Check Example

The first page of output is a copy of the XEDIT input data file. The format is described under "INPUT DATA FORMAT (XEDIT)".

Input data – Output Pages 1 to 5

These pages contain the input data as described above under DESIGN.

Factored Loads for Column Design Check – Output Page 6

These pages contain the information as described above under DESIGN. In the "CHECK" mode the column is checked for the area of steel input (i.e. no design). If the "RATIO" (Mu/M) is greater than or equal to 1.00 an "OK" is printed next to the load case. If the "RATIO" (Mu/M) is less than 1.00 an "NG**" is printed next to the load case.

Moment Magnification and Buckling Calculations – Output Page 7

This table contains the same information as described under DESIGN.

Column Service Loads – Output Page 8

For each group loading at the service level, the program calculates the maximum concrete stress in compression, the maximum steel stress in tension and the maximum steel stress in compression. These stresses are calculated using working stress theory which assumes that the concrete stress varies linearly from zero at the neutral axis to a maximum at the extreme compression fiber. The modular ratio, n = ES/EC, where EC = 57000 × Sqrt(FC). The applied moments are not magnified for slenderness effects and the critical buckling loads are not calculated.

Service and Factored Loads for Footing Design – Output Page 9

This page contains the loads for the footing design at the service (SER) and the factored (FAC) level. The live loads have been reduced by the PERCENT IMPACT. These loads will be written to the FOOT file if that option is selected.

Probable Moment (1.3 × Nominal Moment) – Output Pages 10 & 11

These pages contain the Probable Plastic Moments. The Probable Plastic Moment is 1.3 times the Nominal Yield Moment for axial loads below P-Balance. P-Balance is the balance point. For axial loads greater than P-Balance the column will fail in compression. For axial loads smaller than P-Balance the column will fail in tension. The angle of the resultant moment varies from 90 degrees (Transverse) to 0 degrees (Longitudinal) in 15 degree increments. A plot of these values is available.

Determination of Column Spiral Reinforcement – Output Pages 12 to 16

Section 3.21.7 of the Code and *Memo to Designers* 15-10 (pp 33-35) define the forces resulting from plastic hinging (a column reaching its yield moment capacity) in the columns. The column axial forces are the unfactored dead load axial force plus or minus the axial forces developed as a result of an analysis of the distribution of the plastic hinging forces on the bent.

Output page 11 contains a summary of the plastic hinging design assumptions and formulas used to determine the spiral reinforcement required for Confinement (Case A), Applied Shear (Case B), and Minimum Shear (Case C). This procedure is described in *Bridge Design Practice* section 5 (substructures) pages 5-78 to 5-86.

Output pages 12 and 15 are a summary of the plastic hinging analysis in the transverse and longitudinal directions.

The last page in this section is a plot of the probable moments.

```
HP-UX A.09.03      Tue Jul 25 09:52:24 PDT 1995

DIRECTORY: /user/tsbtl/projects/test
INPUT FILE: adelinec.yield

0...|....1....|....2....|....3....|....4....|....5....|....6....|....7....|....8

4' X 8' RECTANGULAR WITH FILLETS   CHECK     VERSION  1    12.79.83
         3
         2
         3        30
         4
         2       1.0       6.0         1     44.00      3.50       .00
      3250  20000000     .0530     60000
     96.00     48.00      9.00      9.00
     20.49     24.00                           1.56
LOAD 1 AT BOTTOM                      YES      FILE
 2.10 1.04                20.00     22.00    0    0      5.00 0111
      0       0   3087    800   1963   2565   396     0     0   374
    302       0    -34    417    -46     34    28     0     0  3497
   2063       0    272    150    367   -118     0     0     0     0
                  7140   4177   7140                        0
                   -88    587    -88                        0
                   505    279    505                        0
     19350     19500       300         0       651         0
       528      6084       300         0       651         0
        75        70       300         0       392         0

0...|....1....|....2....|....3....|....4....|....5....|....6....|....7....|....8
```

```
TITLE C: X E' RECTANGULAR WITH FILLETS   CHECK  7/25/1995  09:52:18 PAGE  1

*****************************************************************************
*                 YIELD PROGRAM   VERSION 1.01     10-11-90                 *
*****************************************************************************

COLUMN TYPE                      =  3  (RECTANGULAR W/FILLETS)
CONCRETE LOOPS                   =  1
TOTAL NO. OF CONCRETE COORD.     =  8
STEEL REBAR PATTERN              =  2  (INTERSECTING LOOPS)
NUMBER OF STEEL REBAR LOOPS      =  3
TOTAL NO. OF STEEL REBARS        = 30
PLOT TYPE                        =  4  (MNZ VS. MNX)
DESIGN TYPE                      =  2  (CHECK)
PERCENT STEEL LIMITS             =     (1.00 * MIN.  6.00 * MAX.)


*************
* BENT DATA *
*****************************************************************************

NUMBER OF COLUMNS IN BENT                        =     2
OUT TO OUT DISTANCE (DIAMETER) OF SPIRAL         = 44.00 (INCHES)
DISTANCE FROM TOP COLUMN PLASTIC HINGE TO
CENTER OF GRAVITY OF THE SUPERSTRUCTURE          =  3.50 (FEET)
CENTER TO CENTER SPACING OF COLUMNS              =   .00 (FEET)


*************************
* MATERIAL PROPERTIES *
*****************************************************************************

ULTIMATE CONCRETE COMPRESSIVE STRESS - FC =      3350. (PSI)
YOUNG'S MODULUS FOR CONCRETE         - FC =  5749500. (PSI)
YOUNG'S MODULUS FOR STEEL BARS         FS = 29000000. (PSI)
ULTIMATE CONCRETE COMPRESSIVE STRAIN   EO =       .003 (IN PER IN)
YIELDING STRESS FOR STEEL BARS         FY =    60000. (PSI)
```

```
TITLE 4' X 8' RECTANGULAR WITH FILLETS   CHECK  7/25/1995  05:52:19 PAGE  3


  RECTANGULAR CROSS-SECTION  (WITH FILLETS)

        DX        DY        FX        FY
     96.00     48.00      9.00      9.00


  CONCRETE COORDINATES  (INCHES)

  COORD       X         Y

    1       48.00     15.00
    2       39.00     24.00
    3      -39.00     24.00
    4      -48.00     15.00
    5      -48.00    -15.00
    6      -39.00    -24.00
    7       39.00    -24.00
    8       48.00    -15.00
```

```
TITLE 2' X 8' RECTANGULAR WITH FILLETS   CHECK  7/25/1995  10:52:10 PAGE  3

  INTERSECTING LOOP PATTERN

     RADIUS    SPACING       AREA
     20.49      24.00        1.56

  STEEL REBAR COORDINATES  (INCHES)

  COORD.        X          Y

    1        -12.00      16.61
    2         12.00     -16.61
    3        -18.74      19.80
    4         18.74     -19.80
    5        -26.18      20.37
    6         26.18     -20.37
    7        -33.33      18.24
    8         33.33     -18.24
    9        -39.24      13.70
   10         39.24     -13.70
   11        -43.13       7.33
   12         43.13      -7.33
   13        -44.49        .00
   14         44.49        .00
   15        -43.13      -7.33
   16         43.13       7.33
   17        -39.24     -13.70
   18         39.24      13.70
   19        -33.33     -18.24
   20         33.33      18.24
   21        -26.18     -20.37
   22         26.18      20.37
   23        -18.74     -19.80
   24         18.74      19.80
   25         12.00      16.61
   26        -12.00     -16.61
   27          4.24      20.05
   28         -4.24     -20.05
   29         -4.24      20.05
   30          4.24     -20.05

  THE MAIN LONGITUDINAL STEEL IS ASSUMED TO BE # 11 BARS.
```

```
TITLE 4  X 9  RECTANGULAR WIRE FILLETS   CHECK  7/25/1995  00:53:15 PAGE  4


    ***************************
    * INITIAL REFERENCE DATA *
    ***************************************************************************

    TOTAL AREA OF THE SECTION                 AG =     30.88 FT**2
    NOMINAL AXIAL LOAD STRENGTH               PO =  14960.79 KIPS
    TOTAL REINFORCEMENT AREA                 AST =     46.80 IN**2
    PERCENT STEEL                                =      1.0% %

    GROSS MOMENT OF INERTIA ABOUT Y-AXIS  IYC =    156.81 FT**4
    GROSS MOMENT OF INERTIA ABOUT X-AXIS  IXC =     39.13 FT**4

    STEEL MOMENT OF INERTIA ABOUT Y-AXIS  IYS =    1.0359 FT**4
    STEEL MOMENT OF INERTIA ABOUT X-AXIS  IXS =     .5197 FT**4
```

```
TITLE 4: 8 8 RECTANGULAR WITH FILLETS   CHECK  7/25/1995  09:52:19 PAGE  5


*****************************
* COLUMN LOAD DATA (K-FT) *
*****************************************************************************

LOAD NAME:          LOAD 1 AT BOTTOM
FOOTING DATA FILE: YES
TYPE FOOTING:         PILE


COLUMN                                  COLUMN  STEEL      LOCATION  DUCTILITY
EFFECTIVE LENGTH FACTORS  PERCENT  LENGTH  1=FIE      1=TOP        FACTOR
   KY (TRAN)   KX (LONG)   IMPACT  (FEET)  0=SPIRAL   0=BOTTOM        (Z)

        2.10        1.04    20.00   22.00         1          0       6.00

COLUMN END CONDITIONS (TOPY TOPX BOTY BOTX) (1=FIX 0=PIN)  0111



COLUMN GROUP LOADS - SERVICE (K-FT)

                    :-- LL+IMPACT -:
                    CASE 1 CASE 2 CASE 3
       DEAD     PRE  TRANS   LONG  AXIAL
       LOAD  STRESS MY-MAX MX-MAX  N-MAX   WIND    WL    LP CP-MS  TEMP

MY        0       0   3087    800   1963   2565   398     0     0   374
MX      302       0    -34    417    -46     34    28     0     0  3497
P      2083       0    272    150    367   -118     0     0     0     0
PMY                   7140   4177   7140                        0
PMX                    -88    587    -88                        0
P                      505    279    505                        0

COLUMN SEISMIC AND ARBITRARY LOADS (K-FT)

     (ABS) UNREDUCED SEISMIC     ARBITRARY LOADS     ARBITRARY LOADS
             CASE 1    CASE 2   SERVICE   SERVICE  FACTORED  FACTORED
           MAX TRAN  MAX LONG       AL1       AL2       AL1       AL2

MY TRAN     19350.    19500.      300.        0.      651.        0.
MX LONG       628.     6084.      300.        0.      651.        0.
P AXIAL        75.       70.      300.        0.      390.        0.
```

```
TITLE 4' X 8' RECTANGULAR WITH FILLETS   CHECK  7/25/1995  05:52:19 PAGE  6


*****************************************************
* FACTORED LOADS FOR COLUMN DESIGN CHECK  (KIP-FT) *
*****************************************************************************

APPLIED FACTORED MOMENTS ARE MAGNIFIED FOR SLENDERNESS IN ACCORDANCE WITH
CALTRANS BRIDGE DESIGN SPECIFICATIONS. (ART 8.16.5)

LENGTH =  22.00 FT     FC  =   3.25 KSI      FY  = 60.00 KSI
STEEL  =   1.05 %      AST =   46.80 SQ IN

              |--- APPLIED FACTORED ---| CAPACITY
GROUP CASE  TRANS      LONG      COMB    AXIAL (PHI*MN)  PHI RATIO
              MY        MX         M         P        MU        MU/M

  IH    1    6688.      445.     6703.    2620.    11777.  .75 1.76 OK
  IH    2    1733.     1195.     2107.    2356.     8159.  .75 3.87 OK
  IH    3    4253.      596.     4295.    3503.    11981.  .75 2.79 OK
  IP    1    9282.      457.     9293.    2687.    11908.  .75 1.28 OK
  IP    2    5430.     1056.     5532.    2394.    10947.  .75 1.96 OK
  IP    3    9282.      572.     9300.    3364.    12365.  .75 1.33 OK
  II         3335.      339.     3352.    1878.    10731.  .75 3.20 OK
  III   1    5531.      398.     5545.    2339.    11451.  .75 2.07 OK
  III   2    2558.      886.     2707.    2180.     9651.  .75 3.57 OK
  III   3    4070.      534.     4104.    3139.    11856.  .75 2.89 OK
  IV    1    4499.     4796.     6576.    2385.     7306.  .75 1.11 OK
  IV    2    1526.     5383.     5595.    2226.     6203.  .75 1.11 OK
  IV    3    3038.     4879.     5747.    3188.     7171.  .75 1.25 OK
  V          3674.     4697.     5963.    1805.     6551.  .75 1.10 OK
  VI    1    5786.     4660.     7429.    2249.     7741.  .75 1.04 OK
  VI    2    2927.     5223.     5988.    2098.     6435.  .75 1.07 OK
  VI    3    4381.     4739.     6454.    3018.     7619.  .75 1.18 OK
  VII   1    3225.      390.     3248.    2158.    13672. 1.00 4.21 OK
  VII   2    3250.     1316.     3506.    2153.    11598. 1.00 3.31 OK


*****************************************************
* ARBITRARY LOADS FOR COLUMN DESIGN CHECK  (KIP-FT) *
*****************************************************************************

ARBITRARY APPLIED FACTORED MOMENTS ARE NOT MAGNIFIED FOR SLENDERNESS.

              |--- APPLIED FACTORED ---|CAPACITY
GROUP CASE  TRANS      LONG      COMB    AXIAL (PHI*MN)  PHI RATIO
              MY        MX         M         P        MU        MU/M

  ALI         851.      851.      921.     390      6848. 1.00 7.28 OK

NOTE: THE AXIAL (ARS) UNREDUCED SEISMIC LOADS (P) ARE NOT DIVIDED
BY THE DUCTILITY FACTOR Z
```

```
TITLE 4: X 8' RECTANGULAR WITH FILLERS   CHECK  7/25/1995  09:52:19 PAGE: 7

   ***************************************************
   * MOMENT MAGNIFICATION AND BUCKLING CALCULATIONS *
   ***************************************************************************

   REFERENCE: "CALTRANS BRIDGE DESIGN SPECIFICATIONS" (ART # 10.1)
              (COLUMN ASSUMED TO BE UNBRACED AGAINST SIDESWAY.)

   MAGY    = MOMENT MAGNIFACTION FACTOR ABOUT Y-AXIS
   MAGX    = MOMENT MAGNIFACTION FACTOR ABOUT X-AXIS

   PCY     = CRITICAL BUCKLING LOAD ABOUT Y-AXIS
   PCX     = CRITICAL BUCKLING LOAD ABOUT X-AXIS

   KY      = EFFECTIVE LENGTH FACTOR ABOUT Y-AXIS =  2.32
   KX      = EFFECTIVE LENGTH FACTOR ABOUT X-AXIS =  1.04

   KY*L/R = SLENDERNESS RATIO ABOUT Y-AXIS        = 31.
   KX*L/R = SLENDERNESS RATIO ABOUT X-AXIS        = 30.

   IYS     = STEEL MOMENT OF INERTIA ABOUT Y-AXIS =  2.3159 FT**4
   IXS     = STEEL MOMENT OF INERTIA ABOUT X-AXIS =   .5197 FT**4


                 MOMENT                 CRACKED                 CRITICAL
          :-MAGNIFICATION-:-TRANSFORMED SECTION-:--BUCKLING--:  AXIAL
   GR  CA  TRAN  LONG  COMB        E*IY         E*IX      TRAN     LONG    LOAD
           MAGY  MAGX   MAG                                PCY      PCX       P
   IH   1  1.000 1.000 1.000   43384307.    5923456.  200608.  111677.   2521.
   IH   2  1.000 1.000 1.000   43384307.    9509520.  200608.  179286.   2257.
   IH   3  1.000 1.000 1.000   43384307.    5923456.  200608.  111677.   3371.
   IP   1  1.000 1.000 1.000   43384307.    5923456.  200608.  111677.   2588.
   IP   2  1.000 1.000 1.000   43384307.    9266791.  200608.  174710.   2294.
   IP   3  1.000 1.000 1.000   43384307.    5923456.  200608.  111677.   3232.
   II      1.000 1.000 1.000   43384307.    6337003.  200608.  119474.   1778.
   III  1  1.000 1.000 1.000   43384307.    5977871.  200608.  112703.   2239.
   III  2  1.000 1.000 1.000   43384307.    8892358.  200608.  167660.   2081.
   III  3  1.000 1.000 1.000   43384307.    5923456.  200608.  111677.   3007.
   IV   1  1.000 1.000 1.000   43384307.   11161690.  200608.  210435.   2285.
   IV   2  1.000 1.000 1.000   43384307.   11232456.  200608.  211769.   2127.
   IV   3  1.000 1.000 1.000   43384307.   10964601.  200608.  206719.   3053.
   V       1.000 1.000 1.000   43384307.   11146034.  200608.  210177.   1706.
   VI   1  1.000 1.000 1.000   43384307.   11142779.  200608.  210078.   2149.
   VI   2  1.000 1.000 1.000   43384307.   11214720.  200608.  211435.   1997.
   VI   3  1.000 1.000 1.000   43384307.   10940547.  200608.  206266.   2866.
   VII  1  1.000 1.000 1.000   43384307.    5923456.  200608.  111677.   2026.
   VII  2  1.000 1.000 1.000   43384307.    9124743.  200608.  172033.   2021.
```

TITLE 4' X 8' RECTANGULAR WITH FILLETS CHECK 7/25/1995 09:53:19 PAGE 3

COLUMN SERVICE LOADS (K-FT) AND MAXIMUM WORKING STRESSES (PSI)

YOUNG S MODULUS FOR CONCRETE - EC = 3249500 PSI
MODULAR RATIO (FS/EC) - N = 8.9

		SERVICE LOADS (K-FT)			MAX STRESS (PSI)			
		TRANS	LONG	COMB	AXIAL	CONC	STEEL	STREL
GP	CASE	MY	MX	M	P	COMP	TEN	COMP
IH	1	3089.	258.	3099.	2355.	1045.	0.	8628.
IH	2	800.	719.	1076.	2233.	796.	0.	6485.
IH	3	1963.	256.	1980.	2450.	878.	0.	7320.
II		2052.	259.	2070.	1572.	715.	20.	5833.
III	1	3404.	245.	3412.	1856.	1029.	1867.	8376.
III	2	1574.	606.	1687.	1758.	764.	0.	6140.
III	3	2504.	235.	2515.	1932.	856.	0.	7054.
IV	1	2769.	3012.	4091.	1884.	2368.	17628.	16806.
IV	2	939.	3373.	3501.	1786.	2167.	19221.	15772.
IV	3	1870.	3002.	3537.	1950.	2100.	14065.	15325.
V		2099.	2758.	3490.	1404.	2142.	19703.	14950.
VI	1	3306.	2717.	4279.	1657.	2384.	19309.	16573.
VI	2	1573.	1999.	3469.	1570.	2187.	19651.	15531.
VI	3	2503.	2708.	3688.	1725.	2123.	19447.	15098.
AL1		300.	300.	424.	300.	220.	725.	1655.
DL		0.	302.	302.	2082.	628.	0.	4580.

TITLE 4' X 8' RECTANGULAR WITH FILLETS CHECK 7/25/1995 08:52:33 PAGE 9

```
*****************************************************
* SERVICE LOADS FOR SCOPING DESIGN (UNITS KIP-FT) *
*****************************************************
```

GROUP	CASE	TRANS MY	LONG MX	COMB M	AXIAL P
IM	1	2573.	274.	2587.	2310.
IM	2	667.	650.	931.	2208.
IM	3	1636.	264.	1657.	2389.
II		2052.	269.	2070.	1572.
III	1	2992.	249.	3003.	1819.
III	2	1667.	550.	1587.	1739.
III	3	2243.	261.	2256.	1883.
IV	1	2357.	3017.	3828.	1948.
IV	2	833.	3317.	3420.	1766.
IV	3	1608.	3009.	3411.	1911.
V		2099.	2728.	3450.	1404.
VI	1	2939.	2721.	4005.	1624.
VI	2	1577.	2995.	3380.	1592.
VI	3	2270.	2712.	3537.	1681.
ALL		302.	300.	424.	300.

```
*****************************************************
* FACTORED LOADS FOR SCOPING DESIGN (UNITS KIP-FT) *
*****************************************************
```

GROUP	CASE	TRANS MY	LONG MX	COMB M	AXIAL P
IM	1	5574.	221.	5584.	3199.
IM	2	1444.	1146.	1644.	2979.
IM	3	3544.	310.	3558.	3371.
IP	1	7735.	297.	7741.	3255.
IP	2	4525.	1029.	4640.	3020.
IP	3	7735.	297.	7741.	3255.
II		3335.	437.	3363.	2555.
III	1	4882.	405.	4879.	2957.
III	2	2384.	994.	2547.	2826.
III	3	3644.	392.	3665.	3059.
IV	1	3830.	4902.	6221.	3003.
IV	2	1353.	5390.	5559.	2870.
IV	3	2613.	4889.	5543.	3305.
V		3674.	4751.	6038.	2454.
VI	1	5143.	4761.	7008.	2843.
VI	2	2760.	5231.	5914.	2716.
VI	3	3972.	4769.	6191.	2962.
ALL		551.	551.	921.	390.

```
TITLE 4  X 8' RECTANGULAR WITH FILLETS   CHECK  7/25/1995  00:52:19 PAGE 10


*****************************************************************
* PROBABLE PLASTIC MOMENT (1.3 X NOMINAL MOMENT) (KIP-FT.) *
*****************************************************************

CODE (8.16.4.4) AND MEMO TO DESIGNERS 15-10

FC  =   3.25 KSI              FY  =  60.00 KSI
EO  =  .0030 IN/IN            AST =  46.80 SQ IN

     ANGLE        TRANS       LONG       COMB      AXIAL   P-BALANCE
                   MPY        MPX         MP         P     (APPROX)

      90.0        19019.        0.      19019.     8976.      5534
                  20969.        0.      20969.     7479.
                  22125.        0.      22125.     5984.
                  21794.        0.      21794.     4490.
                  19979.        0.      19979.     2993.
                  18178.        0.      18178.     2084.
                  16752.        0.      16752.     1497.
                  12152.        0.      12152.        1.
                   9330.        0.       9330.     -747.
                   6186.        0.       6186.    -1495.

      75.0        16331.     4368.      16905.     8975.      5459
                  17798.     4755.      18422.     7479.
                  18612.     4936.      19255.     5986.
                  18430.     4929.      19075.     4490.
                  17145.     4586.      17748.     2994.
                  15781.     4224.      16336.     2084.
                  14698.     3934.      15215.     1498.
                  10934.     2927.      11319.        1.
                   8520.     2281.       8620.     -747.
                   5735.     1535.       5937.    -1495.

      80.0        12174.     7000.      14045.     8975.      5309
                  13286.     7559.      15286.     7479.
                  13720.     7883.      15823.     5986.
                  13690.     7833.      15772.     4497.
                  12738.     7314.      14698.     2994.
                  11752.     6793.      13600.     2084.
                  10978.     6330.      12672.     1498.
                   8159.     4730.       9465.        1.
                   6453.     3726.       7455.     -747.
                   4420.     2599.       5090.     1495.
```

TITLE 6: X 8 RECTANGULAR WITH FILLETS CHECK 7/05/1995 09:51:10 PAGE 11

***

```
TITLE: BT 8 5 RECTANGULAR WITH FILLETS   DATE  7/25/1995  09:02:13 PAGE: 1


DESIGN ASSUMPTIONS:

1. ALL COLUMNS ARE THE SAME I.E., PRISMATIC, EQUAL LENGTH, EQUAL STIFFNESS.
2. PLASTIC HINGES FORM AT THE TOP AND BOTTOM OF THE COLUMNS.
3. THE DISTANCE BETWEEN THE PLASTIC HINGES IS TAKEN AS THE COLUMN LENGTH.
4. THE OVER-TURNING FORCE ACTS THROUGH THE C.G. OF THE SUPERSTRUCTURE AT A
   DISTANCE 'CGS' ABOVE THE TOP OF THE COLUMN.
5. THE COLUMNS ARE NUMBERED FROM LEFT TO RIGHT, AND THE OVERTURNING FORCE
   ACTS TO THE RIGHT.

DETERMINATION OF COLUMN LATERAL REINFORCEMENT

NUMBER OF COLUMNS IN BENT                    =   1
OUT TO OUT DISTANCE (DIAMETER) OF
LATERAL REINFORCEMENT                        =  44.00 IN
DISTANCE FROM TOP COLUMN PLASTIC HINGE
TO CENTER OF GRAVITY OF SUPERSTRUCTURE       =   7.50 FT
CENTER TO CENTER SPACING OF COLUMNS          =    .00 FT
COMPRESSIVE STRENGTH OF CONCRETE     - FC    =   3.25 KSI
YIELD STRENGTH OF REINFORCEMENT      - FY    =  60.00 KSI
CONCRETE GROSS AREA (3" COVER)       - AG    =  25.57 FT**2
CONCRETE CORE AREA                   - AC    =  25.21 FT**2
TRANSVERSE DIRECTION                 - BW    =  44.00 IN
TRANSVERSE DIRECTION                 - D     =  73.60 IN
LONGITUDINAL DIRECTION               - BW    =  92.00 IN
LONGITUDINAL DIRECTION               - D     =  35.20 IN


AMOUNT OF REINFORCEMENT CONFORMS TO THE FOLLOWING BRIDGE DESIGN
SPECIFICATIONS:

CASE A - CONFINEMENT REINFORCEMENT     -  (SECTION 8.18.2.2)
         RS1 = .45 (AG/AC - 1) FC/FY (.5 + 1.25 N/(AC * AG))
         RS2 =            (.12 FC/FY (.5 + 1.25 P/(AC * AG)))
         RS3 = .45 (AG/AC - 1) FC/FY

CASE B - APPLIED SHEAR REINFORCEMENT   -  (SECTION 8.16.6)
         VU <= PHI * VN                    (8-66)
         VN  = VC + VS                     (8-67)
         VC  = 2 * SQRT(FC) * BW * D       (8-71)
         VS  = (AV * FY * D) / S           (8-73)

CASE C - MINIMUM SHEAR REINFORCEMENT   -  (SECTION 8.16.6.1)
         AV = (50 * BW * S)/FY             (8-64)
```

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TITLE 4' X 8' RECTANGULAR WITH FILLETS   CHECK  7/25/1995  05:52:15 PAGE 13


*************************
* TRANSVERSE DIRECTION *
*************************************************************************


LOADS RESULTING FROM PLASTIC HINGING OF COLUMN NO. 1

TOP OF COLUMN     AXIAL FORCE                P =  1981. KIPS
                  PLASTIC MOMENT            MP =     0. K-FT
BOTTOM OF COLUMN  AXIAL FORCE                P =  2083. KIPS
                  PLASTIC MOMENT            MP = 18174. K-FT

DESIGN SHEAR FORCE:                         VU =   713. KIPS
CONCRETE FACTORED SHEAR STRENGTH:  .85 * VC =   314. KIPS
STEEL    FACTORED SHEAR STRENGTH:  .85 * VS =   399. KIPS

MAXIMUM CENTER TO CENTER SPACING (PITCH) OF LATERAL REINFORCEMENT. (IN)

  BAR    CASE A          CASE B        CASE C          CONFINEMENT
  SIZE   CONFINEMENT     APP SHEAR     MIN SHEAR      RATIO  EQUATION
   4          2.834         3.764        10.909       .00452     2
   5          4.385         5.835        16.909       .00452     2
   6          6.208         8.281        24.000       .00452     2
   7          9.452        11.293        32.727       .00452     2
   8         11.109        14.865        43.091       .00452     2
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TITLE 4 X 8  RECTANGULAR WITH FILLETS   CHECK  7/25/1995  03:32:18 PAGE 13


*************************
* TRANSVERSE DIRECTION *
*************************************************************************


THE MAXIMUM SPACING OF LATERAL REINFORCEMENT SHALL NOT EXCEED ONE-FIFTH
OF THE LEAST DIMENSION OF THE COLUMN, 6 TIMES THE NOMINAL DIAMETER OF THE
LONGITUDINAL REINFORCEMENT, OR 5 INCHES. (8.21.1.1)

THE MINIMUM SPACING SHALL NOT BE LESS THAN 1.5 BAR DIAMETERS;
1.5 TIMES THE MAXIMUM SIZE COARSE AGGREGATE, OR 1.5 INCHES. (8.21.1)


FACTORED SHEAR STRENGTH  .85 * (VS + VC) BASED ON MAXIMUM AND MINIMUM
CENTER TO CENTER SPACING (PITCH) OF LATERAL REINFORCEMENT:

                                  1.0" AGG
 BAR          MAX      SHEAR          MIN      SHEAR
SIZE        PITCH   STRENGTH        PITCH   STRENGTH
             (IN)     (KIPS)         (IN)     (KIPS)
  4         8.000      502.        2.000     1065.
  5         8.000      605.        2.125     1409.
  6         8.000      727.        2.250     1569.
  7         8.000      877.        2.375     1569.
  8         8.000     1057.        2.500     1569.


NOTE:

THE ABOVE FACTORED SHEAR STRENGTH VALUES ARE BASED ON A
FACTORED CONCRETE SHEAR STRENGTH (.85 * VC) OF 314. KIPS.

IF THE APPLIED AXIAL LOAD IS LESS THAN 1182. KIPS,
THEN THE FACTORED CONCRETE SHEAR STRENGTH DECREASES FROM
 314. KIPS TO 0. KIPS AND THE VALUES IN THE ABOVE TABLE
MUST BE APPROPRIATELY ADJUSTED.

IF THE DESIGNER SELECTS A LATERAL BAR SIZE DIFFERENT THAN
THE ONE ASSUMED, HE SHOULD CONSIDER ADJUSTING THE RADIUS OF
THE MAIN STEEL BAR LOOP AND RE-RUN THE PROBLEM.

MAXIMUM SHEAR CAPACITY OF THE SECTION:
VMAX = .85 * 10 * SQRT(FC) * S * D =  1569. KIPS
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TITLE # X 8: RECTANGULAR WITH FILLETS   CHECK  7/25/1995  05:52:19 PAGE 15


 ***************************
 * LONGITUDINAL DIRECTION *
 ***************************************************************************


 LOADS RESULTING FROM PLASTIC HINGING OF COLUMN NO. 1

 TOP OF COLUMN     AXIAL FORCE                 P =  1981. KIPS
                   PLASTIC MOMENT             MP =  8411. K-FT
 BOTTOM OF COLUMN  AXIAL FORCE                 P =  2003. KIPS
                   PLASTIC MOMENT             MP =  9552. K-FT

 DESIGN SHEAR FORCE:                          VU =   862. KIPS
 CONCRETE FACTORED SHEAR STRENGTH:  .85 * VC =   314. KIPS
 STEEL    FACTORED SHEAR STRENGTH:  .85 * VS =   548. KIPS

 MAXIMUM CENTER TO CENTER SPACING (PITCH) OF LATERAL REINFORCEMENT. (IN)

   BAR     CASE A          CASE B          CASE C          CONFINEMENT
   SIZE    CONFINEMENT     APP SHEAR       MIN SHEAR       RATIO  EQUATION
    4          2.834          3.930          15.652        .00452     2
    5          4.385          6.092          24.261        .00452     2
    6          6.208          8.647          34.435        .00452     2
    7          8.452         11.791          46.957        .00452     2
    8         11.109         15.525          61.826        .00452     2


 NOTE:

 THE UNREDUCED ELASTIC ARE + DEAD LOAD MOMENT ( 6486. K-FT)
 IS LESS THAN THE PROBABLE PLASTIC MOMENT ( 9552. K-FT)
 THEREFORE, PLASTIC HINGING DOES NOT CONTROL.
 (CODE 5.16.6.11.1)

 THE DESIGNER MUST CHECK THE SHEAR REINFORCEMENT (CASE B)
 FOR GROUP LOADS I TO VII
 (USE UNREDUCED ELASTIC ARE + DEAD LOAD SHEAR FOR GROUP VII)
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TITLE 5) X 8) RECTANGULAR WITH BELLETS   CHECK  [illegible]  [illegible]  PAGE 16)


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* LONGITUDINAL CORRECTION *
*************************************************************************


THE MAXIMUM SPACING OF LATERAL REINFORCEMENT SHALL NOT EXCEED ONE-FIFTH
OF THE LEAST DIMENSION OF THE COLUMN, 6 TIMES THE NOMINAL DIAMETER OF THE
LONGITUDINAL REINFORCEMENT, OR 8 INCHES. (8.21.1.1)

THE MINIMUM SPACING SHALL NOT BE LESS THAN 1.5 BAR DIAMETERS,
1.5 TIMES THE MAXIMUM SIZE COARSE AGGREGATE, OR 1.5 INCHES. (8.22.1)


FACTORED SHEAR STRENGTH  .85 * (VS + VC) BASED ON MAXIMUM AND MINIMUM
CENTER TO CENTER SPACING (PITCH) OF LATERAL REINFORCEMENT:

                                  1.0* AGG
 BAR          MAX     SHEAR          MIN     SHEAR
SIZE        PITCH  STRENGTH        PITCH  STRENGTH
             (IN)    (KIPS)         (IN)    (KIPS)
  4         8.000     583.        2.000     1391.
  5         8.000     731.        2.125     1569.
  6         8.000     906.        2.250     1569.
  7         8.000    1112.        2.375     1569.
  8         8.000    1378.        2.500     1569.

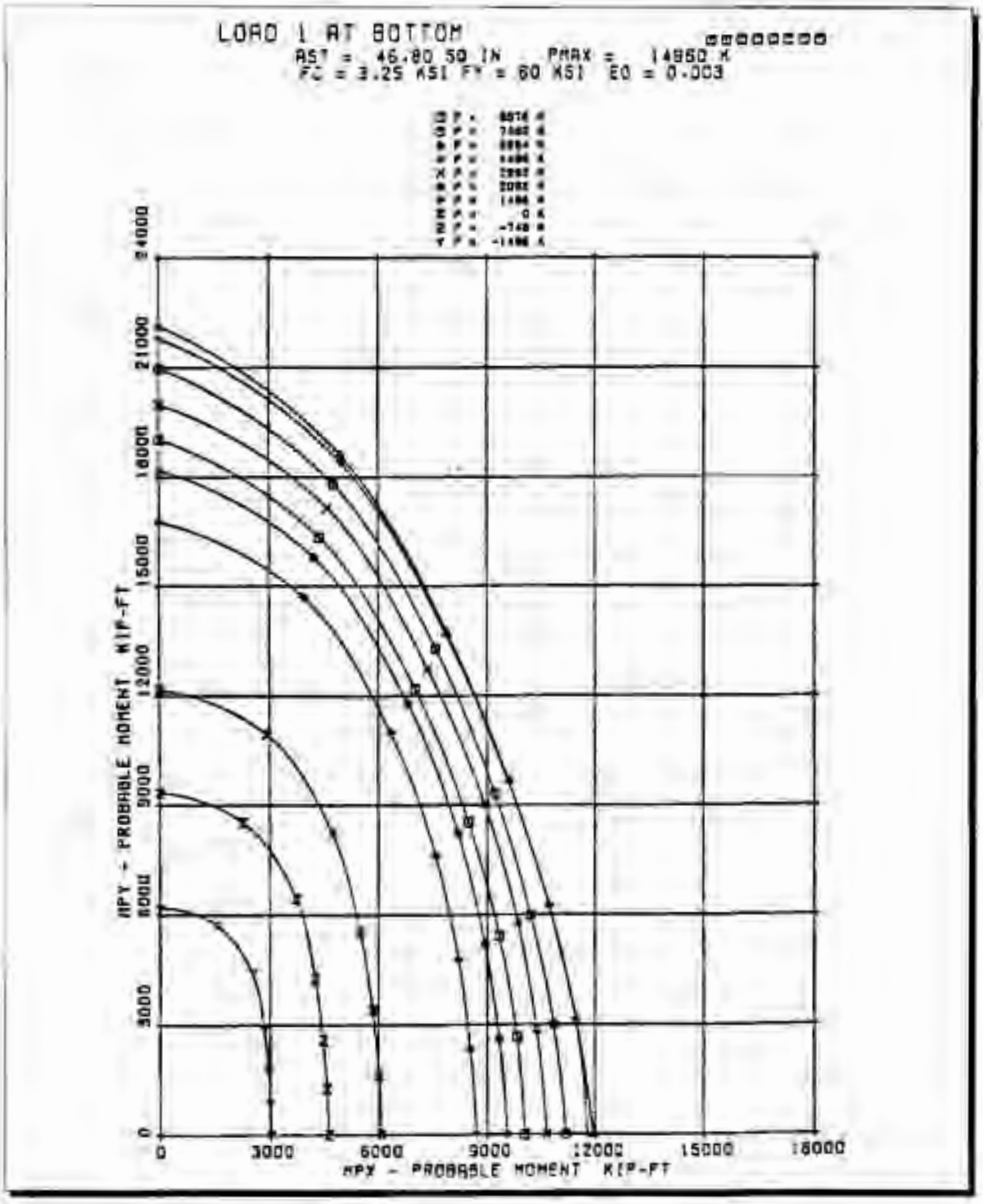

NOTE:

THE ABOVE FACTORED SHEAR STRENGTH VALUES ARE BASED ON A
FACTORED CONCRETE SHEAR STRENGTH (.85 * VC) OF 314. KIPS.

IF THE APPLIED AXIAL LOAD IS LESS THAN 1181. KIPS,
THEN THE FACTORED CONCRETE SHEAR STRENGTH DECREASES FROM
 314. KIPS TO 0. KIPS AND THE VALUES IN THE ABOVE TABLE
MUST BE APPROPRIATELY ADJUSTED.

IF THE DESIGNER SELECTS A LATERAL BAR SIZE DIFFERENT THAN
THE ONE ASSUMED, HE SHOULD CONSIDER ADJUSTING THE RADIUS OF
THE MAIN STEEL BAR LOOP AND RE-RUN THE PROBLEM.

MAXIMUM SHEAR CAPACITY OF THE SECTION:
VMAX = .85 * 10 * SQRT(50) * B * D =  1569. KIPS
```


LOAD 1 AT BOTTOM
AST = 46.80 SQ IN PMAX = 14860 K
FC = 3.25 KSI FY = 60 KSI EO = 0.003
MPY - PROBABLE MOMENT KIP-FT
MPX - PROBABLE MOMENT KIP-FT
0
3000
6000
9000
12000
15000
18000
21000
24000