LFD REINFORCED CONCRETE DATA (Form R)

This input data describes the basic information required to design and analyze the required mild steel reinforcement for the bent cap to resist the input loads based on load factor design.

REINFORCED CONCRETE DATA						CLEARANCES TO REINFORCEMENT							
						MAIN REINF		TRANS. DIST. REINF.					
Fy	F'c	Es	Ec	N	Z	TOP	BOT	TOP SLAB			BOT SLAB		
KSI	KSI	KSI	KSI			IN	IN	#	CLT	NO	#	CLB	NO

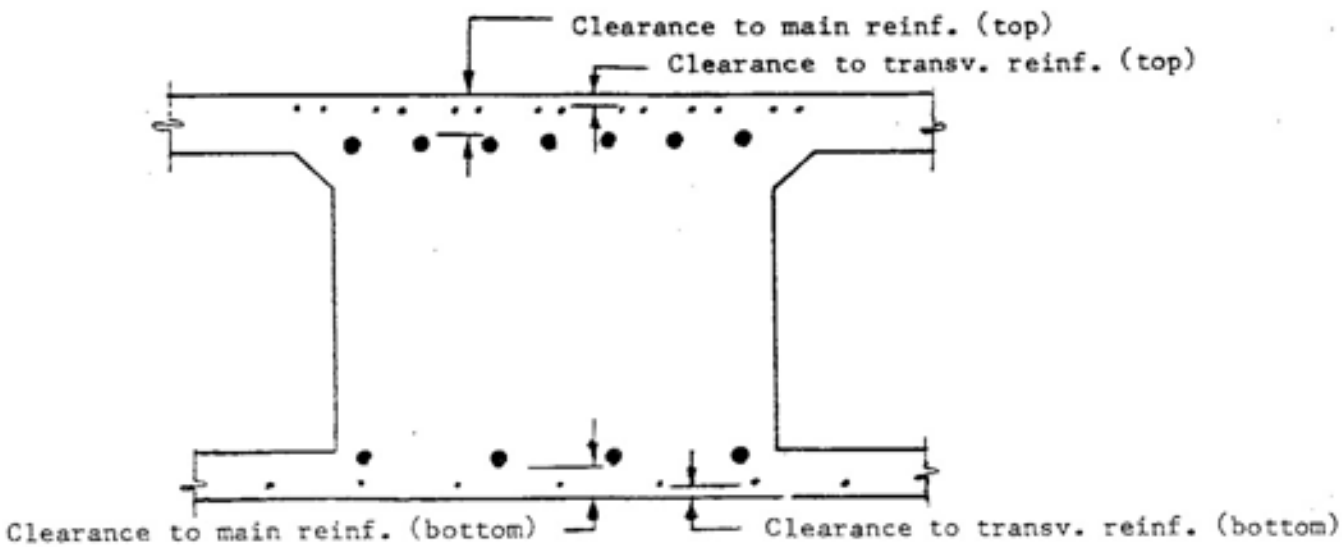
807318

REINFORCED CONCRETE DATA specifies the material properties to be used. If left blank, the following material properties will be used:

fy = 60.00 ksi f'c = 3.25 ksi Es = 29,000 ksi
Ec = 3250 ksi N = 9 Z = 170

If an entry for f'c but not Ec is made, the concrete modulus of elasticity will be automatically calculated per AASHTO Article 8.7.1.

CL TO MAIN (TOP and BOT) is the clearance to the top and bottom main reinforcement. This is the minimum information needed to generate the reinforced concrete design and analysis. Give dimensions to the nearest 0.1 inch. For more than one layer of reinforcing, add the estimated distance from the C.G. of first layer to C.G. of combined layers. See sketch below.



TRANS DIST REINF (TOP SLAB and BOT SLAB) defines the size, clearance and quantity of top and bottom slab transverse distribution reinforcement within and parallel to the bent cap. # is the bar size number. CLT and CLB are the clearances to top and bottom trans. reinforcement measured in inches. And NO. is the total number of top or bottom bars within the bent. Ignore transverse distribution reinforcement when the skew angle is over 20 degrees.

DESCRIPTION OF OUTPUT

Depending on the nature of the problem, the following items will be provided as output by this program (listed in the order they appear).

First, the FRAME DESCRIPTION input is reported as given, except for the concrete strength, deflection, and sidesway entries, which do not appear.

SECTION PROPERTIES are reported for each section described with the Form B and/or Form C section data input. The input is reported as given, followed by the area, centroid location with respect to the X-Y coordinate system chosen, and the moments of inertia about the centroidal X-X and Y-Y axes.

When the above sections supplement a frame member, MEMBER PROPERTIES about the X-X axis are reported. They are: the member length, minimum EI (Elastic modulus x Ixx) about the X-X axis, and the relative stiffness and carry over factors.

LOADING: EQUALLY SPACED GIRDER DATA and NON-UNIFORM GIRDER DATA reports the input Uniform and Non-Uniform Girder Data including the thermal expansion coefficient default value when not specified by input.

ANALYSIS DIAGNOSTICS reports the presence of any errors which were detected in the input data. An error message terminates processing of the problem.

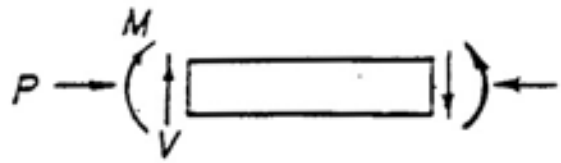
FRAME PROPERTIES is the result of combining the Frame Description with the Member Properties. Carry Over and Distribution Factors are adjusted for pinned end conditions. At this point all data pertaining to the frame should be reviewed to determine if it is reasonable and if it describes the frame as intended.

For each trial, the unfactored LOADINGS are reported as given. Any errors in Load Data are reported and result in termination of that trial's processing. The girder reaction dead load data will be included in Trial 0 as concentrated loads and their location along each member will be reported here.

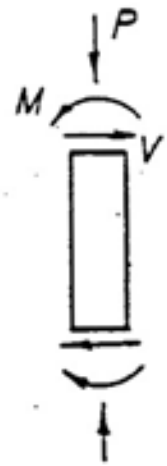
FIXED END MOMENTS are the total FEM's for a trial and are adjusted for pinned end conditions.

Distributed dead load MOMENT and SHEARS are reported at the one-tenth points for each member. Also, HORIZONTAL MEMBER STRESSES at top and bottom fibre are reported at one-tenth points for each cap member. VERTICAL MEMBER REACTIONS include LT and RT Reaction and member weight. The beam sign convention is used (see next page).

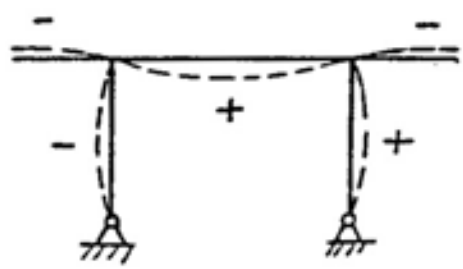
Positive Cap Reactions



Positive Column Reactions



The TANGENTIAL ROTATIONS at the ends of each member are measure from the unloaded position, with the clockwise rotation being positive. Deflections are measured from the unloaded position. Positive deflection is downward for cap members and to the right for columns as shown below.



The LIVE LOAD REACTION INPUT DATA for standard HS and P trucks is reported as given.

The following results of the given live loads are reported at the tenth points of the horizontal members.

- positive live load moment envelope (unfactored)
- dead load moment plus positive live load moment envelope (factored and unfactored)

- negative live load moment envelope (unfactored)

- dead load moment plus negative live load moment envelope (factored and unfactored)

- live load shear envelope (unfactored)

- dead load plus live load shear envelope (factored and unfactored)

Only Trial 0 dead load results are added to the live load envelopes.

SUMMARY OF COLUMN LOADS FOR YIELD PROGRAM INPUT provides dead load and live load support results of maximum transverse moment, maximum longitudinal moment, and maximum axial force for the given standard HS loads and combined P and HS loads. And also provides the transverse moment and axial force due to the given or assumed temperature loads, wind loads and wind on live loads. This output has the same coordinate system as the "YIELD" and "FOOT" programs.

Caution: the maximum transverse and longitudinal moments for skewed bents are actually the maximum moments in the direction of the bridge frame transformed into components parallel and transverse to the bent frame.

PRESTRESS RESULTS

For each path the following output is printed:

1. Cable path input
2. Cable path offsets
3. Cable path eccentricities
4. Force coefficients after anchor set and long term losses
5. Secondary moments
6. P/S moment coefficients
7. Horizontal member stresses for prestress only
8. Horizontal and vertical member moments
9. Deflections

For each prestress trial, the following results are printed:

1. Total P/S stresses for all paths
2. DL + P/S STRESSES
3. DL + ADDED DL + P/S STRESSES
4. DL + ADDED DL + LL + I + P/S STRESSES
5. Minimum P-jack for unknown path
6. Required concrete strength

7. Total P/S moments for all members
8. Total P/S deflections for all paths
9. Long term prestress losses
10. Summary of horizontal member deflections at 1/4 points

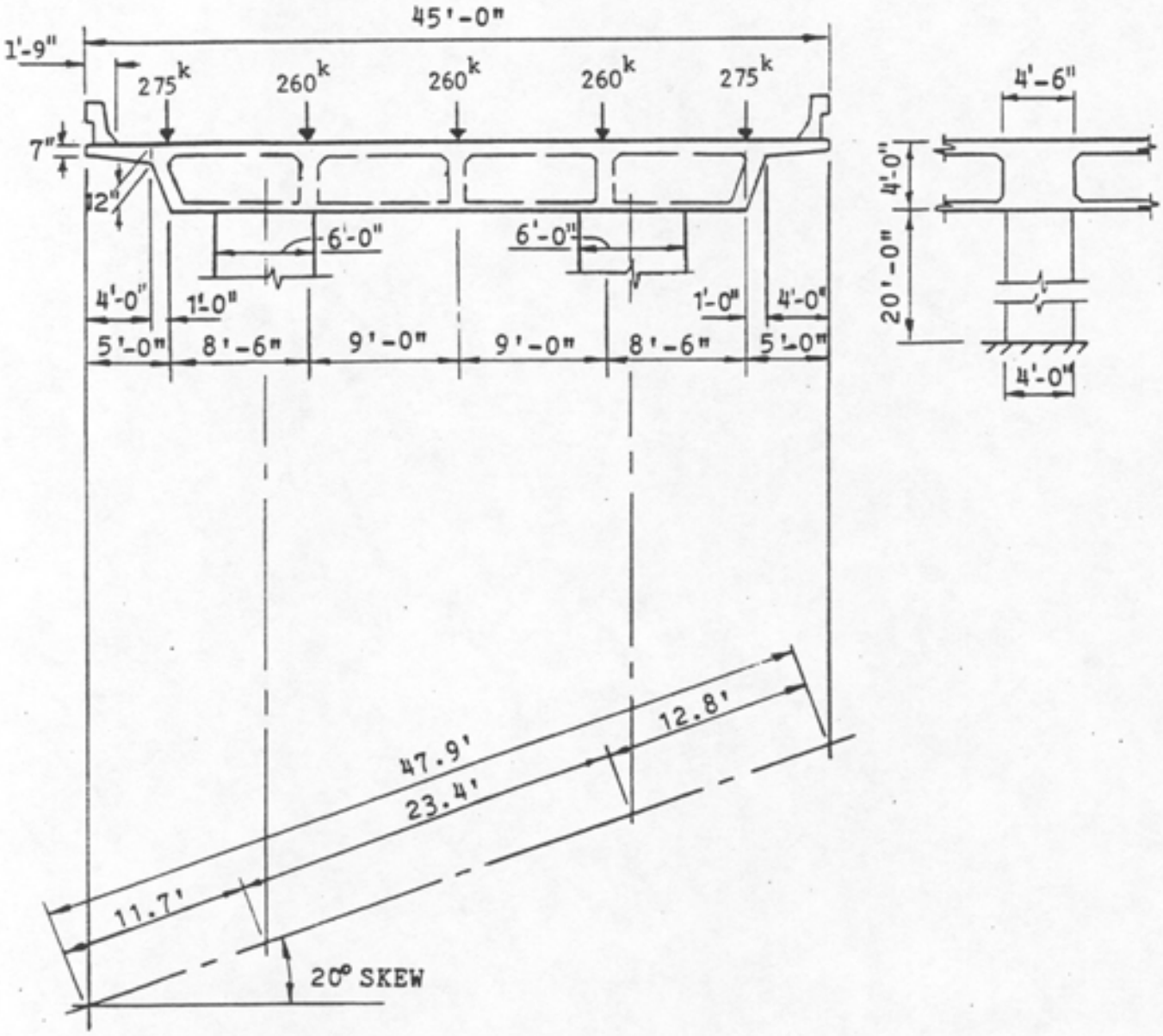
When LOAD FACTOR DESIGN OF REINFORCED CONCRETE MEMBER is generated, first, the LFD INPUT DATA will be reported. This will include the designation of the spec and code used - for now, only Load Factor Design specification and AASHTO Code will be applied. Next, a table containing the following information at each 0.1 point of each member is given:

- maximum and minimum allowable positive or negative area of steel
- required compressive area steel
- the LFD required area of steel for various bar sizes
- allowable steel stress for various bar sizes to meet cracking control requirements
- number of bars required for various bar sizes
- the final area steel for various bar sizes, not including additional slab reinforcement

Also the cracking moment for bar cutoff is provide at the right and left end and center span of each member.

The AASHTO STIRRUP DESIGN FOR SHEAR results will be provided last. This output is provided for both prestressed and reinforced concrete caps. The information reported at each 0.1 point of each member includes amount of applied shear force, shear resistance provided by concrete and cable paths, width of girder (including required girder flare), and required stirrup design shear force. Then a girder spacing design for various bar sizes is given which provides the spacing, shear force resistance, area required per cap and the maximum spacing allowed.

EXAMPLE PROBLEM



INPUT DATA:

FORM A – FRAME DESCRIPTION

	MEMBER NO	END JOINT NO. LT	END JOINT NO. RT	END CONDITION LT	END CONDITION RT	DIRECTION	LENGTH FT	MIN "Z" FT³	HINGE LOC. OR SUPPORT WIDTH FT	E KSI	DEAD LOAD UNIFORM K/FT	DEAD LOAD UNIT WT PCF			FOR FUTURE USE	CONCRETE F'c KSI	RECALL MEMBER	RECALL REVERSE	DL DEFLECTIONS	DL SIDESWAY
	1	1	2	C		H	11.7					150								
	2	2	3			H	23.4					150								
	3	3	4	C		H	12.8					150								
	4	5	2				22.0		6.0			150								
	5	6	3				22.0		6.0			150								

FORM B – SUPERSTRUCTURE SECTIONS

SPACE		MEMBER NO			REF IN CORE		SS DIAM		SLAB DIAM		INT GIRDERS		EXTERIOR GIRDERS						OVERHANGS						
		1	0.		0	3.4	5.5	0.58	1.00	1.00			0.33			0.33									1
		1	4.3		0	3.0	5.5	1.00	1.00	1.00			0.33			0.33									2
		1	5.3		0.	0.	5.5	4.00	8.00	6.00			0.27			0.27			0.5	8	8	0.5	8	8	3
		1	11.7	3																					
		2	0.	3																					
		3	0.	3																					
		3	7.5	3																					
		3	8.3	2																					
		3	12.8	1																					

FORM C – SECTION PROPERTIES BY PARTS

FORM NUMBER: 207312

	MEMBER NO	CROSS SEC LOC X FT	RECALL	NON-OR+	PART CODE	PART DIMENSION VERTICAL V OR DEPTH D FT	PART DIMENSION HOR H FT	REF PT COORD Z FT	REF PT COORD Y FT	ANY SHAPE AREA FT²	ANY SHAPE I FT⁴	ANY SHAPE E KSI	STORE SEC.
	4	0.			1	6.00	4.00	0.	0.				5
	5	0.	5										

INPUT DATA:

FORM N – UNIFORM GIRDER DATA

	EQUALLY SPACED GIRDER DATA						CURB DATA			WIND LOADS				
	REACTION (kips)			Location of Left Ext from left End of Cap	Number of Girders	Girder Spacing (ft)	Left Curb from Left End of Cap (ft)	Curb to Curb Distance (ft)		Group 2 (kips)	Group 3			Skew Angle (degrees)
	Left Exterior	Interior	Right Exterior								Bottom #/ft	Top #/ft	Conc. "Ts"	
	.	.	.	.		.	1.75	41.50						20.00

FORM O – NON-UNIFORM GIRDER SPACING DATA

SEQUENCE NUMBER (16–17)	NUMBER OF GIRDERS (18–19)	GIRDER REACTION (KIPS) (20–24)	GIRDER LOCATION OR SPACING (FT) (25–28)
01	01	275.0	5.00
02	1	260.0	8.50
03	2	260.0	9.00
04	1	275.0	8.50

FORM P – LIVE LOAD LANE REACTION

	LIVE LOAD REACTIONS PER TRUCK (LANE)											
	STANDARD HS TRUCK						SPECIAL P LOADS					
	MAXIMUM AXIAL FORCE			MAXIMUM LONGITUDINAL MOMENT			MAXIMUM AXIAL FORCE			MAXIMUM LONGITUDINAL MOMENT		
	AXIAL (kips)	MOMENT TOP	MOMENT BOTTOM	AXIAL (kips)	MOMENT TOP	MOMENT BOTTOM	AXIAL (kips)	MOMENT TOP	MOMENT BOTTOM	AXIAL (kips)	MOMENT TOP	MOMENT BOTTOM
	200	10	-5	100	1500	750	500	40	-20	300	3800	-1900

FORM R – REINFORCED CONCRETE DATA

REINFORCED CONCRETE DATA						CLEARANCES TO REINFORCEMENT							
						MAIN REINF		TRANS. DIST. REINF.					
Fy	F'c	Es	Ec	N	Z	TOP	BOT	TOP SLAB			BOT SLAB		
KSI	KSI	KSI	KSI			IN	IN	#	CLT	NO	#	CLB	NO
.	4.00		.	.		4.00	4.00	5	2.00	12	5	1.50	8

RESULTS:

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IDENT  EXAMPLE1                  BRIDGE ANALYSIS AND DESIGN          JAN. 31, 1986                PAGE   2
SECTION PROPERTIES

LINE MEM    LOC  RECALL      X      Y        SUPERSTRUCTURE      SLAB THICKNESS   INT. GIRDER      STORE
                                             WIDTH   DEPTH        TOP    BOTTOM     NO.  WEB
      1     0.0    0        0.0    3.4         5.5    0.58        1.00    1.00       0    0.           1

                    LT. EXT. GIRDER      RT. EXT. GIRDER       LT. OVERHANG        RT. OVERHANG
                   TYPE  WEB  FACTOR    TYPE  WEB  FACTOR   LENGTH  EXT.  INT.   LENGTH  EXT.  INT.
                    0    33.   0.00      0    33.   0.00      0.0    0.    0.      0.0    0.    0.

            AREA          CENTROID LOCATION          MOMENT OF INERTIA ABOUT CENTROID
                               X        Y                  X-X                 Y-Y
           3.30            2.75     3.69                  0.09                8.04

LINE MEM    LOC  RECALL      X      Y        SUPERSTRUCTURE      SLAB THICKNESS   INT. GIRDER      STORE
                                             WIDTH   DEPTH        TOP    BOTTOM     NO.  WEB
      1     4.3    0        0.0    3.0         5.5    1.00        1.00    1.00       0    0.           2

                    LT. EXT. GIRDER      RT. EXT. GIRDER       LT. OVERHANG        RT. OVERHANG
                   TYPE  WEB  FACTOR    TYPE  WEB  FACTOR   LENGTH  EXT.  INT.   LENGTH  EXT.  INT.
                    0    33.   0.00      0    33.   0.00      0.0    0.    0.      0.0    0.    0.

            AREA          CENTROID LOCATION          MOMENT OF INERTIA ABOUT CENTROID
                               X        Y                  X-X                 Y-Y
           5.61            2.75     3.51                  0.47               13.87

LINE MEM    LOC  RECALL      X      Y        SUPERSTRUCTURE      SLAB THICKNESS   INT. GIRDER      STORE
                                             WIDTH   DEPTH        TOP    BOTTOM     NO.  WEB
      1     5.3    0        0.0    0.0         5.5    4.00        8.00    6.00       0    0.           3

                    LT. EXT. GIRDER      RT. EXT. GIRDER       LT. OVERHANG        RT. OVERHANG
                   TYPE  WEB  FACTOR    TYPE  WEB  FACTOR   LENGTH  EXT.  INT.   LENGTH  EXT.  INT.
                    0    27.   0.00      0    27.   0.00      0.5    8.    8.      0.5    8.    8.

            AREA          CENTROID LOCATION          MOMENT OF INERTIA ABOUT CENTROID
                               X        Y                  X-X                 Y-Y
          18.78            2.75     2.07                 25.96               34.56

LINE MEM    LOC  RECALL      X      Y        SUPERSTRUCTURE      SLAB THICKNESS   INT. GIRDER      STORE
                                             WIDTH   DEPTH        TOP    BOTTOM     NO.  WEB
      1    11.7    3        0.0    0.0         0.0    0.00        0.00    0.00       0    0.           0

                    LT. EXT. GIRDER      RT. EXT. GIRDER       LT. OVERHANG        RT. OVERHANG
                   TYPE  WEB  FACTOR    TYPE  WEB  FACTOR   LENGTH  EXT.  INT.   LENGTH  EXT.  INT.
                    0     0.   0.00      0     0.   0.00      0.0    0.    0.      0.0    0.    0.
LINE                          +                                   INERTIAS OF PARTS
 NO. MEM    LOC  RECALL - CODE     Y      H       X      Y      AREA        IXX        IYY   STORE
          RECALL  3                             2.75    2.07    18.78       25.96      34.56

            AREA          CENTROID LOCATION          MOMENT OF INERTIA ABOUT CENTROID
                               X        Y                  X-X                 Y-Y
          18.78            2.75     2.07                 25.96               34.56

MEMBER  1 PROPERTIES

                    LENGTH          MIN INERTIA          STIFFNESS              CARRY OVER
                                                        LT        RT           LT        RT
                    11.7                0.09          15.821   329.840       2.979     0.143
```

RESULTS:

MAXIMUM POSITIVE CAP MOMENT ENVELOPES DUE TO FACTORED DL + LL

MEM NO	LEFT	.1 PT.	.2 PT.	.3 PT.	.4 PT.	.5 PT.	.6 PT.	.7 PT.	.8 PT.	.9 PT.	RIGHT
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	-1048.7	427.4	1455.3	2153.7	2626.6	2338.6	1388.3	218.0	-1262.6	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MAXIMUM NEGATIVE CAP MOMENT ENVELOPES DUE TO FACTORED DL + LL

MEM NO	LEFT	.1 PT.	.2 PT.	.3 PT.	.4 PT.	.5 PT.	.6 PT.	.7 PT.	.8 PT.	.9 PT.	RIGHT
1	0.0	-0.5	-2.0	-4.7	-266.8	-907.8	-1775.4	-2648.0	-3525.6	-4466.2	-5791.1
2	-3835.9	-1719.7	-797.2	-16.4	588.4	0.0	572.1	-222.4	-1158.6	-2114.8	-3925.7
3	-7031.6	-5577.2	-4184.1	-3220.1	-2262.2	-1310.2	-428.5	-5.7	-2.4	-0.6	0.0

MAXIMUM CAP SHEAR ENVELOPES DUE TO FACTORED DL + LL

MEM NO	LEFT	.1 PT.	.2 PT.	.3 PT.	.4 PT.	.5 PT.	.6 PT.	.7 PT.	.8 PT.	.9 PT.	RIGHT
1	0.0	-0.8	-1.8	-2.9	-378.1	-739.4	-743.7	-748.8	-752.2	-1130.3	-1134.6
2	1290.6	1186.8	733.7	614.8	496.0	382.9	-549.9	-668.7	-787.6	-902.7	-1344.5
3	1138.6	1133.9	755.5	750.8	746.1	741.4	379.3	3.2	2.0	0.9	-0.0

****** THE LIVE LOAD COULD BE EITHER A 1.15P AND/OR MS TRUCKS, OR A GROUP OF STANDARD MS TRUCKS. ******

* SUMMARY OF COLUMN LOADS FOR YIELD PROGRAM INPUT *

* MEMBER NO. 4 UPPER END :

			LIVE LOAD + IMP.								EQ	
	DEAD LOAD	PS	MI MAXI	MI MAXI	N MAXI	WB	WL	LF	CF	TEMP	TRAN	LONG
MI	400.	0.	-707.	1063.	234.	0.	0.	0.	0.	-162.	0.	
MI			10.	2607.	17.							
N	700.	0.	215.	185.	370.	0.	0.	0.	0.	0.	0.	
PMI			1941.	2931.	1501.							
PMI			46.	5488.	52.							
PS			615.	443.	771.							

RESULTS:

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*****************************************
* LOAD FACTOR DESIGN CF REINFORCED CONCRETE MEMBER *
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MEMBER NO. : 1

				REINFORCING STEEL REQUIRED FOR DIFFERENT BAR SIZES														
				#18			#14			#11			#10			#9		
LOC	TYP	MAXI AS	MINI AS	CORP AS	FS KSI	NO BAR	AS SQIN.	FS KSI	NO BAR	AS SQIN.	FS KSI	NO BAR	AS SQIN.	FS KSI	NO BAR	AS SQIN.	FS KSI	NO BAR	AS SQIN
0.5	REC	50.15	5.54	0.00	18.18	1	2.12	18.20	1	2.08	18.21	1	2.06	18.22	2	2.05	18.22	2	2.0
		TOTAL LFD AS :					4.56			4.55			4.54			4.54			4.5
0.6	REC	50.15	5.54	0.00	24.00	2	5.89	24.00	3	5.86	24.05	4	5.75	24.47	5	5.74	24.49	6	5.7
		TOTAL LFD AS :					9.30			9.26			9.24			9.23			9.2
0.7	REC	50.15	5.54	0.00	24.00	3	11.53	25.75	5	10.70	25.78	7	10.66	25.80	9	10.64	25.82	11	10.6
		TOTAL LFD AS :					14.27			14.19			14.15			14.14			14.1
0.8	REC	50.15	5.54	0.00	24.00	5	17.49	26.30	7	15.88	26.33	10	15.81	26.35	13	15.78	26.36	16	15.7
		TOTAL LFD AS :					19.49			19.37			19.31			19.28			19.2
0.9	REC	50.15	5.54	0.00	25.08	6	22.90	26.32	10	21.70	26.35	14	21.61	26.36	17	21.57	26.37	22	21.5
		TOTAL LFD AS :					25.37			25.20			25.11			25.07			25.0
1.0	REC	50.15	5.54	0.00	25.14	8	30.77	25.20	14	30.50	25.23	20	30.36	25.25	24	30.30	25.27	31	30.2
		TOTAL LFD AS :					34.26			33.99			33.86			33.79			33.7

**** CRACKING MOMENT FOR BAR CUTOFF **** UNIT : FT-KIPS.

1.2*MCR LT END = 0.0 1.2*MCR CTR SP = 1059.8 1.2*MCR RT END = 1059.8

MEMBER NO. : 2

				REINFORCING STEEL REQUIRED FOR DIFFERENT BAR SIZES														
				#18			#14			#11			#10			#9		
LOC	TYP	MAXI AS	MINI AS	CORP AS	FS KSI	NO BAR	AS SQIN.	FS KSI	NO BAR	AS SQIN.	FS KSI	NO BAR	AS SQIN.	FS KSI	NO BAR	AS SQIN.	FS KSI	NO BAR	AS SQIN.
0.0	REC	50.15	5.54	0.00	25.32	6	22.22	29.84	9	18.74	31.52	12	17.69	31.54	14	17.66	31.55	18	17.63
		TOTAL LFD AS :					21.40			21.26			21.19			21.16			21.12
0.1	REC	50.15	5.54	0.00	24.00	2	6.81	24.87	3	6.55	27.51	4	5.91	29.10	5	5.58	29.93	6	5.42
		TOTAL LFD AS :					8.99			8.95			8.93			8.93			8.92
0.2	REC	50.15	5.26	0.00	16.29	1	1.77	16.23	1	1.77	16.20	1	1.77	16.18	1	1.77	16.17	2	1.77
		TOTAL LFD AS :					3.96			3.96			3.96			3.96			3.96
0.3	POS	53.90	5.19	0.00	21.76	1	5.28	21.59	2	5.23	21.50	3	5.20	21.46	4	5.19	21.42	5	5.17
		TOTAL LFD AS :					7.61			7.56			7.53			7.52			7.50
0.4	POS	53.90	5.19	0.00	24.00	3	9.60	25.15	4	9.09	25.19	6	9.04	25.21	7	9.02	25.23	9	8.99
		TOTAL LFD AS :					11.52			11.42			11.37			11.35			11.32
0.5	POS	53.90	5.19	0.00	24.00	4	13.40	27.12	6	11.76	27.15	8	11.70	27.17	9	11.67	27.19	12	11.64
		TOTAL LFD AS :					14.22			14.09			14.03			14.00			13.97
0.6	POS	53.90	5.19	0.00	24.00	3	10.19	24.00	5	10.11	24.00	7	10.07	24.01	8	10.05	24.02	10	10.02
		TOTAL LFD AS :					12.57			12.46			12.41			12.38			12.35
0.7	POS	53.90	5.19	0.00	19.99	1	4.91	19.84	2	4.86	19.76	3	4.84	19.73	4	4.83	19.69	5	4.81
		TOTAL LFD AS :					7.24			7.19			7.17			7.16			7.14
0.8	REC	50.15	5.54	0.00	24.00	1	2.30	24.00	1	2.30	24.00	2	2.30	24.00	2	2.30	24.00	3	2.30
		TOTAL LFD AS :					5.91			5.89			5.88			5.88			5.88
0.9	REC	50.15	5.54	0.00	24.00	3	9.56	25.87	4	8.84	28.63	5	7.97	29.90	6	7.62	29.92	8	7.61
		TOTAL LFD AS :					11.21			11.16			11.13			11.12			11.10
1.0	REC	50.15	5.54	0.00	25.63	6	23.28	30.21	9	19.64	32.43	12	18.25	32.44	15	18.21	32.46	18	18.17
		TOTAL LFD AS :					21.96			21.81			21.74			21.71			21.67

**** CRACKING MOMENT FOR BAR CUTOFF **** UNIT : FT-KIPS.

1.2*MCR LT END = 1059.8 1.2*MCR CTR SP = 991.7 1.2*MCR RT END = 1059.8

RESULTS:

SHEAR MODIFICATION FACTOR -- GIRDER / BENT CAP

BEN NO	LEFT	.1 PT	.2 PT	.3 PT	.4 PT	.5 PT	.6 PT	.7 PT	.8 PT	.9 PT	RIGHT
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

AASHTO STIRRUP DESIGN FOR SHEAR -- (GIRDER / BENT CAP)

MEMBER NO. : 2	LEFT	.1 PT.	.2 PT.	.3 PT.	.4 PT.	.5 PT.	.6 PT.	.7 PT.	.8 PT.	.9 PT.	RIGHT
APPLIED SHEAR FORCE VU :	1518.	1394.	863.	723.	584.	450.	647.	787.	927.	1062.	1582.
CONC. SH RESISTANCE VC :	312.	302.	301.	301.	301.	301.	301.	301.	301.	303.	317.
WIDTH OF GIRD BEN (IN) :	56.	54.	54.	54.	54.	54.	54.	54.	54.	54.	57.
STIRRUP DESIGN SHR. VS :	1207.	1094.	563.	423.	283.	150.	346.	486.	626.	759.	1265.

FINAL STIRRUP DESIGN :

NO.	DESCRIPTION	SHEAR RESISTANCE AT 10TH POINT FOR DIFFERENT STIRRUP SPACING										
05	SPACING INCH	4.	4.	5.	6.	9.	21.	9.	6.	5.	4.	3.
	RESIST. KIPS	1228.	1228.	655.	546.	364.	156.	364.	546.	655.	818.	1637.
	AREA REQ'D/CAP	1.86	1.86	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.86
	MAX SP ALLOWED	4.07	4.49	5.82	7.74	11.57	21.84	9.45	6.73	5.23	4.31	3.88
06	SPACING INCH	3.	4.	6.	9.	15.	24.	12.	9.	6.	6.	3.
	RESIST. KIPS	1549.	1162.	774.	516.	310.	194.	387.	516.	774.	774.	1549.
	AREA REQ'D/CAP	1.76	1.76	.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76
	MAX SP ALLOWED	3.85	4.25	8.26	10.99	16.42	24.00	13.41	9.56	7.42	6.12	3.67
07	SPACING INCH	5.	5.	9.	12.	21.	24.	18.	12.	9.	6.	5.
	RESIST. KIPS	1267.	1267.	704.	528.	302.	264.	352.	528.	704.	1056.	1267.
	AREA REQ'D/CAP	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
	MAX SP ALLOWED	5.25	5.79	11.26	14.99	22.39	24.00	18.29	13.03	10.12	8.34	5.01

BOTH ENDS GIRDER FLARED, THE LT. END FLARE ENDS 2.6 FT. FROM THE LT. END AND THE RIGHT END FLARE ENDS 2.7 FT. FROM THE RIGHT END. ****

```
************************************
YOUR BENT FILENAME IS: PSEXA
************************************
PSEXA          1 1 2PPH 535      0   0          0150   0   0   0   0  0  0   107310
PSEXA          2 3 1 P  450      0  60          0150   0   0   0   0  0  0   107310
PSEXA          3 4 2 P  450      0  60          0150   0   0   0   0  0  0   107310
PSEXA          1   0 0  1  750  600    0    0     0       0       0 0         207312
PSEXA          1   0 0 27  750    0    0    0     0       0       0 1         207312
PSEXA          1 114 1  0    0    0    0    0     0       0       0 0         207312
PSEXA          1 115 0 28   64 1367    0  686     0       0       0 0         207312
PSEXA          1 115 0 29  640  600  384   46     0       0       0 0         207312
PSEXA          1 115 0 30   46 1150  108    0     0       0       0 0         207312
PSEXA          1 115 0 27  750    0    0    0     0       0       0 2         207312
PSEXA          1 497 2  0    0    0    0    0     0       0       0 0         207312
PSEXA          1 498 1  0    0    0    0    0     0       0       0 0         207312
PSEXA          2   0 0- 6  161  161    0    0     0       0       0 0         207312
PSEXA          2   0 0- 8  161  161  550 1000     0       0       0 0         207312
PSEXA          2   0 0- 7  161  161  550    0     0       0       0 0         207312
PSEXA          2   0 0- 5  161  161    0 1000     0       0       0 0         207312
PSEXA          2   0 0  1 1000  550    0    0     0       0       0 3         207312
PSEXA          3   0 3  0    0    0    0    0     0       0       0 0         207312
PSEXA          111 1 050 0 375 683 375   0   0 0   0  0 0L    Y 0    0  0    857315
PSEXA           5200510051001725 5 800 1475 3700  0 0   0  0   0  0    0     307313
PSEXA            182    0    0   0    0    0 340    0    0   0    0    01     557317
BEGINNING OF JOB

AUG. 17, 1988
BDE035   - BRIDGE ANALYSIS AND DESIGN                    CMS VERSION 1.0 REL. 1.25 ----- JAN. 13, 1988
IDENT PSEXA                    BRIDGE ANALYSIS AND DESIGN          AUG. 17, 1988                PAGE   1

FRAME DESCRIPTION

          JOINT  END                          SUPPORT                                                MEMBER
LINE MEM   NO.   COND                           OR                 DEAD LOAD          SKEW           SLOPE     RECALL
 NO.  NO  LT RT  LT RT  DIR  SPAN      I      HINGE     E   UNIFORM SEC     LT    RT    DEGREE     MEM

       1   1  2   P  P   G    53.5     0.0     0.0      0.   0.0   150.   0.0   0.0      0.0       0
       2   3  1       P        45.0     0.0     6.0      0.   0.0   150.   0.0   0.0     90.0       0
       3   4  2       P        45.0     0.0     6.0      0.   0.0   150.   0.0   0.0     90.0       0
IDENT  PSEXA                   BRIDGE ANALYSIS AND DESIGN          AUG. 17, 1988                PAGE   2

SECTION PROPERTIES

LINE                  +                                                INERTIAS OF PARTS
 NO. MEM    LOC  RECALL - CODE     V      H      X      Y      AREA        IXX        IYY   STORE
       1    0.0     0       1    7.50   6.00   0.0    0.0     0.0        0.0        0.0       0
       1    0.0     0      27    7.50   0.0    0.0    0.0     0.0        0.0        0.0       1
              AREA          CENTROID LOCATION          MOMENT OF INERTIA ABOUT CENTROID
                              X       Y                    X-X                  Y-Y
            45.00            3.00    3.75                210.94               135.00

LINE                  +                                                INERTIAS OF PARTS
 NO. MEM    LOC  RECALL - CODE     V      H      X      Y      AREA        IXX        IYY   STORE
       1   11.4     1       0    0.0    0.0    0.0    0.0     0.0        0.0        0.0       0
```

```
RECALL  1                                   3.00    3.75    45.00      210.94      135.00
   AREA            CENTROID LOCATION                MOMENT OF INERTIA ABOUT CENTROID
                      X        Y                        X-X                    Y-Y
 45.00             3.00     3.75                     210.94                 135.00

LINE                                                          INERTIAS OF PARTS
 NO. MEM    LOC  RECALL + - CODE     V      H       X      Y      AREA        IXX        IYY   STORE
      1     11.5    0       28     0.64  13.67    0.0    6.86    0.0         0.0        0.0       0
      1     11.5    0       29     6.40   6.00    3.84   0.46    0.0         0.0        0.0       0
      1     11.5    0       30     0.46  11.50    1.08   0.0     0.0         0.0        0.0       0
      1     11.5    0       27     7.50   0.0     0.0    0.0     0.0         0.0        0.0       2
   AREA            CENTROID LOCATION                MOMENT OF INERTIA ABOUT CENTROID
                      X        Y                        X-X                    Y-Y
 52.44             6.84     3.90                     299.05                 309.75
```

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SECTION PROPERTIES

```
LINE                                                          INERTIAS OF PARTS
 NO. MEM    LOC  RECALL + - CODE     V      H       X      Y      AREA        IXX        IYY   STORE
      1     49.7    2       0      0.0    0.0     0.0    0.0     0.0         0.0        0.0       0
           RECALL  2                                  6.84   3.90    52.44      299.05     309.75
   AREA            CENTROID LOCATION                MOMENT OF INERTIA ABOUT CENTROID
                      X        Y                        X-X                    Y-Y
 52.44             6.84     3.90                     299.05                 309.75

LINE                                                          INERTIAS OF PARTS
 NO. MEM    LOC  RECALL + - CODE     V      H       X      Y      AREA        IXX        IYY   STORE
      1     49.8    1       0      0.0    0.0     0.0    0.0     0.0         0.0        0.0       0
           RECALL  1                                  3.00   3.75    45.00      210.94     135.00
   AREA            CENTROID LOCATION                MOMENT OF INERTIA ABOUT CENTROID
                      X        Y                        X-X                    Y-Y
 45.00             3.00     3.75                     210.94                 135.00
```

MEMBER 1 PROPERTIES

WARNING - MEMBER LENGTHS DISAGREE. THAT GIVEN IN FRAME DESCRIPTION IS USED.

```
                LENGTH        MIN INERTIA          STIFFNESS                CARRY OVER
                                                  LT        RT             LT        RT
                 53.5            210.94           4.462     5.035         0.490     0.434
```

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SECTION PROPERTIES

```
LINE                                                          INERTIAS OF PARTS
 NO. MEM    LOC  RECALL + - CODE     V      H       X      Y      AREA        IXX        IYY   STORE
      2     0.0     0     -  6     1.61   1.61    0.0    0.0     0.0         0.0        0.0       0
      2     0.0     0     -  8     1.61   1.61    5.50  10.00    0.0         0.0        0.0       0
      2     0.0     0     -  7     1.61   1.61    5.50   0.0     0.0         0.0        0.0       0
      2     0.0     0     -  5     1.61   1.61    0.0   10.00    0.0         0.0        0.0       0
```

```
  2     0.0    0     1    10.00   5.50    0.0    0.0     0.0        0.0        0.0      3
          AREA        CENTROID LOCATION          MOMENT OF INERTIA ABOUT CENTROID
                          X       Y                   X-X                Y-Y
        49.82            2.75    5.00               326.49             97.20
```

MEMBER 2 PROPERTIES

```
                    LENGTH        MIN INERTIA          STIFFNESS            CARRY OVER
                                                      LT       RT          LT       RT
                     45.0              326.49        4.000    4.000       0.500    0.500
```

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SECTION PROPERTIES

```
LINE                                                          INERTIAS OF PARTS
 NO. MEM    LOC  RECALL + CODE     V      H      X      Y      AREA       IXX        IYY   STORE
      3     0.0    3  - 0     0.0    0.0    0.0    0.0      0.0       0.0        0.0       0
          RECALL  3                          2.75   5.00    49.82    326.49      97.20
            AREA        CENTROID LOCATION          MOMENT OF INERTIA ABOUT CENTROID
                          X       Y                   X-X                Y-Y
        49.82            2.75    5.00               326.49             97.20
```

MEMBER 3 PROPERTIES

```
                    LENGTH        MIN INERTIA          STIFFNESS            CARRY OVER
                                                      LT       RT          LT       RT
                     45.0              326.49        4.000    4.000       0.500    0.500
```

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LOADING : EQUALLY SPACED GIRDER DATA

EQUALLY SPACED DL GIRDER DATA						CURB WIDTH DATA		TEMP	WIND LOADS PARALLEL TO BT				SKEW
DL LT. EXT	GIRDER REACTION INT GRD	RT. EXT	LT.EXT FROM LT.END	NO OF GDRS	GDR SPA	LT CURB FROM LT. END	CURB TO CURB	THERMAL EXP COEFF	GROUP 2 KIPS	GROUP 3 BOT #/,	TOP #/,	WIND COVER FT.	ANGL IN DEGS
520.0	510.0	510.0	17.25	5	8.00	14.75	37.00	0.00021	0.0	0.0	0.0	0.0	0.0

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ANALYSIS DIAGNOSTICS

NO ERRORS FOUND

FRAME PROPERTIES

MEM NO	JT LT	JT RT	END COND LT	END COND RT	DIR	SPAN	I	SUPPORT OR HINGE	E	CARRY OVER FACTORS LT	CARRY OVER FACTORS RT	DISTRIBUTION FACTORS LT	DISTRIBUTION FACTORS RT	F"C
1	1	2	P	P	G	53.5	210.94	0.0	3600.	0.0	0.0	0.0	0.0	4.00
2	3	1		P		45.0	326.49	6.0	3250.	0.0	0.500	0.0	0.0	3.25
3	4	2		P		45.0	326.49	6.0	3250.	0.0	0.500	0.0	0.0	3.25

STRUCTURE TYPE = P

KEY TO STRUCTURE TYPE :

R = REINFORCED CONCRETE BOX GIRDER (WSD / LFD).
P = PRESTRESSED OR PARTIALLY PRESTRESSED CONCRETE BOX GIRDER (DEFAULT).
T = TEE BEAM (REINFORCED / PRESTRESSED).
I = I GIRDER (REINFORCED / PRESTRESSED).
F = SLAB (REINFORCED / PRESTRESSED).
S = STEEL STRUCTURE (FOR DEFLECTION ONLY).

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LOAD DATA TRIAL 0

LINE	MEM	W OR P	LOAD CODE	A	B	FIXED END MOMENTS LEFT	FIXED END MOMENTS RIGHT	DEFLT	ANGLE	COMMENTS
	1	520.000	P	17.3	0.0	0.	0.			GENERATED GIRDER DATA
	1	510.000	P	25.3	0.0	0.	0.			GENERATED GIRDER DATA
	1	510.000	P	33.3	0.0	0.	0.			GENERATED GIRDER DATA
	1	510.000	P	41.3	0.0	0.	0.			GENERATED GIRDER DATA
	1	510.000	P	49.3	0.0	0.	0.			GENERATED GIRDER DATA

FIXED END MOMENTS TRIAL 0

MEM NO	FIXED END MOMENTS LT	FIXED END MOMENTS RT	MEM NO	FIXED END MOMENTS LT	FIXED END MOMENTS RT	MEM NO	FIXED END MOMENTS LT	FIXED END MOMENTS RT
1	0.	0.	2	-0.	0.	3	-0.	0.

****
**** CAUTION - RESULTS ARE UNFACTORED, UNLESS INDICATED OTHERWISE. ****
****

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*** SIDESWAY NOT CONSIDERED. ***

HORIZONTAL MEMBER MOMENTS TRIAL 0

MEM NO	LEFT	.1 PT	.2 PT	.3 PT	.4 PT	.5 PT	.6 PT	.7 PT	.8 PT	.9 PT	RIGHT
1	0.	6155.	12117.	17873.	21272.	23057.	22628.	19857.	15484.	8922.	0.

HORIZONTAL MEMBER STRESSES TRIAL 0 BOTTOM FIBRE

MEM NO	LEFT	.1 PT	.2 PT	.3 PT	.4 PT	.5 PT	.6 PT	.7 PT	.8 PT	.9 PT	RIGHT
1	0.	-760.	-1496.	-1619.	-1927.	-2089.	-2050.	-1799.	-1403.	-808.	0.

HORIZONTAL MEMBER STRESSES TRIAL 0 TOP FIBRE

MEM NO	LEFT	.1 PT	.2 PT	.3 PT	.4 PT	.5 PT	.6 PT	.7 PT	.8 PT	.9 PT	RIGHT

```
  1        0.      760.    1496.    1494.    1778.    1927.    1891.    1659.    1294.     746.       0.
VERTICAL MEMBER MOMENTS  TRIAL  0
MEM
 NO     LEFT     .1 PT    .2 PT    .3 PT    .4 PT    .5 PT    .6 PT    .7 PT    .8 PT    .9 PT    RIGHT
  2       -0.       -0.      -0.       0.       0.       0.       0.       0.       0.       0.       0.
  3       -0.       -0.      -0.       0.       0.       0.       0.       0.       0.       0.       0.
HORIZONTAL MEMBER SHEARS  TRIAL  0
MEM
 NO     LEFT     .1 PT    .2 PT    .3 PT    .4 PT    .5 PT    .6 PT    .7 PT    .8 PT    .9 PT    RIGHT
  1     1168.5   1132.4   1096.3   1055.0    492.9    -59.2   -101.3   -653.4  -1205.4  -1247.5  -1795.9
VERTICAL MEMBER SHEARS  TRIAL  0
MEM
 NO     LEFT     .1 PT    .2 PT    .3 PT    .4 PT    .5 PT    .6 PT    .7 PT    .8 PT    .9 PT    RIGHT
  2       0.0       0.0      0.0      0.0      0.0      0.0      0.0     -0.0     -0.0     -0.0     -0.0
  3       0.0       0.0      0.0      0.0      0.0      0.0      0.0     -0.0     -0.0     -0.0     -0.0
IDENT  PSEXA                    BRIDGE ANALYSISI AND DESIGN          AUG. 17, 1988                PAGE  10
VERTICAL MEMBER REACTIONS  TRIAL  0
MEM        LT                  RT                MEMBER
NO      REACTION            REACTION            WEIGHT

  2      1504.8              1168.5              336.3
  3      2132.1              1795.9              336.3
IDENT  PSEXA                    BRIDGE ANALYSIS AND DESIGN           AUG. 17, 1988                PAGE  11
TRIAL  0
TANGENTIAL ROTATIONS - RADIANS - CLOCKWISE POSITIVE
   SPAN    LT. END     RT. END     SPAN    LT. END     RT. END     SPAN    LT. END     RT. END
     1     0.002638   -0.002715     2    -0.000000   -0.000000     3    -0.000000   -0.000000
HORIZONTAL MEMBER DEFLECTIONS IN FEET AT 1/ 4 POINTS FROM LEFT END - DOWNWARD POSITIVE
     MEMBER  1    E= 3600.     0.0          0.125        0.177        0.128        0.0
VERTICAL MEMBER DEFLECTIONS IN FEET AT 1/ 4 POINTS FROM LEFT END.
     MEMBER  2    E= 3250.     0.0          0.000        0.000        0.000        0.0
     MEMBER  3    E= 3250.     0.0          0.000        0.000        0.000        0.0


*** MEMBER DEFLECTIONS BASED ON THE DEFAULT CONCRETE STRENGTH OF 4.0 KSI FOR SUPER AND 3.25 KSI FOR SUB. *****

*** MEMBER DEFLECTIONS HAVE BEEN MULTIPLIED BY A CONCRETE CREEP FACTOR OF 4.0 .  ******
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LIVE LOAD REACTION INPUT DATA :
```

STANDARD HS TRUCK / ALTERNATIVE TRUCK		>> P LOAD / SPECIAL TRUCK <<	
MAXI. AXIAL FORCE	MAX. LONGI MOMENT	MAXI. AXIAL FORCE	MAX. LONGI MOMENT
AXIAL MOMENT TOP BOT KIPS KIP-FT	AXIAL MOMENT TOP BOT KIPS KIP-FT	AXIAL MOMENT TOP BOT KIPS KIP-FT	AXIAL MOMENT TOP BOT KIPS KIP-FT

```
  1        0.      760.    1496.    1494.    1778.    1927.    1891.    1659.    1294.     746.       0.
VERTICAL MEMBER MOMENTS  TRIAL  0
MEM
 NO     LEFT     .1 PT    .2 PT    .3 PT    .4 PT    .5 PT    .6 PT    .7 PT    .8 PT    .9 PT    RIGHT
  2       -0.       -0.      -0.       0.       0.       0.       0.       0.       0.       0.       0.
  3       -0.       -0.      -0.       0.       0.       0.       0.       0.       0.       0.       0.
HORIZONTAL MEMBER SHEARS  TRIAL  0
MEM
 NO     LEFT     .1 PT    .2 PT    .3 PT    .4 PT    .5 PT    .6 PT    .7 PT    .8 PT    .9 PT    RIGHT
  1     1168.5   1132.4   1096.3   1055.0    492.9    -59.2   -101.3   -653.4  -1205.4  -1247.5  -1795.9
VERTICAL MEMBER SHEARS  TRIAL  0
MEM
 NO     LEFT     .1 PT    .2 PT    .3 PT    .4 PT    .5 PT    .6 PT    .7 PT    .8 PT    .9 PT    RIGHT
  2       0.0       0.0      0.0      0.0      0.0      0.0      0.0     -0.0     -0.0     -0.0     -0.0
  3       0.0       0.0      0.0      0.0      0.0      0.0      0.0     -0.0     -0.0     -0.0     -0.0
IDENT  PSEXA                    BRIDGE ANALYSISI AND DESIGN          AUG. 17, 1988                PAGE  10
VERTICAL MEMBER REACTIONS  TRIAL  0
MEM        LT                  RT                MEMBER
NO      REACTION            REACTION            WEIGHT

  2      1504.8              1168.5              336.3
  3      2132.1              1795.9              336.3
IDENT  PSEXA                    BRIDGE ANALYSIS AND DESIGN           AUG. 17, 1988                PAGE  11
TRIAL  0
TANGENTIAL ROTATIONS - RADIANS - CLOCKWISE POSITIVE
   SPAN    LT. END     RT. END     SPAN    LT. END     RT. END     SPAN    LT. END     RT. END
     1     0.002638   -0.002715     2    -0.000000   -0.000000     3    -0.000000   -0.000000
HORIZONTAL MEMBER DEFLECTIONS IN FEET AT 1/ 4 POINTS FROM LEFT END - DOWNWARD POSITIVE
     MEMBER  1    E= 3600.     0.0          0.125        0.177        0.128        0.0
VERTICAL MEMBER DEFLECTIONS IN FEET AT 1/ 4 POINTS FROM LEFT END.
     MEMBER  2    E= 3250.     0.0          0.000        0.000        0.000        0.0
     MEMBER  3    E= 3250.     0.0          0.000        0.000        0.000        0.0


*** MEMBER DEFLECTIONS BASED ON THE DEFAULT CONCRETE STRENGTH OF 4.0 KSI FOR SUPER AND 3.25 KSI FOR SUB. *****

*** MEMBER DEFLECTIONS HAVE BEEN MULTIPLIED BY A CONCRETE CREEP FACTOR OF 4.0 .  ******
IDENT  PSEXA                    BRIDGE ANALYSIS AND DESIGN           AUG. 17, 1988                PAGE  12

LIVE LOAD REACTION INPUT DATA :
```

STANDARD HS TRUCK / ALTERNATIVE TRUCK		>> P LOAD / SPECIAL TRUCK <<	
MAXI. AXIAL FORCE	MAX. LONGI MOMENT	MAXI. AXIAL FORCE	MAX. LONGI MOMENT
AXIAL MOMENT TOP BOT KIPS KIP-FT	AXIAL MOMENT TOP BOT KIPS KIP-FT	AXIAL MOMENT TOP BOT KIPS KIP-FT	AXIAL MOMENT TOP BOT KIPS KIP-FT

LIVE LOAD SHEAR ENVELOPES AND ASSOCIATED MOMENT FOR CAP DESIGN

MEM NO	LEFT	.1 PT.	.2 PT.	.3 PT.	.4 PT.	.5 PT.	.6 PT.	.7 PT.	.8 PT.	.9 PT.	RIGHT
1	212.0	212.0	212.0	212.0	169.3	127.6	-109.4	-200.4	-236.8	-316.7	-331.4
MOMENT	0.0	1134.3	2268.6	3402.9	3623.3	3412.5	3801.1	3215.9	2533.4	1694.5	0.0

***** STANDARD HS TRUCKS *****

DEAD LOAD SHEAR PLUS LIVE LOAD SHEAR ENVELOPES FOR CAP DESIGN

MEM NO	LEFT	.1 PT.	.2 PT.	.3 PT.	.4 PT.	.5 PT.	.6 PT.	.7 PT.	.8 PT.	.9 PT.	RIGHT
1	1380.5	1344.4	1308.3	1267.0	662.2	68.4	-210.7	-853.7	-1442.2	-1564.3	-2127.3

***** STANDARD HS TRUCKS *****

DEAD LOAD SHEAR PLUS LIVE LOAD SHEAR ENVELOPES FOR CAP DESIGN * FACTORED *

MEM NO	LEFT	.1 PT.	.2 PT.	.3 PT.	.4 PT.	.5 PT.	.6 PT.	.7 PT.	.8 PT.	.9 PT.	RIGHT
1	1979.4	1932.4	1885.5	1831.8	1008.3	200.0	-369.1	-1284.4	-2081.1	-2309.4	-3054.2

***** COMBINATION OF P AND/OR HS TRUCKS *****

POSITIVE LIVE LOAD MOMENT ENVELOPES AND ASSOCIATED SHEARS FOR CAP DESIGN

MEM NO	LEFT	.1 PT.	.2 PT.	.3 PT.	.4 PT.	.5 PT.	.6 PT.	.7 PT.	.8 PT.	.9 PT.	RIGHT