Column Dimensions (Types 2,3,4,6,8,9)

Rectangle	(type 2)
Rectangle/Fillets	(type 3)
Semi-Circular Ends	(type 4)
Hexagon	(type 6)
Octagon	(type 8)
Round	(type 9)

X-Width (Types 2,3,4,6,8,9)

Enter the width (in) of the column parallel to the x-axis (i.e. transverse direction). The largest dimension of the column must be oriented in the x-direction.

Y-Thick (Types 2,3,4)

Enter the thickness (in) of the column parallel to the y-axis (i.e. longitudinal direction). The smallest dimension of the column must be oriented in the y-direction.

X-Fillet Y-Fillet (Type 3)

Enter the fillet dimensions (in) parallel to the x and y axes. This is used to describe a rectangular column with chamfers on the corners or to describe a hexagonal or octagonal shape that is not regular.

Steel Panels

Rebar Layout (Type 1 – Manual Input)

This option may be used to describe a column with an unusual or non-symmetric rebar pattern.

Total Number of Steel Loops

Enter the number of steel loops to be input. All rebar locations in single loop must have the same area.

Total Number of Steel Coordinates

Enter the total number of steel coordinates (rebar or bundled rebar locations) for all the loops. The maximum number of steel coordinates is 300.

Loop Number _ Has __ Coordinates

The program generates the number of the current steel rebar loop being described. You cannot write over this number, it is for your information only. The input panel allows up to 60 steel coordinates per loop.

Enter the number of coordinate sets (rebar locations) in this loop.

Area of Each Bar

Enter the area of steel (sq in) at each coordinate (rebar location) in this loop.

X(IN) & Y(IN)

Enter the x and y coordinates (in) of each individual reinforcing bar or bundle of bars. The origin (0,0) of the coordinates is located at the centroid of the cross-section.

Rebar Layouts (Types 2,3,4,5)

Intersecting Loops (Type 2)
Semi-Circular Ends (Type 3)
Concentric Loops (Type 4)

Number of Steel Rebar Loops (Type 2)

Enter the number of intersecting steel rebar loops.

Total Number of Steel Rebars (Type 2,3)

Enter the number of steel rebars.

Loop Radius (Type 2,3,4)

Enter radius (in) of the circle that passes through the center of each rebar. When bundled bars are used, the radius should pass through the center of gravity of the bundle.

Intersecting Loops (Type 2)

All the loops have the same radius. The centers of the intersecting circles lie on and are symmetrically spaced along the x-axis. There is no limit to the number of intersecting loops.

Semi-Circular Ends (Type 3)

The semi-circles at each end have the same radius and their centers lie on the x axis.

Concentric Loops (Type 4)

Enter a radius for each circle. The center of each circle is at the origin. The maximum number of Concentric Loops is five.

Loop Spacing (Type 2,3)

For Intersecting loops (Type 2) or Semi-Circular Ends (Type 3) enter the distance (in) from the center of one circle to the center of the adjoining circle.

Area of Each Bar

Enter the area of steel (sq in) at each location. The area of steel at each location in a row or loop is the same. For bundled bars, enter the combined area of all the bars in the bundle; i.e., for a bundle of 3 #8 bars, enter an area of (3×0.79) 2.37 square inches.

Number of Bars (Type 4,5)

Enter the number of rebar locations in the row or loop being described. A bundle is considered as one location.

Rows (Type 5)

X-Coor & Y-Coor Start Row

Enter the x and y coordinates (in) of the first bar in each row.

X-Coor & Y-Coor End Row

Enter the x and y coordinates (in) of the last bar in each row of bars. Be careful not to enter the same bar twice as the end bar in two different rows; especially for corner bars.

Load Panel

Load Page __ of __

This is the current load page (set). You may enter up to 10 separate load pages (sets).

Footing Data File ? (Yes/No)

Enter 'YES' to create a "FOOT" input data file. This file will contain the column dimensions, column end conditions, the service loads, factored loads, ARS unreduced seismic, and probable plastic loads to be used in the footing design program. For columns fixed at the bottom in both directions, or pinned at the bottom in one direction and fixed in the other direction, the loads must be described at the bottom of the column. However, for columns that are pinned at the bottom in both directions, the loads must be described at the top of the column. For this case the program will automatically increase the dead load to include the weight of the column (based on the column area and length), and not pass any moments to the "FOOT" input data file. This option is only available in the "CHECK" mode of the yield program.

Footing Type (Spread) (Pile)

Enter the type of footing to be designed at a later time using the footing program. The 'PILE' option refers to a multiple pile footing.

Load Name

Enter up to 30 characters to define this page (set) of loads. This information will also appear at the top of any plots.

Effective Length Factors
Ky (Trans) Kx (Long)

Enter the effective length factors, Ky and Kx, in the transverse and longitudinal directions respectively. These K-factors are used to calculate critical buckling loads and moment magnification factors. The longitudinal K-factor (Kx) may be obtained from the BDS program and the transverse K-factor (Ky) may be obtained from the Bent program. These K-factors may also be calculated using the nomograph (Table C-2) and the procedures outlined in Appendix C of the Caltrans *Bridge Design Specifications* manual.

Percent Impact

Enter the Percent Impact used to calculate 'Live Load + Impact'. The program uses the Percent Impact in the "CHECK" mode when the loads are described at the bottom of the column to calculate the service and factored loads for the footing design. (The live loads are reduced by the Percent Impact for footing design loads.)

Column Length

Enter the clear length (ft) of the column (i.e. the distance from the top of the footing to the bottom of the soffit). This length is used in the plastic hinging analysis (CHECK mode) and to calculate moment magnification factors and critical buckling loads (DESIGN and CHECK mode). Enter a zero to suppress the above features.

Tie=1

Spiral=0

Enter 1 for a tied column or a 0 for a spirally reinforced column.

Top=1

Bottom=0

Enter 1 if the section description and the loads are for the top of the column. Enter 0 if the section and the loads are for the bottom of the column. If the loads are at the bottom of the column and the program is in the "CHECK" mode the appropriate loads for the footing design will be calculated and printed.

Ductility Factor (Z)

Enter the seismic ductility and risk factor (Z). The program will reduce the ARS seismic moments by this factor. The program does not reduce the ARS seismic axial loads.

Column End Connection (Topy Topx Boty Botx)

Enter the end condition at the top and bottom of the column. Input a '0' for a pinned end condition or a '1' for a fixed end condition. For a single column bent enter a '0' for "Topy" to model a cantilever condition in the transverse direction. The default is '1' to model fixed at both ends.

Group Loading Data (Kip-Feet)

My is the moment in the transverse direction of the bent, this is the moment about the y-axis of the bent. Mx is the moment in the longitudinal direction of the bent, this is the moment about the x-axis of the bent. N is the normal force (axial load). The x and y axes pass through the centroid of the column and the loads are applied at the centroid of the column. Input the loads at the service level except for the arbitrary factored loads and ARS unreduced seismic loads.

PMY, PMX and PN are moments and axial loads due to the 'P' live loading. Input 1.15 times one lane of 'P' load (1.15P) or input 1.15 times one lane of 'P' load plus one lane of 'H' load (1.15P + H), whichever controls. (CODE Table 3.2.22A)

Dead Load

Enter the moments and axial load due to the dead load.

PS (Prestress)

Enter the moments and axial load due to effect of prestressing.

Live Load + Impact

Enter the moments and axial loads due to live loads plus impact for Cases 1, 2, and 3.

Case 1 - Maximum transverse moment and associated loads.
Case 2 - Maximum longitudinal moment and associated loads.
Case 3 - Maximum axial load and associated moments.

W (Wind)

Enter moments and axial load due to wind pressure.

WL (Wind on Live Load)

Enter moments and axial load due to wind on live load.

LF (Longitudinal Force)

Enter moments and axial load due to the longitudinal force of a braking live load.

CF (Centrifugal Force)

Enter the transverse moments (My) caused by the Centrifugal Force of the appropriate live load moving around a curved structure. The centrifugal force for each case (H or P: 1, 2, or 3) will vary according to the number of lanes loaded and the location of the loads with respect to the column being analyzed.

T (Temperature)

Enter the moments and axial load due to thermal expansion or contraction in the structure.

Unreduced Seismic

Enter the ARS unreduced elastic seismic moments and axial loads (i.e. unreduced STRUBAG) for Case 1 (Transverse) and Case 2 (Longitudinal). (Code 3.21.1.1)

Case 1

Combine the forces resulting from the transverse loading with 30% of the corresponding forces from the longitudinal loading.

Case 2

Combine the forces resulting from the longitudinal loading with 30% of the corresponding forces from the transverse loading.

Arbitrary Loads Service

Enter optional arbitrary loads at the service level. The program does not apply any factors to these loads. Phi is set equal to 1.00 and the moments are not magnified for slenderness. No check is made on critical buckling. These loads are used to make a working stress analysis in the "CHECK" mode.

Arbitrary Loads Factored

Enter optional arbitrary loads at the factored level. The program does not apply any factors to these loads. Phi is set equal to 1.00 and the moments are not magnified for slenderness. No check is made on critical buckling. These loads are used in the "DESIGN" and "CHECK" mode using ultimate strength theory.

Note:

The absolute value of the algebraic sum of each load combination is applied to produce compression in the upper right hand quadrant of the column.

Example Problem

The following example problems will demonstrate how to "DESIGN", "CHECK" and "ANALYZE" a column. Plots are included for the "CHECK" and "ANALYZE" options.

```
                          GENERAL DATA PANEL - 1
*****************************************************************************
*                                                                           *
*                                                                           *
*                       YIELD GENERAL INFORMATION - 1                       *
*                                                                           *
*              TITLE: 4' X 8' RECTANGULAR WITH FILLETS  DESIGN              *
*                                                                           *
*   1 = MANUAL                  6 = HEXAGON                COLUMN   TYPE = 3 *
*   2 = RECTANGLE               8 = OCTAGON                                  *
*   3 = RECTANGLE/FILLETS       9 = ROUND                                    *
*   4 = SEMI-CIRCULAR ENDS                                                   *
*                                                                           *
*                                                                           *
*   1 = MANUAL                  4 = CONCENTRIC LOOPS       REBAR    TYPE = 2 *
*   2 = INTERSECTING LOOPS      5 = ROWS                                     *
*   3 = SEMI-CIRCULAR ENDS                                                   *
*                                                                           *
*                                                                           *
*   0 = NO PLOT                 3 = PN VS MNY              PLOT     TYPE = 4 *
*   1 = PN VS MN                4 = MNX VS MNY                               *
*   2 = PN VS MNX                                                            *
*                                                                           *
*                                                                           *
*   0 = ANALYZE                 2 = CHECK                  PROBLEM  TYPE = 1 *
*   1 = DESIGN                                                               *
*                                                                           *
*   <ENTER>=CONTINUE   PF3=ESCAPE   PF5=CONCRETE  PF6=STEEL  PF7=LOADS  PF9=FILE *
*                                                                           *
*                                                                           *
*****************************************************************************
```

```
                          GENERAL DATA PANEL - 2
*****************************************************************************
*                                                                           *
*                                                                           *
*                       YIELD GENERAL INFORMATION - 2                       *
*                                                                           *
*                                                                           *
*   STEEL LIMITS:          MINIMUM PERCENT LONGITUDINAL STEEL    =    1.00 PERCENT *
*                          MAXIMUM PERCENT LONGITUDINAL STEEL    =    6.00 PERCENT *
*                                                                           *
*                                                                           *
*   MATERIAL PROPERTIES:   ULT CONCRETE COMPRESSIVE STRESS  (PC) =    3250 PSI *
*                          YOUNG'S MODULUS FOR STEEL REBARS (ES) = 29000000 PSI *
*                          ULT CONCRETE COMPRESSIVE STRAIN  (EO) =    .003 IN/IN *
*                          YIELDING STRESS FOR STEEL REBARS (FY) =   60000 PSI *
*                                                                           *
*                                                                           *
*   BENT DATA:             NUMBER OF COLUMNS IN THE BENT         =       1 COLS *
*                          OUT TO OUT DIAMETER OF SPIRAL         =   44.00 INCHES *
*                          DISTANCE FROM TOP PLASTIC HINGE TO                *
*                          CENTER OF GRAVITY OF SUPERSTRUCTURE   =    3.50 FEET *
*                          CENTER TO CENTER SPACING OF COLUMNS   =    0.00 FEET *
*                                                                           *
*                                                                           *
*   <ENTER>=CONTINUE   PF3=ESCAPE   PF5=CONCRETE  PF6=STEEL  PF7=LOADS  PF9=FILE *
*                                                                           *
*                                                                           *
*****************************************************************************
```

```
                    CONCRETE - RECTANGLE/FILLETS  PANEL (TYPE = 3)
                      STEEL - INTERSECTING LOOPS PANEL (TYPE = 2)
*****************************************************************************
*                                                                           *
*                                                                           *
*                        COLUMN DIMENSIONS (INCHES)                         *
*                  ORIENT LARGEST DIMENSION IN X-DIRECTION                  *
*                                                                           *
*                            X-WIDTH  =  96.00                              *
*                            Y-THICK  =  48.00                              *
*                            X-FILLET =   9.00                              *
*                            Y-FILLET =   9.00                              *
*   ***************************************************************************
*                                                                           *
*                          REBAR LAYOUT (INCHES)                            *
*                                                                           *
*                       INTERSECTING LOOPS (TYPE 2)                         *
*                                                                           *
*                                                                           *
*                    NUMBER OF STEEL REBAR LOOPS  =      3                  *
*                    TOTAL NUMBER OF STEEL REBARS =     26                  *
*                    LOOP RADIUS                  =  20.49                  *
*                    LOOP SPACING                 =  24.00                  *
*                    AREA OF EACH BAR             =   1.56                  *
*                                                                           *
*   LOOP RADIUS  = RADIUS OF A CIRCLE THAT PASSES THROUGH THE CENTER OF EACH BAR.  *
*   LOOP SPACING = DISTANCE FROM CENTER TO CENTER OF ADJACENT CIRCLES.      *
*                                                                           *
*        <ENTER>=CONTINUE   PF3=ESCAPE   PF4=GENERAL PF7 = LOADS  PF9=FILE  *
*                                                                           *
*                                                                           *
*****************************************************************************
```

```
                                    LOAD PANEL
*****************************************************************************
*                                                                           *
*                                                                           *
*   LOAD PAGE  1 OF  1                        FOOTING DATA FILE ? (YES/NO) = YES   *
*   LOAD NAME LOAD 1 AT BOTTOM                FOOTING TYPE (SPREAD) (PILE) =   PILE *
*   EFFECTIVE LENGTH FACTORS  PERCENT   COLUMN      TIE=1      TOP=1    DUCTILITY *
*   KY (TRANS)      KX (LONG)   IMPACT   LENGTH   SPIRAL=0   BOTTOM=0   FACTOR (Z) *
*         2.10          1.04    20.00    22.00          0          0         6.00 *
*                                                                           *
*   COLUMN END CONNECTION (TOPY TOPX BOTY BOTX)  (1=FIX 0=PIN)  0 1 1 1     *
*   SERVICE LOADS:          :-- LL+IMPACT --:                          UNITS K-FT *
*                          CASE 1  CASE 2  CASE 3                           *
*         DEAD      PRE    TRANS    LONG   AXIAL                             *
*         LOAD   STRESS   MY-MAX  MX-MAX   N-MAX    WIND     WL     LF  CF-MY   TEMP *
*   MY       0        0     3087     800    1963    2565    398      0      0    374 *
*   MX     302        0      -34     417     -46      34     28      0      0   3497 *
*   N     2083        0      272     150     367    -118      0      0      0      0 *
*   PMY                     7140    4177    7140                          0        *
*   PMX                      -88     587     -88                          0        *
*   PN                       505     279     505                          0        *
*                                                                           *
*              :-UNREDUCED SEISMIC -:- ARBITRARY LOADS -:- ARBITRARY LOADS -:  *
*               CASE 1     CASE 2    SERVICE    SERVICE   FACTORED   FACTORED  *
*             MAX TRANS   MAX LONG      AL-1       AL-2       AL-1       AL-2  *
*         MY      19350      19500       300          0        651          0  *
*         MX        528       6084       300          0        651          0  *
*         N          75         70       300          0        390          0  *
*   <ENTER>=CONT PF3=ES PF4=GEN PF5=CON PF6=ST PF9=FILE PF10=ADD LOAD PF11=DEL LOAD *
*                                                                           *
*****************************************************************************
```

Description of Output

Design 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 printed in a formatted form. The program generates and prints a table of the concrete and steel rebar coordinates. Output Page 4 contains a table of Initial Reference Data and the Column Load Data. The designer should carefully check these pages for accuracy.

Factored Loads for Column Design – Output Page 6

The input loads are combined into groups and cases as defined in section 3.22.1A of the Code and printed as "APPLIED FACTORED" loads.The program iterates between the maximum and minimum percent steel to determine the controlling group loading and the area of steel required. Using this area of steel, the moment capacity (Mu), PHI × Nominal Moment (Mn), is determined for each applied axial load at the same angle as the applied resultant moment. The "RATIO" (Mu/M), the moment capacity (Mu) of the column divided by the applied factored moment (M), is printed next to each group loading. This "RATIO" gives the designer an indication of the relative capacity of the column for the non-controlling group loads.

Final Resuts – Output Page 7

This table contains the controlling group loading and the area of steel required. The program maintains the column shape and rebar location while the area of each rebar location is varied. If the designer decides to change the size of the rebar, the radius of the main steel bar loop should be adjusted before the problem is re-run.

Moment Magnification and Buckling Calcutations – Output Page 8

This table contains the moment magnification factors used to magnify the transverse and longitudinal moments. Also the critical buckling load is printed in transverse and longitudinal directions of the column.

```
HP-UX A.09.03      Tue Jul 25 09:54:03 PDT 1995

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

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

4' X 8' RECTANGULAR WITH FILLETS  DESIGN     VERSION  1    12.09.83
         3
         2
         3        26
         0
         1       1.0       6.0         1     44.00      3.50       .00
      3250  29000000     .0030     60000
     96.00     48.00      9.00      9.00
     20.49     24.00                          1.56
LOAD 1 AT BOTTOM                      YES      PILE
 2.10 1.04                20.00     22.00    0    0      6.00 0111
      0       0   3087    800   1963   2565   398     0     0   374
    302       0    -34    417    -46     34    28     0     0  3497
   2083       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       390         0

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

```
TITLE 4' X 8' RECTANGULAR WITH FILLETS  DESIGN  7/25/1995  09:54:01 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        = 26
PLOT TYPE                        =  0  (NO PLOT)
DESIGN TYPE                      =  1  (DESIGN)
PERCENT STEEL LIMITS             =     (1.00 % MIN.  6.00 % MAX.)

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

NUMBER OF COLUMNS IN BENT                        =     1
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 =     3250. (PSI)
YOUNG'S MODULUS FOR CONCRETE         - EC =  3249500. (PSI)
YOUNG'S MODULUS FOR STEEL BARS       - ES = 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  DESIGN  7/25/1995  09:54:01 PAGE  2


   RECTANGULAR CROSS-SECTION  (WITH FILLETS)

         HX         HY         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 4' X 8' RECTANGULAR WITH FILLETS  DESIGN  7/25/1995  09:54:01 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       -20.20      20.14
   4        20.20     -20.14
   5       -29.13      19.84
   6        29.13     -19.84
   7       -37.08      15.77
   8        37.08     -15.77
   9       -42.54       8.71
  10        42.54      -8.71
  11       -44.49        .00
  12        44.49        .00
  13       -42.54      -8.71
  14        42.54       8.71
  15       -37.08     -15.77
  16        37.08      15.77
  17       -29.13     -19.84
  18        29.13      19.84
  19       -20.20     -20.14
  20        20.20      20.14
  21        12.00      16.61
  22       -12.00     -16.61
  23         4.24      20.05
  24        -4.24     -20.05
  25        -4.24      20.05
  26         4.24     -20.05


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


  ERROR ... THE INPUT PERCENT STEEL IS LESS THAN 1.00 %
  PERCENT STEEL ASSUMED TO BE 1.01 %  - EXECUTION CONTINUES.
```

```
TITLE 4' X 8' RECTANGULAR WITH FILLETS  DESIGN  7/25/1995  09:54:01 PAGE  4


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

   TOTAL AREA OF THE SECTION                AG =     30.88 FT**2
   NOMINAL AXIAL LOAD STRENGTH              PO =  14852.30 KIPS
   TOTAL REINFORCEMENT AREA                AST =     44.90 IN**2
   PERCENT STEEL                             =      1.01 %

   GROSS MOMENT OF INERTIA ABOUT Y-AXIS  IYC =    154.81 FT**4
   GROSS MOMENT OF INERTIA ABOUT X-AXIS  IXC =     39.19 FT**4

   STEEL MOMENT OF INERTIA ABOUT Y-AXIS  IYS =    1.8634 FT**4
   STEEL MOMENT OF INERTIA ABOUT X-AXIS  IXS =     .6002 FT**4
```

```
TITLE 4' X 8' RECTANGULAR WITH FILLETS  DESIGN  7/25/1995  09:54:01 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=TIE      1=TOP        FACTOR
   KY (TRAN)   KX (LONG)   IMPACT  (FEET)  0=SPIRAL   0=BOTTOM        (Z)

        2.10        1.04    20.00   22.00         0          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    LF CF-MY  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)

     (ARS) 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      528.     6084.      300.        0.      651.        0.
P AXIAL       75.       70.      300.        0.      390.        0.

NOTE:  A FOOTING INPUT DATA FILE WAS NOT CREATED.  A FOOTING
INPUT DATA FILE IS ONLY AVAILABLE IN THE "CHECK" MODE.


ARBITRARY SERVICE LOADS ARE ONLY USED TO MAKE A
WORKING STRESS ANALYSIS IN THE CHECK MODE.
```

TITLE 4' X 8' RECTANGULAR WITH FILLETS DESIGN 7/25/1995 09:54:01 PAGE 6

```
*********************************************
* FACTORED LOADS FOR COLUMN DESIGN  (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 = 1.00 % AST = 44.46 SQ IN

GROUP	CASE	:— APPLIED FACTORED —: TRANS MY	LONG MX	COMB M	AXIAL P	CAPACITY (PHI*MN) MU	PHI	RATIO MU/M
IH	1	6688.	445.	6703.	2620.	11436.	.75	1.71
IH	2	1733.	1198.	2107.	2356.	7997.	.75	3.80
IH	3	4253.	596.	4295.	3503.	11680.	.75	2.72
IP	1	9282.	457.	9293.	2687.	11562.	.75	1.24
IP	2	5430.	1058.	5532.	2394.	10565.	.75	1.91
IP	3	9282.	572.	9300.	3364.	12023.	.75	1.29
II		3335.	339.	3352.	1878.	10408.	.75	3.11
III	1	5531.	398.	5545.	2339.	11124.	.75	2.01
III	2	2558.	886.	2707.	2180.	9412.	.75	3.48
III	3	4070.	534.	4104.	3139.	11546.	.75	2.81
IV	1	4499.	4796.	6576.	2385.	7163.	.75	1.09
IV	2	1526.	5383.	5595.	2226.	6076.	.75	1.09
IV	3	3038.	4879.	5747.	3185.	7055.	.75	1.23
V		3674.	4697.	5963.	1805.	6408.	.75	1.07
VI	1	5786.	4660.	7429.	2249.	7579.	.75	1.02
VI	2	2927.	5223.	5988.	2096.	6305.	.75	1.05
VI	3	4381.	4739.	6454.	3018.	7483.	.75	1.16
VII	1	3225.	390.	3248.	2158.	13254.	1.00	4.08
VII	2	3250.	1316.	3506.	2153.	11286.	1.00	3.22

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*********************************************
* ARBITRARY LOADS FOR COLUMN DESIGN  (KIP-FT) *
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ARBITRARY APPLIED FACTORED MOMENTS ARE NOT MAGNIFIED FOR SLENDERNESS.

GROUP	CASE	:— APPLIED FACTORED —: TRANS MY	LONG MX	COMB M	AXIAL P	CAPACITY (PHI*MN) MU	PHI	RATIO MU/M
AL1		651.	651.	921.	390.	6380.	1.00	6.93

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

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TITLE 4' X 8' RECTANGULAR WITH FILLETS  DESIGN  7/25/1995  09:54:01 PAGE  7


*****************
* FINAL RESULTS *
*****************************************************************************

CONTROLLING GROUP LOADING    ...     GROUP VI  CASE 1
NOMINAL AXIAL LOAD STRENGTH ...    14827.  KIPS
TOTAL NO. OF BARS INPUT      ...        26  BARS
PERCENT STEEL REQUIRED       ...      1.00  PERCENT
ADJUSTED AREA OF EACH BAR    ...      1.71  SQ. IN.

TOTAL AREA OF STEEL REQ.     ...     44.46  SQ. IN.
NUMBER OF BARS REQUIRED      ...      28.5  BARS AT 1.56 SQ.IN. PER BAR

** NOTE: IF THE BAR SIZE IS CHANGED, THE BAR LOCATIONS WILL
CHANGE AND THE DESIGNER SHOULD CONSIDER ADJUSTING THE RADIUS
OF MAIN STEEL BAR LOOP AND RE-RUN THE PROBLEM.

** NOTE: THE DESIGNER MUST CHECK TO ENSURE THAT THE BAR SPACING LIMITS
OF THE CODE ARE SATISFIED.

** NOTE: ALL GROUP LOADS REQUIRED LESS THAN 1.00 % STEEL.
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TITLE 4' X 8' RECTANGULAR WITH FILLETS  DESIGN  7/25/1995  09:54:01 PAGE  8

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

   REFERENCE: "CALTRANS BRIDGE DESIGN SPECIFICATIONS" (ART 8.16.5)
              (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 =  2.10
   KX      = EFFECTIVE LENGTH FACTOR ABOUT X-AXIS =  1.04

   KY*L/R  = SLENDERNESS RATIO ABOUT Y-AXIS       = 21.
   KX*L/R  = SLENDERNESS RATIO ABOUT X-AXIS       = 20.

   IYS     = STEEL MOMENT OF INERTIA ABOUT Y-AXIS =  1.8634 FT**4
   IXS     = STEEL MOMENT OF INERTIA ABOUT X-AXIS =   .6002 FT**4
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		MOMENT :-MAGNIFICATION-:			CRACKED :-TRANSFORMED SECTION-:		CRITICAL :--BUCKLING--:		AXIAL
GR	CA	TRAN MAGY	LONG MAGX	COMB MAG	E*IY	E*IX	TRAN PCY	LONG PCX	LOAD P
IH	1	1.000	1.000	1.000	42312037.	5864858.	195650.	110572.	2521.
IH	2	1.000	1.000	1.000	42312037.	9415446.	195650.	177512.	2257.
IH	3	1.000	1.000	1.000	42312037.	5864858.	195650.	110572.	3371.
IP	1	1.000	1.000	1.000	42312037.	5864858.	195650.	110572.	2588.
IP	2	1.000	1.000	1.000	42312037.	9175118.	195650.	172981.	2294.
IP	3	1.000	1.000	1.000	42312037.	5864858.	195650.	110572.	3232.
II		1.000	1.000	1.000	42312037.	6274314.	195650.	118292.	1778.
III	1	1.000	1.000	1.000	42312037.	5918734.	195650.	111588.	2239.
III	2	1.000	1.000	1.000	42312037.	8804390.	195650.	165992.	2081.
III	3	1.000	1.000	1.000	42312037.	5864858.	195650.	110572.	3007.
IV	1	1.000	1.000	1.000	42312037.	11051273.	195650.	208353.	2285.
IV	2	1.000	1.000	1.000	42312037.	11121338.	195650.	209674.	2127.
IV	3	1.000	1.000	1.000	42312037.	10856133.	195650.	204674.	3053.
V		1.000	1.000	1.000	42312037.	11037752.	195650.	208098.	1706.
VI	1	1.000	1.000	1.000	42312037.	11032549.	195650.	208000.	2149.
VI	2	1.000	1.000	1.000	42312037.	11103777.	195650.	209343.	1997.
VI	3	1.000	1.000	1.000	42312037.	10832317.	195650.	204225.	2896.
VII	1	1.000	1.000	1.000	42312037.	5864858.	195650.	110572.	2026.
VII	2	1.000	1.000	1.000	42312037.	9034476.	195650.	170330.	2021.