			
	P	MY	MZ		P	MY	MZ		P	MY	MZ
DL	300.44	0.00	28.69	DL	300.44	0.00	28.69	DL	300.44	0.00	28.69
LL	0.00	0.00	0.00	LL	105.11	0.00	-4.27	LL	105.11	0.00	-4.27
GROUP 5	-41.74	-397.02	582.64	GROUP 6	-34.89	-285.00	565.97	GROUP 6	-34.89	-285.00	565.97
SERVICE	258.70	-397.02	611.33	SERVICE	370.66	-285.00	590.39	SERVICE	370.66	-285.00	590.39
STRENGTH	323.37	-496.28	764.16	STRENGTH	463.32	-356.25	737.99	STRENGTH	463.32	-356.25	737.99

**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 129 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	0.00	0.00	0.000	618	0	1.000	1.000	104	*
MZ	35.928	47.364	3.3	28.05	37.30	1.330	618	0	1.000	1.000	86	*

**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	516.13	0.00	0.000	373	0	1.000	1.000	516	
MZ	35.928	47.364	3.3	79.08	37.30	0.472	373	0	1.000	1.000	79	

**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	370.50	0.00	0.000	519	0	1.000	1.000	371	
MZ	35.928	47.364	3.3	51.86	37.30	0.719	519	0	1.000	1.000	72	*

**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	491	0	1.000	1.000	83	*
MZ	35.928	47.364	3.3	747.40	37.30	0.050	491	0	1.000	1.000	747	

**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	496.28	0.00	0.000	323	0	1.000	1.000	496	
MZ	35.928	47.364	3.3	764.16	37.30	0.049	323	0	1.000	1.000	764	

**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	356.25	0.00	0.000	463	0	1.000	1.000	356	
MZ	35.928	47.364	3.3	737.99	37.30	0.051	463	0	1.000	1.000	738	

\* MINIMUM MOMENT CONTROLS

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**COLUMN LOADS**

	HLB 129			PMIN MEMBER 10			JOINT FOOTING		
	<u>GROUP 1</u>				<u>GROUP 2</u>				
	P	MY	MZ		P	MY	MZ		
DL	225.33	0.00	28.69	DL	225.33	0.00	28.69		
LL	46.52	0.00	-14.77	LL	0.00	0.00	0.00		
GROUP 1	0.00	0.00	0.00	GROUP 2	-13.54	-397.02	32.14		
SERVICE	271.85	0.00	13.92	SERVICE	211.79	-397.02	60.83		
STRENGTH	393.72	0.00	5.30	STRENGTH	275.33	-516.13	79.08		
	<u>GROUP 3</u>				<u>GROUP 4</u>				
	P	MY	MZ		P	MY	MZ		
DL	225.33	0.00	28.69	DL	225.33	0.00	28.69		
LL	46.52	0.00	-14.77	LL	46.52	0.00	-14.77		
GROUP 3	-6.69	-285.00	15.47	GROUP 4	-28.20	0.00	550.50		
SERVICE	265.16	-285.00	29.39	SERVICE	243.65	0.00	564.42		
STRENGTH	344.71	-370.50	38.21	STRENGTH	316.74	0.00	733.75		
	<u>GROUP 5</u>				<u>GROUP 6</u>				
	P	MY	MZ		P	MY	MZ		
DL	225.33	0.00	28.69	DL	225.33	0.00	28.69		
LL	0.00	0.00	0.00	LL	46.52	0.00	-14.77		
GROUP 5	-41.74	-397.02	582.64	GROUP 6	-34.89	-285.00	565.97		
SERVICE	183.59	-397.02	611.33	SERVICE	236.96	-285.00	579.89		
STRENGTH	229.49	-496.28	764.16	STRENGTH	296.20	-356.25	724.86		

**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 129 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

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

**GROUP 1**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	0.00	0.00	0.000	394	0	1.000	1.000	66	*
MZ	35.928	47.364	3.3	5.30	37.30	7.043	394	0	1.000	1.000	55	*

**GROUP 2**

	B	D	KL/R	M <sub>U</sub>	M <sub>DL</sub>	B <sub>D</sub>	P <sub>U</sub>	P <sub>C</sub>	δ <sub>b</sub>	δ <sub>s</sub>	M <sub>C</sub>	
	In.	In.		Ft. Kips	Ft. Kips		Kips	Kips			Ft. Kips	
MY	35.928	47.364	0.0	516.13	0.00	0.000	275	0	1.000	1.000	516	
MZ	35.928	47.364	3.3	79.08	37.30	0.472	275	0	1.000	1.000	79	

**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	370.50	0.00	0.000	345	0	1.000	1.000	371	
MZ	35.928	47.364	3.3	38.21	37.30	0.976	345	0	1.000	1.000	48	*

**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	317	0	1.000	1.000	53	*
MZ	35.928	47.364	3.3	733.75	37.30	0.051	317	0	1.000	1.000	734	

**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	496.28	0.00	0.000	229	0	1.000	1.000	496	
MZ	35.928	47.364	3.3	764.16	37.30	0.049	229	0	1.000	1.000	764	

**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	356.25	0.00	0.000	296	0	1.000	1.000	356	
MZ	35.928	47.364	3.3	724.86	37.30	0.051	296	0	1.000	1.000	725	

\* MINIMUM MOMENT CONTROLS

*Jms 7/06*  
*WDB 7/06*

```
0000000 00000 00000 00000 00000 00
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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 0000 00 00 0000 0000 0000 (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\HLB129\PCACOL~1\M10PLAN.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #129 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

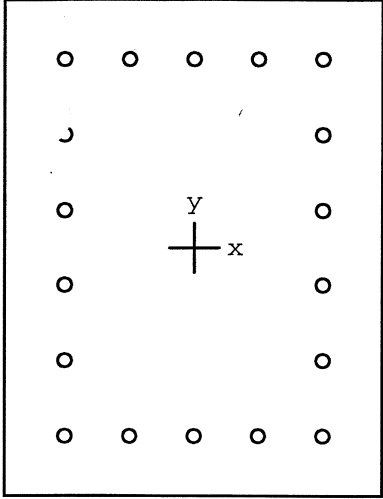
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

=====  
 =====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	613.0	103.0	86.0	1220.0	1016.9	11.836
2	367.0	448.0	71.0	1779.4	283.1	3.972
3	513.0	329.0	72.0	1739.2	382.5	5.288
4	485.0	82.0	717.0	156.6	1368.2	1.908
5	318.0	431.0	653.0	791.5	1198.4	1.836
6	458.0	316.0	681.0	589.6	1276.2	1.873
7	389.0	66.0	54.0	1207.3	987.4	18.289
8	271.0	448.0	71.0	1748.5	278.6	3.903
9	340.0	329.0	48.0	1780.9	257.3	5.412
10	312.0	53.0	719.0	100.7	1337.1	1.860
11	225.0	431.0	653.0	773.5	1173.9	1.797
12	292.0	316.0	682.0	582.3	1254.8	1.840
13	618.0	104.0	86.0	1229.1	1013.7	11.806
14	373.0	516.0	79.0	1783.9	274.8	3.458
15	519.0	371.0	72.0	1764.2	344.0	4.756

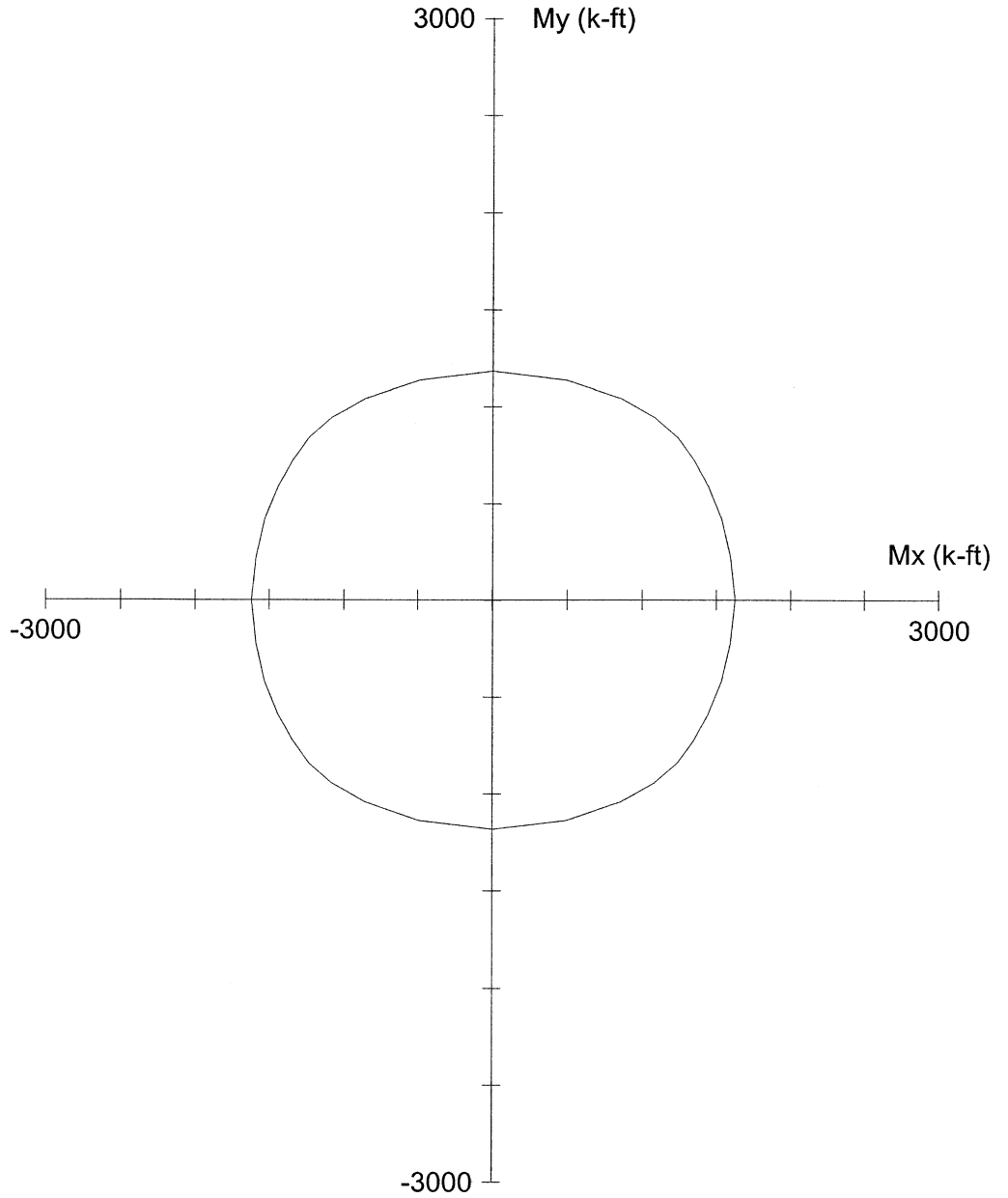
16	491.0	83.0	747.0	152.2	1368.9	1.833
17	323.0	496.0	764.0	782.3	1202.4	1.575
18	463.0	356.0	738.0	611.3	1269.3	1.719
19	394.0	66.0	55.0	1194.5	996.0	18.103
20	275.0	516.0	79.0	1753.2	270.1	3.398
21	345.0	371.0	48.0	1790.9	232.7	4.827
22	317.0	53.0	734.0	97.6	1338.9	1.824
23	229.0	496.0	764.0	763.5	1178.7	1.542
24	296.0	356.0	725.0	611.4	1247.8	1.720

\*\*\* 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: 14:38:25



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\HLB129\PCACOL~1\M10PLAN.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #129

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  
 Appendix F.1

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

JMS 7/06  
WDB 7/06

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00  00000  00  00  00000  00000  00000  (TM)

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

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

General Information:

=====

File Name: S:\DGN-ST\NORTH~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M10ACT.COL  
 Project: BONNER BRIDGE - OREGON INLET  
 Column: HLB #129 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)

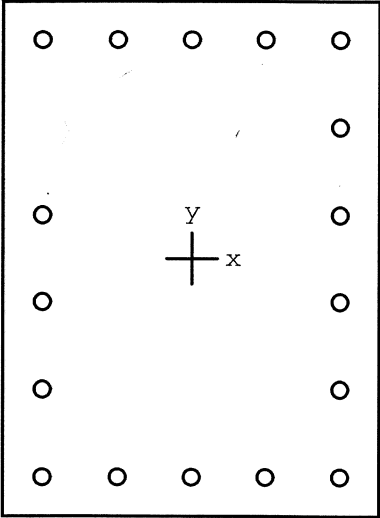
=====

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	613.0	103.0	86.0	1171.7	981.3	11.390
2	367.0	448.0	71.0	1731.8	276.0	3.866
3	513.0	329.0	72.0	1725.0	380.2	5.245
4	485.0	82.0	717.0	152.0	1319.9	1.841
5	318.0	431.0	653.0	755.4	1143.1	1.751
6	458.0	316.0	681.0	572.0	1232.3	1.810
7	389.0	66.0	54.0	1176.3	963.4	17.830
8	271.0	448.0	71.0	1691.5	268.5	3.776
9	340.0	329.0	48.0	1730.1	250.1	5.258
10	312.0	53.0	719.0	95.3	1276.1	1.775
11	225.0	431.0	653.0	733.7	1113.9	1.705
12	292.0	316.0	682.0	553.1	1194.2	1.751
13	618.0	104.0	86.0	1181.6	977.3	11.363
14	373.0	516.0	79.0	1737.2	267.4	3.367
15	519.0	371.0	72.0	1746.2	339.7	4.707

16	491.0	83.0	747.0	146.0	1321.6	1.769
17	323.0	496.0	764.0	745.4	1148.0	1.503
18	463.0	356.0	738.0	593.4	1227.3	1.664
19	394.0	66.0	55.0	1164.7	971.7	17.656
20	275.0	516.0	79.0	1696.8	260.0	3.288
21	345.0	371.0	48.0	1741.6	223.3	4.694
22	317.0	53.0	734.0	94.2	1278.4	1.742
23	229.0	496.0	764.0	724.6	1118.4	1.463
24	296.0	356.0	725.0	582.1	1186.8	1.637

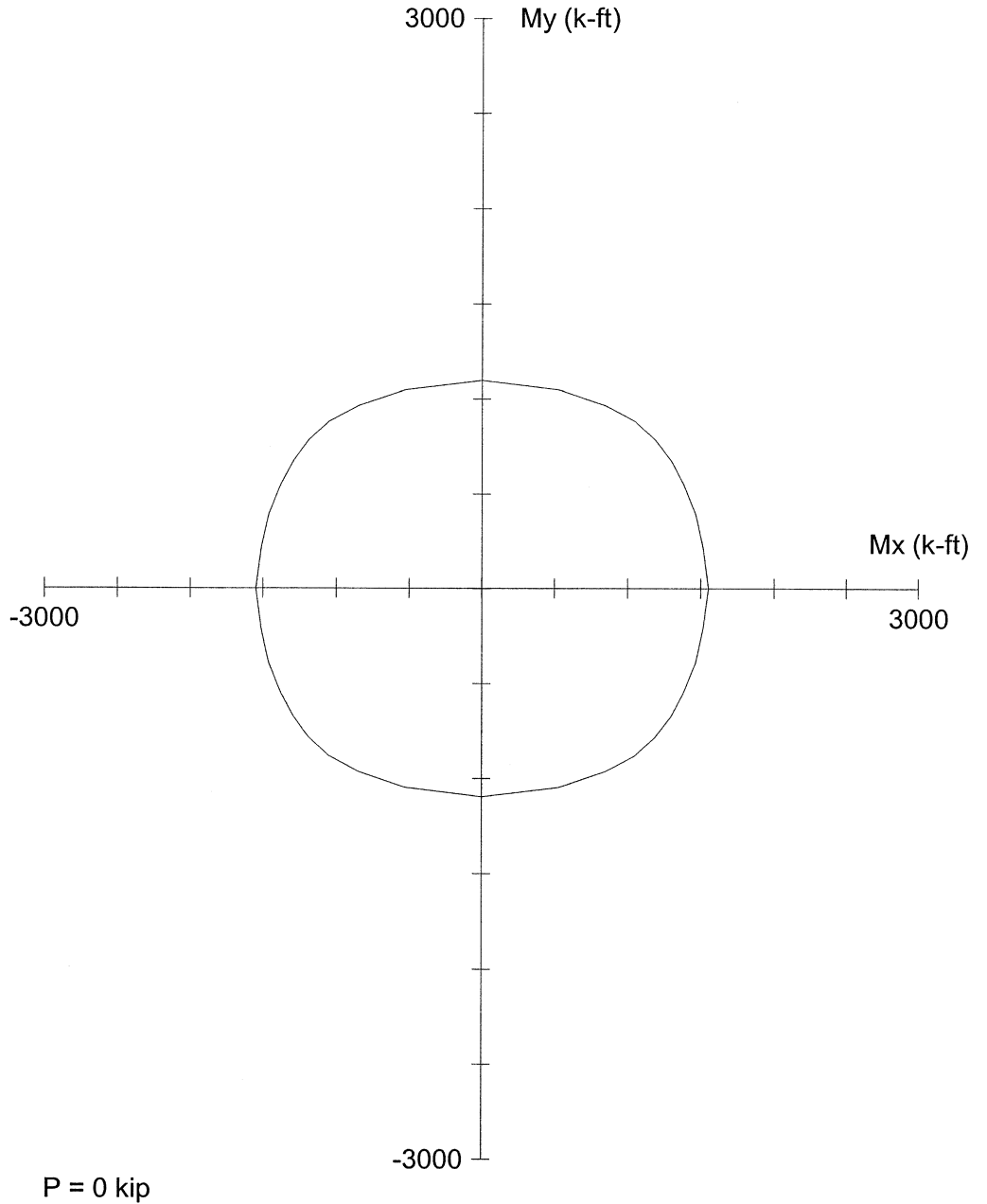
\*\*\* Program completed as requested! \*\*\*





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: 12:19:31



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File: S:\DGN-ST\NORTH-C~1\BONNER~1\ANALYSIS\PIERS\HLB129\PCACOL~1\M10ACT.COL

Project: BONNER BRIDGE - OREGON INLET

Column: HLB #129

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 #129  
 SUBJECT: TOP OF CAP - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 WDB Jun-06

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	590.510	Ft. Kips	Working Stress Mom.	725.060	Ft. Kips
Live Load Moment	134.550	Ft. Kips	Load Factor Mom.	1059.771	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>0.33</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	=	(725.06 x 12.00) / 10.93 x 35.29	=	22.56 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 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	= 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 = 22.56      <      f<sub>s</sub> Allow = 36.00      OK

φM<sub>n</sub> = 1157.13      >      Mu = 1059.77      OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #129  
 SUBJECT: BOTTOM OF CAP - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 WDB Jun-06

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	107.150	Ft. Kips	Working Stress Mom.	274.170	Ft. Kips
Live Load Moment	167.020	Ft. Kips	Load Factor Mom.	501.895	Ft. Kips
Bar Clearance	3.625	In.	Z For Steel Dist.	170	
Cover	3.000	In.	fc	=	3.000 Ksi
Width of Member (b)	36.00	In.	fy	=	40.000 Ksi
Depth of Member (h)	42.00	In.			

**AREA OF STEEL**

Bar Size	11		dc =	4.330	In.
No. Bars	5		dc' =	2.705	In.
As	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	=	(274.17 x 12.00) / 7.81 x 35.97	=	11.72	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 (fc) <sup>1/2</sup>		= 0.411 Ksi
Ig =	1/12 * b * h <sup>3</sup>	yt = 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> =      842.46      >      1.2 M<sub>cr</sub> =      434.78      OK

f<sub>s</sub> Act =      11.72      <      f<sub>s</sub> Allow =      36.00      OK

φM<sub>n</sub> =      842.46      >      Mu =      501.90      OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT #129  
 SHEAR - BASED ON PLAN DIMENSIONS

JMJ Jun-06  
 WDB Jun-06

**SHEAR DESIGN - CAP COMPLETE**

$V_{DL} = 120.56$  KIPS       $V_{LL} = 58.17$  KIPS       $F_V = 40000$  PSI  
 $d = 37.67$  INCHES       $b = 36.00$  INCHES       $f_c = 3000$  PSI  
 $V@ d$  DIST. FROM FACE OF SUPPORT      Col. Width =       $D = 3.00$  FT  
 ASSUME FACE OF SUPPORT       $D/4 = 0.75$  FT.      FROM CENTER OF COL.  
 $d_{DIST.} = 37.67 / 12.00 + 0.750 = 3.89$  FT.       $W_{DL} CAP = 1.575$  KIPS/FT

$$V_{DL} = V_{DL} - W_{DL} * d_{DIST} = 114.43$$

$$V_U = 1.3(V_{DL} + (1.67 * V_{LL})) = 275.05$$

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

$$V_U < q V_C + q V_S$$

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

$$q V_S = V_U - q V_C$$

$$V_S = V_U / q - V_C = 175.04 \text{ KIPS}$$

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

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

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

$$S = A_V * F_V * d / V_S = 5.3 \text{ INCHES}$$

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

$$S_{ACT} = 6.00 \text{ INCHES} \quad \text{NO GOOD}$$

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jul-06

SUBJECT: HIGH LEVEL BENT #129

WDB Jul-06

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

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	590.510	Ft. Kips	Working Stress Mom.	725.060	Ft. Kips
Live Load Moment	134.550	Ft. Kips	Load Factor Mom.	1059.771	Ft. Kips
Avg. 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)	33.000	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 4.06 x 2.705	=	21.98	
f <sub>s</sub> 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 <sub>s</sub> Act	=	(725.06 x 12.00) / 10.93 x 35.90	=	22.17	Ksi
θM <sub>N</sub>	=	0.90 x 10.93 x 40.00 x 35.90 / 12	=	1177.14	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>		= 0.497 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> =	0.497 x 203742 / 21.00 / 12		= 402.22 Ft. Kips

AASHTO 8.17.1      φM<sub>n</sub> = 1177.14      >      1.2 M<sub>cr</sub> = 482.67      OK

f<sub>s</sub> Act = 22.17      <      f<sub>s</sub> Allow = 36.00      OK

φM<sub>n</sub> = 1177.14      >      Mu = 1059.77      OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jul-06

SUBJECT: HIGH LEVEL BENT #129

WDB Jul-06

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

**CONCRETE DESIGN - CAP**

**INPUT**

Dead Load Moment	107.150	Ft. Kips	Working Stress Mom.	274.170	Ft. Kips
Live Load Moment	167.020	Ft. Kips	Load Factor Mom.	501.895	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	=	(274.17 x 12.00) / 7.81 x 36.40	=	11.58 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> >	1.2Mcr	Mcr =	fr Ig/yt
fr	= 7.5 (f <sub>c</sub> ) <sup>1/2</sup>			=	0.497 Ksi
Ig	= 1/12 * b * h <sup>3</sup>	=	203742 In. <sup>4</sup>	yt =	h/2
Mcr	= 0.497 x 203742 / 21.00 / 12			=	402.22 Ft. Kips

AASHTO 8.17.1	φM <sub>n</sub> =	852.67	>	1.2 Mcr =	482.67	OK
	f <sub>s</sub> Act =	11.58	<	f <sub>s</sub> Allow =	36.00	OK
	φM <sub>n</sub> =	852.67	>	Mu =	501.90	OK

**LOCHNER**

SHEET

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ Jul-06

SUBJECT: HIGH LEVEL BENT #129

WDB Jul-06

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

**SHEAR DESIGN - CAP COMPLETE**

$$V_{DL} = 120.56 \text{ KIPS} \quad V_{LL} = 58.17 \text{ KIPS} \quad F_V = 40000 \text{ PSI}$$

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

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

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

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

$$V_{DL} = V_{DL} - W_{DL} * d_{DIST} = 114.95$$

$$V_U = 1.3(V_{DL} + (1.67 * V_{LL})) = 275.72$$

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

$$V_U < q V_C + q V_S$$

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

$$q V_S = V_U - q V_C$$

$$V_S = V_U / q - V_C = 159.45 \text{ KIPS}$$

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

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

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

$$S = A_V * F_V * d / V_S = 5.8 \text{ INCHES}$$

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

$$S_{ACT} = 6.00 \text{ INCHES} \quad \text{NO GOOD}$$

H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 9 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**FOOTING LOADS**

HLB 129				PMIN MEMBER 9			
<u>GROUP 1</u>				<u>GROUP 2</u>			
	P	MY	MZ		P	MY	MZ
DL	270.39	0.00	26.20	DL	270.39	0.00	26.20
LL	36.11	0.00	-11.48	LL	0.00	0.00	0.00
GROUP 1	0.00	0.00	0.00	GROUP 2	13.54	382.85	-32.13
SERVICE STRENGTH	306.50 429.75	0.00 0.00	14.72 9.19	SERVICE STRENGTH	283.93 369.11	382.85 497.71	-5.93 -7.71
<u>GROUP 3</u>				<u>GROUP 4</u>			
	P	MY	MZ		P	MY	MZ
DL	270.39	0.00	26.20	DL	270.39	0.00	26.20
LL	36.11	0.00	-11.48	LL	36.11	0.00	-11.48
GROUP 3	6.69	280.75	-15.47	GROUP 4	-28.20	0.00	550.50
SERVICE STRENGTH	313.19 407.15	280.75 364.98	-0.75 -0.98	SERVICE STRENGTH	278.30 361.79	0.00 0.00	565.22 734.79
<u>GROUP 5</u>				<u>GROUP 6</u>			
	P	MY	MZ		P	MY	MZ
DL	270.39	0.00	26.20	DL	270.39	0.00	26.20
LL	0.00	0.00	0.00	LL	36.11	0.00	-11.48
GROUP 5	-14.67	382.85	518.37	GROUP 6	-21.52	280.75	535.03
SERVICE STRENGTH	255.72 319.65	382.85 478.56	544.57 680.71	SERVICE STRENGTH	284.99 356.23	280.75 350.94	549.75 687.19



H. W. LOCHNER, INC.

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
 SUBJECT: HIGH LEVEL BENT ANALYSIS  
 HLB 129 MEM. 10 JT. FOOTING

JMJ Jun-06  
 WDB Jun-06

**FOOTING LOADS**

HLB 129				P MEMBER 10				JOINT FOOTING			
<u>GROUP 1</u>				<u>GROUP 2</u>							
	P	MY	MZ		P	MY	MZ				
DL	300.44	0.00	28.69	DL	300.44	0.00	28.69				
LL	82.28	0.00	-3.20	LL	0.00	0.00	0.00				
GROUP 1	0.00	0.00	0.00	GROUP 2	-13.54	-397.02	32.14				
SERVICE	382.72	0.00	25.49	SERVICE	286.90	-397.02	60.83				
STRENGTH	568.85	0.00	30.36	STRENGTH	372.97	-516.13	79.08				
<u>GROUP 3</u>				<u>GROUP 4</u>							
	P	MY	MZ		P	MY	MZ				
DL	300.44	0.00	28.69	DL	300.44	0.00	28.69				
LL	82.28	0.00	-3.20	LL	82.28	0.00	-3.20				
GROUP 3	-6.69	-285.00	15.47	GROUP 4	-28.20	0.00	550.50				
SERVICE	376.03	-285.00	40.96	SERVICE	354.52	0.00	575.99				
STRENGTH	488.84	-370.50	53.25	STRENGTH	460.88	0.00	748.79				
<u>GROUP 5</u>				<u>GROUP 6</u>							
	P	MY	MZ		P	MY	MZ				
DL	300.44	0.00	28.69	DL	300.44	0.00	28.69				
LL	0.00	0.00	0.00	LL	82.28	0.00	-3.20				
GROUP 5	-41.74	-397.02	582.64	GROUP 6	-34.90	-285.00	565.97				
SERVICE	258.70	-397.02	611.33	SERVICE	347.83	-285.00	591.46				
STRENGTH	323.38	-496.28	764.16	STRENGTH	434.78	-356.25	739.33				

H. W. Lochner, Inc. PHONE: 859-224-4476 | SHEET 1 OF 9  
1040 Monarch St. Suite 300 Lexington, KY 40513 | JOB NO. HLB#129  
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.1-90

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PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ 7/06  
WDB 7/06

PROJECT DATA  
=====

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#129  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #129 - 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	-429.75	0.00	----	----
Force	Y	0.00	-568.85	1.00	----	----
Moment	Z	----	9.19	0.00	----	----
Moment	Z	----	30.36	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	-369.11	0.00	----	----
Force	Y	0.00	-372.97	1.00	----	----
Moment	X	----	-516.13	1.00	----	----
Moment	X	----	497.71	0.00	----	----
Moment	Z	----	-7.71	0.00	----	----
Moment	Z	----	79.08	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	-407.15	0.00	----	----
Force	Y	0.00	-488.84	1.00	----	----
Moment	X	----	-370.50	1.00	----	----
Moment	X	----	364.98	0.00	----	----
Moment	Z	----	-0.98	0.00	----	----
Moment	Z	----	53.25	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)	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	-429.75	0.00	4.87	97.67	
				2	1	1.000	-568.85	0.00	30.34		
				1	4	1.250	407.15	-364.75	5.05		-60.27
				2	4	1.250	488.84	370.27	-53.23		
2	2.80	90.0	30.0	1	1	1.000	-429.75	0.00	4.87	105.81*	
				2	1	1.000	-568.85	0.00	30.34		
				1	4	1.250	407.15	-364.75	5.05		-64.89
				2	4	1.250	488.84	370.27	-53.23		
3	10.80	186.0	30.0	1	1	1.000	-429.75	0.00	4.87	117.65*	
				2	1	1.000	-568.85	0.00	30.34		
				1	4	1.250	407.15	-364.75	5.05		-71.59
				2	4	1.250	488.84	370.27	-53.23		
4	18.80	282.0	30.0	1	1	1.000	-429.75	0.00	4.87	129.48*	
				2	1	1.000	-568.85	0.00	30.34		
				1	4	1.250	407.15	-364.75	5.05		-78.30
				2	4	1.250	488.84	370.27	-53.23		
5	24.30	348.0	30.0	1	1	1.000	-429.75	0.00	4.87	137.62*	
				2	1	1.000	-568.85	0.00	30.34		
				1	4	1.250	407.15	-364.75	5.05		-82.91
				2	4	1.250	488.84	370.27	-53.23		
6	-2.70	24.0	-30.0	1	1	1.000	-429.75	0.00	4.87	97.67	
				2	1	1.000	-568.85	0.00	30.34		
				1	4	1.250	407.15	-364.75	5.05		-60.72

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

Loc	X	Y	Z	Col	Comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Reac, kips
7	2.80	90.0	-30.0	2	4	1.250	488.84	370.27	-53.23	
				1	1	1.000	-429.75	0.00	4.87	105.81*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-65.33
8	10.80	186.0	-30.0	2	4	1.250	488.84	370.27	-53.23	
				1	1	1.000	-429.75	0.00	4.87	117.65*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-72.03
9	18.80	282.0	-30.0	2	4	1.250	488.84	370.27	-53.23	
				1	1	1.000	-429.75	0.00	4.87	129.48*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-78.74
10	24.30	348.0	-30.0	2	4	1.250	488.84	370.27	-53.23	
				1	1	1.000	-429.75	0.00	4.87	137.62*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-83.35
				2	4	1.250	488.84	370.27	-53.23	

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

=====

Pile	Loc(X)	X	Z	col#	comb	Ovs	Column Loads	Mxx, kft	Mzz, kft	Pile Reac.
	ft	in	in				P, kips			kips
1	-2.70	24.0	30.0	1	1	1.000	-429.75	0.00	4.87	97.67
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-48.22
				2	4	1.250	488.84	370.27	-53.23	
2	2.80	90.0	30.0	1	1	1.000	-429.75	0.00	4.87	105.81*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-51.91
				2	4	1.250	488.84	370.27	-53.23	
3	10.80	186.0	30.0	1	1	1.000	-429.75	0.00	4.87	117.65*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-57.27
				2	4	1.250	488.84	370.27	-53.23	
4	18.80	282.0	30.0	1	1	1.000	-429.75	0.00	4.87	129.48*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-62.64
				2	4	1.250	488.84	370.27	-53.23	
5	24.30	348.0	30.0	1	1	1.000	-429.75	0.00	4.87	137.62*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-66.33
				2	4	1.250	488.84	370.27	-53.23	
6	-2.70	24.0	-30.0	1	1	1.000	-429.75	0.00	4.87	97.67
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-48.57
				2	4	1.250	488.84	370.27	-53.23	
7	2.80	90.0	-30.0	1	1	1.000	-429.75	0.00	4.87	105.81*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-52.26
				2	4	1.250	488.84	370.27	-53.23	
8	10.80	186.0	-30.0	1	1	1.000	-429.75	0.00	4.87	117.65*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-57.63
				2	4	1.250	488.84	370.27	-53.23	
9	18.80	282.0	-30.0	1	1	1.000	-429.75	0.00	4.87	129.48*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-62.99

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

				2	4	1.250	488.84	370.27	-53.23	
10	24.30	348.0	-30.0	1	1	1.000	-429.75	0.00	4.87	137.62*
				2	1	1.000	-568.85	0.00	30.34	
				1	4	1.250	407.15	-364.75	5.05	-66.68
				2	4	1.250	488.84	370.27	-53.23	

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 = 119.83 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	87.5	1	2.15	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	200.8	1	5.01	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	314.2	1	7.93	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#129  
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.1-95

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PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

JMJ 7/06  
WDB 7/06

PROJECT DATA  
=====

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#129  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #129 - 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	-361.79	0.00	----	----
Force	Y	0.00	-460.88	1.00	----	----
Moment	Z	----	734.79	0.00	----	----
Moment	Z	----	748.79	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	-319.65	0.00	----	----
Force	Y	0.00	-323.38	1.00	----	----
Moment	X	----	-496.28	1.00	----	----
Moment	X	----	478.56	0.00	----	----
Moment	Z	----	680.71	0.00	----	----
Moment	Z	----	764.16	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	-356.23	0.00	----	----
Force	Y	0.00	-434.78	1.00	----	----
Moment	X	----	-356.25	1.00	----	----
Moment	X	----	350.94	0.00	----	----
Moment	Z	----	<del>678.16</del> 687.19	0.00	----	----
Moment	Z	----	739.33	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

Footings 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.				
			col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	kips		
1	-2.70	24.0	30.0	1	1	1.000	-361.92	0.00	729.38	105.78*	
				2	1	1.000	-460.75	0.00	747.67		
				1	4	1.250	356.36	-350.72	-672.93		-68.96
				2	4	1.250	434.65	356.03	-738.28		
2	2.80	90.0	30.0	1	1	1.000	-361.92	0.00	729.38	103.45*	
				2	1	1.000	-460.75	0.00	747.67		
				1	4	1.250	356.36	-350.72	-672.93		-65.76
				2	4	1.250	434.65	356.03	-738.28		
3	10.80	186.0	30.0	1	1	1.000	-361.92	0.00	729.38	100.05*	
				2	1	1.000	-460.75	0.00	747.67		
				1	4	1.250	356.36	-350.72	-672.93		-61.10
				2	4	1.250	434.65	356.03	-738.28		
4	18.80	282.0	30.0	1	1	1.000	-361.92	0.00	729.38	96.66	
				2	1	1.000	-460.75	0.00	747.67		
				1	4	1.250	356.36	-350.72	-672.93		-56.45
				2	4	1.250	434.65	356.03	-738.28		
5	24.30	348.0	30.0	1	1	1.000	-361.92	0.00	729.38	94.33	
				2	1	1.000	-460.75	0.00	747.67		
				1	4	1.250	356.36	-350.72	-672.93		-53.25
				2	4	1.250	434.65	356.03	-738.28		
6	-2.70	24.0	-30.0	1	1	1.000	-361.92	0.00	729.38	105.78*	
				2	1	1.000	-460.75	0.00	747.67		
				1	4	1.250	356.36	-350.72	-672.93		-69.38

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

				2	4	1.250	434.65	356.03	-738.28	
7	2.80	90.0	-30.0	1	1	1.000	-361.92	0.00	729.38	103.45*
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-66.18
				2	4	1.250	434.65	356.03	-738.28	
8	10.80	186.0	-30.0	1	1	1.000	-361.92	0.00	729.38	100.05*
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-61.53
				2	4	1.250	434.65	356.03	-738.28	
9	18.80	282.0	-30.0	1	1	1.000	-361.92	0.00	729.38	96.66
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-56.87
				2	4	1.250	434.65	356.03	-738.28	
10	24.30	348.0	-30.0	1	1	1.000	-361.92	0.00	729.38	94.33
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-53.67
				2	4	1.250	434.65	356.03	-738.28	

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	-361.92	0.00	729.38	105.78*
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-55.16
				2	4	1.250	434.65	356.03	-738.28	
2	2.80	90.0	30.0	1	1	1.000	-361.92	0.00	729.38	103.45*
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-52.60
				2	4	1.250	434.65	356.03	-738.28	
3	10.80	186.0	30.0	1	1	1.000	-361.92	0.00	729.38	100.05*
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-48.88
				2	4	1.250	434.65	356.03	-738.28	
4	18.80	282.0	30.0	1	1	1.000	-361.92	0.00	729.38	96.66
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-45.16
				2	4	1.250	434.65	356.03	-738.28	
5	24.30	348.0	30.0	1	1	1.000	-361.92	0.00	729.38	94.33
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-42.60
				2	4	1.250	434.65	356.03	-738.28	
6	-2.70	24.0	-30.0	1	1	1.000	-361.92	0.00	729.38	105.78*
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-55.50
				2	4	1.250	434.65	356.03	-738.28	
7	2.80	90.0	-30.0	1	1	1.000	-361.92	0.00	729.38	103.45*
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-52.94
				2	4	1.250	434.65	356.03	-738.28	
8	10.80	186.0	-30.0	1	1	1.000	-361.92	0.00	729.38	100.05*
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-49.22
				2	4	1.250	434.65	356.03	-738.28	
9	18.80	282.0	-30.0	1	1	1.000	-361.92	0.00	729.38	96.66
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-45.50

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

				2	4	1.250	434.65	356.03	-738.28	
10	24.30	348.0	-30.0	1	1	1.000	-361.92	0.00	729.38	94.33
				2	1	1.000	-460.75	0.00	747.67	
				1	4	1.250	356.36	-350.72	-672.93	-42.94
				2	4	1.250	434.65	356.03	-738.28	

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 = 87.99 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	64.2	1	1.57	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	147.5	1	3.65	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	230.7	1	5.77	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#129  
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.1-100

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PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

PROJECT DATA  
=====

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#129  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #129 - Load Groups 1-3 (For Ease of Checking) - Per Field Data, Assume Pile #5 is Missing

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

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

PHONE: 859-224-4476  
 Lexington, KY 40513  
 BY JMJ DATE Jun/12/2006  
 CKD. DATE

SHEET 2 OF 8  
 JOB NO. HLB#129  
 BY JMJ DATE Jun/12/2006  
 CKD. DATE

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	-429.75	0.00	----	----
Force	Y	0.00	-568.85	1.00	----	----
Moment	Z	----	9.19	0.00	----	----
Moment	Z	----	30.36	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	-369.11	0.00	----	----
Force	Y	0.00	-372.97	1.00	----	----
Moment	X	----	-516.13	1.00	----	----
Moment	X	----	497.71	0.00	----	----
Moment	Z	----	-7.71	0.00	----	----
Moment	Z	----	79.08	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	-407.15	0.00	----	----
Force	Y	0.00	-488.84	1.00	----	----
Moment	X	----	-370.50	1.00	----	----
Moment	X	----	364.98	0.00	----	----
Moment	Z	----	-0.98	0.00	----	----
Moment	Z	----	53.25	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 = 782.50 ft<sup>2</sup>

Surcharge = 0.00 ksf

Piles: Circular Size: 22.00 in Capacity: 100.00 kips

Design Parameters:

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

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

=====

Pile	Loc(X) ft	X in	Z in	Column Loads			Pile Reac.			
				col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	kips
1	-2.70	24.0	30.0	1	1	1.000	-429.75	0.00	4.88	142.57*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-92.46
				2	4	1.250	488.84	370.33	-53.25	
2	2.80	90.0	30.0	1	1	1.000	-429.75	0.00	4.88	141.46*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-92.07
				2	4	1.250	488.84	370.33	-53.25	
3	10.80	186.0	30.0	1	1	1.000	-429.75	0.00	4.88	139.84*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-91.50
				2	4	1.250	488.84	370.33	-53.25	
4	18.80	282.0	30.0	1	1	1.000	-429.75	0.00	4.88	138.22*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-90.93
				2	4	1.250	488.84	370.33	-53.25	
5	24.30	348.0	30.0	1	1	1.000	-429.75	0.00	4.88	137.10*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-90.54
				2	4	1.250	488.84	370.33	-53.25	
6	2.80	90.0	-30.0	1	1	1.000	-429.75	0.00	4.88	121.62*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-65.96

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

PHONE: 859-224-4476  
 Lexington, KY 40513  
 TAMPA AREA: 813-985-9170

SHEET 4 OF 8  
 JOB NO. HLB#129  
 BY JMJ DATE Jun/12/2006  
 CKD. DATE

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

				2	4	1.250	488.84	370.33	-53.25	
7	10.80	186.0	-30.0	1	1	1.000	-429.75	0.00	4.88	120.00*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-65.39
				2	4	1.250	488.84	370.33	-53.25	
8	18.80	282.0	-30.0	1	1	1.000	-429.75	0.00	4.88	118.38*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-64.82
				2	4	1.250	488.84	370.33	-53.25	
9	24.30	348.0	-30.0	1	1	1.000	-429.75	0.00	4.88	117.27*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-64.43
				2	4	1.250	488.84	370.33	-53.25	

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

=====

Pile Loc(X)	X	Z	Column Loads				Pile Reac.			
ft	in	in	col#	comb	Ovs	P, kips	Mxx, kft	Mzz, kft	kips	
1	-2.70	24.0	30.0	1	1	1.000	-429.75	0.00	4.88	142.57*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-73.97
				2	4	1.250	488.84	370.33	-53.25	
2	2.80	90.0	30.0	1	1	1.000	-429.75	0.00	4.88	141.46*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-73.66
				2	4	1.250	488.84	370.33	-53.25	
3	10.80	186.0	30.0	1	1	1.000	-429.75	0.00	4.88	139.84*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-73.20
				2	4	1.250	488.84	370.33	-53.25	
4	18.80	282.0	30.0	1	1	1.000	-429.75	0.00	4.88	138.22*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-72.75
				2	4	1.250	488.84	370.33	-53.25	
5	24.30	348.0	30.0	1	1	1.000	-429.75	0.00	4.88	137.10*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-72.43
				2	4	1.250	488.84	370.33	-53.25	
6	2.80	90.0	-30.0	1	1	1.000	-429.75	0.00	4.88	121.62*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-52.77
				2	4	1.250	488.84	370.33	-53.25	
7	10.80	186.0	-30.0	1	1	1.000	-429.75	0.00	4.88	120.00*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-52.31
				2	4	1.250	488.84	370.33	-53.25	
8	18.80	282.0	-30.0	1	1	1.000	-429.75	0.00	4.88	118.38*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-51.86
				2	4	1.250	488.84	370.33	-53.25	
9	24.30	348.0	-30.0	1	1	1.000	-429.75	0.00	4.88	117.27*
				2	1	1.000	-568.85	0.00	30.35	
				1	4	1.250	407.15	-364.81	5.05	-51.55
				2	4	1.250	488.84	370.33	-53.25	

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)

=====

Working Stress pile reaction = 124.67 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
-4.34	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	16.6	1	0.40	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	60.9	1	1.48	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	105.3	1	2.58	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	149.6	1	3.69	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	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27



PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

	-200.3	1	0.00	7.48	7.48	3.73	10.27	10.27
4.30	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-828.6	1	0.00	7.48	7.48	15.94	10.27 *	10.27
6.15	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1028.8	1	0.00	7.48	7.48	19.94	10.27 *	10.27
8.47	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1281.1	1	0.00	7.48	7.48	25.03	10.27 *	10.27
10.79	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1533.3	1	0.00	7.48	7.48	30.18	10.27 *	10.27
13.11	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1208.4	1	0.00	7.48	7.48	23.56	10.27 *	10.27
15.44	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-881.5	1	0.00	7.48	7.48	17.00	10.27 *	10.27
17.28	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-621.9	1	0.00	7.48	7.48	11.86	10.27 *	10.27
20.08	92.3	1	2.26	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	303.4	1	7.61	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	214.3	1	5.33	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	125.2	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
24.16	36.1	1	0.87	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	259.7	1	5.69	37.96	37.96	0.00	7.44	7.44
1.98	324.7	1	7.13	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
-----					

PROJECT: BONNER BRIDGE - OREGON INLET NORTH CAROLINA

X direction

1	-4.30	1	48.00	0.0	326.7
	4.30	1	33.62	108.6	228.8
2	17.28	1	33.62	140.8	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	482.6	1508.6
2	26.94	45.14	1	39.08	639.4	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#129  
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

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

PROJECT DATA  
=====

JMJ 7/06  
WDB 7/06

Project : BONNER BRIDGE - OREGON INLET NORTH CAROLINA  
User Job No.: HLB#129  
State : North Carolina State Job No. :  
Code : AASHTO STANDARD (17th Edition 2002)  
Comments : Bonner Bridge HLB #129 - Load Groups 4-6 (For Ease of Checking) - Per Field Data, Assume Pile #5 is 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	-361.79	0.00	----	----
Force	Y	0.00	-460.88	1.00	----	----
Moment	Z	----	734.79	0.00	----	----
Moment	Z	----	748.79	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	-319.65	0.00	----	----
Force	Y	0.00	-323.38	1.00	----	----
Moment	X	----	-496.28	1.00	----	----
Moment	X	----	478.56	0.00	----	----
Moment	Z	----	680.71	0.00	----	----
Moment	Z	----	764.16	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	-356.23	0.00	----	----
Force	Y	0.00	-434.78	1.00	----	----
Moment	X	----	-356.25	1.00	----	----
Moment	X	----	350.94	0.00	----	----
Moment	Z	----	687.19	0.00	----	----
Moment	Z	----	739.33	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 = 782.50 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	-----			-----			Pile Reac. kips
				col#	comb	Ovs	Column Loads P, kips	Mxx, kft	Mzz, kft	
1	-2.70	24.0	30.0	1	1	1.000	-361.88	0.00	729.81	150.38*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-102.28
				2	4	1.250	434.69	356.09	-738.69	
2	2.80	90.0	30.0	1	1	1.000	-361.88	0.00	729.81	137.33*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-92.67
				2	4	1.250	434.69	356.09	-738.69	
3	10.80	186.0	30.0	1	1	1.000	-361.88	0.00	729.81	118.33*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-78.68
				2	4	1.250	434.69	356.09	-738.69	
4	18.80	282.0	30.0	1	1	1.000	-361.88	0.00	729.81	99.34
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-64.70
				2	4	1.250	434.69	356.09	-738.69	
5	24.30	348.0	30.0	1	1	1.000	-361.88	0.00	729.81	86.29
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-55.08
				2	4	1.250	434.69	356.09	-738.69	
6	2.80	90.0	-30.0	1	1	1.000	-361.88	0.00	729.81	129.22*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-74.82

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

PHONE: 859-224-4476  
 Lexington, KY 40513  
 BY JMJ DATE Jun/12/2006  
 CKD. DATE

SHEET 4 OF 8  
 JOB NO. HLB#129  
 DATE Jun/12/2006

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	434.69	356.09	-738.69	
				1	1	1.000	-361.88	0.00	729.81	110.23*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-60.84
8	18.80	282.0	-30.0	2	4	1.250	434.69	356.09	-738.69	
				1	1	1.000	-361.88	0.00	729.81	91.24
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-46.85
9	24.30	348.0	-30.0	2	4	1.250	434.69	356.09	-738.69	
				1	1	1.000	-361.88	0.00	729.81	78.18
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-37.24
				2	4	1.250	434.69	356.09	-738.69	

File 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	-361.88	0.00	729.81	150.38*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-81.82
				2	4	1.250	434.69	356.09	-738.69	
2	2.80	90.0	30.0	1	1	1.000	-361.88	0.00	729.81	137.33*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-74.13
				2	4	1.250	434.69	356.09	-738.69	
3	10.80	186.0	30.0	1	1	1.000	-361.88	0.00	729.81	118.33*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-62.94
				2	4	1.250	434.69	356.09	-738.69	
4	18.80	282.0	30.0	1	1	1.000	-361.88	0.00	729.81	99.34
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-51.76
				2	4	1.250	434.69	356.09	-738.69	
5	24.30	348.0	30.0	1	1	1.000	-361.88	0.00	729.81	86.29
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-44.06
				2	4	1.250	434.69	356.09	-738.69	
6	2.80	90.0	-30.0	1	1	1.000	-361.88	0.00	729.81	129.22*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-59.86
				2	4	1.250	434.69	356.09	-738.69	
7	10.80	186.0	-30.0	1	1	1.000	-361.88	0.00	729.81	110.23*
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-48.67
				2	4	1.250	434.69	356.09	-738.69	
8	18.80	282.0	-30.0	1	1	1.000	-361.88	0.00	729.81	91.24
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-37.48
				2	4	1.250	434.69	356.09	-738.69	
9	24.30	348.0	-30.0	1	1	1.000	-361.88	0.00	729.81	78.18
				2	1	1.000	-460.79	0.00	748.11	
				1	4	1.250	356.32	-350.78	-682.36	-29.79
				2	4	1.250	434.69	356.09	-738.69	

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)

=====

Working Stress pile reaction = 127.25 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:

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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	17.0	1	0.41	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	62.2	1	1.51	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	107.5	1	2.64	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	152.7	1	3.77	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	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27

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	-204.4	1	0.00	7.48	7.48	3.80	10.27	10.27
4.30	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-845.7	1	0.00	7.48	7.48	16.28	10.27 *	10.27
6.15	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1050.1	1	0.00	7.48	7.48	20.37	10.27 *	10.27
8.47	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1307.6	1	0.00	7.48	7.48	25.57	10.27 *	10.27
10.79	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1565.0	1	0.00	7.48	7.48	30.83	10.27 *	10.27
13.11	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-1233.4	1	0.00	7.48	7.48	24.07	10.27 *	10.27
15.44	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-899.7	1	0.00	7.48	7.48	17.36	10.27 *	10.27
17.28	0.0	1	0.00	7.48	7.48	0.00	10.27	10.27
	-634.8	1	0.00	7.48	7.48	12.12	10.27 *	10.27
20.08	94.2	1	2.31	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	309.7	1	7.77	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	218.7	1	5.44	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	127.8	1	3.14	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	36.8	1	0.89	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	265.1	1	5.81	37.96	37.96	0.00	7.44	7.44
1.98	331.4	1	7.28	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
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H. W. Lochner, Inc.	PHONE: 859-224-4476	SHEET 7 OF 8
1040 Monarch St. Suite 300	Lexington, KY 40513	JOB NO. HLB#129
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

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X direction

1	-4.30	1	48.00	0.0	326.7
	4.30	1	33.62	110.8	228.8
2	17.28	1	33.62	143.7	228.8
	25.88	1	48.00	0.0	326.7

Z direction

Z -5.09 ----- Outside of Footing

Two Way Shear:

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#	Bo ft	Ao ft^2	Comb	Avg. d in	V kips	Vc kips
-----						
Columns:						
1	26.94	45.14	1	39.08	492.6	1508.6
2	26.94	45.14	1	39.08	652.6	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.