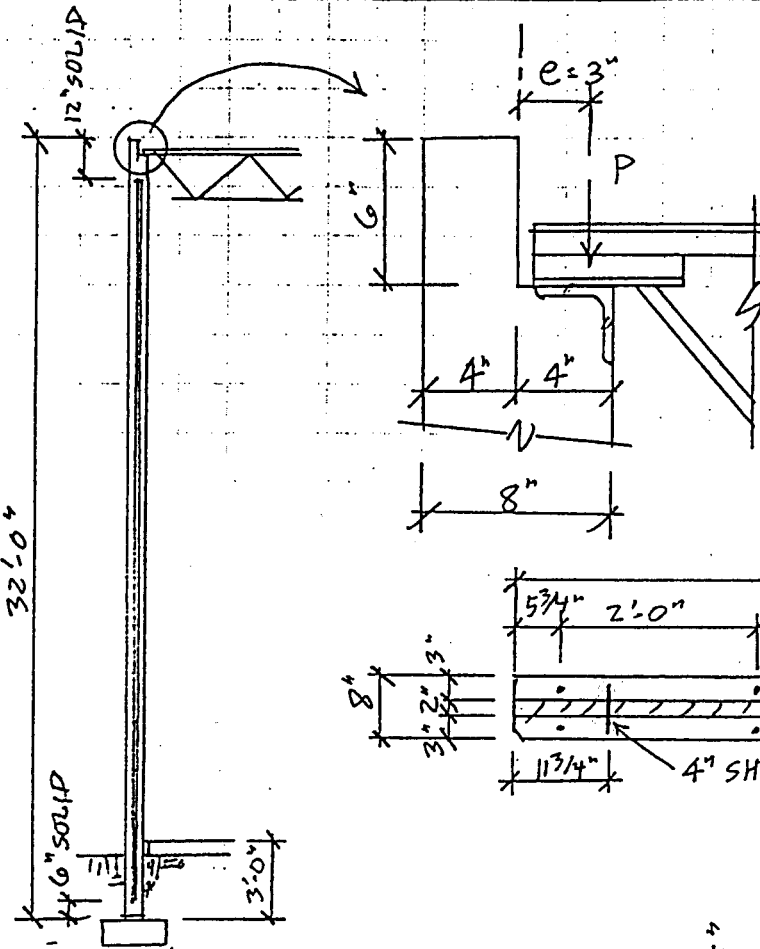
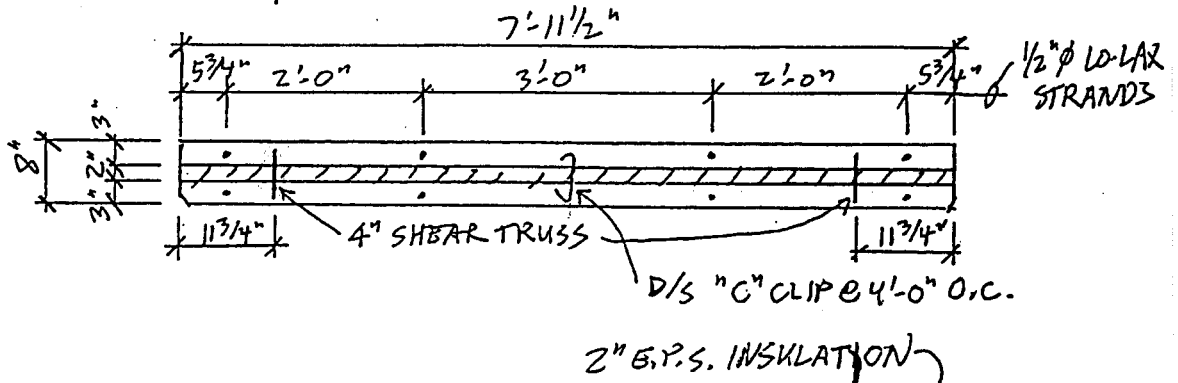


CHECK TYP. LOAD BRG. PNL ON EAST WALL:



TOTAL SERVICE LOAD = 1000 PLF (FROM ENGR.)  
 ASSUME: 50% DEAD, 50% LIVE  
 $PSDL = \frac{1000 PLF (8')}{(2)(1000)} = 4.0 KIP/3$   
 $PLL = 4.0 KIPS, e_L = e_{SDL} = 3''$   
 WIND LOAD = 20 PSF (8') = 160 PLF  
 CLEAR SPAN = 32' - 0.5' = 31.5'



FIND SECTION PROPERTIES:

subtract reveal  
 $A = (3 + 2.5) 95.5 = 525.25 \text{ in}^2$

$$\bar{y}_b = \frac{3(95.5)6 + 2.5(95.5)1.25}{525.25} = 3.84'' \quad , \quad y_t = 3.66''$$

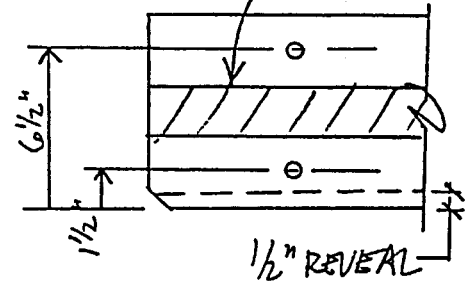
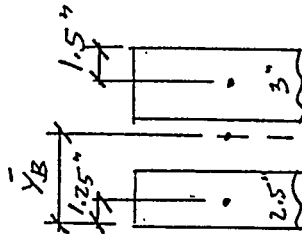
$$I = EI_0 + EAd^2 = \frac{95.5}{12} (3^3 + 2.5^3) + 95.5 (3(2.16)^2 + 2.5(2.59)^2) = 3278 \text{ in}^4$$

$$z_B = \frac{I}{c} = 3278 / 3.84 = 853.6 \text{ in}^3, \quad z_T = \frac{3278}{3.66} = 895.6$$

$$\text{NON-COMPOSITE } I = EI_0 = \frac{95.5}{12} (3^3 + 2.5^3) = 339.2 \text{ in}^4, \quad \text{NC } z = \frac{I}{c} = \frac{339.2}{1.5} = 226.1$$

FINAL LOSSES = 9.5% (CALC DONE SEPARATELY)

$$\text{UNSUPPORTED LENGTH} = 32.0 - 0.5 = 31.5'$$



CHECK COMBINED LOADING:

$P_u = .75(1.4D + 1.7L + 1.7W)$ , ASSUME 80% COMPOSITE

$I_{80\%} = I_{NC} + .8(I_c - I_{NC}) = 339.2 + .8(3278 - 339.2) = 2690 \text{ in}^4$

$Z_{B80\%} = Z_{BNC} + .8(Z_{BC} - Z_{BNC}) = 226.1 + .8(853.6 - 226.1) = 728.1 \text{ in}^3$

$P_{SELF WT.} = 2.96'(31.5/2 + .5') \cdot 150 \text{ PCF} \left(\frac{3' + 3'}{12''/1}\right) \frac{1}{1000} = 9.70 \text{ KIPS}$   
 (@ MAX. MU)

$f_{ps} = A_{ps}(\text{Per. Bull}) f_{pu} \left(\frac{100 - \text{loss}}{100}\right) / \text{Area} = 8(.153) \cdot 7(270) \left(\frac{100 - 9.5}{100}\right) \left(\frac{1000}{525.25}\right)$   
 $= 398.5 \text{ PSI}$

$P_{u1} = .75(1.4P_{SD} + 1.7P_L) = .75(1.4(4.0) + 1.7(4.0)) = 9.3 \text{ KIPS (ECCENTRIC)}$

$P_{u2} = P_{u1} + P_{s.w}(1.4) = 9.3 + 9.70(1.4)(.75) = \boxed{19.49 \text{ KIPS}} \approx 19.53 \text{ k. CHECKS (PG. 7)}$

$M_{1W} = \frac{.75(1.7W)L^2}{8} = \frac{.75(1.7) \cdot 160(31.5)^2}{8} = 25.3 \text{ K1}$

$\frac{\Delta_{WIND}}{(\text{SUCTION})} = \frac{5WL^4}{384EI_{80\%}} = \frac{5(1.3)(16)(31.5)^4(1728)}{384EI_{80\%}} = \frac{4,607,740}{EI_{80\%}}$ ,  $\Delta_{BOW} = 0.5''$  (ASSUMED)

ASSUME 40° TEMP. DIFF. (SUN ON PNL, OUTWARD BOW):

$\Delta_T = \alpha \frac{l^2}{8h}$  (PCI 3.3.2),  $\alpha = C(T_1 - T_2) = 6 \times 10^{-6}(100^\circ - 60^\circ) = .00024$   
 COEF. OF THERMAL EXPANSION

$\Delta_T = \frac{.00024(31.5)^2(144)}{8(8)} = 0.536''$  (THERMAL)

FIND EI:  $\phi = .9 - .2\left(\frac{P_{u2}}{.1 F_c A_g}\right) = .9 - .2\left(\frac{19.49}{.1(5)525.25}\right) = .885$

$\beta_d = \emptyset$  (Wind load not a sustained loading)

$EI = \frac{\phi E_c I_g}{1 + \beta_d} = \frac{.885(4074)2690}{1 + \emptyset} \leftarrow 80\% \text{ comp.} = 9.699 \times 10^6$

$\Delta_{WIND} = \frac{4,607,740}{9.699 \times 10^6} = .475''$

FIND DEFLECTION DUE TO ECCENTRIC AXIAL LOAD:

$$\Delta_p = \frac{PeL^2}{16EI} = \frac{9.3k(3'')(31.5'')^2(144)}{16(5,580,000)} = .0447'' \quad (\text{PCI Ex. 3.5.1})$$

$\beta_1 = .75(1.4(4+9.7))/19.49 = .738, EI = 5,580 \times 10^6$

$$\Delta_{TOT} = \Delta_{WIND} + \Delta_{BCW} + \Delta_{TEMP} + \Delta_p = .475'' + .5'' + .536'' + .0447''$$

$$= \underline{1.556''}$$

ADD P-Δ SLENDerness EFFECTS:

$$\Delta = \frac{PeL^2}{8EI} = \frac{9.3k e (31.5'')^2 144}{8(5,580,000)} = .0298e$$

FIRST ITERATION:  $\Delta = .0298(1.556'') = .0463''$

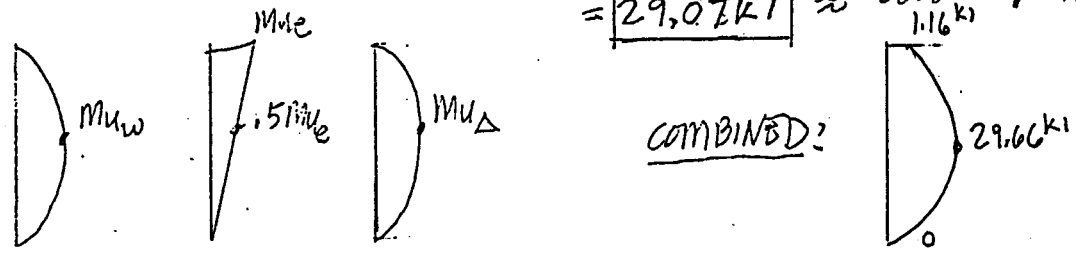
SECOND ITERATION:  $e = 1.556 + .0463 = 1.602''$   
 $\Delta = .0298(1.602) = .0477''$

THIRD ITERATION:  $e = 1.556 + .0477 = 1.603''$   
 $\Delta = .0298(1.603) = .0478''$  (CONVERGENCE)

$$\Delta_{TOT} = 1.556 + .0478'' = \boxed{1.604''} \quad \checkmark \text{CHKS (PG. 7)}$$

$$M_{u_{e \text{ MIDHT.}}} = M_{u_w} + \frac{M_{u_e}}{2} + M_{u_\Delta} = 25.3k + \frac{9.3k(3'')}{2(12)} + \frac{19.49k(1.604'')}{(12)} = 25.3 + 1.16 + 2.605$$

$$= \boxed{29.07k} \approx \frac{28.8k}{1.16k} \checkmark \text{CHKS (PG. 7)}$$



CHECK TENSION STRESS:

$$f = \frac{M_y}{Z_{E_{50\%}}} - f_{ps} - \frac{P}{A} = \frac{29.07k(12000)}{728.1} - 398.5 - \frac{19.49(10000)}{525.25}$$

$$= 479.1 - 398.5 - 37.1 = \boxed{44 \text{ PSI}} < 7.5 \sqrt{5000}$$

$$\approx 41.6 \text{ PSI} = 530 \text{ PSI } \checkmark \text{OK}$$

∴ PANEL IS UNCRACKED  $\checkmark \text{CHKS (PG. 7)}$

THE CONSULTING ENGINEERS GROUP, INC. (312) 729-0646  
 PRESTRESSED PANEL AND COLUMN ANALYSIS (INTRCURV)

SERIAL NO. 0001 LICENSEE: CEG

\*\*\*\*\*  
 \* ALL INFORMATION IS PRESENTED FOR THE INTERPRETATION, \*  
 \* APPROVAL AND APPLICATION BY A REGISTERED ENGINEER \*  
 \*\*\*\*\*

FILE NAME: banner.int

JOB NO: 4058 MARK:  
 MEMBER SIZE: 95.5 X 7.5  
 SOLID WALL PANEL OR COLUMN  
 FPC= 5000 PSI; STRAND DIAMETER = 0.500 IN  
 8.00 STRANDS; 270 KSI 0.153 SQ IN PER STRAND  
 ROW 1 4 STRANDS AT 1 IN FROM BOTTOM  
 ROW 2 4 STRANDS AT 6 IN FROM BOTTOM  
 AREA OF REBAR= 0.00 SQ IN; FY= 60 KSI  
 CAPACITY CALCULATED AT 192 INCHES FROM END

AT PU=0: COMP BLOCK= 0.73 IN  
 MUO= 85.93 FT-KIPS (PHI=0.9)

AT BALANCE PT: COMP BLOCK= 3.65 IN  
 PB= 902.21 KIPS (PHI=0.7)  
 MB= 177.23 FT-KIPS (PHI=0.7)

AT MU=0: PUO= 2058.02 KIPS (PHI=0.7)

0.10\*FPC\*AG= 358.13 KIPS

INTERACTION POINTS		
PHI*PN(KIPS)	PHI*MN(FT-KIPS)	PHI
0.0	85.9	0.900
0.9	85.9	0.899
5.7	86.8	0.896
11.4	87.8	0.893
17.1	88.7	0.889
22.7	89.7	0.886
28.2	90.6	0.882
33.7	91.6	0.879
39.0	92.5	0.875
44.3	93.3	0.872

ULTIMATE CAPACITY:  
 $16.3 + (88.7 - 16.3) \cdot 8$   
 $= 74.2 \text{ k} \approx 16.85$   
 $= 63.1 \text{ k} \text{ (NO COL, TIES)}$   
 $= 757 \text{ k}$   
 ✓ SEE PG. 8)

THE CONSULTING ENGINEERS GROUP, INC. (312) 729-0646  
 PRESTRESSED PANEL AND COLUMN ANALYSIS (INTRCURV)

SERIAL NO. 0001 LICENSEE: CEG

\*\*\*\*\*  
 \* ALL INFORMATION IS PRESENTED FOR THE INTERPRETATION, \*  
 \* APPROVAL AND APPLICATION BY A REGISTERED ENGINEER \*  
 \*\*\*\*\*

FILE NAME: banner2.int

JOB NO: 4058 MARK:  
 MEMBER SIZE: 95.5 X 3  
 SOLID WALL PANEL OR COLUMN  
 FPC= 5000 PSI; STRAND DIAMETER = 0.500 IN  
 4.00 STRANDS; 270 KSI 0.153 SQ IN PER STRAND  
 ROW 1 4 STRANDS AT 1.5 IN FROM BOTTOM  
 AREA OF REBAR= 0.00 SQ IN; FY= 60 KSI  
 CAPACITY CALCULATED AT 192 INCHES FROM END

AT PU=0: COMP BLOCK= 0.39 IN  
 MUO= 15.49 FT-KIPS (PHI=0.9)

AT BALANCE PT: COMP BLOCK= 1.51 IN  
 PB= 364.51 KIPS (PHI=0.7)  
 MB= 26.63 FT-KIPS (PHI=0.7)

AT MU=0: PUO= 815.92 KIPS (PHI=0.7)

0.10\*FPC\*AG= 143.25 KIPS

INTERACTION POINTS		
PHI*PN(KIPS)	PHI*MN(FT-KIPS)	PHI
0.0	15.5	0.900
1.9	15.4	0.897
7.3	15.8	0.889
12.5	16.0	0.880
17.7	16.3	0.872
22.8	16.6	0.863
27.8	16.8	0.855
32.7	17.1	0.846
37.5	17.3	0.837
42.3	17.5	0.829

$4M_n 80\% = 15.5 + (85.9 - 15.5) \cdot 8 = 71.8 \text{ k}$   
 $= 862 \text{ k} \approx 865 \text{ k}$   
 (PG. 5)  
 CHECKS

SECTION DIMENSIONS:

Top Wythe: Width = 95.5 in      Thickness = 3 in      Main Structural Wythe: Top      No. of Wythes = 2  
 Bot Wythe: Width = 95.5 in      Thickness = 2.5 in      Member Length = 384 in      Insulation Thk = 2 in  
 Insulation Start from Top = 0 in      Insulation Stop from Bottom = 0 in  
 No. of Hollow-Core Voids = 0  
 No. of Stems = 0

MATERIALS:    F'c (psi)    Ec (ksi)    F'ci (psi)    Eci (ksi)    Conc Wt (pcf)

Top Wythe:      5000      4074      3500      3409      150  
 Bot Wythe:      5000      4074      3500      3409      150      Average Relative Humidity = 70 %  
 Superimposed Load = 6.25 psf      Fy, Reinf Bar Grade = 60 ksi      Fpu, Strand = 270 ksi      Lo-Lax = Yes

STRAND ROWS:      A      B      C      D

Strand Diam(in) =      .5      .5  
 Strand Area(in2) =      .153      .153  
 % Pull =      75      75  
 No. Strand in Row =      4      4  
 Cent frm Bot/Sect(in) =      1      6

Initial Prestress Loss = 1.728401 % (Calculated)      Final Prestress Loss = 9.5 % (Manual Input)

COMPARE TO 862 KN VCHKS (PG. 4)

(Click on graph to display moments at any point)     Show Factored M Only

Stripping    Ultimate  
 Trucking    Load Factor  
 Erection    = 1.40

Positive Bending at 144.00 in:

Factored M = 864.42 K-in  
 Capacity ≤ 865.58 K-in  
 1.2M<sub>Cr</sub> = 878.85 K-in

Negative Bending at 144.00 in:

Capacity = -756.02 K-in  
 1.2M<sub>Cr</sub> = -824.95 K-in

   Z Composite  
    Handling Factor  
    Left Pick Point, in.  
    Left Gap, in.  
    Rt Pick Point, in.  
    Right Gap, in.

Factored Moment in Red    Ultimate Cap. in Blue    1.2 \* Cracking M. in Green

   Left Pick Pt.        Left Gap        Right Gap        Right Pick Pt.

       File Name: C:\LECWALL\BANNER

License No. 0001 Losch Engineering Corp, (708) 705-1396

6

INPUT DATA FOR FILE: C:\LECWALL\BANNER

02-02-1996

16:13:06

Pg. 2

Service Wind, plf:

Suction: 160

Pressure: 160

Face Temperature, Degrees F:

Outside: 110

Inside: 75

Applied Loads:

Superimposed dead load in kips: 4

Eccentricity, e from inside face of member, in: -1

Superimposed live load in kips: 4

Eccentricity, e from inside face of member, in: -1

Horizontal surcharge at floor or grade, psf: 0

Active lateral earth pressure, psf: 0

Distance from base to top of retained earth, in: 0

Initial member bow at midheight, in: .5

Percent composite at ultimate: 80

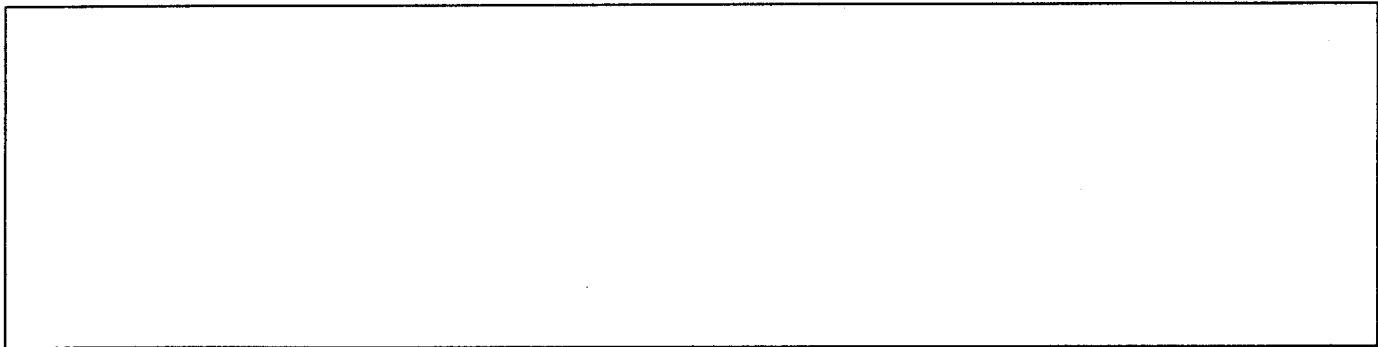
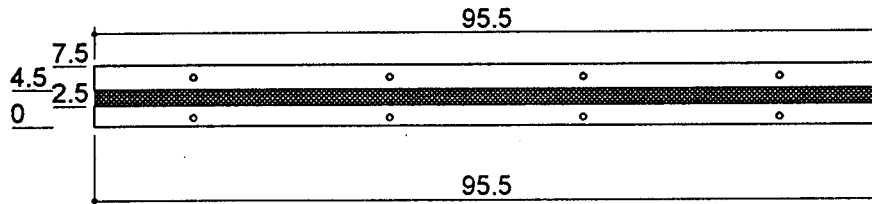
Cracking stress coefficient: 7.5

Slenderness effects are included

Top support location from top of member, in: 6

Optional floor conn. loc. from bot. of member, in: 0

Main structural wythe is inside



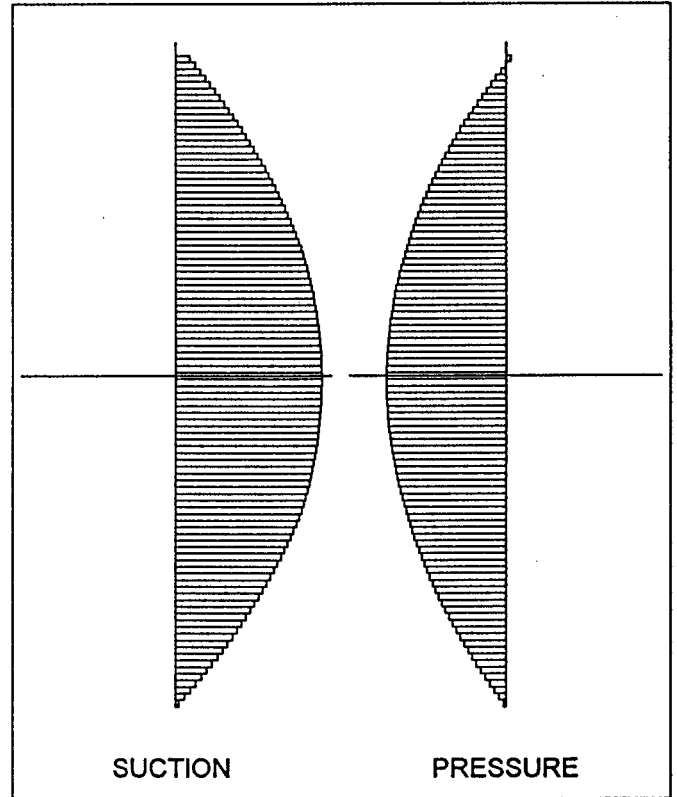
LOAD CASE 3 ACI .75(1.4D+1.7L+1.7W):

Suction at 193.92 in:  $\approx 19.49 \text{ K}$  ✓CHECKS (PG. 2)  
 Pu (kips) = 19.53  
 Mu (kip-in) = 345.82  $/12 = 28.8 \text{ KI}$  ✓CHECKS (PG. 3)  
 Outer Stress (psi) = -41.64  $\approx 44 \text{ PSI}$  ✓CHECKS (PG. 3)  
 Inner Stress (psi) = -866.94  
 Section is Uncracked  
 Midpoint Bow (in) = 1.60 ✓CHECKS (PG. 3)  
 (Outward Bow is Positive)  
 Force in Floor Ties in Kips = 0.00  
 (Compression is Negative)

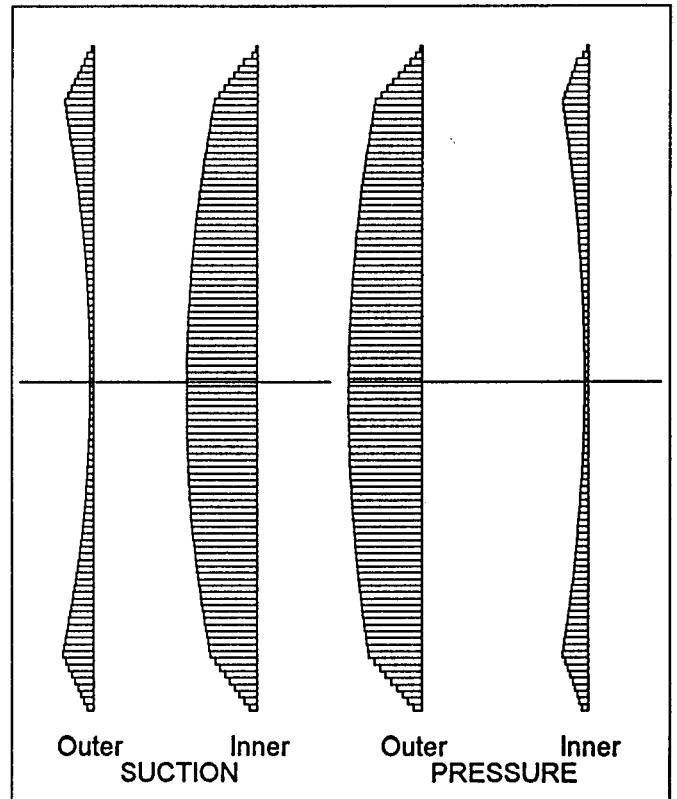
Pressure at 193.92 in:

Pu (kips) = 19.53  
 Mu (kip-in) = -280.52  
 Inner Stress (psi) = -44.75  
 Outer Stress (psi) = -902.15  
 Section is Uncracked  
 Midpoint Bow (in) = 0.61  
 (Outward Bow is Positive)  
 Force in Floor Ties in Kips = 0.00  
 (Compression is Negative)

MAGNIFIED MOMENT

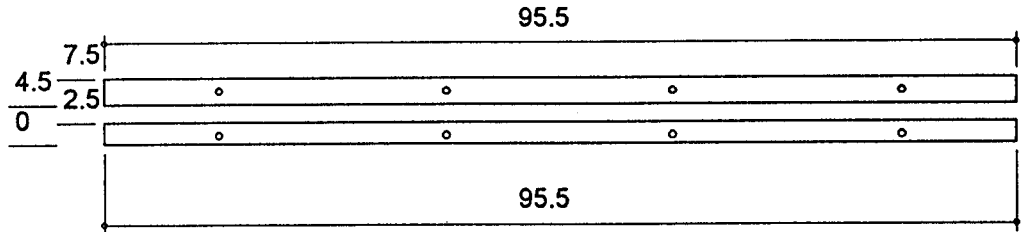


STRESSES



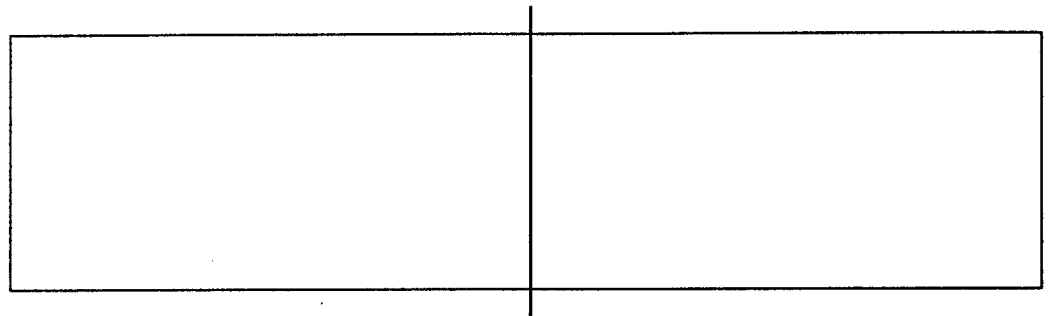
LOAD CASES:

- 1 ACI .9 Dead + 1.3 Wind
- 2 ACI 1.4 Dead + 1.7 Live
- 3 ACI .75(1.4D+1.7L+1.7W)
- 4 Service Dead + Wind
- 5 Service Dead + Live
- 6 Service Dead + Live + Wind



Section cut location from left end (in) = 193.9199

Compression face not reversed



0% Composite: .....

80 % Composite: \_\_\_\_\_

100% Composite: - - - - -

